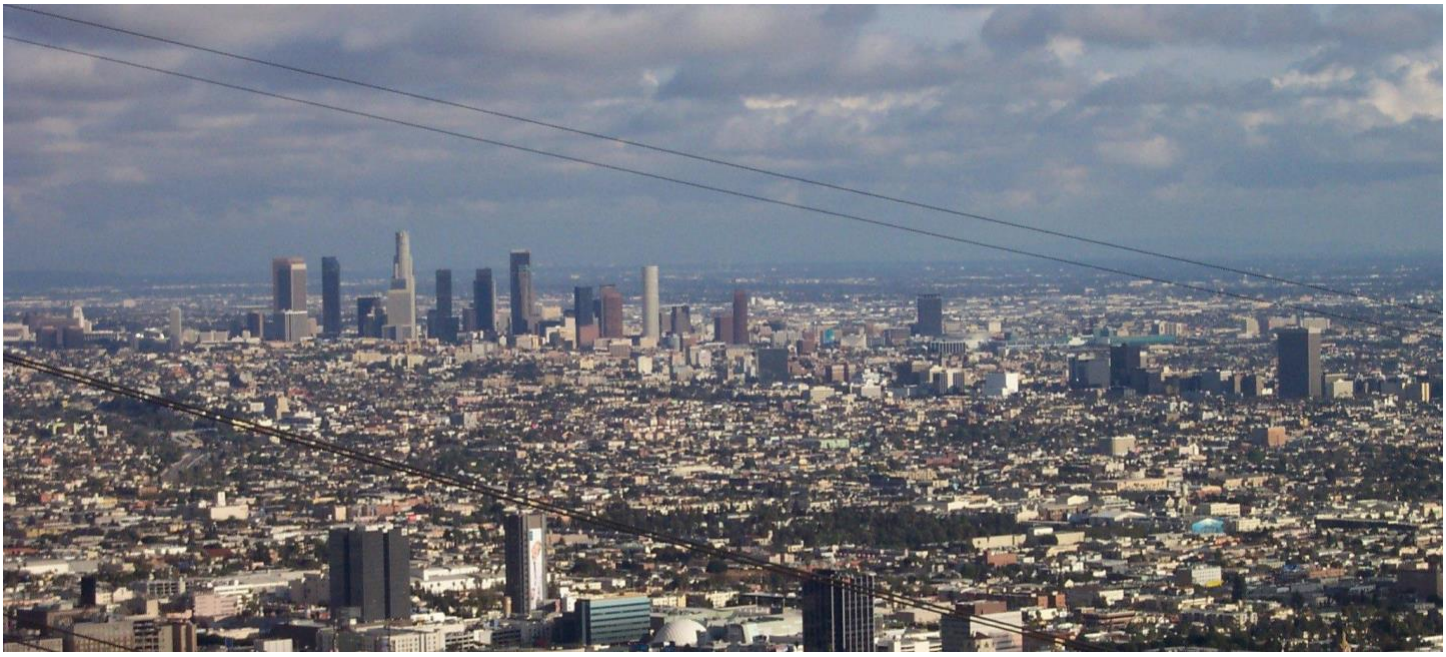
LA100 EQUITY STRATEGIES



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Chapter 13. Energy Affordability and Policy Solutions Analysis

FINAL REPORT: LA100 Equity Strategies

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Contents

ES Executive Summary 1
ES.1 Background and Motivation 1
ES.2 Key Findings and Recommendations 2
ES.3 Data, Methods, and Major Analysis Sections 4
ES.4 Regulatory and Legal Constraints 5
ES.5 Baseline Affordability Analysis 6
ES.6 Policy Action 9
ES.7 Energy Affordability Metrics 14
ES.8 Next Steps 17
1 Introduction 18
2 Data and Methods Overview 20
2.1 Major Data Source Categories 20
2.2 Primary Quantitative Data Sources 21
3 LADWP's Legal and Regulatory Constraints on Ratemaking 27
3.1 Introduction 27
3.2 California State Law 29
3.3 Los Angeles Municipal Law 37
3.4 LADWP Residential Electricity Rates 40
3.5 LADWP Affordability Program History 43
4 Baseline Affordability Analysis 45
4.1 Data and Defining "In-Need" Households and Customers 45
4.2 Background: LADWP Organizational Structure, Bills, Available Programs and Ratemaking Process Relevant to Residential Affordability 46
4.3 Key Questions in Characterizing Affordability for LADWP In-need Households and Customers 54
5 Energy Affordability Policies 76
5.1 Direct Assistance Discount Programs 79
5.2 Structural Energy Efficiency & Comprehensive Affordable Multifamily Retrofits (CAMR) 89
5.3 Community Solar & Virtual Net Energy Metering (VNEM) 99
5.4 Shutoffs & Crisis Relief 111
6 Energy Affordability Metrics 124
6.1 Indoor Thermal Comfort Metric 124
6.2 Energy Insecurity Metric 139
6.3 Discount Program Metric 149
6.4 Crisis Relief Metric 159
7 Conclusion 168
8 Appendices 170
8.1 Appendix 1: Direct Assistance Precedent — State, Utility, and Municipal Discount Programs 170
8.2 Appendix 2: Secondary Metrics Analysis 177
8.3 Appendix 3: Secondary Policies Background Analysis 184
8.4 Appendix 4: Additional shutoff and arrearage results from 2017-2020 201
8.5 Appendix 5: Customer Billing-Data Preparation and Management 204
8.6 Appendix 6: 4-Question Indicator Metric 207
8.7 Appendix 7: Information on Originally-Planned, LCI-Led Survey 209
9 References 210

ES Executive Summary

ES.1 Background and Motivation

In March 2021, the National Renewable Energy Laboratory (NREL) released the Los Angeles 100% Renewable Energy Study (LA100), a milestone analysis laying out pathways for the Los Angeles Department of Water and Power (LADWP, or DWP) to transition to 100% renewable energy by 2045. Among the options presented by the study, the Board of Water and Power Commissioners (the Board) selected the most ambitious: a scenario in which the 100% clean energy goal is met ten years earlier, in 2035, without reliance on biofuels (the Early & No Biofuels scenario). Although a boon for the City of LA's environmental goals, fulfilling this plan entails significant investments in infrastructure, renewable generating capacity, and cutting-edge technological solutions, all of which have cost and downstream affordability impacts.

Affordability refers to customers' ability to pay their bills. The costs of the transition to 100% renewable electricity by 2035 are considerable, but necessary to combat climate change. Because home heating and transportation expenditures will be folded into electric bills as these services become electrified, increasing electricity costs are a particular equity concern for LADWP, as well as for LA residents and small businesses. Changing costs will directly influence energy burden and indirectly affect broader affordability for LADWP customers.

Generally, public utilities, such as LADWP, must directly recover costs through revenue increases — including the cost of transitioning to renewable energy. This primarily means increasing rates and fees assessed on customers. Since many low- and moderate-income LA residents already struggle with the burden of their LADWP bills and general cost of living, cost and revenue increases at the utility scale have equity- and economic justice-related ramifications that must be directly addressed by policy. It is thus a delicate balancing act to complete the transition to 100% clean energy without creating untenable financial burdens on the Angelenos least able to absorb them, while also ensuring that the broader benefits of the transition are equitably distributed. This task is also made more challenging by the considerable uncertainty about the exact level and timing of costs associated with the utility's 100% renewable investments.

To that end, LADWP commissioned the UCLA Luskin Center for Innovation (LCI) and School of Law to conduct an Energy Affordability and Policy Solutions analysis as part of the broader LA100 Equity Strategies effort. This work builds on LCI's past work and ongoing engagement on utility affordability and broader equity issues in both Los Angeles and California. Our work on affordability in LA100 Equity Strategies complements NREL's affordability-focused rate structure and on-bill financing modeling. Consequently, our research goes beyond rate (re)design to focus on implementable, robust, and long-term structural solutions. Specifically, this entails data, analysis, and strategy architecture that will comprehensively address affordability, building on ongoing efforts. This work also complements the UCLA Center for Neighborhood Knowledge's analysis of ethnic small business energy equity issues, including affordability.

ES.2 Key Findings and Recommendations

We highlight the most important and salient takeaways from our analysis here to inform necessary steps for LADWP and other city partners to take to enhance affordability and broader equity in the near and medium-term. These broad findings and recommendations provide a context for more specific metric and policy adoption recommendations which we outline below.

Finding: Affordability is a key equity concern for all stakeholders. As discussed above, costs associated with the LA100 transition will necessitate additional utility revenue. Short-term rate increases exacerbate the intense budgetary strain on in-need households. In broader LADWP customer equity conversations, affordability is one of the most — if not the most — common concern voiced.

Recommendation: Commit to a long-term, transparent and impactful data and policy architecture, potentially under the Equity Metrics Data Initiative, which holistically addresses customer affordability

Finding: LADWP bill complexity creates challenges for affordability. LADWP bills can encompass four different services in 15 distinct combinations. Inability to disaggregate bill payments and the applicability of fiscal assistance toward some services but not others, among other factors, can make it challenging for in-need households to pay their bills and avoid falling into arrears. The magnitude of the entire bill must be kept top of mind when thinking about affordability — not just electricity costs or other components.

Recommendation: Prioritize efforts that substantially reduce total LADWP bill expenditures for in-need customers.

Finding: Propositions 26 and 218 continue to present legal obstacles to addressing affordability holistically. Structural changes to LADWP's electricity rates and discount programs can help the department achieve parity with utilities in California and around the country. Implementing these changes will require a serious evaluation of what is possible under Proposition 26 restrictions, including understanding whether Sacramento Municipal Utility District's (SMUD's) legal reasoning for rate changes is applicable in LADWP's case. If it is determined that structural rate changes are not feasible for LADWP under Proposition 26 restrictions, a city-wide ballot initiative will likely be necessary to ensure electricity rates do not disproportionally burden vulnerable households.

Recommendation: Examine SMUD's legal justifications for rate changes under Proposition 26 while laying out the steps required for a successful ballot initiative.

Finding: Energy and revenue impacts of supporting in-need customer consumption are muted. Consumption data indicate that low-income households use substantially less electricity than other customer groups. Consequently, low-income households constitute a small part of LADWP's revenue pool in the aggregate. Therefore, actions with potential adverse impacts on revenue generation from this group (e.g., bill discounts, shutoff protections) will likely only produce minor effects on overall revenue. There is no evidence to date that expanding these efforts will appreciably damage the utility's business model.

Recommendation: Expand customer protections while measuring impacts of the permanent shutoff moratoria.

Finding: Ensuring indoor thermal comfort is an essential part of affordability policy efforts and critical to broader city and state goals. The negative effects of inability to maintain a healthy, temperate indoor environment on in-need households already facing other stressors are unequivocal. Furthermore, thermal comfort (or lack thereof) is indicative of the success of affordability efforts more generally and illustrates the link between energy affordability and public health. The city should set and enforce an aggressive indoor temperature standard which establishes LA as a statewide leader on this climate equity front.

Recommendation: In concert with other city departments, adopt specific metrics and associated supportive policies to ensure indoor thermal comfort which can serve as a statewide model.

Finding: Improving discount program efficacy is a crucial near-term step to increase affordability. LADWP's flagship discount programs — EZ-SAVE and Lifeline — currently have large gaps between actual enrollment and eligible population. Increasing enrollment is a clear next step to amplify the overall benefits these programs deliver to in-need households, a goal that should be pursued rapidly. The household-level benefits provided by these programs — especially EZ-SAVE — are also relatively modest at this time. In the mid- to long-term, LADWP should consider increasing the benefits provided by these programs.

Recommendation: Quickly increase enrollment in existing major discount programs among eligible customers using proven streamlining methods, while seeking to expand benefit levels and potentially expand eligibility in the longer term.

Finding: LADWP has instituted a highly progressive shutoff moratorium. Though not universal, the limited, permanent shutoff moratorium for discount program-enrolled customers is an ambitious and important step to reduce compounding harms that result from utility shutoffs affecting in-need households. The next priority should be to ensure protection for eligible Angelenos by expanding enrollment and setting strict metrics for uncovered residential and small business customers.

Recommendation: Increase protection of eligible customers in the existing shutoff moratorium via discount program enrollment and adopt metrics to protect uncovered customers from shutoffs, while ensuring customer repayment levels remain high.

Finding: Promising, novel demand- and supply-side affordability policies merit evaluation and scaling. Recently instituted programs like the Comprehensive Affordable Multifamily Retrofits (CAMR) program and the virtual net energy metering (VNEM) pilot aptly target historically neglected action areas (e.g., low-income multifamily residential). However, these new programs are also of limited scale, meaning the benefits will be highly diffuse compared with the magnitude of LA's low-income population and broader affordability goals. Early, rigorous data gathering and evaluation will be needed to assess program performance and address shortcomings, accompanied by efforts to quickly scale them up.

Recommendation: Evaluate, enhance, consolidate and scale up promising new programs which impact customers via demand reduction and supply enhancement pathways, starting with the CAMR and VNEM pilot programs.

ES.3 Data, Methods, and Major Analysis Sections

To undertake this work, we synthesize data from five major types of sources using a mix of quantitative and qualitative methods. We decided to use this approach, rather than using a single one-off original survey design, in part to facilitate replication and refinement of a sustainable strategy architecture by LADWP in the future.

Our main data source categories are:

1. Existing primary quantitative, representative, or census-type household and customer data, including:

    a. LADWP customer level data shared through the UCLA California Center for Sustainable Communities' Energy Atlas.

    b. Recurring external survey sources such as the Loyola Marymount University's Los Angeles Public Opinion Survey and the California Energy Commission's Residential Appliance Saturation Study.

2. Secondary sources, including published reports by LADWP and city offices including the Office of Public Accountability and City Controller.

3. Stakeholder input, including from LA100 ES Steering and Advisory Committees.

4. Academic and peer utility literature review.

5. LADWP administrative staff interviews.

Using these data sources, we produce four distinct but interrelated analyses, outlined below:

1. Regulatory and Legal Constraints on Affordability Support

    We analyze regulatory and legal constraints on LADWP's ratemaking, as careful consideration and understanding of these constraints is crucial in the implementation of any major rate or policy changes.

2. Baseline Affordability

    We provide a wide-ranging overview of electricity affordability considerations for households in the City of Los Angeles, addressing the effect of bureaucratic processes and structures, legal constraints, effects of rates and costs, utility policy actions, and consumption trends.

3. Energy Affordability Metrics

   Our analysis focuses on four potential, feasible metric areas where real-world data can help LADWP accurately assess whether equity and affordability goals are being realized: thermal comfort, energy insecurity, discount enrollment, and crisis relief.

4. Policy Action

   We assess four key policy areas identified as highly promising based on background analysis and expert guidance: direct assistance discount programs, structural energy efficiency, community solar and virtual net energy metering, and shutoffs & crisis relief.

ES.4 Regulatory and Legal Constraints

The section on regulatory and legal constraints summarizes the laws that govern LADWP's ratemaking. It also delves into the history and details of Propositions 13, 218, and 26, which may be the most visible obstacles to affordable ratemaking, as they require voter approval for some changes to the city's rates and discount programs.

Overall, this section's aim is to establish the historical and current context for potential affordability strategies and to arm readers with the tools to fight for their implementation. For example, we review the California Public Utilities Code, which holds the majority of state laws governing municipal utilities like LADWP and includes specific requirements for low-income affordability. We also look at Los Angeles' Charter and Administrative Codes to clarify the Board of Commissioners' rate setting authority. We conclude with details on rates and a brief history of LADWP's rate assistance programs.

We also assess the implications of Propositions 218 and 26 in the context of affordability-focused rate structure changes. This includes a review of recent legal challenges to municipal electricity rates, specifically those questioning annual transfers of surplus Power Revenue Funds General Funds (City Transfers). For example, although a 2018 class action settlement imposed a cap on LADWP's future City Transfers, the courts have recently sided with municipal utilities in litigation against these transfers, citing that they are a reasonable part of the cost of providing electricity and are therefore legal under Proposition 26.

The implications of these cases are not totally clear — especially in the context of affordability changes, such as adapting LADWP's EZ-Save Program. However, they do demonstrate that municipal utilities still have some autonomy under Proposition 26. On this note, we also look at SMUD's recent rate changes, and the district's explanation of new rates' compliance under Proposition 26. For example, in 2019, SMUD implemented a new, tiered structure for their low-income discount program, providing different levels of financial assistance based on customers' need. As discussed in Chapter 5 and the Energy Affordability Policies section of this chapter, a tiered discount structure like SMUD's or like the California IOUs' CARE and FERA programs could greatly improve affordability outcomes of the LA100 transition. Thus, it may be useful to explore whether SMUD's rationale is applicable in LADWP's case.

Finally, we explore the process of putting forth a city-wide ballot initiative, which is the method through which Propositions 218 and 26 enable LADWP to modify rates without constraints. A successful ballot initiative could allow for explicit affordability-focused programs and electricity rate modifications. Ballot initiative approval would undoubtedly require a rigorous campaign to educate voters on the value of rate modifications and instill trust in LADWP. However, recent case law has demonstrated that if the initiative was citizen originated, it could be approved by a simple majority, as opposed to a two-thirds majority, which was previously thought to be necessary.

ES.5 Baseline Affordability Analysis

The baseline affordability analysis drew upon numerous data sources, including community listening sessions; the UCLA Energy Atlas; the LA Public Opinion Survey; the Residential Appliance Saturation Study; the LA County Quality of Life Index; and data analysis and published reports from LADWP, the City of LA, and affiliated entities. Because of the diversity of these sources, our definition of "in-need" households is somewhat broad and varies depending on context. Generally, income is the most common factor in classifying a household as "in-need," though other factors (such as disability, age, and chronic illness) are also used.

Using these sources, we broadly characterize the status quo facing in-need LA households with respect to energy affordability and energy burden. Generally, the baseline analysis focuses on the following questions:

1. How will the LA100 transition affect affordability for in-need households?

2. How do rates and billing affect affordability?

3. What is the profile of in-need households with respect to knowledge of cost-saving programs and technologies, use of energy-saving technologies, and other factors?

4. What are potential barriers that might influence the transition to renewables and accompanying efforts to promote affordability?

Meeting the 100% renewable energy goal by 2035 will affect rates differently depending on time frame. The Early & No Biofuels pathway will call for significant investments on an accelerated timeline, creating short-term revenue needs that are expected to lead to rate increases. The most pronounced cost increase will likely be within the first five years. However, the cost-saving advantages of renewable energy and electrification may offset these increases in the long term.

Independent of long-term trends, affordability generally varies inversely with rate levels for a modest level of consumption: higher rates increase fiscal strain on in-need households, who generally spend a larger proportion of disposable income on energy than higher-income households, despite consuming a smaller total amount. At a more granular level, LADWP rates and fixed charges are designed to avoid regressive impacts. Variable charges are administered in price tiers that increase more steeply at high consumption levels than low ones. However, bill complexity can create affordability challenges for in-need families, as LADWP customers can

have up to four services (water, power, sewer, and trash) in different combinations on a single bill. This prevents customers from prioritizing payment of particular bills and complicates implementation of bill assistance and shutoff policies. Other factors also influence affordability, including autopay enrollment, availability of LADWP locations, and billing frequency (see Baseline Affordability section).

In developing a profile of in-need LA households, we focused on a variety of elements that currently influence the success of affordability policy efforts, or may do so in the future. See the Baseline Affordability section for a full explication of the findings.

Key takeaways include:

- As illustrated in Figure X, the whole LADWP bill — encompassing up to 4 services (power, water, sewer, and trash) in 15 possible combinations — matters for affordability. Power charges must be understood in the context of broader affordability and energy insecurity dynamics.
- Inequitable customer utility debt burden persists across the City of LA, despite recent shutoff moratoria and crisis relief policies. Debt is concentrated in communities of color and stratified by income and housing status.
- There is evidence that the cost of electricity constrains use among in-need households, despite progressive rate structures and established discount programs.
- Both of LADWP's direct assistance discount programs are significantly under-enrolled, with roughly 62% and 29% of eligible customers enrolled for Lifeline and EZ-SAVE, respectively.
- Reaching 100% enrollment of eligible Lifeline and EZ-Save customers under the same program structure would approximately double the financial assistance provided by the power system from $33 million to $67 million annually.
- Approximately half of LADWP customers have a positive impression of the utility. Service reliability and cost are the most important factors driving positive and negative opinions, respectively.
- Lack of knowledge and lack of trust are key obstacles that prevent eligible customers from enrolling in discount programs.
- Most residents are willing to absorb at least a 5% cost increase for clean electricity.
- In-need households tend to be less knowledgeable of energy-saving and/or electrification technologies, less likely to have natural gas access, and less likely to own an electric vehicle; they also face greater challenges in maintaining thermal comfort.

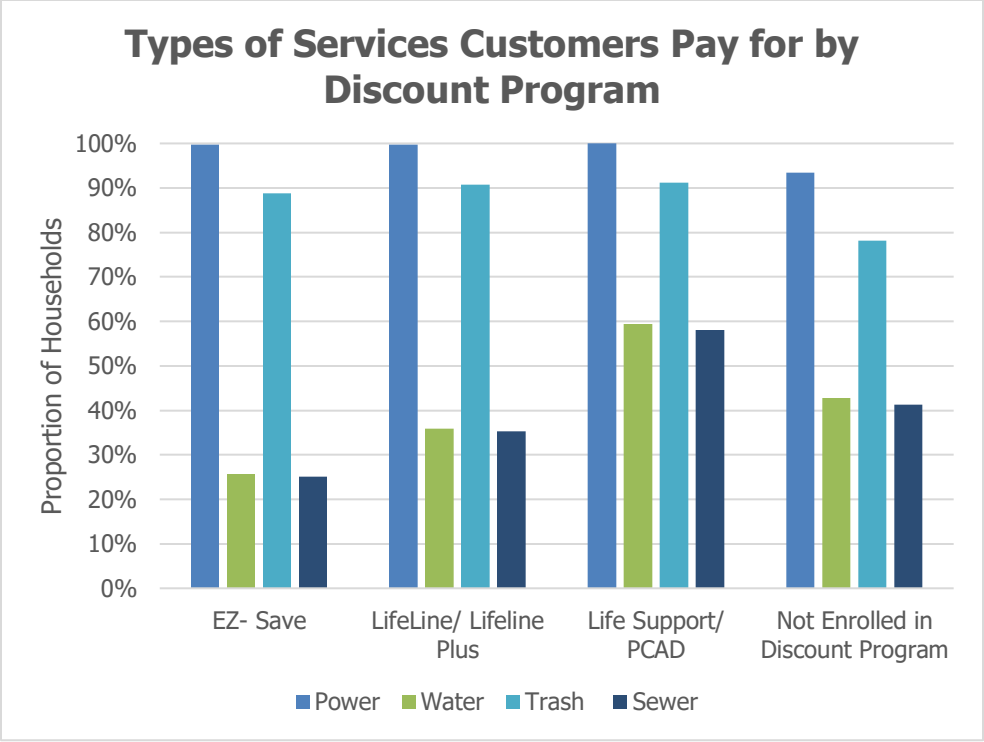

Figure 1. Utility Services Paid For by Discount Program Enrollment Status

With respect to barriers, two types are particularly important for their relevance to the LA100 transition and associated affordability goals: knowledge barriers preventing program enrollment and split incentive issues. Regarding the former, 30% of LA residents are unaware of LADWP's existing discount programs. Among eligible but unenrolled individuals, 42% state a lack of knowledge about the program as a driving reason, followed by concern that benefits would not materialize (38%). Concerns about not fully understanding programs are more pronounced among lower-income households. In a similar vein, in-need households are less likely to be knowledgeable about energy-saving upgrades like household battery storage.

Split incentive issues occur when landlords do not take energy-saving steps that would primarily benefit tenants. Because tenants typically pay their own energy bills, measures such as energy efficiency retrofits or appliance electrification do not deliver fiscal benefits to property owners. Split incentives present a challenge in numerous policy action areas in multifamily residential contexts (where tenants tend to have lower incomes), including structural energy efficiency, electrification, electric vehicle charging, and multifamily residential community solar. Policies focused on delivering the benefits of these upgrades to low-income tenants will need to overcome split incentive issues (see the Policy Options section for a more detailed discussion).

ES.6 Policy Action

The goal of the policy analysis component is to provide insight to LADWP on courses of action it can take to better ingrain affordability and equity into the LA100 transition. We approached this analysis in three distinct stages, each centered around a key line of inquiry:

1. What policy strategies could LADWP consider implementing to reduce energy burden for low-income ratepayers and/or deliver other benefits (e.g., reliability)?
2. Among the broad menu of strategies identified, which are likely to be the best investment of LADWP time and resources in terms of returned benefit?
3. Within the selected subset of strategies, what actions should LADWP take in the short and long term to best maximize benefits to ratepayers and assess program performance?

In the first stage, we conducted a background analysis of 11 policy areas (see Figure 2), all of which can produce direct or secondary affordability benefits and most of which also deliver co-benefits of some kind (e.g., increased reliability, improved indoor air quality).

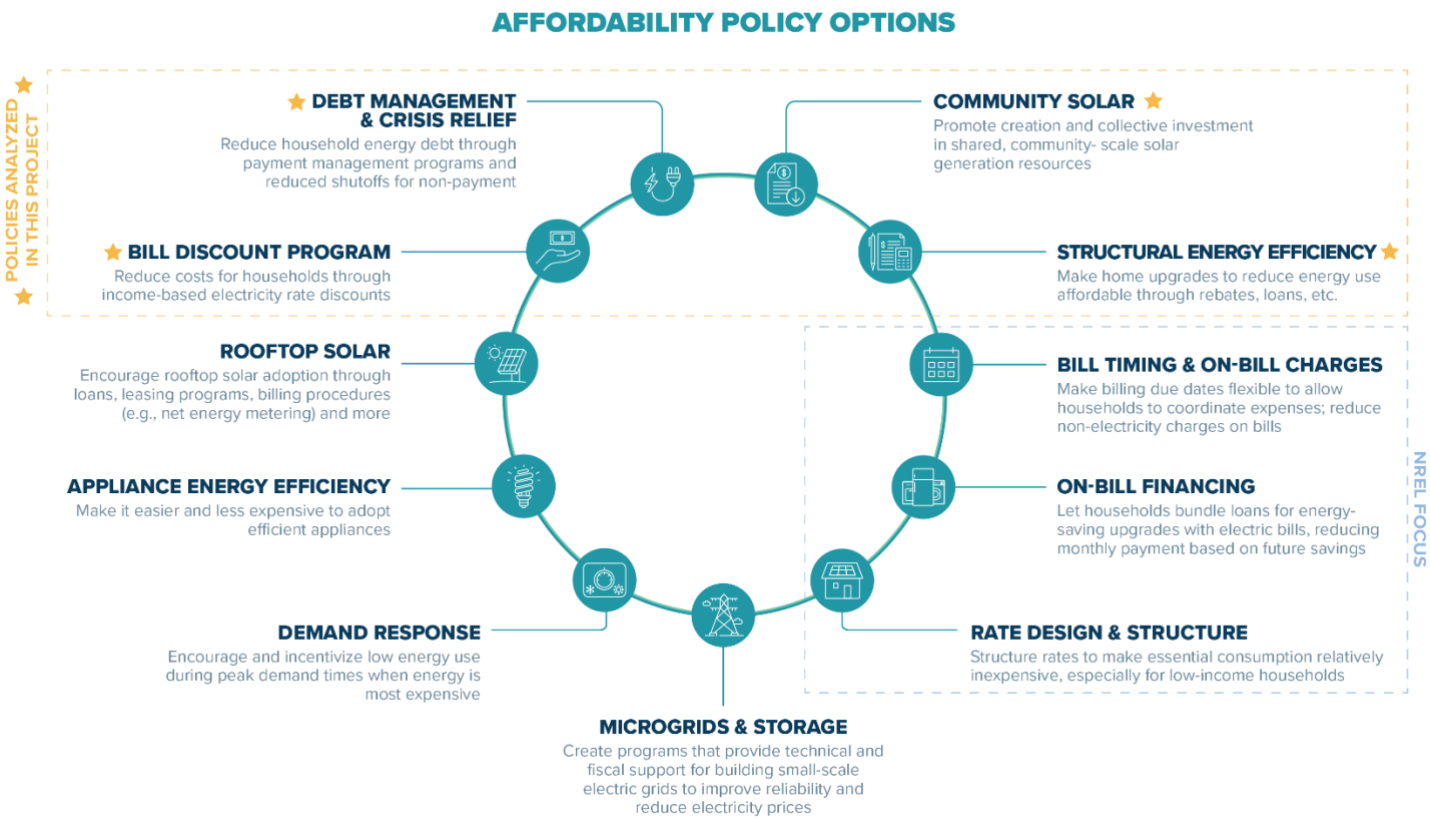

Figure 2. Energy Affordability Policy Options Identified and Selected for Analysis

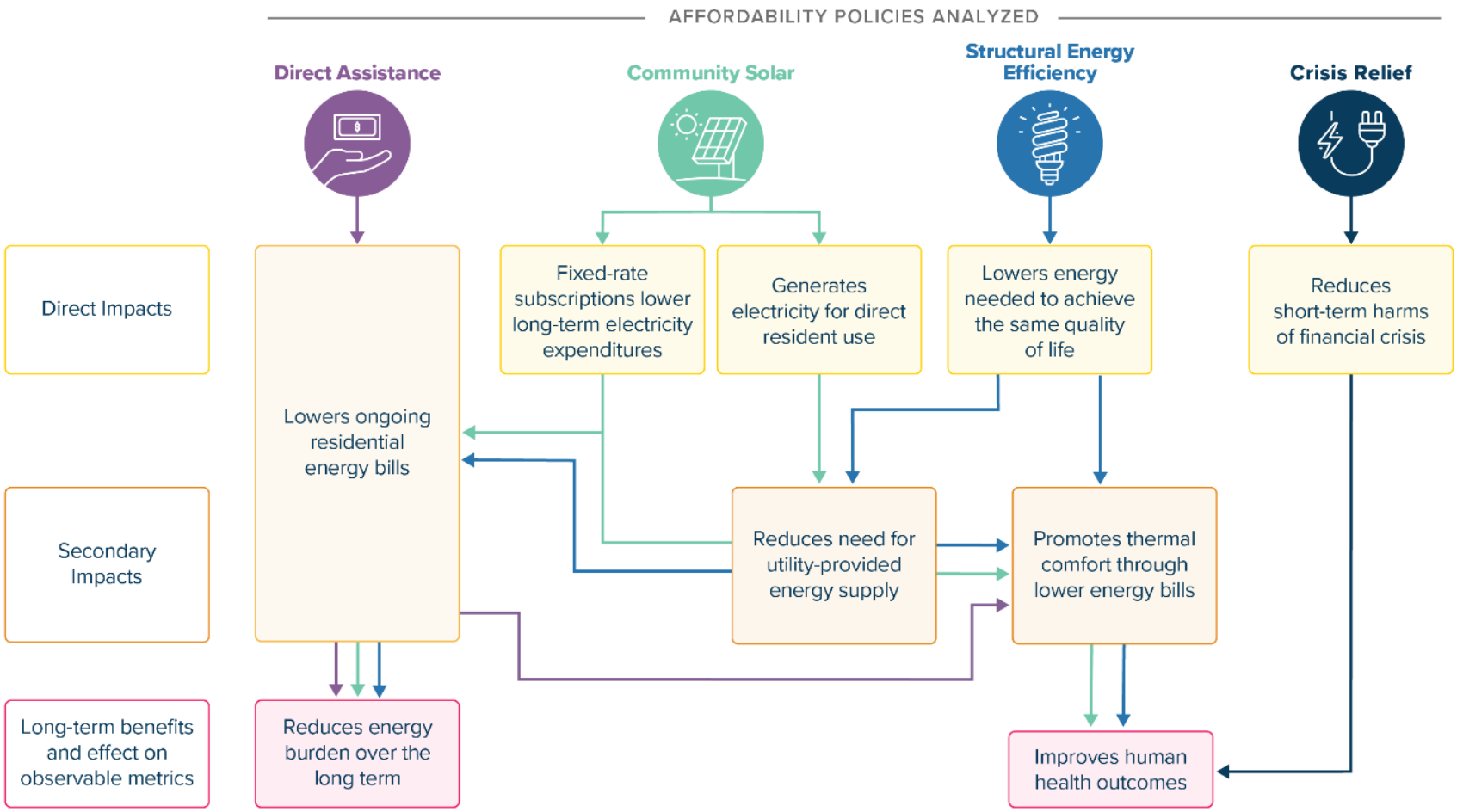

Figure 3. Logic Model of How Affordability Policies Produce Tangible Benefits

We characterized four elements of each policy area:

1. **Function:** How do they work? What distinct mechanisms and policy structures exist in each area, and how do they differ?

2. **Precedent:** Where have they been implemented, either by LADWP or in other service areas?

3. **Barriers:** What barriers exist that can present challenges to participation?

4. **Benefits:** What demonstrable benefits have been documented in existing implementation?

We presented the findings of this background analysis to the LA100 Steering Committee and requested input on which policy areas to prioritize. Based on the feedback we received, as well as a review of relevant National Renewable Energy Laboratory (NREL) analysis, we selected four policy areas to target for further analysis and actionable recommendations for LADWP (see Figure 2). The four target policy areas are indicated with stars in Figure 2 and described in more detail below.

ES.6.1 Community Solar

Although there are several distinct policy models within the area collectively termed "community solar," our primary focus is on facilitating expanded installation of rooftop solar in low-income multifamily residential developments. This would address a historical gap in access to rooftop solar programs — a gap largely resulting from "split incentive" barriers — that also delivers benefits to households that tend to be lower-income than those in single-family homes.

LADWP has recently acted in this area through the creation of the Virtual Net Energy Metering (VNEM) pilot program. VNEM is a method of allocating generated solar energy among multiple users; thus, in the case of a multi-family housing installation, solar energy can be virtually divided among tenant units and the property's non-housing areas. The VNEM pilot program offers incentives to install solar on low-income multifamily housing properties and deliver a portion of the benefits directly to tenants and is designed to work hand-in-glove with the CAMR program (discussed below). Because the VNEM pilot is very new, in the near term, we recommend LADWP focus primarily on gathering project performance data and evaluating how effectively the program reduces energy costs for low-income renting households. Depending on the outcome of this analysis, the utility will need to consider how to adjust program benefits and requirements and whether to decouple the VNEM program from CAMR in order to achieve affordability goals.

ES.6.2 Crisis Relief

In November 2022, the LADWP Board of Commissioners motion directed staff to halt the practice of water and power shutoffs as a debt collection tool for residents enrolled in EZ-SAVE,

Lifeline, and other related programs. This means that LADWP has recently instituted one of the most progressive utility shutoff moratoria in the country. Given this new moratorium, as well as the changes in policies and other circumstances due to the COVID-19 pandemic, it is difficult to establish a relevant historical baseline for debt levels in LA. Pre-pandemic data do not account for the utility's changing policies and intentions since the onset of the pandemic, and data from 2020 through 2023 do not provide an accurate baseline due to changing shutoff policies.

Overall, using multiple sources of evidence, we find that limiting residential shutoff protections is not justified by revenue recovery aims. One of the immediate goals of the limited, permanent moratorium is boosting discount program enrollment, given that is the underlying condition for protections. The effectiveness of the policy can be bolstered by the development of guardrails against potential customer abuse stemming from the permanent, limited moratoria and by further evaluating the moratoria's fiscal impact. As the Board motion mentioned, in the near term, further consideration must be given to ensuring shutoff protection via discount program enrollment and setting strict metrics for currently uncovered residential and small business customers. Moreover, LADWP must determine the feasibility of running a dedicated debt forgiveness program, within legal parameters, as an additional crisis relief measure alongside shutoff protections.

ES.6.3 Direct Assistance

LADWP already offers several direct assistance discount programs to ratepayers, the two most notable being EZ-SAVE (formerly the Low-Income Discount Program, or LIDP) and the Lifeline Rate program. Our analysis focuses on EZ-SAVE, as it is the most broadly accessible in terms of eligibility. EZ-SAVE is currently significantly under-enrolled compared to the pool of potential beneficiaries among LADWP customers. It also faces shortcomings in both how it determines eligibility (a federal poverty level-based threshold) and benefit levels (a simplistic flat monthly discount of approximately $8).

However, LADWP has recently reduced the administrative barriers to enrollment in EZ-SAVE. Enrollees now self-verify income eligibility, significantly reducing upfront time and effort associated with enrolling. Since the change, enrollment trends have seen a noticeable uptick.

Therefore, we recommend that LADWP's near-term efforts focus on continuing to promote EZ-SAVE enrollment using proven categorical eligibility and cross-enrollment streamlining techniques, along with gathering data and evaluating enrollment trends in order to maximize program penetration. In the longer term, we recommend the utility consider building upon EZ-SAVE's current discount model to make benefits more generous, particularly given the fiscal strain facing many low-income Angelenos coping with the high cost of living in Los Angeles. In particular, LADWP should consider integrating elements of the state-level CARE/FERA program (including its stepwise nature), as well as using rate-based discounts to supplement the flat amount currently provided by EZ-SAVE.

ES.6.4 Structural Energy Efficiency

As in other policy areas, structural energy efficiency programs have historically been relatively inaccessible to renters, who tend to have lower incomes than homeowners. Because energy efficiency upgrades (e.g., weatherization, electrification) necessitate investments by property owners but primarily benefit tenants, they fall victim to the split incentive problem. Thus, policy strategies that overcome this barrier and reduce energy bills for low-income renters are an area ripe for action.

LADWP has taken such action with the recent implementation of the Comprehensive Affordable Multifamily Retrofits (CAMR) program, which offers incentives to promote efficiency upgrades for low-income multifamily residential properties. The program aligns well with design elements we identified as priorities while conducting background analysis. However, it is also quite new, with no projects yet nearing completion. For that reason, we focus our analysis on strategies for LADWP to gather data proactively and evaluate the efficacy of the program as it progresses, with an emphasis on measuring real-world affordability benefits for low-income tenants. Based on evaluation results, the utility could consider adjusting elements of the program to achieve higher penetration and/or benefit levels.

A brief overview of our findings and recommendations in each area follows and is summarized in the figure below. Generally, we recommend focusing on data collection and evaluation of novel programs in the near term and on scaling up and expanding program activities and benefits in the long term.

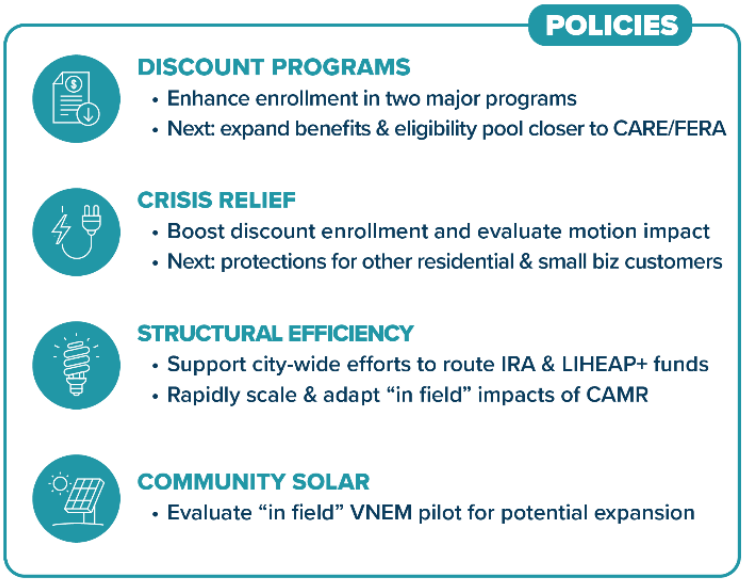

Figure 4. Energy Affordability Policy Summary Recommendations

ES.7 Energy Affordability Metrics

As the LA100 transition moves forward, LADWP will need to commit to tracking and transparently reporting on specific, quantitative affordability outcomes to assess whether equity and affordability goals are being realized. Capturing data that accurately reflects real-world outcomes calls for a multifaceted approach commensurate with the breadth of ways in which energy costs influence day-to-day life. At the same time, metrics must also be feasible to implement, necessitating reliable data collection options.

In the first stage of our analysis (see Figure 5, we reviewed the pros and cons of eight core metric categories to reduce energy burden.

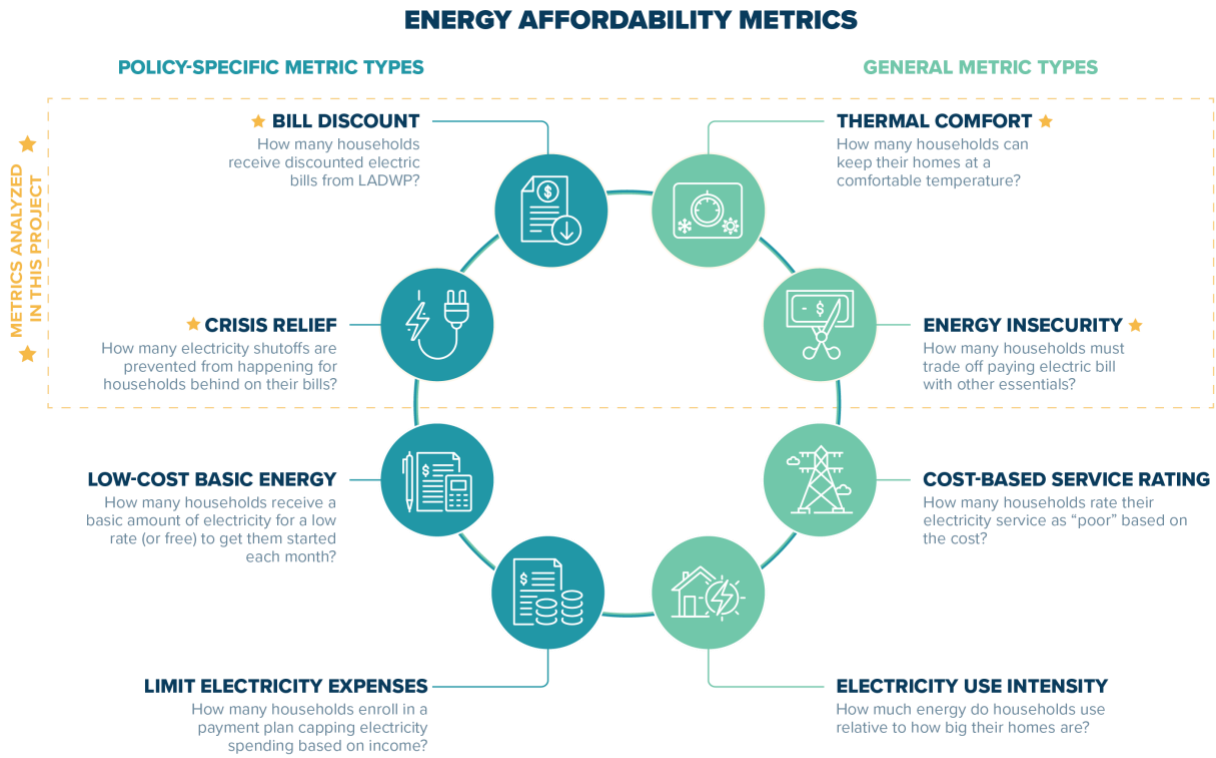

Figure 5. Energy Affordability Metrics Identified and Selected for Analysis

Based on the results of this background analysis and input from the LA100 Steering Committee and other stakeholders, the second stage of our analysis focused in more detail on four potential metric areas: Discount Programs, Crisis Relief, Thermal Comfort and Energy Insecurity.

ES.7.1 Discount Programs

Utilities often use discount programs to provide financial assistance to low-income customers. The major investor-owned utilities (IOUs) in California offer bill discounts through the

California Alternative Rates for Energy program (CARE), which was established by the California Public Utilities Commission (CPUC). The Family Energy Rate Assistance program (FERA) complements CARE by providing a smaller discount to customers who have marginally higher income than the CARE income threshold. LADWP currently offers two major bill discount programs: EZ-SAVE and Lifeline. Despite the widespread use of direct assistance discount programs, little research has been done into how well existing programs achieve affordability goals (Pierce et al. 2021).

These programs are the primary way in which LADWP provides financial assistance to low-income customers and therefore a key factor in ensuring electricity affordability. An entirely new way of delivering benefits is not necessary to improve electricity affordability. Rather, LADWP should measure the success of these existing programs and then adjust the framework and administration of the programs as needed.

There are three main program dimensions to measure: eligibility, enrollment, and benefits. Eligibility refers to the households that are qualified to enroll in these programs, which is typically determined by income and household size but can include factors such as age and medical condition or disability. Enrollment refers to the proportion of eligible customers who sign up to receive the discount, which is affected by barriers to enrollment, such as program awareness, stringent verification requirements, and inaccessible program administration. Benefits refers to the degree to which the discount program alleviates the financial burden of low-income customers' utility bills.

ES.7.2 Crisis Relief

The standards for substantial crisis relief interventions have grown rapidly in the last decade as utility affordability has become more of a concern, and even more so during the COVID-19 pandemic. While numerous temporary relief programs have emerged, as pandemic-related shutoff moratoria have been phased out, major utilities have large been expected to substantially reduce or eliminate shutoffs and provide debt relief on their own. However, few utilities have yet provided firm commitments on shutoff and debt levels metrics and long-term support programs, as opposed to publicizing input efforts and time-bound funding allocations.

LADWP's extension of a permanent (but limited) moratorium for vulnerable customers makes it both easier and harder to set new crisis relief metrics, compared to other affordability metric areas. In light of this policy, there is no need for open-ended exploration of potential crisis relief metrics. An important outcome for crisis relief is for LADWP to enroll as many eligible customers as possible in its discount programs and now-associated shutoff protections — a relatively straightforward approach. On the other hand, the establishment of a permanent, limited moratorium makes it harder to set additional crisis relief metrics, as it is difficult to compare pre- and post-universal moratorium shutoff rates retroactively in order to set a reasonable baseline for shutoff limitation targets. Moreover, new revenue management and customer engagement strategy metrics must be established.

ES.7.3 Thermal Comfort

"Thermal comfort" refers to households' ability to keep where they live at a comfortable indoor temperature. Thermal comfort becomes an affordability issue when a household forgoes or reduces use of cooling or heating equipment to save money on utility bills. Inability to afford utility payments can cause households to maintain unhealthy indoor air temperatures. This poses a significant public health hazard because heat stress leads to an increase in hospitalizations and mortality.

Little global guidance exists on thermal comfort in terms of a maximum acceptable temperature, although there are maximum temperatures established for some specialized facilities. Researchers and policymakers are beginning to explore maximum temperature policies for homes. At the city level, there is considerable momentum on support for policies ensuring indoor thermal comfort. LADWP has introduced measures to make it easier for low-income customers stay cool during heat waves. In addition to the need for policy support around a maximum temperature standard establishment and enforcement, there are practical nuances in the methodology of applying the metric of indoor thermal comfort given measurement limitations.

ES.7.4 Energy Insecurity

"Electricity insecurity" is a term used variously in academic literature to refer to several dimensions of energy affordability. For the purposes of this analysis, we define the term as the extent to which paying electricity bills constrains households' ability to pay for other essential goods or services that are core to health and welfare, and vice versa. The concept of energy insecurity and its associated metrics both overlap with other metrics and are subject to a set of factors outside of LADWP's control. Moreover, for LADWP customers, energy insecurity is intertwined with water insecurity because the two services are usually billed together.

The impacts of energy insecurity have been well documented recently, especially since the onset of the COVID-19 pandemic, but there is little precedent for adopting policy-relevant metrics. One challenge is that the list of relevant essential goods or services is subjective and differs across existing instruments. This suggests that the most feasible way to collect consistent data on energy insecurity is to survey households about trade-offs they have made between paying their electric bill and other essential services as an aggregate.

ES.7.5 Summary of Metric Recommendations

Two of the metrics discussed above (discount programs and crisis relief) relate to specific policies, whereas thermal comfort and energy insecurity can be used as metrics for success for a wider range of policy strategies. See Figure 6 for our core recommendations for adoption and tracking in these metric areas.

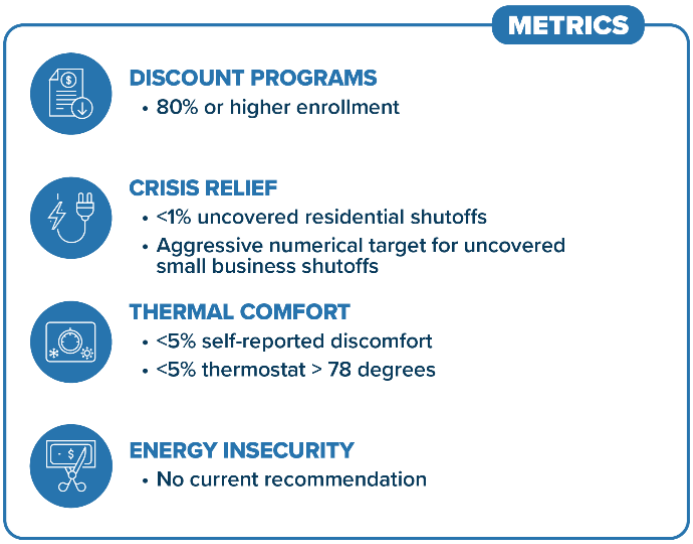

Figure 6. Energy Affordability Metric Summary Recommendations

ES.8 Next Steps

Ensuring energy affordability for all City of Los Angeles residents throughout the renewable energy and electrification transitions is likely to require decades of work. This report and the associated set of on-paper strategies begin this endeavor, but they by no means finish it.

In conjunction with stakeholders, LADWP has already begun to implement substantial, progressive policies to support affordability. The next stage of this work is to evaluate the pathways outlined in this report in discussion with residents, then commit to robust long-term metrics, a policy implementation framework, and a reporting process. This process must allow for iterative refinement, given inherent uncertainties in the climate, technology, and economic conditions which affect affordability.

As outlined in this report, UCLA is both a resident and customer of the city. The university is committed to continuing to support energy equity strategy implementation and evaluation well into the future, in collaboration with LADWP and community partners.

1 Introduction

The Los Angeles 100% Renewable Energy Study (LA100), published by the National Renewable Energy Laboratory (NREL) in March 2021, presented the Los Angeles Department of Water and Power (LADWP, or DWP) with several pathways to transition to 100% renewable energy by 2045. The transition to a fully decarbonized electricity grid constitutes a highly complex, multi-year effort necessitating significant investments in new infrastructure and renewable energy generating capacity, as well as accompanying technological upgrades. Even more ambitious, the Board of Water and Power Commissioners (the Board) chose to pursue the quickest, most demanding pathway of those laid out by NREL. The "Early & No Biofuels" scenario calls for LADWP to achieve 100% renewable energy by 2035, with no reliance on biofuels. Consequently, the investments and expenditures necessary for the transition will be even more concentrated in the coming years. This will have significant ramifications for the cost of energy for LADWP customers — especially low-income households. However, it will also create myriad benefits across environmental, public health, and fiscal dimensions.

The LA100 Equity Strategies effort was commissioned by the Board as a follow-up to NREL's initial LA100 study to evaluate and identify strategies to address the transition's fiscal impacts on ratepayers. Because utilities like LADWP must typically recover costs (such as investments associated with the renewable energy transition) through increased revenue via rates and feeds on customers, the LA100 transition will impact energy affordability for Angelenos. This poses equity- and economic justice–related challenges for the utility, as many low- and moderate-income LA households already face fiscal stress from energy bills, inflation, and LA's high cost of living.

The LA100 Equity Strategies study is a joint effort between LADWP, NREL, and UCLA. Within the UCLA team, several units have collaborated, and have been coordinated by the UCLA Sustainable LA Grand Challenge. UCLA analysis teams are led by the Luskin Center for Innovation, the Center for Sustainable Cities (CCSC) within the Institute of Environment and Sustainability (IoES), the Center for Neighborhood Knowledge, the Latino Policy and Politics Institute, and the School of Law. The respective efforts of these entities are distinct but complementary. Modeling and analytical work by NREL and CCSC has assisted in prioritization and analysis of policy strategies. Legal analysis is also an integral part of this work, as the legal landscape fundamentally determines the policy terrain in which LADWP must operate as it pursues affordability goals.

Our approach throughout this effort has been to draw on a large, diverse set of rigorous data sources. We have utilized a plethora of quantitative and qualitative data sources to assess baseline affordability conditions and analyze energy affordability metrics and policies for LADWP to implement. On the quantitative side, we reviewed data from five different tools (see Data and Methods below) to characterize a variety of factors, including energy consumption, customer data and profiles, knowledge and opinion data, and structural information. We also reviewed several recent reports published by LADWP or affiliates as well as numerous academic publications on energy policy, affordability, and related topics. Throughout the study, we integrated guidance and input from stakeholders, especially the LA100 Steering and Advisory Committees. This input was particularly useful as we finalized which metrics and policies to prioritize for deep analysis. We also drew from on-the-ground expertise of LADWP staff with

intimate knowledge of the utility's inner workings, as well as existing affordability-focused efforts via interviews.

It is worth emphasizing that affordability is a broader and more complex concept than rate figures or average bill costs can capture. Energy affordability and energy burden interact with a multitude of other fiscal stressors affecting in-need LA households. Additionally, LADWP's billing structure — which covers four different services in many combinations — creates complexity that can exacerbate affordability concerns. This structure makes it difficult for households to prioritize which bills to pay and can negatively interact with assistance programs that have mismatching eligibility requirements. The way LADWP approaches rate structures and other revenue-generating mechanisms also profoundly affect energy costs encountered by in-need households, which can in turn affect other quality of life factors, like health. For this reason, we devote special attention to LADWP ratemaking procedures and the revenue implications of changes to low-income household energy costs in our Baseline Affordability Analysis. Equally important in this discussion is the legal framework that underpins LADWP's ratemaking — especially the possible limitations that Propositions 26 and 218 place on the restructuring of electricity rates and affordability programs without voter approval. Because legal considerations will have a fundamental influence on the utility's ability to implement certain affordability solutions, our analysis of Legal and Regulatory Constraints on Ratemaking precedes the Baseline Affordability Analysis.

Having addressed the legal and customer-side affordability status quos, the bulk of our forward-looking analysis examines energy affordability metrics and policies for LADWP to implement in the near- to long-term. At the most basic level, these analyses revolve around two themes:

1. How can LADWP maximize energy affordability while simultaneously mitigating the adverse cost impacts and equitably distributing the benefits of the LA100 transition?
2. How should LADWP gather data and measure outcomes in order to accurately gauge the success of these efforts, maximize transparency, and foster public accountability?

We closely examine four categories of metrics — discount program enrollment, crisis relief, thermal comfort, and energy insecurity — laying out potential specific operationalization options and targets, their mechanisms, the feasibility of data collection and measurement over time, and other pros and cons. In each of the first three we recommend specific targets for LADWP; no action is recommended in the energy insecurity area at this time, for reasons discussed in the energy affordability metrics section.

Similarly, we identify and discuss in detail four policy areas with high benefit potential for LADWP: discount programs, structural energy efficiency, community solar, and crisis relief. These strategies are diverse in their mechanisms and how they influence affordability and create co-benefits, creating a complementary suite of approaches for LADWP to consider. Our analysis and recommendations are closely tailored to current state of the utility's efforts in each area, as LADWP has been active in exploring new policy models and making progressive administrative changes where some of these policies are concerned. In short, we do not call for new programs as much as the enhancement of existing ones. We predominantly focus our recommendations on what we assess to be the most timely and impactful efforts to emphasize, recommending data gathering and evaluation for newer programs in some cases and larger reforms for others.

2 Data and Methods Overview

To undertake this work, we synthesize data from five major types of sources and analyze these data using a mix of quantitative and qualitative research methods. We chose to use a mixed methods research approach, rather than using a single original survey or statistical modeling design, in part to better facilitate replication and refinement of a sustainable analysis and strategy architecture by LADWP and its partners in the future.

Our methodological approach complements, but differs from, the majority of the quantitative analysis in the Equity Strategies project. This difference is particularly notable with respect to the modeling of future affordability impacts undertaken by NREL researchers. The outcomes of this important and insightful research can be found in Chapter 5 of NREL's report. However, an important distinction between NREL's affordability modeling and UCLA researchers' quantitative work is that NREL's models use simulated household energy consumption data based on a sample of LA households. NREL's simulations and computing power are crucial to understanding the potential long-term impacts of both decarbonization and various policy impacts on customer affordability and LADWP revenues, especially in the case of impacts related to rate design and on-bill financing.

By contrast, our main data source categories for affordability analysis are detailed through the analysis but summarized here in five major categories below. Using these data sources, we produce four interrelated analyses that use different data sources and methods.

Several of these data sources are updated on an ongoing basis, and most are public, which may facilitate long-term evaluation of LA100 metric achievement and policy effectiveness. We do not provide an extensive analysis of the validity of these data sources, but rather summarize themes and lessons learned from these data sources as they relate to affordability considerations, metrics, and policies.

2.1 Major Data Source Categories

In the course of our analysis we drew on data from a variety of sources, across five major categories:

1. Existing primary quantitative, representative, or census-type household and customer data, including:

    a. LADWP customer level data shared through the UCLA California Center for Sustainable Communities' Energy Atlas.

    b. Recurring external survey sources such as the Loyola Marymount University's Los Angeles Public Opinion Survey and the California Energy Commission's Residential Appliance Saturation Study.

2. Secondary sources including published reports and presentations by LADWP, as well as other city offices including the Office of Public Accountability and City Controller.

3. Direct stakeholder input, including from LA100 ES Steering and Advisory Committees and NREL-led listening sessions.

4. Academic and peer utility literature review.

5. LADWP administrative staff interviews.

2.2 Primary Quantitative Data Sources

At the outset of our engagement, the UCLA Luskin Center for Innovation (LCI) and LADWP envisioned deploying an extensive household-level energy affordability survey[1] linked to LADWP customer bills. After developing a draft survey and vetting survey feasibility with firms and partners, including CCSC, NREL, and LADWP's customer service division, we determined that a new survey-centered approach had limited utility and feasibility at this time, and so discarded this approach.

Moreover, after identifying and reviewing available data sources that measure household level energy burden and insecurity in Los Angeles, it became clearer that there are a number of other existing robust data sources and partners that already measure aspects of energy affordability in the City of Los Angeles, either utilizing a representative sample or census approach of city households or targeted large sample of "in need" households, which can be utilized now and over time. We supplement these data sources with new insights from NREL-led listening sessions conducted with City of Los Angeles households, and data shared directly via LADWP, including some internal one-off survey efforts.

2.2.1 Overview of Primary Data Sources Used to Characterize Profile

Below, we describe the main household- and customer-level data sources that we used in this analysis. The following are the primary household- or customer-level quantitative data sources, in order of relevance[2]:

- UCLA Energy Atlas (California Center for Sustainable Communities)
- Los Angeles Public Opinion Survey (Loyola Marymount University (LMU))
- Residential Appliance Saturation Study (California Energy Commission)
- Customer and Program Enrollment Data and Analysis (LADWP Customer Service)
- Los Angeles County Quality of Life Index (UCLA Lewis Center)

[1] See Appendix 7 for more details.

[2] Other data sources considered and used elsewhere in LA 100 Equity Strategies analysis include NREL's Distributed Generation Adoption (dGen) model. It was originally envisioned that the results of LADWP's "Customer Connections Survey," which focuses on affordability and the broader experience of customers who received debt relief assistance during the pandemic, could also be used for this analysis, but the timing of survey deployment was extended and thus did not allow for inclusion in this phase of the research.

We corroborated our findings using other publicly available sources, such as Census block group data, and previous LCI energy and transportation affordability surveys.

2.2.1.1 UCLA California Center for Sustainable Communities (CCSC) Energy Atlas

We utilized LADWP's residential billing and energy use data from 2018-2021 for this analysis. CCSC coordinated and conducted the transfer, storage, geocoding, and querying of LADWP customer bill-level data. It has been an integral connector in UCLA's LA100 Equity Strategies research and maintain a wealth of knowledge on energy use across California — available to the public through the UCLA Energy Atlas. The Energy Atlas data can be matched to other Census block group-level data to do analyses about energy burden across the LADWP region. More information about the specific Energy Atlas data and methods that were used in this research can be found in Appendix 5.[3]

Data Included

- Electricity (and natural gas consumption-*pending*) at the customer level.
- Building age and additional attributes.
- Shutoff levels and arrears, 2017-2020
- Customer rate schedule and bill level, discount program enrollment–
- List of variables: https://ucla.app.box.com/s/wemv75nvgg9ov63dhc9rw5lrlf806raq.

Limitations

- Data can only be viewed and analyzed by those a part of the NDA with LADWP.
- Data is only able to be reported publicly at the block group scale.

2.2.1.2 LMU 2014-2021 Los Angeles Public Opinion Survey

LMU conducts a public opinion survey of Los Angeles city and county residents on a variety of topics, which includes socioeconomic variables of interest. They have issued this survey from 2014 through 2021.[4]

Data Included

- Attitudes toward utilities and their general performance over time (2019-2021).
- Knowledge of, participation in, and attitudes toward discount and other energy programs (2021).
- Knowledge of and interest in (limited) clean energy sources (2019).
- Support for paying more for clean energy (2020).

[3] Also see https://energyatlas.ucla.edu/.
[4] See https://lmu.app.box.com/s/g2w9411eyb9qfgzcruwsqjc56qf5f438.

Limitations

- Highest geographic resolution of respondents is zip code.
- Questions are fairly general for policy development purpose.

2.2.1.3 Residential Appliance Saturation Study (RASS)

In 2019, the California Energy Commission issued a statewide household survey to customers in the three main investor-owned utilities (IOUs) and two largest publicly owned utilities (POUs) (including LADWP, with a sample of about 2,000 households in the city) to estimate their energy consumption based on appliances. The RASS survey has been deployed by the Commission on irregular intervals since 2003. More information can be found at https://webtools.dnv.com/CA_RASS/.

Data Included

- Demographic info including income, race/ethnicity, etc.
- Household attributes including insulation, window type, and number of bedrooms.
- Modules include electric vehicle access, space heating, space cooling, water heating, laundry, food preparation, refrigerators, freezers, spas and hot tubs, entertainment and technology, lighting, miscellaneous, on-site renewable energy technology.
- Fuel types of these household appliances.
- Survey instrument accessible at: https://webtools.dnv.com/CA_RASS/Uploads/CEC-200-2021-005-APA-P.pdf.

Limitations

- Uncertain exactly when future rounds of survey data will be available, and how frequently.
- Limitation on geographic resolution of respondents.

2.2.1.4 LADWP Customer and Program Enrollment Data (Customer Service Division)

In a current effort, LADWP's customer service division has aggregated contemporary LADWP customer-level enrollment data (Nov 2019-present) in low-income/at need affordability-related programs currently offered by LADWP and matched those to Census characteristics at the block group scale, as well as performed an assessment with staff of potential future program development.

Data Included

- Enrollment levels in key LADWP financial assistance programs, which may be matchable to the UCLA Energy Atlas.
- Average power and water consumption, monthly bill (trailing twelve months).
- Average monthly bill (trailing twelve months), premise type.

- Shutoff levels and arrears, 2017-2020
- Community socio-economic data from the Census.

Limitations

- Does not include all LADWP programs of interest to LA100 Equity Strategies.

2.2.1.5 UCLA Lewis Center Quality of Life Index

The UCLA Quality of Life Index is an annual survey of Los Angeles County residents aimed at measuring individuals' perception of the quality of their life. Respondents are asked to rate the quality of 40 aspects of life organized into 9 categories, as well as the relative importance of each to them. The survey touches upon electricity affordability in the cost of living section, which asks respondents about satisfaction with utility cost and relative importance compared to other household expenses.

Data Included

- Satisfaction with what residents pay for basic utilities, such as electricity.
- Importance of utilities as a factor in cost of living, compared to other essential expenses.

Limitations

- Does not differentiate between electricity and other utilities.

2.2.2 Recent published reports and presentations by LA City or LADWP-affiliated entities

Rather than recreate past knowledge, we also rely heavily for quantitative and qualitative data on the LADWP website and published annual financial records, LADWP's Equity Metrics Data Initiative (EMDI) reports, and LADWP board meeting documents and presentations. In other words, we rely on the published expertise and analysis of LADWP staff wherever possible.

Other city data sources we rely on include several reports authored by the city's Office of Public Accountability (OPA) which was established in 2011 to "provide public independent analysis of department actions as they relate to water and electricity rates." OPA regularly publishes reports reviewing LADWP rates, programs and discounts. Additional reports include examples such as an analysis by the LA City Controller office in 2020 evaluating the effectiveness of the City utility discount programs. The report offered strategies for improving program impact as well as for preventing waste.

2.2.3 Stakeholder input, including from LA100 ES Steering and Advisory Committees.

We also brought to this project a historical understanding, experience and network of relationships which enabled ready social and political knowledge of the L.A. region. Our established, trusted relationships with regional and local stakeholders provide complementary qualitative insights that were critical to sharpening our analysis on specific metrics and policies, based on broader LA and California specific policy conversations.

In addition to informal information gathering and contextual understanding, we engaged in the formal LA100 ES Steering Committee and Advisory Committee processes facilitated by Kearns and West. We presented at and discussed our analysis with committee participants at the below steering committee meetings, as well as a set of follow-on advisory committee meetings. As described below, at the July 20, 2022 meeting we solicited input and conducted a poll of metrics and policy options, which directly informed the focus of our second-stage analysis on. We also conducted polling regarding the preliminary results of our second-stage analysis which we presented at the March 15, 2023 meeting.

- March 23, 2022- LCI
- July 20, 2022 SC- LCI
- November 16, 2022 — School of Law only
- March 15, 2023 SC meeting — LCI and School of Law

As described more extensively in Chapter 2, NREL led several rounds of listening sessions in partnership with community-based organizations in LA City. LCI staff informed the first round of Listening Session Guide Questions and helped with transcription and lessons learned from sessions in 2021. We also learned from and incorporated session findings which took place in 2022. We cite lessons learned from specific sessions in our analysis below.

2.2.4 Academic and peer utility literature review

For each of the analysis sections following, but especially for the metrics and policy sections, we conducted separate reviews of the relevant U.S. academic literatures. We also conducted a review of metric and policy practices by comparator utilities, both in California and nationally, which informs each of our analyses. For the section addressing legal and regulatory constraints we reviewed publicly available legal materials, including California statutory law, regulations, and case law, as well as the Los Angeles City Charter and Codes. We also consulted secondary analyses of these laws and regulations.

2.2.5 LADWP administrative staff interviews

While we consulted with LADWP staff and reviewed public documents throughout our analysis process, we conducted 60 minute interviews with multiple LADWP staff in the Customer Service; Resource Planning, Development and Programs; and Efficiency Solutions units respectively in the second half of 2022. These interviews focused largely on challenges related to

ongoing program administration, contemporary efforts to improve or modify programs and procedures, and gaining insight into the performance of novel or recently modified programs. Information gained from these interviews particularly informs the policy strategy analysis section of this report.

3 LADWP's Legal and Regulatory Constraints on Ratemaking

3.1 Introduction

As explored through both the LA100 and LA100 Equity Strategies studies, Los Angeles' transition to 100% renewable energy will necessitate changes to LADWP's commercial, industrial, and residential electricity rates. Changes to LADWP's rate structures have the potential to support vulnerable ratepayers through more robust discount programs, while also offering widespread equity and reliability benefits for Los Angeles as a whole. However, LADWP does not have complete control over the rates it sets; rate changes are subject to a complex legal landscape. In the following sections, we focus on residential energy affordability, investigating the potential policy levers and metrics for ensuring energy access and affordability throughout Los Angeles' decarbonization process. In this section, we describe the relevant legal landscape to help readers to understand the department's current rate structure, how this structure originated and evolved, and the regulatory constraints DWP faces in ratemaking moving forward.

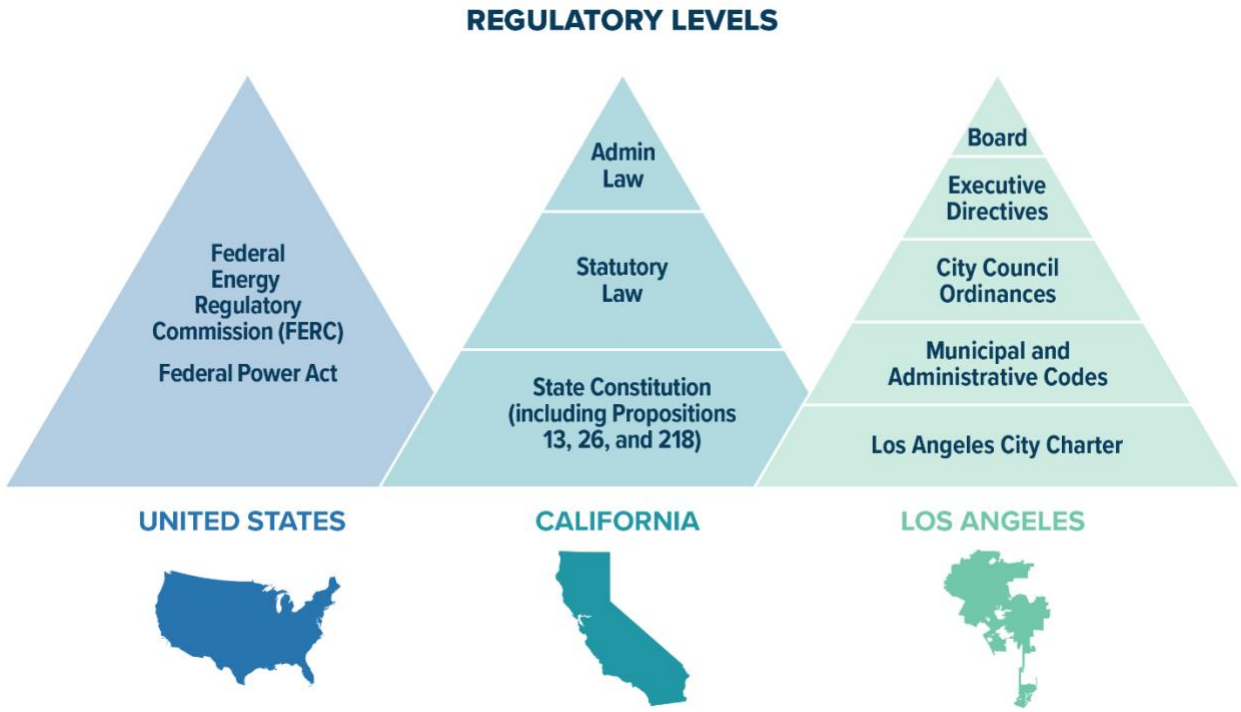

Figure 7. Levels of Regulation for LADWP Ratemaking

3.1.1 Electric Utilities in the United States

Generally, electric utilities in the United States fall into one of three categories: investor-owned utilities (IOUs), rural cooperatives (co-ops), and publicly owned utilities (POUs) (EIA 2019). POUs include both municipally owned utilities (MOUs), and federal power agencies, such as the Tennessee Valley Authority (American Public Power Association 2022).

The majority of customers in the U.S. are served by investor-owned utilities: 178 IOUs that exist in the U.S. serve 67% of all electricity customers. Across the country, there are also 856 co-ops serving 13% of the country's customers, mostly in rural areas that IOUs deemed poor candidates for electrification in the early 20th century (Hanna et al. 2022). Most customers not served by an IOU or co-op get electricity from a POU: there are currently about 2,003 publicly owned utilities serving 15% of customers across the country (Hanna et al. 2022). POUs serve a relatively small proportion of customers because the majority of these utilities operate in small towns or communities and do not own generation or transmission infrastructure. Only about 32% of POUs produce any of their own electricity, and of these the vast majority produce five megawatts or less, whereas LADWP's load is over 8,000 megawatts (Homsy 2018, LADWP 2021).

Thus, as a POU, LADWP is unique for two main reasons. First, it serves approximately 4 million residents, including 1.5 million unique customer accounts, within the city of Los Angeles. Second, it is vertically integrated, meaning it owns and operates its own generation, transmission, and distribution infrastructure (LADWP 2021).

In California, there are three major IOUs: Southern California Edison (SCE) serves 15 million residents across Southern California (Southern California Edison 2019). Pacific Gas & Electric (PG&E) serves 16 million residents in Northern California (PGE n.d.); and San Diego Gas & Electric (SDG&E) serves 3.7 million residents in San Diego and Orange counties (San Diego Gas & Electric n.d). The state also has three other IOUS and two major MOUs, LADWP and Sacramento Municipal Utility District (SMUD) — which serves 1.5 million residents, including 649,000 unique customer accounts, in the capital city of Sacramento and the surrounding region (SMUD 2021). As of 2022, the state's list of electric utilities, or load serving entities (LSEs), also included 46 other MOUs, 26 CCAs and 4 Co-ops.[5]

3.1.2 Electric Utility Regulation

Regulation of privately owned electric utilities in the United States is rooted in two legal and economic concepts: first, that utilities are *affected with the public interest*, or that the provision of energy is an essential service for society, and second, that utilities are *natural monopolies*, or that it is both desirable and economically predestined for a single firm to serve all customers in a given area (RAP 2011). These concepts were foundational in the early 20th century development of U.S. utility regulation as regulatory authority moved from the municipal to the state and then federal level (Tuttle et al. 2016). The 1935 Federal Power Act gives the Federal Energy Regulatory Commission (FERC) jurisdiction over interstate electricity transmission and wholesale electricity markets (Ibid). Within individual states, IOUs and their ratemaking are overseen by regulatory commissions — called utility regulatory commissions (URCs), public utilities commissions (PUCs), or public service commissions (PSCs) (RAP 2011). States vary widely in their regulation of IOUs, and many states — including California — also set out requirements for POUs through state constitutions and statutory and administrative law.

[5] List of California Load Serving Entities, https://www.energy.ca.gov/sites/default/files/2022-07/California_Electric_Load-Serving_Entities_Updated_2022-06-30_ADA.xlsx

3.1.3 Where does LADWP fit in?

As the nation's largest MOU, LADWP has a distinctive opportunity to embrace the clean energy transition, setting an example for other utilities across the country and improving the lives of Angelenos. This transition will include a variety of environmental, health, and reliability benefits, but it will also require significant capital investment in renewable generation resources, distribution grid upgrades, and new transmission infrastructure. Projections for these capital costs and the associated rate increases have been explored in both LADWP's internal Strategic Long Term Resource Plan (SLTRP) and in the LA100 Equity Strategies affordability work by NREL, led by Thomas Bowen (see Chapter 5).

The renewable energy transition will be expensive; LADWP's most recent SLTRP estimates costs between $60 and $81 billion over the next three decades (LADWP 2022). REL's work demonstrates potential pathways to mitigate its effects on energy affordability — especially for residents who are already burdened by their electricity bills. The sections that follow delve into the current state of LADWP's affordability programs, as well as potential metrics and policies to ensure affordability moving forward.

All this work is crucial to inform LADWP's and the city's decisions on which potential policy levers or rate structure changes to implement, as well as how to implement them. However, the process of implementing these changes is not necessarily straightforward. As alluded to above, energy regulation is complicated, and LADWP must consider a variety of laws and regulations from different authorities when setting electricity rates.

The following sections step through some of the municipal, state, and federal rules that underpin LADWP's ratemaking authority. This section is not comprehensive; it presents these laws and regulations for a general audience, as understanding these constraints is a crucial step in creating a successful movement for affordability-focused rate reform. The section concludes by briefly exploring current residential rate structures and the history of LADWP's discount programs through the lens of the laws and ordinances that have shaped them.

3.2 California State Law

A natural place to start when discussing utility regulation, and how it affects LADWP, is at the state level — including California laws, regulations, and Constitution.

3.2.1 Statutory Law: Public Utilities Code

California's Public Utilities Code, contains the statutory laws concerning the state's utilities, including electricity and natural gas providers, private energy producers, telecommunication services, and transit authorities. It includes 33 divisions, hundreds of chapters, and thousands of individual statutes.

Much of Division 1, Chapter 2 of the Public Utilities Code concerns the creation and responsibilities of the California Public Utilities Commission (CPUC), which is tasked with regulating the IOUs that have been given the right to operate as monopolies within their service

territory. Because LADWP is a POU, regulatory oversight by the CPUC is not required, as POUs are meant to be directly responsive to the residents they serve. That being said, LADWP is still beholden to other state laws and regulations, including the following portions of the Public Utilities Code that specifically concern "local publicly owned electric utilities" like LADWP:

Section 224.3 defines a "local publicly owned electric utility" as a "municipality or municipal corporation operating as a 'public utility' furnishing electric service…" (Cal. Pub. Util. Code § 224.3). This applies to LADWP, and therefore, all sections referring to *local publicly owned electric utilities* are relevant for LADWP.

For example, Sections 385 and 386 (Division 1, Chapter 2.3, Article 8: *Publicly Owned Utilities*) set out a variety of requirements for local publicly owned electric utilities. **Section 385** requires that these POUs establish usage-based charges to fund demand-side management, renewable investment, research and development, and low-income services — and that this funding is set aside at levels reflecting those required of IOUs (Cal. Pub. Util. Code § 385 (a)). Further, it directs utilities that had not implemented low-income energy efficiency and discount programs as of December 2000 to assess the need for and implement programs if necessary (Cal. Pub. Util. Code § 385 (b-c)).

Section 386 specifically addresses low-income affordability within POUs, requiring that they ensure that low-income families can afford electricity, either through direct assistance or energy efficiency measures, and that these programs are continuously adjusted to reflect the level of need. The full text of this section reads:

a) Each local publicly owned electric utility shall ensure the following:
    1. Low-income families within the utility's service territory have access to affordable electricity.
    2. The current level of assistance reflects the level of need.
    3. Low-income families are afforded no-cost and low-cost energy efficiency measures that reduce energy consumption.
b) The local publicly owned electric utility shall consider increasing the level of the discount or raising the eligibility level for any existing rate assistance program to be reflective of customer need.
c) A publicly owned electric utility shall streamline enrollment for low-income programs by collaborating with existing providers for the Low-Income Home Energy Assistance Program (LIHEAP) and other electric or gas providers within the same service territory.
d) A local publicly owned electric utility shall establish participation goals for its rate assistance program participation (Cal. Pub. Util. Code § 386).

Statutes concerning POUs are also located in other parts of the Public Utilities Code. For example, Division 4.9, titled *Restructuring of Publicly Owned Electric Utilities in Connection with the Restructuring of the Electrical Services Industry*, includes **Sections 9600** through **9622**, which set out requirements and guidance that have governed POUs since the electricity industry in California was restructured. Subjects covered include the creation of and interaction with the Independent System Operator, the development of irrigation districts, data sharing and reporting requirements for air pollution, energy efficiency requirements, and requirements for planning and reporting on system reliability (Cal. Pub. Util. Code Div. 4.9). Specifically, **Section 9606** requires that city-owned electrical utilities report the amount expected to be transferred to a

city's general fund on periodic bills (Cal. Pub. Util. Code § 9606). **Sections 9621** and **9622**, which were added in the past decade, establish requirements for developing integrated resource plans (IRPs) (Cal Pub. Util. Code § 9621) and the submission and review of these plans to the California Energy Commission (Cal Pub. Util. Code § 9622).

3.2.1.1 Public Utility Code Statutes Concerning IOUs (Not LADWP)

Although the following discussed statutes concern IOUs, and therefore do not apply to LADWP specifically, they are useful for reference. That is because, for IOUs, the CPUC's regulations are integral to their operations — including ratemaking, affordability, infrastructure, and planning (Warwick 2002).

Many other sections of the Public Utilities Code concern the CPUC and the regulation of IOUs, as this is the primary mechanism of oversight for these utilities. Here are a few examples:

- **Sections 381.4**, **381.5**, **382**, and **382.1** are all specifically relevant to the topics of affordability for the IOUs.
- **Sections 381.4** and **381.5** both address energy efficiency programs.
- **Section 382** directly addresses energy affordability and the CPUC's responsibilities in ensuring residents can pay for their gas and electricity. For example, a subdivision of this section reads:

  > (b) In order to meet legitimate needs of electric and gas customers who are unable to pay their electric and gas bills and who satisfy eligibility criteria for assistance, recognizing that electricity is a basic necessity, and that all residents of the state should be able to afford essential electricity and gas supplies, the commission shall ensure that low-income ratepayers are not jeopardized or overburdened by monthly energy expenditures. Energy expenditure may be reduced through the establishment of different rates for low-income ratepayers, different levels of rate assistance, and energy efficiency programs. (Cal. Pub. Util. Code § 382(b)).
- **Section 382** (particularly section **382.1**) addresses the establishment and responsibilities of a Low-Income Oversight Board for the IOUs, tasked with ensuring access to energy efficiency programs, reporting to the Legislature, and assisting in streamlining program enrollment and funding.

3.2.2 Administrative Law: California Energy Commission — Title 20 and the Renewables Portfolio Standard

In addition to the Public Utilities Code established by the CPUC, LADWP is also regulated by Title 20 of the California Code of Regulations ("Public Utilities and Energy"), which is set by the California Energy Commission (CEC. Title 20, Division 2 directs the creation and responsibilities of the CEC and establishes data and reporting requirements for utilities, energy conservation and appliance standards, power plant siting rules, environmental requirements, and greenhouse gas performance standards (Cal. Admin. Code tit. 20, Div. 2).

Chapter 13 of Title 20 governs enforcement of the state's Renewables Portfolio Standard (RPS) for POUs like LADWP (Cal. Admin. Code tit. 20, Div. 2 Ch. 13). The California RPS was officially established in 2002 by Senate Bill 1078, which created a 20% renewable procurement

goal for IOUs and required the state's POUs to develop and implement their own RPSs (Cal. Pub. Util. code § 387).

From 2004 through 2010, LADWP set its own RPS goals through city council resolutions and board of commissioners actions. These included a goal of 20% renewable energy by 2017 and 13% renewable energy by 2017, which were amended to 20% renewable energy by 2010 and 35% by 2020 (LADWP 2013).

The 2011 California Renewable Energy Resources Act (SB X1-2) required that *both* investor-owned and publicly owned utilities procure increasing percentages of their electricity from renewable sources. Upcoming milestones in the RPS (which have since been amended by Senate Bills 350 and 100) currently require 44% renewable procurement by 2024 and 52% renewable procurement by 2027, with 100% carbon-free resources by 2045 (De León 2018).

State RPS regulations may seem redundant in the case of Los Angeles, given that the city council has directed LADWP to aim for 100% renewable energy by 2035. However, it is still useful to remember that the state has direct oversight of this process. LADWP must report its electricity generation sources to the CEC, which is tasked with certifying and verifying renewable energy resources procured by POUs and monitoring their compliance with the RPS (Cal. Adm. Code tit. 20, Ch. 13). The CEC is also tasked with referring a failure of POU compliance to the California Air Resources Board (CARB), which may then impose penalties for noncompliance (Cal. Adm. Code tit. 20, § 1240(g)).

3.2.3 California Constitution and Propositions 13, 218, and 26

Because LADWP is a department of the City of Los Angeles, it is beholden to aspects of the California Constitution that concern municipal operations and funding, including amendments added via statewide ballot propositions and voter initiatives.

When it comes to constraints on LADWP's ratemaking, arguably the most visible and challenging is Proposition 26, a statewide initiative that amended the California Constitution in 2010 (Hoffman et al. 2021). In short, this proposition introduced new definitions of "taxes" that encompassed — and thereby limited the levying of — many municipal fees and charges, including things like rate subsidies. To understand the full context and limitations imposed by this proposition, it is also important to consider the previous changes to California's tax law that it builds upon, including Propositions 13, 62, and 218.

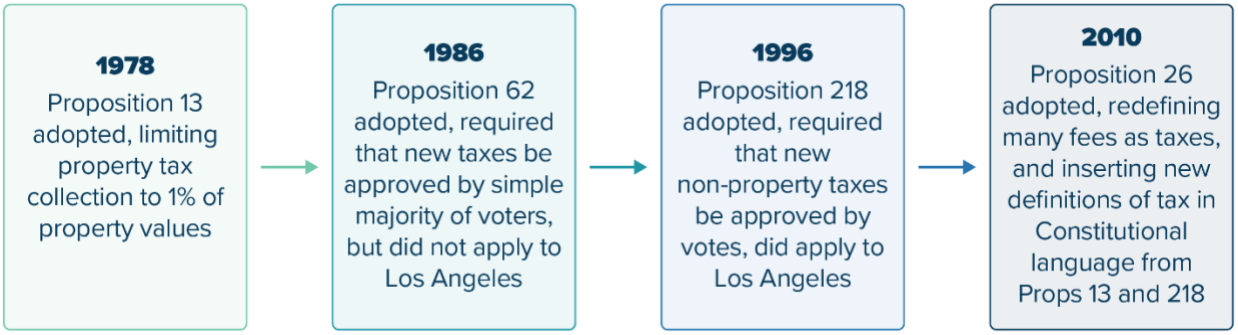

Figure 8. Historical trajectory of Propositions 13, 62, 218, and 26

Proposition 13: In 1978, amid dramatic increases in market-value-tied property taxes, a large state budget surplus, and growing frustration among wealthy homeowners, 65% of Californians voted to approve Proposition 13 (Hahnel 2022). This proposition, nicknamed "the People's Initiative to Limit Taxation," added Article XIII A, Sections 1-4, to the California Constitution (Hoffman et al. 2021). These new sections tied property values to 1975 assessments, limited property taxes to 1% of assessed values, limited future inflation-tied increases to 2% annually, and gave the state government responsibility for distributing property tax revenue (Cohen et al. 2018). Following the implementation of these changes, municipal revenues immediately dropped by half, and the state budget surplus was appropriated to bail out local agencies that were struggling from loss of revenue (Hoffman et al. 2021). Proposition 13 also introduced "special taxes," which could only be levied if cities, counties, and special districts successfully received "a two-thirds vote of the qualified electors of such district" (Cal. Const. Art. XIII A, § 4)

Proposition 62: Although Proposition 13 identified the need for a two-thirds vote for "special taxes," it did not define these taxes or institute a requirement for general (or any other) type of taxes. With the goal of filling this gap, Proposition 62 was adopted in 1986, defining "general taxes" and requiring the approval of a simple majority of voters. However, because Proposition 62 was introduced as a statutory initiative (as opposed to a constitutional amendment initiative), the courts found that its taxation requirements *were not applicable to charter cities, or cities governed by a charter in addition to general law, including Los Angeles* (Hoffman et al. 2021).

Proposition 218: The courts' interpretation of Proposition 13 in the decades that followed its adoption was that it was put in place to limit property taxes, but not other assessments or regulatory fees (Ibid). Thus, in November of 1996 (and in light of Proposition 62's lack of applicability to charter cities), Californians voted to adopt Proposition 218, or the "Right to Vote on Taxes Act" (Legislative Analyst's Office 1996). Proposition 218 added Articles XIII C and D to the California Constitution, defining all taxes imposed by local governments as either "general" or "special" taxes. The proposition required that both types of taxes be approved by the electorate during a regularly scheduled general election (Hoffman et al. 2021).

Under Proposition 218, "general taxes," defined as taxes "imposed for general governmental services," required a simple majority vote (over 50%). "Special taxes," defined as taxes "imposed for specific purposes, including a tax imposed for a specific purpose, which is placed into a general fund," required a supermajority vote (two-thirds) for approval (Ibid). Article XIII D also introduced new definitions of and rules for property-related "fees" and "charges," and Article XIII C Section 3 introduced a new a right for voters to affect local taxes, assessments, fees, and charges through the initiative process (Legislative Analyst's Office 1996).

Proposition 26: After Proposition 218 was adopted, further limiting municipalities' abilities to raise revenues, the courts ruled in *Sinclair Paint Co. v. State Board of Equalization* that fees levied for purposes of lead remediation fell outside of the new definition of "special tax," and therefore did not require a two-thirds approval by voters to be instituted (California Special Districts Association 2013). This ruling, and its implications for the types of fees that could be imposed outside of Proposition 218 restrictions, was one of the main drivers of Proposition 26's adoption by voters in 2010 (Ibid).

Proposition 26 amended Article XIII A, Section 3 and Article XIII C, Section 1 of the Constitution, establishing a new definition of "tax" in both provisions that encompassed "any

levy, charge, or exaction of any kind imposed by a local government," with seven exceptions in the case of local governments (Hoffman et al. 2021). These exceptions include: costs of specific services for the individual paying, reasonable regulatory costs such as licenses or permits, rental costs, fines, and some property-related costs (Cal. Const. Art. XIII C §3 (e)(1-7)). Section 3 concludes by stating,

> The local government bears the burden of proving by a preponderance of the evidence that a levy, charge, or other exaction is not a tax, that the amount is no more than necessary to cover the reasonable costs of the governmental activity, and that the manner in which those costs are allocated to a payor bear a fair or reasonable relationship to the payor's burdens on, or benefits received from, the governmental activity(Cal. Const. Art. XIII C § 3).

3.2.4 Understanding Implications of Proposition 26 and 218 for LADWP

3.2.4.1 LADWP's Legal Challenges

These propositions have had, and continue to have, broad implications for LADWP's ratemaking and affordability. As a department of the Los Angeles government, LADWP's electricity and water rates can be — and have been — scrutinized through the lenses of Propositions 13, 218, and 26.

In this context, electricity charges exacted by municipal utilities could be interpreted as falling under the one of the "tax" exceptions listed in Article XIII C, Section 3 (discussed above). Because rates for electricity are "imposed for a specific government service or product provided directly to the payor that is not provided to those not charged, and which does not exceed the reasonable costs to the local government of providing the service or product" (Cal. Const. Art. XIII C, § 3(e)(2)). With this interpretation, changes in rates that are proportional to anticipated costs of providing the service are permitted. However, unsurprisingly, "the reasonable costs of providing the service or product" — especially for something as complex of the provision of electricity in a constantly changing technological, political, regulatory, and economic environment – are not necessarily clear cut.

Further, in this context, the legality of costs like LADWP's annual city transfer, or the transfer of surplus Power Revenue funds to the city's general fund at fiscal year close, has come into question. The process of conducting this transfer, which has historically represented around 8% of total Power System Revenue, is outlined in the City Charter (Los Angeles Charter § 344).

Over the years there have been official legal challenges to LADWP's and other MOUs' Power Revenue transfers, with mixed outcomes. For example, the California Supreme Court ruled that transfers from public utilities to the general fund does not qualify as a tax under Proposition 26 in the case Citizens for Fair REU Rates vs City of Redding (2015). The reasoning behind this ruling was that these transfers are a part of the cost of service for utilities (Ibid).

In 2013, however, the class action lawsuit *Eck v. City of Los Angeles* was brought against the city (*Eck v. City of Los Angeles* 2019). It alleged that the city transfer was an unlawful tax under

Proposition 26 and resulted in both a $52 million settlement and a strict limitation of future City Transfers to 8% of retail operating revenues from the 2008 Electric Rate Ordinance (Los Angeles CAO 2022).

In 2016, a case was filed against 26 Los Angeles public officials alleging that the annual city transfer was unlawful under both the California Constitution (Proposition 26) *and* federal anti-corruption, racketeering, and extortion laws (*Abcarian v. Levine* 2020). However, both the district and appellate courts ruled in favor of the city's actions in this case — with the district court dismissing the case entirely before it was appealed to the Ninth Circuit court (Ibid).

The Power Revenue Fund transfer was challenged again in 2018 through the *Humphreville v. City of Los Angeles* lawsuit (*Humphreville v. City of Los Angeles* 2020). The plaintiff, a city resident who had opted out of the *Eck* settlement, alleged that the transfer constituted an illegal tax under Proposition 26 (Ibid). The court dismissed the action, determining that the transfer did not qualify as a tax because it does not cause LADWP's rates to exceed the reasonable cost of electricity to rate payers, and the case was dismissed a second time upon appeal (Ibid).

3.2.4.2 SMUD Ratemaking

It is useful to analyze the implications of Propositions 26 and 218 through the lens of other MOUs in California as well as LADWP, as their ratemaking processes are also impacted by these propositions. Sacramento Municipal Utility District (SMUD), for example, has updated its rates multiple times since the adoption of Proposition 26 and maintains that these changes, which occurred in 2017, 2019, and 2021, are all compliant with the state's restrictions.

SMUD's leaders are cognizant of the limitations imposed by Proposition 26. In fact, each of the board's recent rate resolutions acknowledges the potential limitations of Proposition 26, but maintains that "any changes in rates since [it was passed] are cost-justified under the analysis in the respective Chief Executive Officer and General Manager's Report and Recommendation on Rates and Services that supported the adoption of the rates" (SMUD Resolution No. 21-09-06).

In the "2019 CEO and General's Manager's Report and Recommendation on Rates and Services," SMUD leadership justifies rate changes in multiple ways. The first justification of rate changes, and perhaps the most interesting, is an assertion that Proposition 26 does not actually apply to SMUD rates because they are not "'imposed' on customers," but that, instead, "customers pay only for the voluntary use of service, and they have meaningful alternatives to that service, such as self-generation with solar…" (SMUD 2019). The report goes on to say that although they have already demonstrated that Proposition 26 does not apply to SMUD rates, even if it did, the rates would be compliant based on the cost-of-service exception (as discussed above), and the fact that rate structures implemented before Proposition 26 are exempted (Ibid). The 2019 report addresses proposed rate increases; grid access charges and grid access charge waivers for low-income customers; and restructuring of commercial charges — all of which SMUD asserts are compliant because they either reflect the cost of service or were in existence in the same or similar form before Proposition 26's passage (Ibid).

In 2017, SMUD also reconfigured its time-of-day rates and restructured its low-income discount rate, called the Energy Assistance Program Rate (SMUD Resolution No. 17-06-09). Like the

report, this resolution includes explicit descriptions of the changes' compliance with Proposition 26. It states that changes are cost-justified, that time-of-day rates reflect the true cost of providing electricity throughout the day, and that fixed rates (for customers who opt out of time-of-day rates) are compliant because they are optional, and thus not "imposed." It also explains that the Energy Assistance Program Rate is compliant because it not only predates the adoption of Proposition 26, but also because it "provides an increased discount to certain customers who can least afford energy charges, while transitioning other customers that are better able to afford the charges out of the program. The net effect is to decrease the aggregate discount…" (Ibid).

III. Discount for Residential Customers

Eligible residential customers will receive a discount based on qualifying federal poverty level income guidelines beginning as early as the first full bill cycle in 2021. The EAPR discount will include two components:

1. A $10 System Infrastructure Fixed Charge discount per month; and
2. An additional discount is applied as a 100% reduction in the electricity usage cost per kilowatt hour up to the maximum discount according to the following income guidelines:

Federal Poverty Level	2021 Maximum Electricity Usage Discount
0-50%	$60
>50 to 100%	$32
>100 to 150%	$10
>150 to 200%	$0

Figure 9. SMUD Energy Assistance Program Rate Structure from the 2021 Resolution[6]

SMUD's rate changes have faced legal challenges. For example, in 2016, a Sacramento resident sued SMUD, alleging that their transition to default smart meters and time-of-day rates was unlawful (*Graham v. Sacramento Mun. Util. Dist.*). Although this case was dismissed by the district court, this same plaintiff filed another lawsuit on the basis that SMUD's rates, specifically fixed charges and related increases, are in violation of Proposition 26's additions to the Constitution — although it is unclear how or whether this case will move forward (2022b).

3.2.4.3 Ballot Initiative Potential

A key function of Propositions 218 and 26 is to provide residents with a say in new taxes and fees before municipal governments impose them. Thus, one path for LADWP to avoid legal scrutiny when amending its rate structure and discount programs is to achieve city-wide approval through a ballot initiative.

Passing a ballot initiative is no small feat. The initiative vote must take place during a "regularly scheduled general election for members of the governing body of the local government, except in cases of emergency declared by a unanimous vote of the governing body," but "can be placed on the ballot by the local governmental bodies or by citizens" (California Tax Foundation 2021). Additionally, the initiative must follow the guidelines of the municipality in which it its vote is being held. For Los Angeles, the details and timelines for ordinance initiatives and charter

[6] See tariff here: https://www.smud.org/-/media/Documents/Rate-Information/Rates/01_EAPR.ashx

amendment initiatives are detailed in the *City's Initiative, Referendum & Recall Petition Handbook* (Los Angeles Office of the City Clerk 2012).

Further, Propositions 218 and 26 indicate that for "special taxes" such as rate changes, the ballot initiative must be approved by not just a majority, but a supermajority (two-thirds) of registered voters (Hoffman et al. 2021). However, within the last few years the California Supreme Court has established that this supermajority requirement is not applicable in the case of a citizen initiative, even when sponsored by an elected official (California Tax Foundation 2021). Thus, it is likely that, if the initiative was brought by a CBO or community member, it would only need a simple majority to pass.

Lastly, and perhaps most importantly in the context of this report, LADWP cannot lobby for the ballot initiative, and public funds cannot be used for campaigns unless the proposed taxes are described in neutral terms (Ibid). Thus, it is likely that a ballot initiative would need to be brought by non-elected official and would require widespread community buy-in to succeed — even with just a simple majority required to pass.

Yet, while it may not be easy, pushing for a change through this process has the potential to unlock rate structures that not only support vulnerable ratepayers through more robust discount programs, but also offer widespread equity and reliability benefits for Los Angeles as a whole.

3.3 Los Angeles Municipal Law

3.3.1 Los Angeles Charter

In the Los Angeles City Charter, updated in the year 2000, Volume 1, Article VI contains the sections that address the Department of Water and Power. This includes Sections 670-684, which address the board of commissioners and general manager, water and land rights, assets, contracts, rate setting, Water and Power Revenue Funds, and the Office of Public Accountability (Los Angeles Charter §§ 670-684).

For example, Section 674, "Power Contracts," gives the board the right to enter into contracts for both infrastructure and electricity. Section 675, "Powers and Duties of the Board," details the board's responsibilities, including enforcing rules governing water and power assets, in subdivision (a), and the following powers for rates and charges:

b) **Rates and Charges.** The board shall have the power and duty to:
    1. regulate and control the use, sale and distribution of water, reclaimed water, surplus water, electric energy and surplus electric energy owned or controlled by the City;
    2. grant permits for connections with the water or electric works of the City and fix the charges for these connections;
    3. fix the rates to be charged for water, reclaimed water, surplus water, electric energy or surplus electric energy for use inside or outside the City in accordance with Section 676; and
    4. prescribe the time and the manner of payment for the collection of the rates and charges for water and electric energy.

(Los Angeles Charter § 675). This section also addresses Water and Power Assets, real estate, and other incidental authorities.

Arguably the most relevant section of Article XI, however, is Section 676, *Rate Setting*. This Section addresses the board's power to fix rates and the allowance of individual power contracts:

a) **Rate Setting Procedure.** Subject to approval by ordinance, rates for water, reclaimed water, surplus water, electric energy and surplus energy shall be fixed by the board from time to time as necessary. Except as otherwise provided in the Charter, rates shall be of uniform operation for customers of similar circumstances throughout the City, as near as may be, and shall be fair and reasonable, taking into consideration, among other things:
    1. the nature of the uses;
    2. the quantity supplied; and
    3. the value of the service.

    The rates inside the City may be less, but not greater, than the rates outside the City for the same or similar uses.
b) **Individual Power Contracts.** Rates for electric energy may be negotiated with individual customers, provided that these rates are established by binding contract, contribute to the financial stability of the electric works and are consistent with procedures established by ordinance. (Los Angeles Charter § 676)

This is especially important in the context of rate setting for affordability and potential upcoming rate cases, the processes through which LADWP's electricity and water rates are updated and approved. This section gives the board the authority to fix rates, which are subject to city council approval, based on the requirements that rates are "fair and reasonable." Rates may be differentiated based on the "nature of uses," "quantity," and "value of service," and must be comparable or less than those in surrounding utilities/regions (e.g., SCE, SDG&E, or Burbank Water and Power) (Ibid).

Section 678, "Powers and Duties of the General Manager," addresses the responsibilities of the LADWP general manager, whose job is generally to implement rules and procedures set out by the board and supervise LADWP work and improvements (Los Angeles Charter § 678). Section 679, "Water and Power Revenue Funds," defines that all revenue from the Water and Power Systems is to be deposited into the Water Revenue and Power Revenue Funds, respectively, controlled by the city treasury. Money in these funds can be used for operations and maintenance, debt service, asset development, reimbursement, business promotion, conservation promotion, employee benefits, bond reserve funds, and general fund transfers (Los Angeles Charter § 679).

When authorizing Water or Power Revenue Fund use for transfer to the City General Fund, the charter references Section 344, which provides more detail on the transfer of surplus. This section gives the City Council authority to transfer, by ordinance and with approval from the LADWP board, surplus Power and/or Water Revenue funds to the city's Reserve Fund at the end of each fiscal year (Los Angeles Charter § 344 (a-b)). These surplus funds can be withheld by the board if they report that a transfer will negatively affect LADWP operations — which they may determine through the required presentation of audited financials from LADWP after each fiscal year. However, if the board decides not to approve the fund transfer, they must present a detailed explanation as to why to the city council and mayor, to be verified by the city administrative

officer and then reviewed again by the board, city council, and mayor ((Los Angeles Charter § 344 (b)(3-4)).

Lastly, Section 683 — added in 2011 — defines the Office of Public Accountability's (OPA's) role in monitoring LADWP, its internal structure, budget requirements, and the creation of a Ratepayer Advocate (Los Angeles Charter § 683). More details on the OPA and its role and responsibilities are included in the city's administrative code.

3.3.2 Los Angeles Administrative Code

The Los Angeles Administrative Code serves as a resource to "assist City offices, departments and other governmental agencies in their functions." It also includes articles and sections on LADWP in Division 23, "Departments Having Control of their Own Funds," Chapter 7 (Los Angeles Admin. Code, Ch. 7).

Chapter 7, Article 1 defines the department, while Article 2 is designated "Reserved" and contains two empty sections. Article 3, "Powers and Duties in General," contains the bulk of Administrative Code sections concerning LADWP, and specifically the Board of Commissioners and their authority in transmission-scale decision making, including when it bumps up against FERC jurisdiction (Los Angeles Admin Code, Ch. 7 Art. 3). For example, Section 23.133 addresses the ability of the LADWP general manager, as delegated by the board, to enter into transmission contracts that are compliant with Section 211 of the Federal Power Act and subsequently approved by FERC (Los Angeles Admin. Code § 23.133). Section 23.134 authorizes the board to set transmission related "tariffs, terms, conditions and charges" by a simple majority vote in the city council, and "which would otherwise fall within the jurisdiction of the Federal Energy Regulatory Commission" (Los Angeles Admin. Code § 23.134). The remaining sections authorize the board enter into power and energy efficiency contracts, to contract with the surrounding power systems and system operators for purposes of reliability, and to buy and sell environmental attributes — such as Renewable Energy Credits (RECs) (Los Angeles Admin. Code §§ 23.135-23.143.1).

Article 4 includes details and responsibilities of the OPA to complement the requirements outlined in the charter (Section 683). The OPA was established by voters in 2011 "to provide public independent analysis of department [DWP] actions as they relate to water and electricity rates" and "to shed greater light on the DWP's operations and finances" (Los Angeles Adm. Code § 23.144). Section 23.144 emphasizes that OPA is to operate independently of LADWP in order to analyze and report on the department's planning, procedures, decisions, and ratemaking — and to make this reporting available to both the city council and mayor and the public (Los Angeles Adm. Code § 23.144). Section 23.145 describes the appointment and removal of OPA's executive director through the work of a five-member citizens' committee (Los Angeles Adm. Code § 23.145). The article concludes by reviewing the OPA budget (Los Angeles Adm. Code § 23.146).

3.3.3 City Council Ordinances and Executive Directives

As established in the Charter Section 676, board-fixed electric rates are subject to city council ordinance for approval (Los Angeles Charter § 676). When LADWP goes through the process of a rate case, new tariffs are ultimately approved and implemented through a city council ordinance.

In addition to directly approving rates, city council ordinances can also impact LADWP Power System operations by setting requirements for infrastructure, finances and financial structures, employees and employee benefits, and assistance programs — examples of which will be given in the below sections on the history of the Lifeline and EZ-Save programs.

From time to time, the Los Angeles mayor may also pass executive directives that directly implicate LADWP operations and, by extension, ratemaking. The most recent, and directly relevant, executive orders passed by previous Mayor Eric Garcetti were the 2015 Executive Directive No. 7, *Sustainable City pLAn,* and the 2020 Executive Directive No. 25, *L.A.'s Green New Deal: Leading by Example* (Garcetti 2015, Garcetti 2020).

According to the executive directive, the Sustainable City pLAn "set[] the course for a Los Angeles that is economically prosperous and environmentally sustainable and that ensures equal opportunity for all" (Garcetti 2015). The pLAn ordered heads of departments/offices of the city, including LADWP, to engage in sustainability planning and reporting, and to designate a department chief sustainability officer responsible for implementing the pLAn initiatives (Garcetti 2015).

LA's Green New Deal provided a four-year update to the pLAn, integrating more explicit equity measures and focusing on the "five zeros": zero-carbon grid, zero-carbon buildings, zero-carbon transportation, zero waste, and zero wasted water. Each "zero" includes specific steps, projects, and interim goals for related city departments and agencies. Goals for LADWP include expanding access to clean energy programs, collaborating to streamline electric vehicle (EV) charger installation, and deploying electricity and then water smart meters city-wide (Garcetti 2020).

3.4 LADWP Residential Electricity Rates

3.4.1 2008 Rate Ordinance

The current electric rates — including residential rates, which are the focus of this research — are based in the 2008 Electric Rate Ordinance, Ordinance No. 180,127 (as amended by Ordinance No. 181,181) (Los Angeles Ord. No. 180127). The rates approved in this ordinance were fixed by Board Resolution No. 009-008 on July 2, 2008.

There are few fundamental elements of these residential electricity rates:

Tiers: For residential customers, the basic structure of electricity rates in this ordinance included an energy charge, a charge for each kilowatt-hour (kWh) of electricity a customer uses that increases incrementally when usage crosses certain thresholds within a bimonthly billing period. This structure is often referred to as a tiered model, and LADWP has three tiers. The general

purpose of this structure is to encourage conservation; usage above each cutoff becomes more expensive per unit of consumption.

Zones: There are two sets of tier cutoffs that are used across Los Angeles, and the set that a customer falls into is determined by their climate zone (Figure xx). Climate zones were originally designated by the CEC for the purpose of maintaining appropriate building code requirements for the varying climates across California (California Energy Commission 2022). However, utilities (including LADWP) now also utilize these zones to determine tier cutoffs for electricity usage, with the goal of allowing more or less usage per tier based on the temperature-moderation requirements of that region. LADWP territory has two zones (see figure xx): Zone 1, which covers the more temperate zip codes near the coast, and Zone 2, which covers the inland areas that experience more extreme heat in the summer.

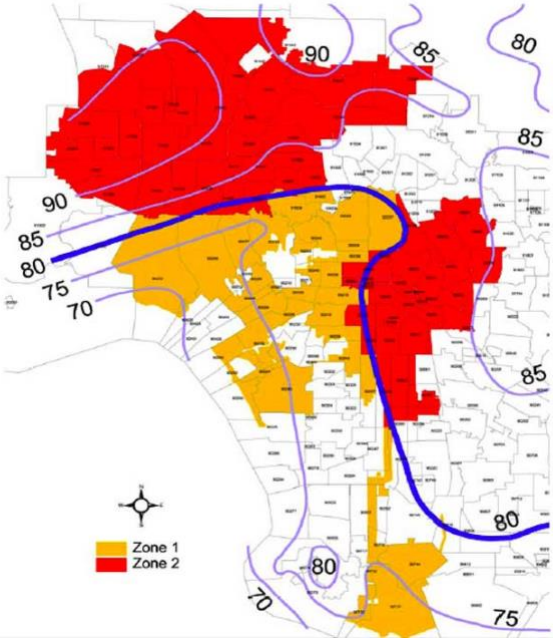

Figure 10. Climate zones and median average temperatures in Los Angeles[7]

Adjustment Factors: The other element of residential rates in the 2008 Ordinance, and today, are adjustment factors that get added to the basic per-kwh charge to create a total per-kwh charge. At the time of this original ordinance, there were three mandatory adjustment factors and one voluntary adjustment factor, all of which would be changed every three months to address changing costs in their respective categories (Los Angeles Ord. No 180127). The first adjustment factor is the energy cost adjustment (ECA), which recovers the varying costs of fuel, purchased power including renewable resources, and demand side management (DSM) costs — all of which are added together and divided by anticipated number of kWh sold.

[7] Hecht, Sean. 2012. "UCLA and City of Los Angeles Publish First-Ever Detailed Long-Term Climate Forecast for a City's Neighborhoods." Accessed 20 July 2022. https://legal-planet.org/2012/06/22/ucla-and-city-of-los-angeles-publish-first-ever-detailed-long-term-climate-forecast-for-a-citys-neighborhoods/.

The second is the electric subsidy adjustment (ESA) which recovers the cost of discounts given to customers on the Lifeline and EZ-Save rates, as well as the commercial discount rates, enterprise zone, disaster recovery, street lighting, and traffic control. Customers on any of the aforementioned rates, therefore, do not pay for that adjustment factor. The last mandatory adjustment factor is the reliability cost adjustment (RCA) which recovers the operation, maintenance, and debt service expenses for maintaining system reliability. This ordinance also included the voluntary renewable energy adjustment (REA), which recovered the cost of renewable generation procurement for customers who had opted for the renewable energy option (REO).

Low-Income and Lifeline Service: The ordinance defines the Lifeline and low-income discounts as of July 1, 2009 as $17.71/month and $8.17/month, respectively. It includes the Lifeline designations of senior/disabled, life-support device, and physicians-certified discount, and notes that customers in two categories shall receive 150% of the Lifeline credit, and customers in three categories shall receive 175% of the Lifeline credit.

Time-of-Use: A final element of residential rates in the 2008 rate ordinance was the option of Time-of-Use service, which included a flat service charger and then different per kwh rates that would be charged at different times of the day — including (from most to least expensive) the *High Peak Period, Low Peak Period, and Base Period.* Customers on this rate also had option of a per kWh electric vehicle (EV) discount if they owned an EV.

3.4.2 2016 Incremental Ordinance

In 2016 the city council passed Ordinance No. 184,133, approving the rates fixed by Board Resolution No. 016-155 (Los Angeles Ord. No. 184133). This new ordinance is known as an "Incremental Electric Rate Ordinance" because it builds upon, but does not replace, the 2008 Ordinance.

Additions to the standard residential rates introduced in this ordinance included:

Power Access Charge: The power access charge is a fixed monthly charge that is added to customers' bills, introduced in the 2016 ordinance to help recover basic infrastructure cost of access to the grid (LADWP 2016). Similar to the energy charge (the per kwh rate), the power access charge varies based on the tier that a customer's total monthly consumption falls under. In order to encourage conservation, Tier 1 (lowest consumption) has the lowest charge while Tier 3 (highest consumption) has the highest charge.

Tiers: The tier cutoffs for both Zone 1 and Zone 2 were amended in this ordinance to the levels at which they are set today. These levels are shown in Table 1.

Table 1. Current Tier Cutoffs for Residential Usage as Amended in 2016[8]

	Zone 1		Zone 2	
	Monthly	Bi-Monthly	Monthly	Bi-Monthly
Tier 1	First 350 kWh	First 700 kWh	First 500 kWh	First 1,000 kWh
Tier 2	Next 700 kWh	Next 1,400 kWh	Next 1,000 kWh	Next 2,000 kWh
Tier 3	Above 1,050 kWh	Above 2,100 kWh	Above 1,500 kWh	Above 3,000 kWh

Adjustment Factors: Four more adjustment factors were created via the 2016 incremental ordinance, resulting in seven total mandatory adjustment factors, which are each added to the per-kWh electricity charge, or Energy Charge. These seven are the adjustment factors that are in place today, and the total of these adjustment factors is now greater than the baseline Energy Charge itself.

The first new adjustment factor that was added is the Incremental Reliability Cost Adjustment (IRCA), which recovers additional costs operations & maintenance and debt service costs related to the Power Reliability Program. The next is the Variable Energy Adjustment (VEA), which recovers the costs of fuel, non-renewable power purchases, and base rate decoupling. The last two added adjustment factors specifically relate to RPS requirements and the associated costs of maintaining and procuring renewable energy. These adjustment factors are the Capped Renewable Portfolio Standard Energy Adjustment (CRPSEA) and the Variable Renewable Portfolio Standard Energy Adjustment (VRPSEA).

3.5 LADWP Affordability Program History

3.5.1 Lifeline Rate

Currently, the Lifeline rate is available to Los Angeles customers who are either a senior citizen (62 years or older) or a disabled citizen and who have a combined adjusted gross household income of less than $47,300. Customers with energy-intensive life-support and health-related mobility devices are also eligible to receive the Lifeline discount on their electricity bills under the Life Support and Physicians Certified Assistance Discount (PCAD) designations, respectively. The number of customers on these special designations is relatively low — in 2021, 6,239 customers received the Life Support discount, and 8,756 customers received the PCAD discount. However, these rates provide an important discount to vulnerable customers for whom electricity is absolutely essential. Approximately 97,416 customers received the general senior/disabled Lifeline discount in 2021.

Lifeline customers are exempted from paying the Utility Users Tax (UUT) and receive subsidies of $17.71 per month ($35.42 bimonthly) for electricity and of $10.00 per month ($20.00 bi-monthly) for water, although the future of the water discount is uncertain due to legal challenges. Historically, for customers who don't pay for their own water — a category that includes most

[8] See https://www.ladwp.com/ladwp/faces/wcnav_externalId/r-cs-elect-rate.

renters — this water discount has been automatically applied to their electric bill. For more about the Lifeline rate's impact on customer bills, see the following section, *Baseline Affordability Analysis.*

The Lifeline rate was first established for the state of California in 1975 by Assembly Bill 167 (AB 167). AB 167 added Section 739 — which now contains regulations on the California Alternative Rates for Electricity (CARE) program — to the Public Utilities Code (Hennessy and Keane 1989). Originally, this rate was introduced on the assumption that heat and light were basic human rights that should be available at "low cost for basic minimum quantities" (Ibid). At a state level, it was challenging to determine an agreed upon essential needs amount, and the concept of Lifeline was amended to a concept of "baseline" with AB 2443 (Ibid).

Lifeline originally meant that up to a certain amount of electricity usage was free or heavily subsidized — and this was how the program was originally implemented in LADWP. Since its inception, the Lifeline program has been run out of the City of Los Angeles' Office of Finance, a choice that likely because of this office's offered exemption from the utility user tax for elderly and disabled residents (Los Angeles Mun. Code § 21.1.12).

In 1983 Lifeline users paid *nothing* for the first 180 kWh per month (Los Angeles Ord. No. 158287). In 1990 Lifeline users saw tiered rates, with at least a $0.02/kWh charge for even the lowest tier, up to 180 kWh per month (Los Angeles Ord. No. 166433). By 1992 the Lifeline rate was made into a block discount, just like the low-income discount program (now EZ-Save) — and just like it is today (Los Angeles Ord. No. 168436).

3.5.2 EZ-SAVE (Formerly Low-Income Discount Program) Rate

The predominant affordability mechanism that LADWP currently employs is its EZ-SAVE Program, formerly the Low-Income Discount Program. EZ-Save is available to households with incomes below the modified 200% federal poverty levels based on household size. In 2021 131,526 LADWP customers received the EZ-SAVE discount. For more information on EZ-SAVE's impact on LADWP revenue and customer bills, see the following section, *Baseline Affordability Analysis*.

LADWP has offered a discount for low-income customers since 1990. In that year, Board Resolution 91-108 and then City Council Ordinance 166,432 established a new residential Rate Class, called Rate D, that would provide $3.75 in "Low Income Subsidy Credits" to help low-income households pay for their electricity (Los Angeles Ordinance No. 166432). The ordinance also designated that revenue losses from this discount would be recovered by "Low Income Subsidy Adjustment Factor" (LISAF), added onto customers' per kwh Energy Charge. In January of 1992 the discount was increased to $4.16 per month (Los Angeles Ord. No. 167535), and in September of 1992, after the protests following the killing of Rodney King, a "Disaster Recovery Service" was created for customers affected by a "major disaster, either natural or man-caused" — with the discount to also be recovered by the LISAF (Los Angeles Ord. No. 168271). By December of 1992 the low-income rate was amended to its current structure, with the cost of financial assistance to be recovered through the "Energy Subsidy Adjustment Factor" (ESAF), just as it is today (Los Angeles Ord. No.168432).

4 Baseline Affordability Analysis

In order to strategize how to pursue affordability and equity goals throughout the LA100 transition, it is crucial to understand the challenges currently facing in-need Angelenos and how energy use and costs affect their quality of life. This analysis characterizes a policy-relevant, status quo profile of electricity affordability considerations for households living in the City of Los Angeles, particularly those "in need" of affordability support, as described below. The analysis synthesizes existing datasets and reports and expert stakeholder insights, but also incorporates data generated specifically through the LA100 Equity Strategies Effort. We structure this analysis through 14 interrelated questions, which we ask and answer using the data sources listed above, in Section 4.3. This analysis contextualizes our analysis of affordability metrics and policy options (Sections 5 and 6). These metrics and policy options provide actionable strategies to change the status quo.

Among LA100 policy scenarios, the LA city council chose the most aggressive transition pathway (Early and No Biofuels). This pathway is also the most expensive in terms of internalizing costs on the LADWP bill. The chosen pathway of transition thus has clear implications for LADWP ratepayer affordability. As home heating and transportation become electrified, their costs are incorporated into the electricity portion of households' LADWP bills, making bill affordability a more important consideration than ever. Beyond LA100, this analysis also informs broader current and future LADWP actions to enhance affordability of electricity service amid evolving affordability dynamics and policy needs, such as what occurred during the COVID-19 pandemic.

4.1 Data and Defining "In-Need" Households and Customers

As illustrated in the Data and Methods section above, our analysis draws upon a large set of diverse data sources, with an emphasis on sources that are recent, robust, and/or recurring (collected or updated on an ongoing basis) so that they could be used to evaluate affordability trends over time and in the long-term. We do not provide an extensive analysis of the validity of these data sources, but rather aim to summarize the themes and lessons learned from these data sources and how these relate to affordability considerations. We answer most questions using multiple data sources to corroborate our findings.

One downside of using multiple data sources is the lack of a consistent definition of household "need" for affordability attention and assistance. Most, if not all, of the datasets cannot be matched at a household or customer level. They can only be joined at Census block group or tract level at best down the line. Moreover, additional household level surveying or focus groups will likely be necessary to assess household interest, trust, and capacity to take advantage a narrowed set of enhanced affordability policies, after those have been specified in the broader, longer-term LA100 ES effort.

On the other hand, it is advisable to look at different dimensions of need, given the multi-dimensional nature of affordability, as well as the variability of affordability and in-need definitions employed both within LADWP and across utilities. The definition of an in-need

customer varies slightly in the analysis below, depending on the available data from the source, and is noted for each data source.

Households "in need" of affordability assistance for utility services have generally been defined in terms of household income, but they are also occasionally identified based on age, disability, or chronic illness status — characteristics that make constant service especially critical for health and welfare (Pierce et al. 2021). Currently, LADWP offers targeted financial assistance to customers on the basis of income, age (senior citizen status), and presence of a disability or medical condition that requires electricity to run medical equipment or to maintain a certain temperature range.

Our characterization of in-need households is thus based on the data source and the definitions that are noted when characterizing each data source. We also acknowledge and address the fact that not every LA household is a direct customer of LADWP (i.e., has an account with and pays a LADWP bill) because of service sub-metering, especially of water service. LADWP is responsible to, interacts with, and has influence over *customers*, not *households*, per se. However, all LA City households are indirect customers of LADWP, and experience affordability impacts form LADWP bills. We thus rely on both household and customer data, depending on the source.

4.2 Background: LADWP Organizational Structure, Bills, Available Programs and Ratemaking Process Relevant to Residential Affordability

4.2.1 Unique Utility Structure

LADWP is a proprietary department of the City of Los Angeles, serving 681,000 customers with water service and 1.4 million customers with electricity. As discussed in Section 3, LADWP is unique in its position as a publicly owned utility (POU) serving a city the size of Los Angeles. In fact, LADWP is the largest POU in the nation. Many other large cities in the U.S. are served by investor-owned utilities (IOUs) for power, but by the municipalities themselves for water.

The preliminary budget for 2020–2021 allocated $3.6 billion for the power system and $1.1 billion for the water system, plus an additional $3 billion for joint system costs (LADWP 2020). Total operating revenues for the same year amounted to $4.3 billion for the power system and $1.5 billion for the water system (KPMG 2021). LADWP operations are financed through rates for services paid by customers, while capital costs are covered through the sale of bonds. Therefore, LADWP operations are not funded through city taxes. In fact, LADWP is a revenue-producing department: it transfers 8% of annual electricity revenues to the City of Los Angeles general fund. The estimated transfer for 2019–2020 was between $227 and $232 million (KPMG 2021).

As discussed in Section 3, the practice of transferring money from Power Revenue Fund to the city's general fund has been challenged a number of times, the outcomes of which have included one settlement (*Eck v. City of Los Angeles* 2019*)* and multiple dismissals (*Abcarian v. Levine*

2020, *Humphreville v. City of Los Angeles* 2020). For more information on these legal challenges, see Section 4.3, "Implications of Proposition 26."

LADWP policy is established by the Board of Water and Power Commissioners. The five board members, appointed by the mayor and confirmed by the city council, serve for five years. As a POU, LADWP is subject primarily to local oversight (Galperin 2020). Unlike IOUs, LADWP is not regulated the California Public Utilities Commission. At the state level, the California Electricity Commission and the California Water Board monitor operations, but do not regulate them. Direct oversight of LADWP comes from the Office of Public Accountability (OPA), a city department established to serve as an independent watchdog of LADWP operations and finances, as well as analyze proposed water and power rate increases (City of Los Angeles n.d.).

Arguably, all LADWP offices (outlined in the organizational chart below) address and influence customer affordability in some fashion. However, some have more of a direct impact than others, and some affect affordability at different stages than others. The customer service unit within the External and Regulatory Affairs (ERA) office, which manages the design of customer billing (the actual transaction of billing is managed by the IT office) and many of the utility's customer assistance and incentive programs, may have the most direct and impactful influence on affordability. The efficiency solutions unit within the ERA office manages many of the utility's conservation incentive programs. Another unit having a direct, sizable impact is the rates and financial planning unit within the Financial Services Office, which takes the lead on technical rate structure design and financing considerations, as well as setting of bill discount levels for the utility. The recently formed Diversity, Equity and Inclusion office is also envisioned to play more of a role in influencing affordability in the future, particularly by managing and enhancing the utility's Equity Metrics Data Initiative and the follow-on effort to LA100 Equity Strategies.

Multiple units within LADWP's Corporate Strategy & Communications office, particularly the community affairs & outreach unit, also interact with community groups and customers to raise awareness regarding and receive feedback on the affordability and assistance programs which LADWP offers. Last, but not least, the Power Engineering & Technical Services offices and Water System offices manages the procurement of power and water resources respectively, and thus the input cost and long-term affordability of core LADWP services.

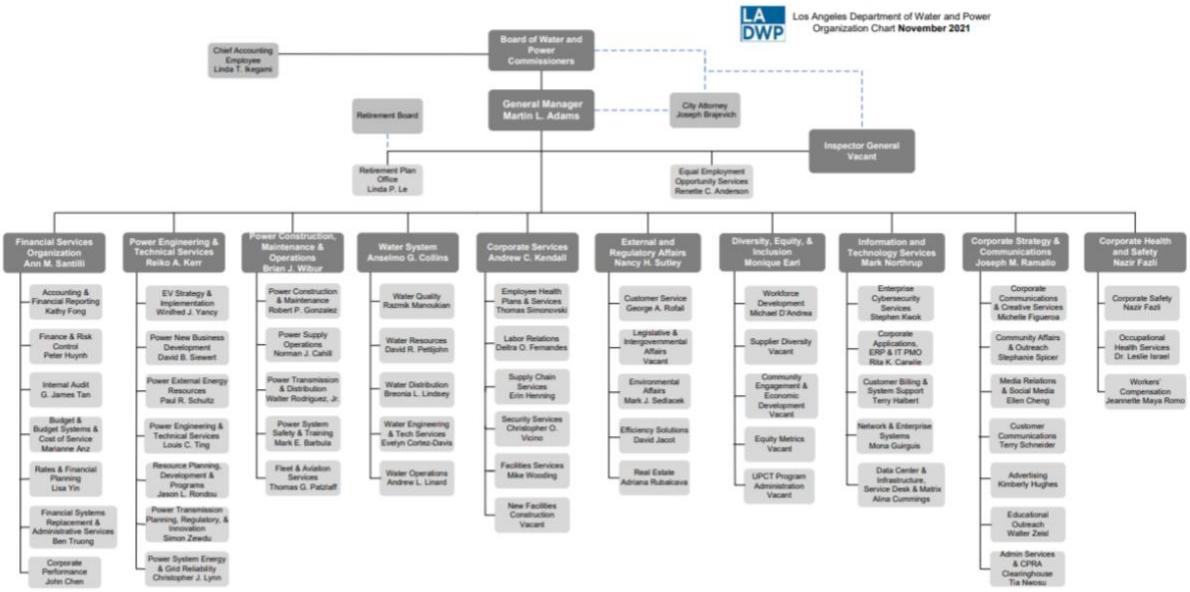

Figure 11. Los Angeles Department of Water and Power Organization Chart, 2021.

4.2.2 Ratemaking Process[9]

LADWP most recently underwent a rate setting process in 2015 to set rates for 2016-2020. The increase was based on a need to replace aging infrastructure, ensure power reliability, and transition supplies to meet regulatory mandates and sustainability goals. The proposed rates would increase 4.7% per year system wide for five years. The rates were designed to promote conservation as well as distributed energy generation. Price tiers for higher consumption levels were increased more steeply than low consumption levels.

LADWP electric rates are comprised of the base rate and pass-through adjustment factors, which are tied to specific costs. Pass-through adjustment factors reflect costs beyond LADWP control, such as fuel costs or regulatory mandates. LADWP charges, and proposes to continue charging, five adjustment factors:

- Variable Energy Adjustment: fuel costs, power purchase agreements.
- Variable Renewable Portfolio Standard Energy Adjustment: additional renewable power purchases.
- Capped Renewable Portfolio Standard Energy Adjustment: Renewable Portfolio Standards operation & maintenance, debt services, and energy efficiency regulatory requirements.
- Capped Incremental Reliability Cost Factor: Power System Infrastructure.

[9] See http://clkrep.lacity.org/onlinedocs/2016/16-0065_misc_20_01-28-2016.pdf and https://ens.lacity.org/opa/importantdoc/opaimportantdoc3249143150_08272020.pdf.

- Incremental Base: Rebuilding in-basin power plants, base level distribution & transmission costs.

Rates are further adjusted through a decoupling mechanism, which considers consumption patterns. Revenue collected from rates is based on consumption patterns, which are difficult to forecast, especially in light of increasing energy conservation efforts. If consumption is less than forecasted and revenue falls short of covering costs, decoupling allows rates to be increased to recover the revenue gap. Similarly, if consumption is greater than forecasted and there is a revenue surplus, rates can be lowered to avoid over collection.

As part of this rate making process LADWP proposed adding a fixed charge to residential bills. Fixed charges are a cost that do not depend on consumption per kilowatt hour. The proposed tiered fixed charge would add the lowest fixed charge to customers in the lowest tier of consumption and a higher fixed charge to customers in higher tiers of consumption, with the intention being to prevent fixed charges falling disproportionately on low consumption customers. This fixed charge would be in addition to the existing minimum charge for customers, which requires a certain amount of payment, regardless of consumption, and applies in the case of very low consumption customers whose bill would otherwise be less than the set minimum payment. The fixed charges are intended to address the fact that many costs of energy provision are fixed rather than marginal. Fixed charges are used by a number of other public utilities, and were proposed by IOUs, but ultimately rejected by the CPUC.

The tiered fixed charges, combined with higher rate increases for the highest consumption tier, are designed to promote conservation and distributed by increasing rates the most for customers who demand the most grid power. This also has implications for affordability, because low-income customers typically have lower consumption. Thus, designing rates in a way to minimize impact to the lowest-consumption tier also ensures that in-need customers do not bear the brunt of rate increases.

4.2.3 Bill Components and Timing

Electricity affordability for households in the City of Los Angeles cannot be considered without taking into account the entire LADWP bill. The LADWP bill that a household receives can include up to 4 services: electricity, water, sanitation, and/or trash. Two of these services, sanitation and trash, are not managed by LADWP, but are included on the LADWP bill on behalf of LA Sanitation.

There are 15 different combinations these services can be billed, as customers may directly pay for one, two, three, or all four of these services depending on leasing agreements or building management. However, only three of these are most common for residential customers: Power only; Power & Trash, and Power, Water, Sewer & Trash. Generally, customers who pay for power only or power and trash are multi-tenant renters, while customers who pay for all four services live in detached units.

EZ-SAVE customers are more likely to pay for just Power & Trash than all customers, while Life Support customers are more likely to pay for all four services than all customers. These

trends likely reflect trends in tenancy arrangements between different in-need groups, thus highlighting differences between household and customer analysis. Looking at services individually, the highest proportion of customers pay for electricity, followed by trash. Less than half of customers pay directly for water and sewer service. EZ-SAVE customers are less likely to pay for trash and sewer service, while Life Support customers are more likely to pay for water and sewer service.

The services included on the bill depend on that household's tenancy and submetering arrangement. As households cannot choose which portions or services of the bill to pay, it creates a greater challenge for affordability than a single bill for electricity. Although we are focused on the electricity portion, which is typically the largest portion of the total LADWP bill, we cannot ignore that there are up to three other services on many low-income household bills when discussing electricity affordability.

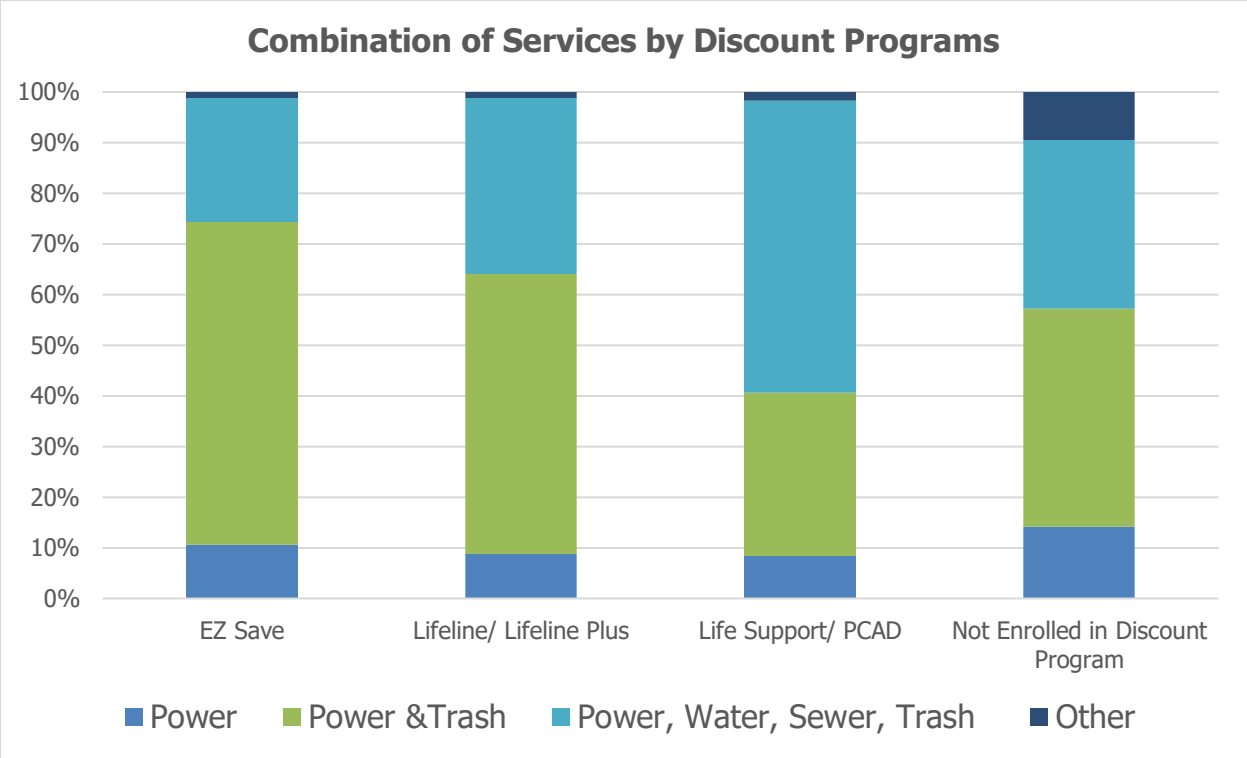

Figure 12. Combination of Services Provided to Residential Customers by Discount Program. (Data: LADWP Customer Service Division)

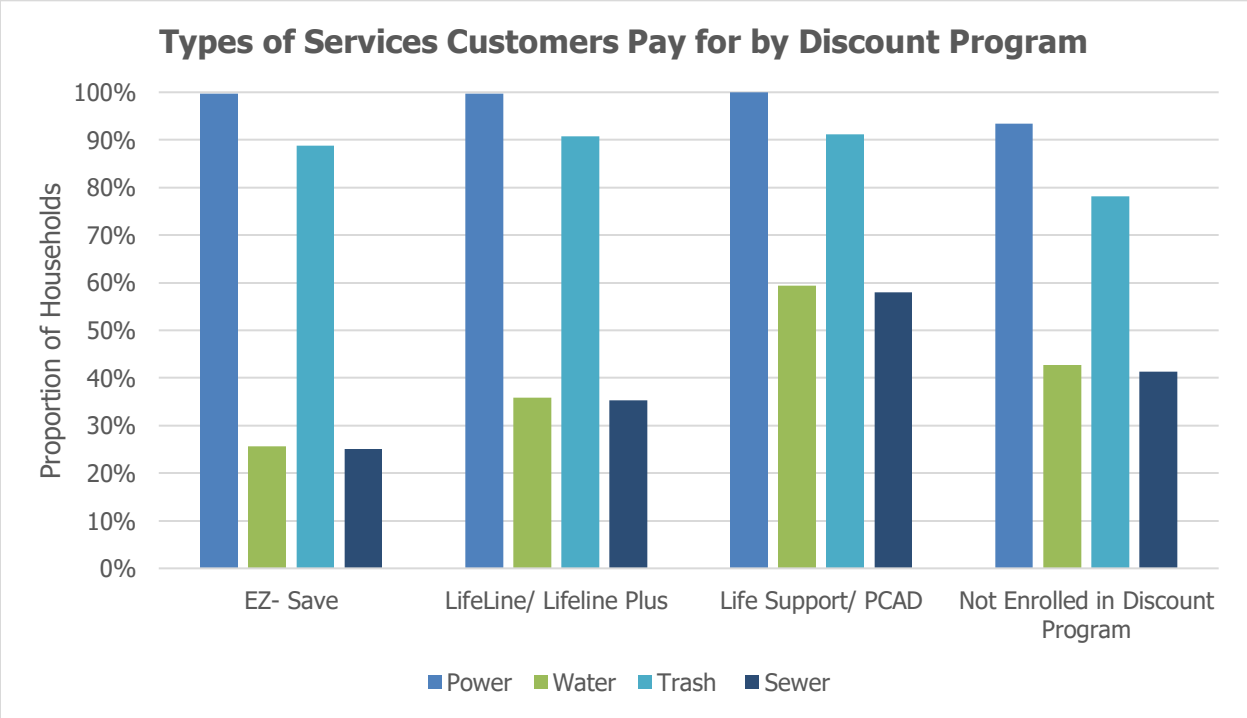

Figure 13. Services Customers Pay For by Discount Program. (Data: LADWP Customer Service Division)

Another part of residents' bills is the Utility User Tax (UUT), which is applied to electricity (10%), gas (10%), and communications (9%) services. Thus, on the LADWP bill, the UUT is only applied to the electricity portion. The revenue of these taxes goes to the City of Los Angeles general fund. Senior and disabled residents who are income qualified are eligible for an exemption from this tax through the Lifeline discount program. For fiscal year 2019-2020 the UUT revenue was projected to be between $430 to $445 million (Wright 2019).

To establish an account for residents with poor or no payment history, a $205 deposit is required (Wright 2019). Thereafter, LADWP customers are charged on a bimonthly basis. As discussed more in subsequent sections, bi-monthly billing can lead to challenges for in-need customers because it is significantly less frequent than most customers receive their paycheck or benefits. Customers have the option to pay these bills online, either as a one-time payment or automatic payment, over the phone, by main, or in person. There are 14 LADWP customer service locations where customers may drop off payment in person. While these locations still operate as drop off locations, at time of writing, they were closed for services to the public for an extended period of the COVID-19 pandemic, and are now available by appointment only.[10]

4.2.4 Snapshot of Historical Programs

LADWP and different California agencies have offered a number of programs to help make utility costs more affordable for in- need customers, some of which we discuss in further depth in pertinent policy background analysis later in this report. Depending on the program residents may qualify as 'in-need' based on income, medical condition, or age. These programs apply to the individual services on the bill, primarily electricity and water, rather than the whole bill. The table below summarizes the main discount and direct crisis relief support programs. Among these, the focus of later analysis will primarily be the LADWP EZ-SAVE program (Formerly the Low Income Discount Program) and emerging shutoff policies and funding sources.

[10] See "Customer Service Centers" page on https://www.ladwp.com/ (direct URL link not available, last accessed on March 21, 2023).

Table 2. State and Local Utility Direct Assistance Programs.

Program	Benefits	Eligibility	Utility	Provider
EZ-SAVE (formerly LIDP)[11]	-$8.17 monthly bill discount on electricity and $5 monthly bill discount on water (+$1 per additional occupant up to $10)	Low Income Households	Electricity Water Sewer Trash	LADWP LA Sanitation
Lifeline[12]	UUT Tax Exemption and $17.71 monthly bill discount on electricity and $10 monthly bill discount on water	Low-income senior or disabled citizens	Electricity Water Sewer Trash	LA Office of Finance LADWP LA Sanitation
Life-Support Equipment Discount[13]	-$17.71 monthly discount on electric bill[14]	Resident who require use of an essential life-support device	Electricity	LADWP
Physician Certified Allowance Discount[15]	$17.71 monthly discount on electric bill	Verification from certified physical of qualifying medical condition (e.g., para/hemi/quadriplegic, neurological condition, immunocompromised status).	Electricity	LADWP
LIHEAP[16]	Financial assistance, crisis assistance, weatherization, energy efficiency education, energy budget counseling	Low Income	Electricity (Gas)	State/ Federal

In addition to these programs, which fall within our core focus, other policy activities — many pandemic-related — influence affordability for in-need LA households. A number of these are listed below to provide accurate context of the broader policy landscape, which has changed dramatically since pandemic onset, but the long-term permanence of these programs is unclear. See the staff September 2022 presentation to the Board for a fuller picture.

[11] Data from "Assistance Programs" by LADWP, accessed 7 February 2022.
[12] Ibid.
[13] Ibid.
[14] Data from "Special Assistance Programs 2011-2012" by LADWP, accessed 1 March 2023.
[15] Ibid.
[16] Data from California Department of Community Service & Development. N.d. (see reference).

Table 3. Secondary Fiscal Aid Programs

Program	Benefits	Eligibility	Utility	Provider
LIHWAP[17]	Assistance for past due water utility payments	Low Income	Water	State
Housing is Key[18]	Assistance for past due utility payments	Low Income	Electricity (Gas) Sewer Trash Internet Fuel	State
CAPP	Reduce past due energy bill balances during COVID-19	Utility customers with unpaid balances between March 2020 and December 2021	Electricity (Gas)	State
CWWAPP	Reduce past due water & sewer bill balances during COVID-19	Utility customers with unpaid balances between March 2020 and June 2021	Water Sewer	State

4.3 Key Questions in Characterizing Affordability for LADWP In-need Households and Customers

We next characterize the following dimensions and enduring characteristics of in-need customers in LA city which LADWP needs to take account of in designing effective affordability policy broadly.

4.3.1 How should we generally expect the cost of the chosen pathway of LA100 implementation to affect revenue demands, rates and in-need customers?

The LA100 study projected rates for the four pathways to 100% renewable energy modeled in the study. The most significant impact on customer rates is expected to come in the early years of the transition to renewable energy, regardless of pathway. The largest rate increase for all pathways, except the reference case, was projected in the first five-year time period of the transition, with rates stabilizing after a decade. By 2045, the rates for all scenarios except for one were equal to or less than current rates adjusted for inflation. At that point, projected rates range between 25 cents per kWh for the SB100 High Load scenario and 36 cents per kilowatt hour for the Early and No Biofuels moderate load scenarios. For all pathways, the moderate load projection was predicted to result in higher rates by 2045 than the high load scenario. Therefore, widespread electrification, which would increase electric loads, has the potential to help keep rates lower.

Key Takeaways: The renewable energy transition will increase electricity rates in the short term. However, by 2045 rates should have stabilized at a rate equal to or less than that projected

[17] Data from California Department of Community Service & Development. N.d. (see reference).
[18] Data from State of California Business, Consumer Services, and Housing Agency. N.d. (see reference).

by normal inflation. Higher loads of electricity result in lower rates, indicating that electrification could contribute to rate stabilization during the transition.

4.3.2 What are the constraints in addressing affordability imposed on LADWP?

Local utilities such as LADWP receive little ongoing subsidy from the state or federal government, as a percentage of their overall revenues. Moreover, as a publicly owned utility in California, LADWP is subject to regulation over how customer charges are levied and how revenue is used. Particularly relevant for affordability are the constraints imposed by voter-approved Propositions 218 and 26 are particularly notable for the limitations they impose on LADWP concerning rate design and low-income ratepayer subsidies. See Section 3 above for more information on these and other aspects of the legal and regulatory landscape.

Key Takeaways: LADWP is limited in its ability to raise rates to cover costs of providing financial assistance to within the reasonable cost of providing service. Additionally, LADWP cannot provide utility service to those who are not charged for utility service.

4.3.3 What are the current implications of LADWP rate and bill structure and process for affordability of power for in-need residential customers?

Consolidating four services — water, power, sewer, and trash — on a single bill creates complexity in addressing affordability. Current affordability policy offerings target individual services on the bill, typically electricity and/or water, rather than the whole bill. This means that in-need customers may be paying full rates for some services, affecting their ability to pay the whole bill, including the services they receive discounted rates for. Additionally, charges not tied directly to rates, such as the User Utility Tax on electricity, are often not covered by assistance programs. Again, as customers must pay the whole bill, these additional costs affect affordability beyond service rates and discounts. Multiple services also complicate shutoff policy, as customers cannot choose to prioritize individual portions of the bill to avoid service shutoffs.

The bimonthly billing cycle presents challenges for affordability because most customers, especially in-need customers, are paid on a weekly or biweekly basis. More frequent billing cycles better align with pay schedules as well as benefit distributions such as CalFresh and SSI (Koh 2021). Such alignment can help prevent in-need customers from falling behind on payments. Lifeline customers on monthly billing cycles across all Los Angeles neighborhoods were less likely to fall behind than customers on a bimonthly billing cycle (Ibid).

Enrollment in autopay also helps prevent customers from falling behind on payments. Between November 2019 and August 2021, only 2% of LIDP (now EZ-SAVE) customers on autopay were behind on payments, while 35% of LIDP customers not on autopay were behind on payments (Ibid). Similarly, only 1% of lifeline customers enrolled in autopay were behind on payments compared to 26% of Lifeline customers not enrolled in autopay who were behind on payments (Ibid). Providing a $5 to $10 monthly discount for LIDP and Lifeline autopay customers is expected to increase autopay enrollment and reduce unpaid balances (Ibid).

A dearth of LADWP locations limits customers' ability to pay their utility bill in cash. This especially impacts in-need customers because a higher proportion of in-need customers pay in cash. In January 2020, 30% of LIDP customers and 24% of Lifeline customers had paid in cash at least once in the previous 12 months, compared to only 12% of non-enrolled customers (Ibid). However, LADWP has only 14 locations where customers can pay in person, compared to around 120 for Southern California Edison and SoCal Gas (Ibid). Furthermore, these centers have closed to the public during the COVID-19 pandemic. While they still operate as drop off locations for payments, cash payments have dropped significantly since the closure of these locations (Ibid).

Key Takeaways: LADWP bill structure impacts customers' ability to pay on time by combining multiple services, infrequent billing, under enrollment in autopay, and lack of locations to pay in person.

4.3.4 What are prevailing consumption and expenditure levels among in need customers?

LADWP residential rates are competitive with peer utilities and are designed to be affordable for covering basic needs. LADWP's electricity prices from 2009 to 2014 were lower than average and lower than those of nearly all its POU and IOU peers in California (LADWP 2015). Between 2015 and 2018, LADWP residential electricity rates were lower than that of PG&E, SDG&E, and SCE, which corresponded to a lower monthly electric bill for residential LADWP customer compared to those of IOUs (Wyman 2020).

LADWP uses a three-tiered system to set residential electricity rates. Tier one has the lowest price and applies to electricity use up to 350 kWh or 500 kWh depending on the climate zone, while tier three has the highest price and applies to electricity use above 1,050 kWh. The intention of this pricing is to set low, affordable rates for basic electricity consumption needs, and higher rates to discourage excessive electricity use.

Even with this affordable rate structure, data suggests that the cost of utilities constrains power use for in need customers, including those enrolled in discount programs. In 2018, citywide, customers enrolled in Lifeline and EZ Save used less energy than customers not enrolled in these programs. Lifeline customers used a median of 276 kWh and low-income customers used a median of 265 kWh compared to non- discount enrolled customers who used a median of 292 kwh (City of Los Angeles 2019). Specifically in low-income neighborhoods, customers enrolled in EZ-SAVE on average use marginally more power (221 kWh) than those not enrolled (218 kWh), with both using significantly less than the city average (Ibid). This suggests that utility cost is also a constraint for those not enrolled in EZ-SAVE in these neighborhoods. Additionally, it demonstrates that there is no evidence of a "rebound" effect, whereby utility discounts inadvertently incentivize excessive electricity use. Even with the discount, EZ-SAVE customers use notably less energy than non-enrolled customers.

Furthermore, utility cost is increasingly constraining use amongst the lowest income EZ-SAVE eligible customers. Within EZ-SAVE eligible customers, average monthly electricity use decreases amongst customers in higher tiers of poverty (Koh 2021). Customers 200% above the

federal poverty level use a median of 364 kWh while customers 50% above the federal poverty level use a median of only 294 kWh (Ibid). All EZ Save eligible income tiers use less electricity than the non-income qualified mean electricity usage, and customers 150% or less above the federal poverty line use less than the non- income qualified median electricity usage (Ibid). This may be in part because EZ-SAVE offers a flat discount to all qualified customers, and is not tiered to offer greater assistance to lower income customers.

Key Takeaways: Even with discount programs, utility bills could be a financial constraint for in-need customers, especially those with the lowest incomes.

4.3.5 What are prevailing enrollment levels in assistance programs among in need customers?

Despite the constraints utility bills create for low-income customers, LADWP discount programs are significantly under-enrolled. By determining the number of residential accounts below 200% of the poverty level using census data, it was estimated in 2021 that around 570,616 accounts would qualify for LIDP (now EZ-SAVE) under contemporary criteria (Ibid). However, at time of writing, only around 240,000 accounts are enrolled, meaning there is an enrollment gap of about 330,616 eligible accounts (Ibid). Within the estimated number of eligible customers, about 26% would qualify for the lifeline program while 74% would qualify for EZ-SAVE (Ibid). Comparing these eligibility estimates to actual enrollment demonstrates that only about 62% of eligible customers are enrolled in the lifeline program, and only about 29% of eligible customers are enrolled in EZ SAVE.

Within these eligible but unenrolled customers, there are a number of trends. Eligible customers who are not enrolled in discount programs are more likely to reside in communities of color. There is a positive correlation between the percentage of customers eligible but not enrolled for discount programs and the percentage of the community that identifies as Hispanic or Latino, Black or African American, American Indian or Alaskan Native, and Native Hawaiian or Pacific Islander (Koh 2021). Additionally, unenrolled customers are more likely to have larger families as there is a positive correlation within neighborhoods between percentage unenrolled customers and family size (Ibid). There is also a positive correlation within neighborhoods between unenrolled customers and the number of households held by females with no partner present (Ibid). There is a negative correlation within neighborhoods between unenrolled customers and residents who have attained a high school education or higher (Ibid). Finally, the proportion on unenrolled in-need customers varies throughout the city with Central LA, the San Fernando Valley, and South LA being the regions with the most unenrolled, in-need customers (Ibid).

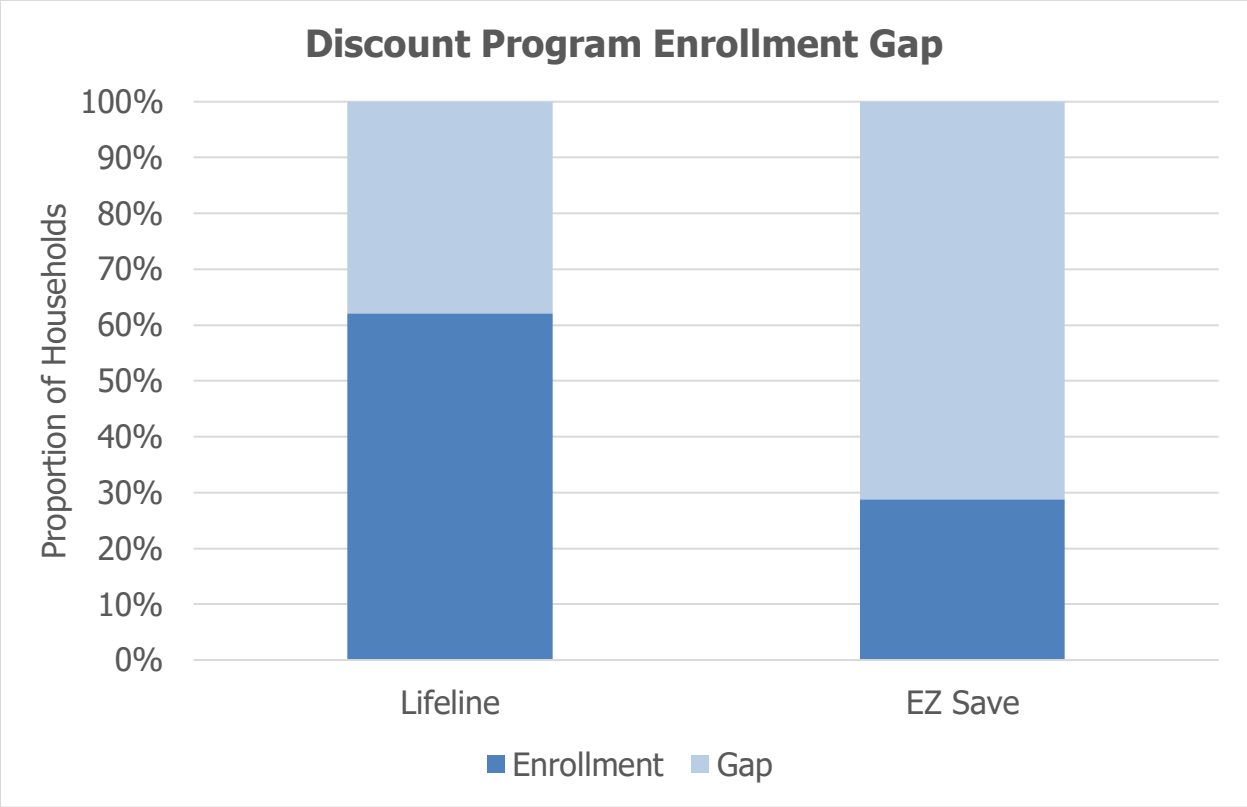

Figure 14. Proportion of Eligible Customers Enrolled in LADWP Discount Programs (Data: Fuse Corp Fellowship Year 1 Discussion)

Changes to the EZ-SAVE program intended to boost enrollment are already underway. In November 2021, LADWP announced that the EZ-SAVE program would no longer require up-front income verification. Instead, income would be self-reported on the application, and could then be verified later by LADWP through targeted follow-up audits. This change is discussed further in the metrics and policy sections of this report.

Key Takeaways: EZ-SAVE (previously LIDP) and Lifeline programs are significantly underenrolled. Eligible but unenrolled customers are correlated with communities of color, large families, female lead households, and less educated residents.

4.3.6 How much do customers on discounted rates contribute to overall Power System Revenue?

Historically, bills from residents on discounted electricity rates have comprised only a small portion of total Power System Revenue. The actual revenue from fiscal years 2019-2021 for each of the four discount programs, as well as their sum, is reported in the table below.[19]

Table 4. Discount Program Revenue, FYs 2019-2021

Program	Revenue FY2019	Revenue FY2020	Revenue FY2021
Lifeline	$49,998,208	$53,283,737	$56,551,734
EZ Save	$59,012,258	$56,439,006	$69,740,251
Life Support	$3,650,562	$3,825,641	$3,976,249
PCAD	$5,978,413	$7,237,751	$8,348,604
Discount Programs Total	$118,639,440	$120,786,136	$138,616,839

From the fiscal years 2019-2021, the total revenue contribution from customers on discounted rates ranged from $118.6 million to $138.6 million. To better understand how these revenues compare to the revenue from other commercial and residential users, as well as the overall Power System values and percentages are reported in the table and pie charts below.

Table 5. Discount Program Revenue in Comparison to Overall Power System, FYs 2019-2021

Category	Revenue FY2019	Revenue FY2020	Revenue FY2021
Discount Programs Total	$119 million	$121 million	$139 million
Other Residential	$1.26 billion	$1.24 billion	$1.48 billion
Commercial	$2.56 billion	$2.37 billion	$2.56 billion
Total Power System Revenue	$4.07 billion	$3.8 billion	$4.27 billion

[19] The values in this section and the one that follows were generated using actual bills shared by LADWP and CCSC, as well as the work of the 2021 Fuse Corps fellowship (Koh 2021).

Figure 15. Proportional Revenue of Discount Program Enrollees vs. Others, FYs 2019-2021

Over these fiscal years, discount program customer bills have represented about 3% of total Power System revenue, and between 9% and 10% of Residential Power System revenue.

These values emphasize that payments from customers in vulnerable segments of the population have historically not made up a large portion of DWP's Power System Revenue. This piece of information is especially important when evaluating the potential risks of implementing debt relief programs and/or permanent shutoff moratoria — as discussed in depth in Section 7.4, *Crisis Relief*, of this report. It is likely that this relatively minimal (although not zero) revenue impact, as discussed at the November 8th LADWP Board meeting, was an important factor in the decision to implement a permanent shutoff moratorium for customers enrolled in discount programs (LADWP News 2022).

These numbers also support the fact that low-income customers on discounted rates do not consume large amounts of energy, meaning that helping these customers through more robust discounts and more widespread enrollment is likely to have a smaller revenue impact than if this were not the case. Of course, this piece of information is dependent on the total number of enrolled customers, and must be validated through bill-level, and not just aggregate, data. That being said, CCSC researchers *have* found lower consumption among low-income residents, concluding that per-capita consumption of households in DAC zip codes is, on average, about half of those in non-DAC zip codes (Fornier et al. 2020). A second caveat is that is likely that some customers are under-consuming due to worries about being unable to afford their bills (see Section 6.2 *Energy Insecurity Metric*, for discussion of this challenge). Therefore, it is a public health imperative that, in many cases, low-income customers either increase their consumption or are given access to affordable weatherization and energy efficiency upgrades in order to maintain thermal comfort without requiring bill tradeoffs.

4.3.7 How much financial assistance would be required to enroll all eligible customers in existing affordability assistance and to expand existing programs?

In addition to considering actual revenue from discount program residents, which is especially relevant in the context of shutoffs and debt relief, we also consider current costs of financial assistance to these residents — as well as the costs of expanding program enrollment and eligibility.

Table 6. LADWP Discount Program Subsidy and Customer Data, FYs 2019-2021[20]

	FY 2019		FY 2020		FY 2021	
Program	**Subsidy**	**Customers**	**Subsidy**	**Customers**	**Subsidy**	**Customers**
Lifeline	$22.8 million	98,597	$23.5 million	97,764	$22.8 million	97,416
EZ-Save	$10.4 million	126,801	$9.17 million	113,615	$10.2 million	131,526
Life Support	$0.85 million	5,186	$0.86 million	5,100	$0.86 million	6,239
Physicians Certified Discount (PCAD)	$1.36 million	6,545	$1.59 million	7,390	$1.79 million	8,756
Total Discount Program	$35.5 million	237,129	$35.1 million	222,869	$35.6 million	243,937

Using 2021 enrollment and subsidy values (for Lifeline and EZ-Save) as a baseline, we conclude that reaching 80% enrollment under the current 200% FPL eligibility would add approximately $21 million of annual financial assistance, while reaching 100% enrollment would approximately double the annual financial assistance (see Tables 7 and 8 for the breakdown of costs).

Table 7. Estimated Additional Cost of 80% Enrollment in Discount Programs

	FY 2021 (29% Enrollment)		80% Enrollment (Estimated)		
Program	**Subsidy**	**Customers**	**Customers**	**Total Subsidy**	**Additional Subsidy**
Lifeline	$22.8 million	97,416	117,889	$27.6 million	$4.8 million
EZ-Save	$10.2 million	131,526	338,604	$26.3 million	$16.1 million
Total	$33 million	228,942	456,493	$54 million	$21 million

[20] The values presented in this and the following tables are only representative of electricity rate discounts, and do not include the added benefits that many EZ-Save and Lifeline residents receive from the Water System or the exemption from utility user's tax (UUT) that Lifeline customers receive. Thus, these subsidies only describe the specific costs to the Power System, which is recovered through the Energy Subsidy Adjustment factor.

Table 8. Estimated Additional Cost of 100% Enrollment in Discount Programs

	FY 2021 (29% Enrollment)		100% Enrollment (Estimated)		
Program	**Subsidy**	**Customers**	**Customers**	**Total Subsidy**	**Additional Subsidy**
Lifeline	$22.8 million	97,416	147,361	$34.5 million	$11.7 million
EZ-Save	$10.2 million	131,526	423,255	$32.8 million	$22.6 million
Total	$33 million	228,942	570,616	$67 million	$34 million

In addition to enrolling eligible customers, adjustments to the structure of the programs could provide additional assistance to in need customers. Eligibility for EZ-SAVE is based on the federal poverty level, which does not consider the place-based implications of the cost of living in Los Angeles. One potential reform to make utility bills more affordable is to expand income eligibility, based on Area Median Income (AMI) for the region rather than the federal poverty level. The additional financial assistance required to offer the Lifeline and LIDP discounts to households below 80% AMI, and achieve 80% enrollment, would be approximately $49 million annually, or $82 million in total assistance annually. Achieving 100% enrollment with this expanded definition of eligibility would require an additional $70 million in assistance annually, or about $103 million in total annually (see Tables 9 and 10 for breakdown of costs).

Table 9. Estimated Additional Cost of 80% Enrollment, Expanded Eligibility (80% AMI)

	FY 2021 (29% Enrollment)		80% Enrollment (Estimated)		
Program	**Subsidy**	**Customers**	**Customers**	**Total Subsidy**	**Additional Subsidy**
Lifeline	$22.8 million	97,416	181,156	$42.4 million	$19.6 million
EZ-Save	$10.2 million	131,526	515,597	$40 million	$29.8 million
Total	$33 million	228,942	696,753	$82 million	$49 million

Table 10. Estimated Additional Cost of 100% Enrollment, Expanded Eligibility (80% AMI)

	FY 2021 (29% Enrollment)		100% Enrollment (Estimated)		
Program	**Subsidy**	**Customers**	**Customers**	**Total Subsidy**	**Additional Subsidy**
Lifeline	$22.8 million	97,416	226,445	$53 million	$30.2 million
EZ-Save	$10.2 million	131,526	644,496	$50 million	$39.8 million
Total	$33 million	228,942	870,941	$103 million	$70 million

Another potential reform would be to pay the entire utility bill of customers who qualify for EZ-SAVE or Lifeline programs, as even discounted rates are seen to be constraining. This exercise is also helpful in establishing an absolute upper bound for the cost of financial assistance for vulnerable ratepayers. Using 2021 enrollment, subsidy, and rates as a baseline, the cost of

completely covering bills for a 100% enrollment of Lifeline and EZ-SAVE customers that are eligible under current requirements would be about $377 million annually. The cost of completely covering bills for a 100% enrollment of Lifeline and EZ-SAVE customers under the 80% AMI definition of eligibility would be about $576 million annually.

Table 11. Estimated Costs of Total Bill Coverage for Lifeline and EZ-SAVE Customers

	200% FPG (Current Eligibility)			80% AMI (Expanded Eligibility)	
Program	**Current Enrollment**	**80% Enrollment**	**100% Enrollment**	**80% Enrollment**	**100% Enrollment**
Lifeline	$79.4 million	$96 million	$120 million	$148 million	$184 million
EZ-Save	$79.9 million	$206 million	$257 million	$313 million	$392 million
Total	$159 million	$302 million	$377 million	$461 million	$576 million

Key Takeaways: Providing financial assistance to all eligible customers under the current discount framework would cost the Power System about $67 million annually. Reforming the current framework to increase assistance and/or increase eligibility would cost between $100 million and $575 million depending on the framework adopted.

4.3.8 What is general in-need customer satisfaction with LADWP? What is satisfaction with affordability, contextualized among reasons for dissatisfaction with LADWP?

The LMU 2020 Public Opinion Survey asked LADWP customers to rate their utility services (water, electricity, and sustainability) on a scale of good, fair, and poor. For electricity, 53% of respondents reported good service, while 38% reported fair service, and 9% reported poor service. Senior residents reported "Good" electricity service 10% more than non- seniors. There was no discernable trend in satisfaction for in-need customers. Of all customers reporting good service, reliability was the primary reason given for their rating (54%). For residents who reported fair or poor service, cost of billing was the primary reason given for their rating (50% and 63% respectively).

When asked how much they trust their energy provider to do what is right, 51% of respondents in the LADWP service area responded, "Just about always" or "most of the time." This was the lowest compared to other energy providers surveyed including Edison (58%), LA County (56%) or other providers (75%). There are no discernable trends in satisfaction among in-need customers.

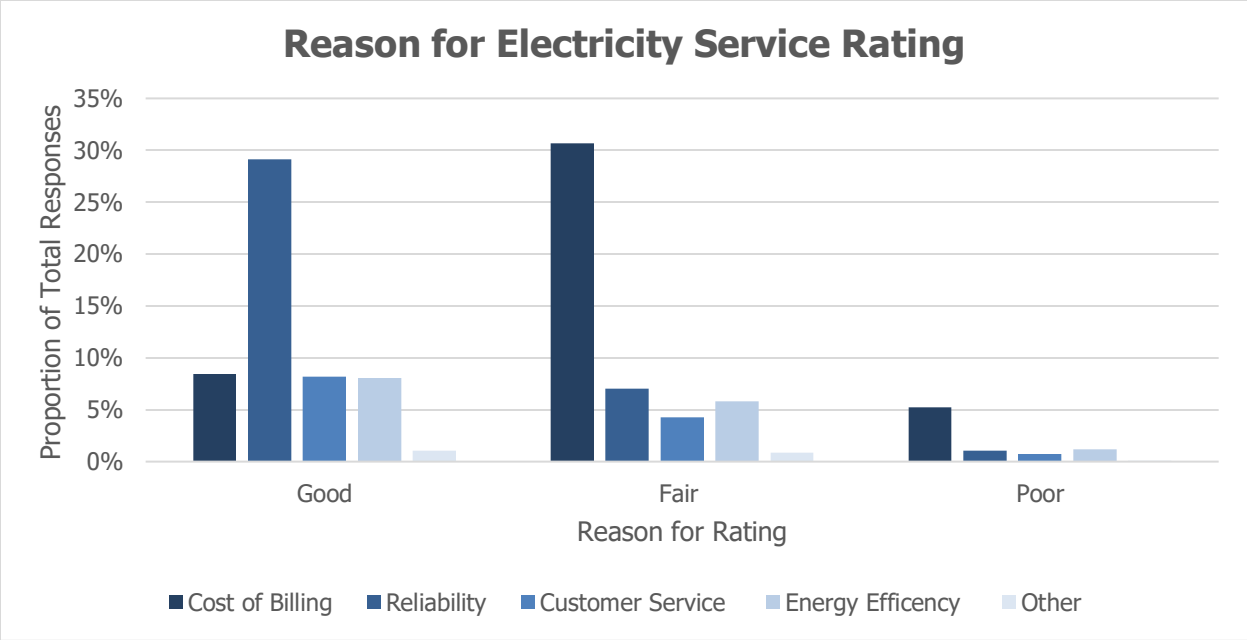

Figure 16. Reason for Electricity Rating by Rating (Data: LMU Public Opinion Survey 2020)

Key Takeaways: Reliability of electric service is a key component of current customer satisfaction with LADWP, while the cost of billing is a key point of dissatisfaction amongst customers, including in need customers. Only about half of LADWP customers have trust in the department's ability to make good decisions.

4.3.9 How do utility costs impact quality of life for LA residents?

City of LA Respondents to a similar UCLA-led Quality of Life Index Survey conducted in 2021 were asked which cost of living factor between housing, transportation, utilities, food, and taxes is most important to them. There is a statistically significant relationship between income within the City of LA and whether utilities are the most important cost of living. For higher income brackets, utilities are more likely to be classified as the most important factor in cost of living.

Respondents were additionally asked to rate their satisfaction with their utilities on a scale from 1 to 10. Respondents within the City of LA reported statistically significantly lower satisfaction than respondents outside the city of LA, with a mean satisfaction of 4.7 compared to a satisfaction of 5.2 for residents outside the city.

Key Takeaways: Utilities not always the most important factor to cost of living for in-need customers. Satisfaction with utilities is lower for respondents within the City of LA compared to the rest of the County.

4.3.10 Are there barriers to procedural equity in assistance program enrollment, and if so, what are they?

According to the 2021 LMU Public Opinion Survey, there is relatively widespread awareness of utility discount programs; about 70% of LA residents are aware of the discount programs offered by LADWP (LADWP Data Brief 2021). However, only 24% of all customers have participated in a discount program, as echoed in the findings from NREL's listening sessions outlined in Chapter 2. Customers who make less than $55,000 were most likely to respond that they were aware of the programs and had participated, while customers with higher incomes were most likely to respond that they had heard of the programs but not participated. This finding is consistent with the structure of the program, as customers with higher incomes are less likely to be eligible.

Likewise, customers with a disability or medical condition were most likely to respond they were aware of and had participated in the program, while customers without a disability were more likely to respond that they were aware but had not participated. There was no significant difference in awareness between seniors and non- seniors. Importantly, between 20% and 30% of customers in all in-need categories had never heard of the program. Those that have participated are mostly satisfied with the program, with at least 78% reporting being very satisfied or somewhat satisfied. There are no strong discernable trends in satisfaction with the program between in-need groups of customers.

Of those who know about the discount and rebate programs but have not participated, 40% do not know whether they are eligible. Another 8% know they are eligible, but choose not to participate, while 15% do not understand how the program is administered. Looking specifically at in-need customers, there are differences in reason for not participating in discount programs between different income brackets and age groups. For those who make below $70,000 the primary reason cited for not signing up for discount programs is that respondents did not know if they were eligible. For higher income brackets the primary response for not signing up for discount programs is that respondents knew they were not eligible. This is as expected because higher income customers are less likely to qualify for discount programs. There is also a significant difference in reasons for not participating in discount programs between senior citizens and younger residents. For respondents over 62 the primary reason for not enrolling in discount programs is respondents know they are not eligible. Notably, senior respondents were less likely to report not knowing if they were eligible compared to non-senior respondents. However, about 30% of seniors still did not know if they were eligible. Seniors are also more likely than non-seniors to know they are eligible and choose not to participate.

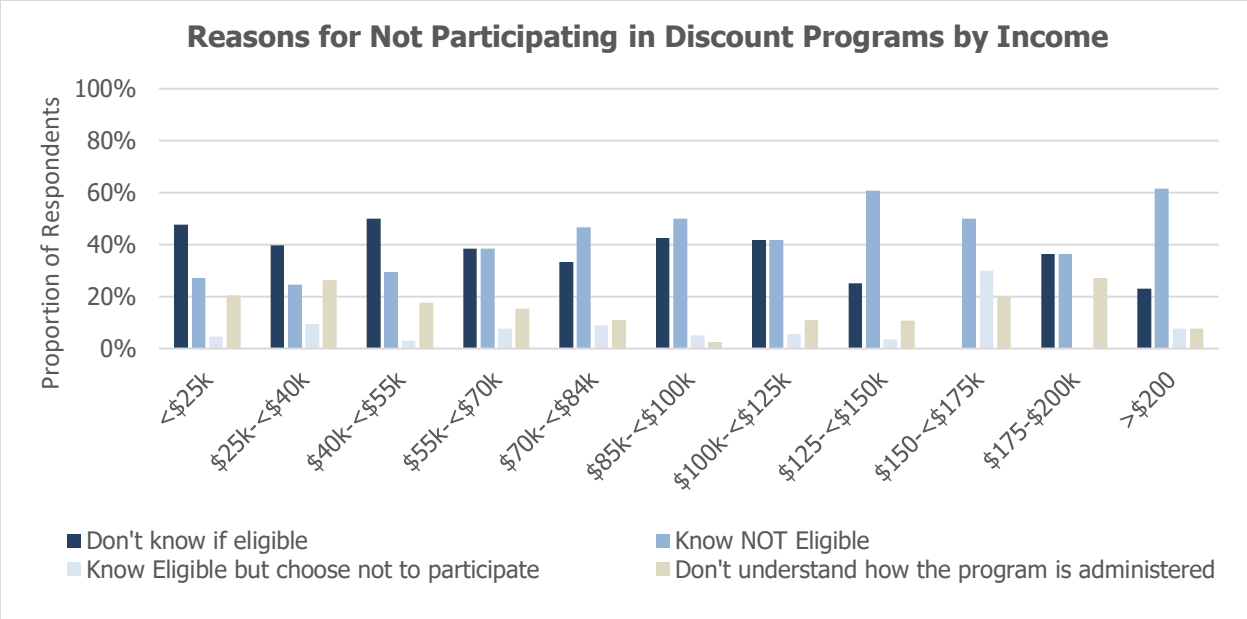

Figure 17. Reasons for Not Participating in Discount Programs Across Incomes (Data: LMU Public Opinion Survey 2021)

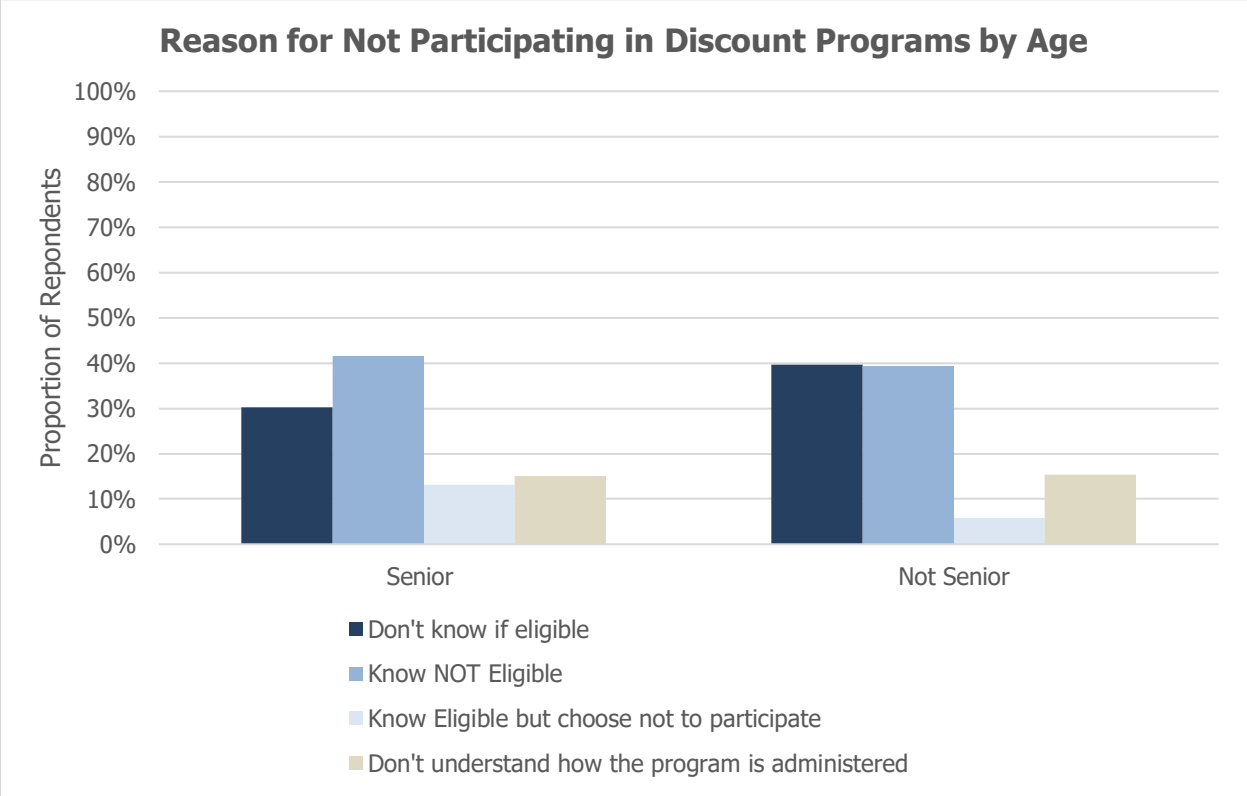

Figure 18. Reasons for Not Enrolling in Discount Programs Among Seniors and Non-Seniors (Data: LMU Public Opinion Survey 2021)

Those who are eligible but choose not to sign up for discount programs are primarily (42%) concerned that they don't know enough about the programs. Those who choose not to participate in other rebate programs are primarily (38%) concerned that they are not guaranteed that they would receive the rebate.

A majority of respondents in the <$40,000 income bracket reported they chose not to sign up for the discount programs because they did not know enough about it, while a majority reported "other" reasons for not signing up for rebate programs. A majority of respondents in the $40,000 to $69,000 income bracket reported that the discount program was too difficult to sign up for, while for the rebate programs a majority of respondents reported concern that there was no guarantee they would receive the rebate. Those with a disability medical condition reported the primary reason for not participating in discount programs being too difficult to sign up (25%) and not knowing enough about it (22%). These respondents listed the primary reason for not signing up for the rebate program as no guarantee of receiving the rebate. Respondents over 65 reported "other" as the primary (29%) reason for not signing up for discount programs and "No guarantee that I would receive the rebate" as the primary reason for not signing up for rebate programs.

Those who did not understand how the program was administered were asked what would help them better understand. The most popular classification of responses were more information/awareness/ads (31%) and more clear instructions (24%). Those that were aware of the program, whether or not they had participated, were asked how they found out about the programs. The most reported methods for both the discount and rebate programs were word of mouth and mail.

LADWP also maintains a Community Partnership Outreach Grants Program which provides grants to non-profit organizations who play a vital role to help further the goal of sustainability efforts for the City of Los Angeles. However, the utility has stopped short of a full-scale emPOWER type model as employed elsewhere in Southern California and the San Joaquin Valley. The emPOWER approach involves building a user-friendly, customer platform and wherein community-based organizations are directly contracted by the utility to inform and help low-income residents sign up for the full suite of environment-related financial assistance programs offered by LADWP, including those offering clean and affordable energy, water and clean transportation (Pierce and Connolly, 2020).

Key Takeaways: There is high uncertainty among in-need customers as to whether they are eligible for the discount and rebate programs offered for LADWP. In-need customers who know they are eligible for discount programs do not sign up because they do not know enough about the programs and they are too difficult to sign up for, which an emPOWER type approach might address. In- need customers who know they are eligible for rebate programs do not sign up because they are concerned there is no guarantee that they will receive the rebate.

4.3.11 What do we know about in-need customer support willingness to pay for the renewables transition?

In one sense, customers have expressed support for the transition to 100% renewable electricity by electing city councilors who supported the LA100 study and the adoption of the most aggressive pathway for this transition. We also consider survey data on this point.

In the 2020 LMU survey, when asked how much more they would be willing to pay for 100% clean energy, 65% of all respondents in LADWP service area reported being willing to pay at least 5% more; 43% reported being willing to pay at least 10% more; 20% reported being willing to pay at least 20% more; and 7% reporting being willing to pay 30% more (percentages are cumulative) (Guerra et al. 2020). 35% of respondents reported that they would not be willing to pay more to transition to 100% clean energy.

Broken down by income bracket, a majority of respondents who make less than $70,000 are willing to pay at least 5% more for renewable energy. A majority of respondents who make between $70,000 and $150,000 are willing to pay at least 10% more for renewable energy. A majority of respondents who make more than $200,000 are willing to pay at least 20% more for renewable energy.

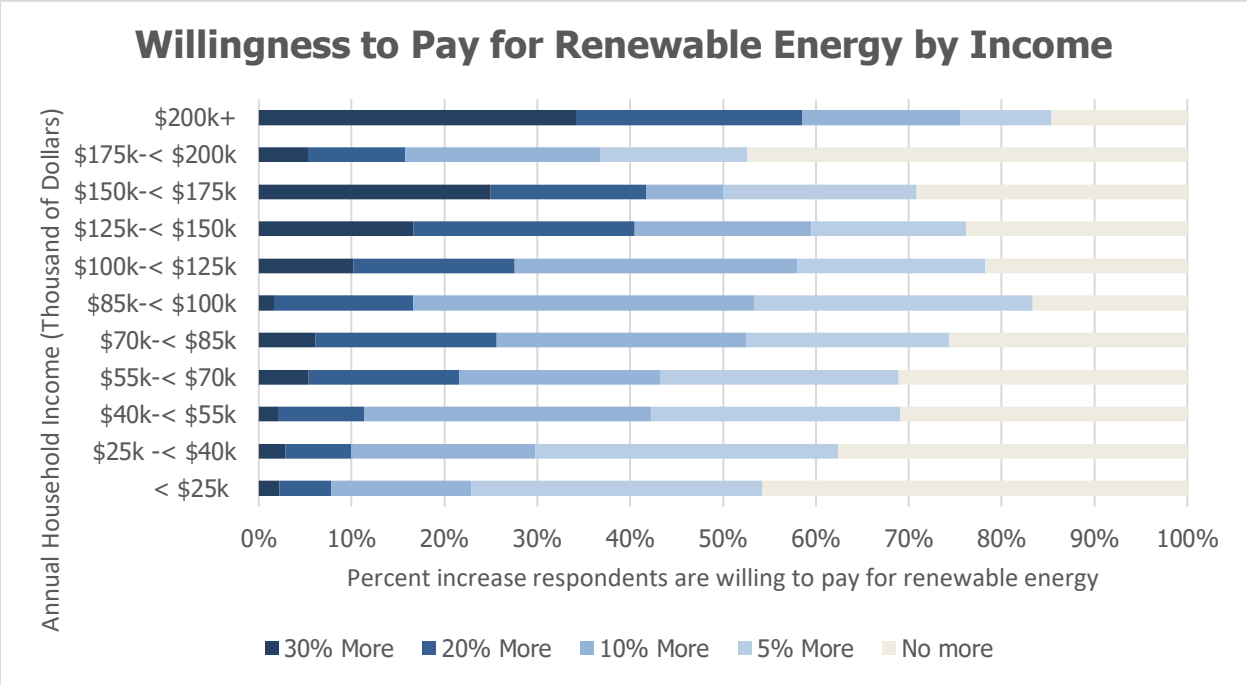

Figure 19. Respondent Willingness to Pay More for Renewable Energy Across Incomes (Data: LMU Public Opinion Survey 2020)

Residents were asked if they would support an increase in taxes or fees to help decrease energy and water costs for those in financial need on a scale of strongly support, somewhat support, somewhat oppose, and strongly oppose. 61% of residents strongly support or somewhat support increasing taxes or fees to decrease costs for those in financial need. This trend is seen across all income brackets, with the strongest support (65%) from respondents who make between

$100,000 and $150,000 and the weakest support (52.8%) from respondents who make between $70,000 and $100,000. This trend also tracks across age groups with a majority (61%) of respondents over the age of 65 strongly supporting or somewhat supporting an increase in taxes or fees to help decrease energy and water costs for those in financial need.

Key Takeaways: Most residents across the board are willing to pay at least 5% more on their electricity bills, while most residents who make more than $70,000 are willing to pay at least 10% more on their electricity bill. Most in-need customers (both low income and seniors) are willing to pay 5% more for clean electricity. A majority of all residents would support higher taxes or fees to decrease costs for those in need, including within in-need customer demographics.

4.3.12 What do we know about (in-need) customer awareness of electrification technologies?

In the 2019 LMU survey, residents were asked how much they know about the risks and benefits of battery energy storage systems, either 'nothing at all', 'a little', 'a moderate amount', or 'a great deal' (Guerra et al. 2019). The primary response (36%) across the board was "Nothing at all" followed by "A little" (25.7%). This trend is consistent across most income brackets except for respondents who make between $100,000 and $150,000 who primarily reported knowing "A moderate amount" (29.3%) followed by "A little" (23.4%). In contrast, respondents who made under $40,000 had the highest proportion of respondents (45.3) reporting knowing "Nothing at all" about battery storage Likewise, when broken down by age bracket, the primary response from respondents over 65 was "nothing at all" (42.2%) followed by "very little" (42.2%).

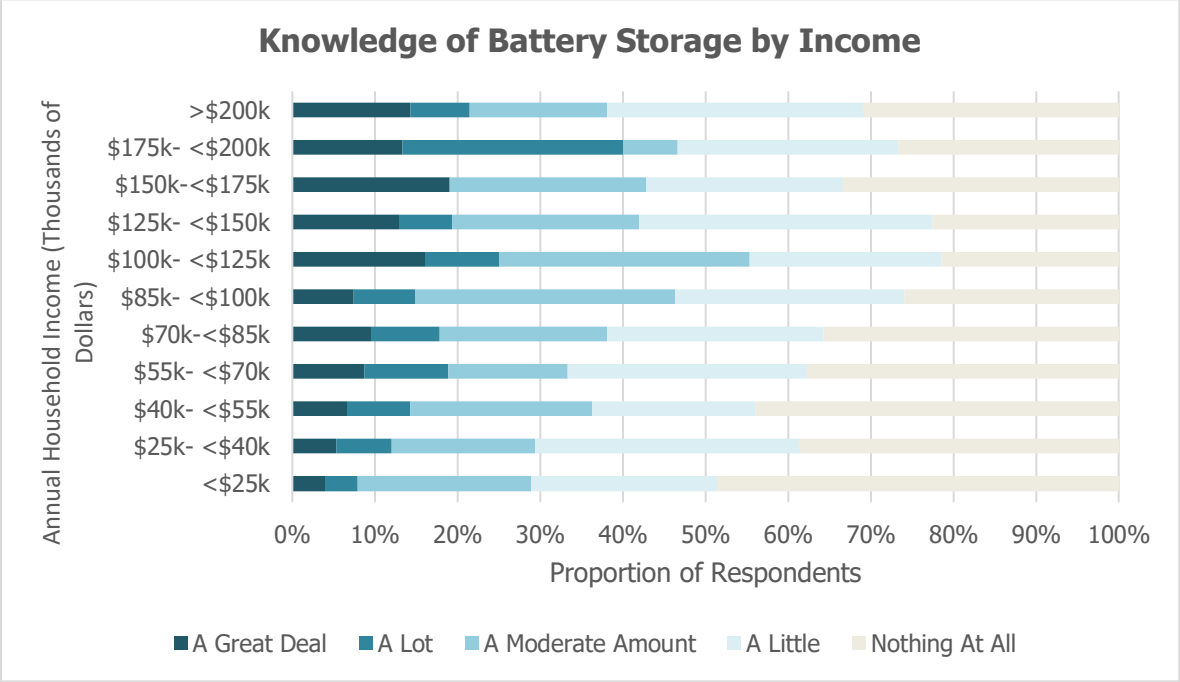

Figure 20. Knowledge of Battery Storage by Income Bracket (Data: LMU Public Opinion Survey 2019)

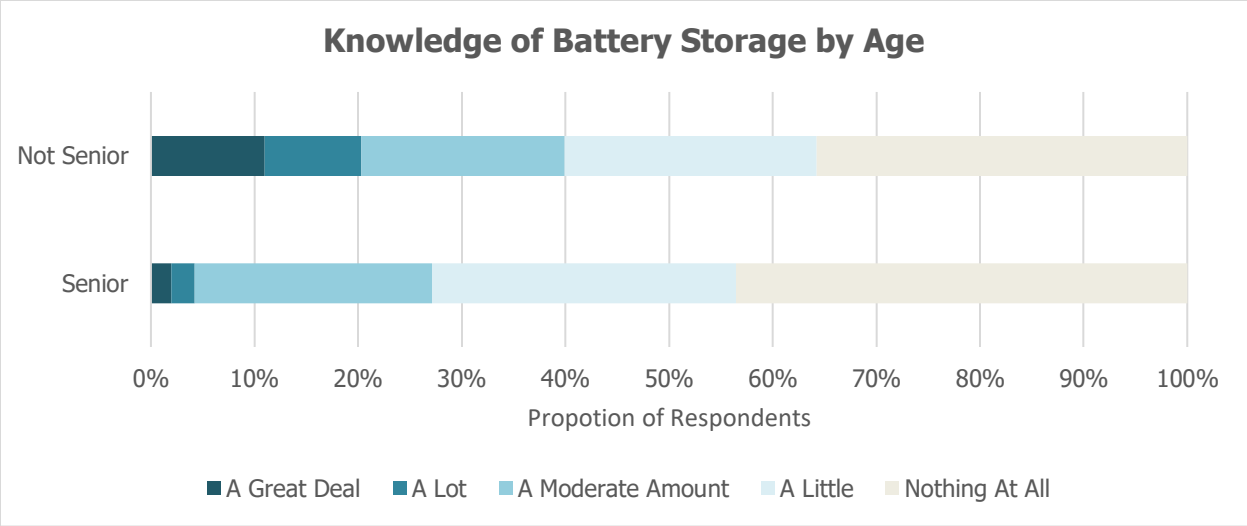

Figure 21. Knowledge of Battery Storage by Age (Data: LMU Public Opinion Survey 2019)

Key Takeaways: Knowledge of battery energy systems is low across the board, but particularly so for in-need residents.

4.3.13 How do tenant-landlord split incentive issues affect in-need customers now and in the renewable energy and electrification transitions?

Split incentive issues arise when the benefits and costs of an investment are not proportionately distributed (Bird & Hernández 2012). This occurs in landlord-tenant relationships when a landlord makes capital improvements to a rental unit and then the benefits of those improvements are captured by the tenant, a concern also echoed in the listening sessions conducted by NREL as part of the broader LA100 ES project (see Chapter 2). This issue is prevalent regarding energy upgrades because the cost savings of the investment, paid by the landlord, are reflected in the utility bill, which is usually paid by the tenant. The split incentive issue discourages a number of sustainability efforts including weatherization, electrification, and the electric vehicle transition.

Electrification is a split incentive issue because landlords are presented with little benefit from switching gas appliances to electric, even as the state transitions away from natural gas. In-need customers who are renters do not have the property rights to electrify and are least able to afford the upfront cost of electrification (Greenlining 2019). Therefore, in-need customers are the most likely to be left behind using gas infrastructure as the state electrifies. As the customer base for gas service grows smaller, rates will have to increase for existing customers to cover fixed costs, and these increased costs will fall disproportionately on in-need customers (Ibid). Additionally, a smaller customer base may lead to underinvestment in infrastructure causing safety and reliability issues for in-need customers (Ibid). At the moment however, residents who own their home and higher income residents are more likely to have a gas hook up to their home. This may be reflective of a historic preference for gas appliances, especially stoves. Renters and low-

income customers should not be left behind in the current switch electrification, the way historic disparities have left them with less access to gas.

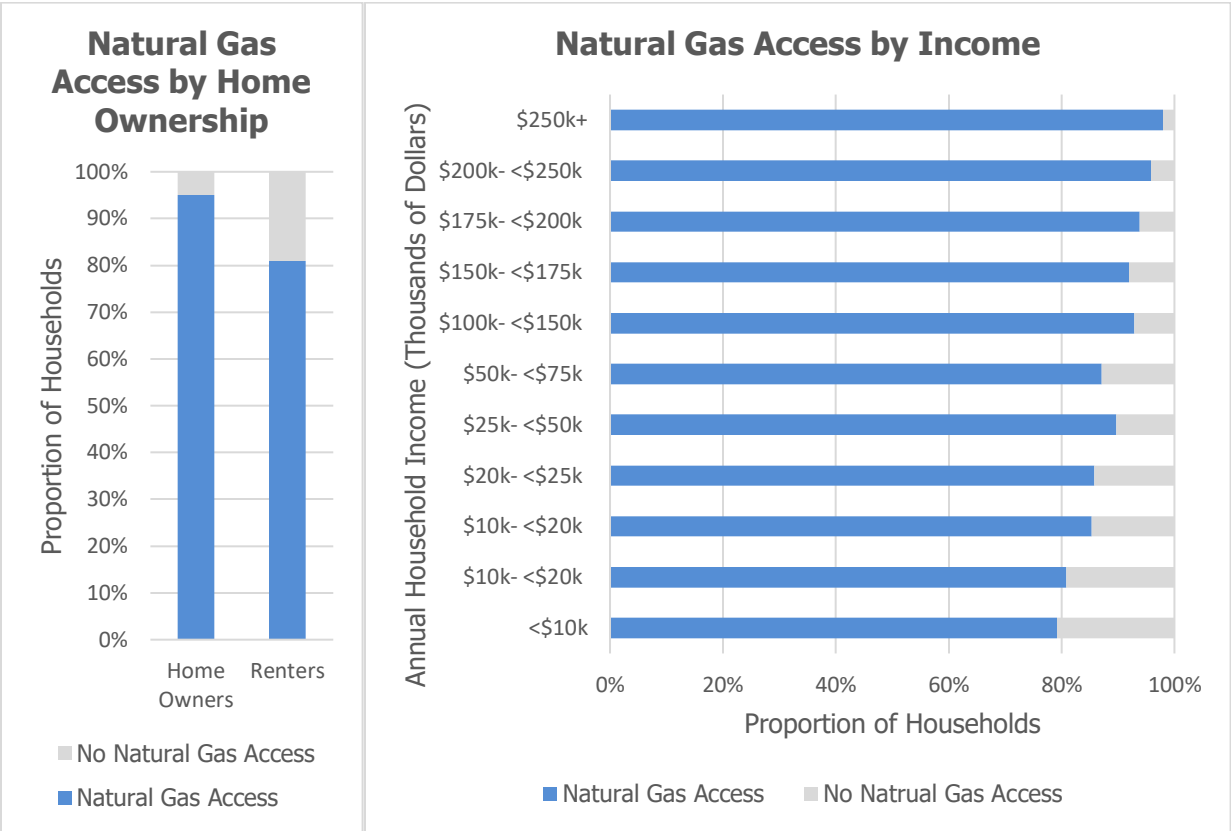

Figure 22. Natural Gas Access by Demographics (Data: RASS 2019)

Weatherization is hindered by the split incentive because landlords are responsible for the initial upgrades including insulating the unit and upgrading windows. However, the benefits are reflected in lower heating and cooling costs captured by the tenants. Thus, landlords are not motivated to make weatherization improvements, leaving tenants to pay higher utility costs. Such a trend is reflected in responses to the LADWP customer responses to the RASS survey: only 14% of renters reported insulation in all walls, while 36% of owners reported the same. Similar trends of less likely to have insulated exterior walls are reflected across the low-income and disabled in-need customers. Low-income tenants are most affected by the split incentive for weatherization because they spend the highest percentage of their income on electricity and tend to have the lowest levels of energy efficiency (Ibid).

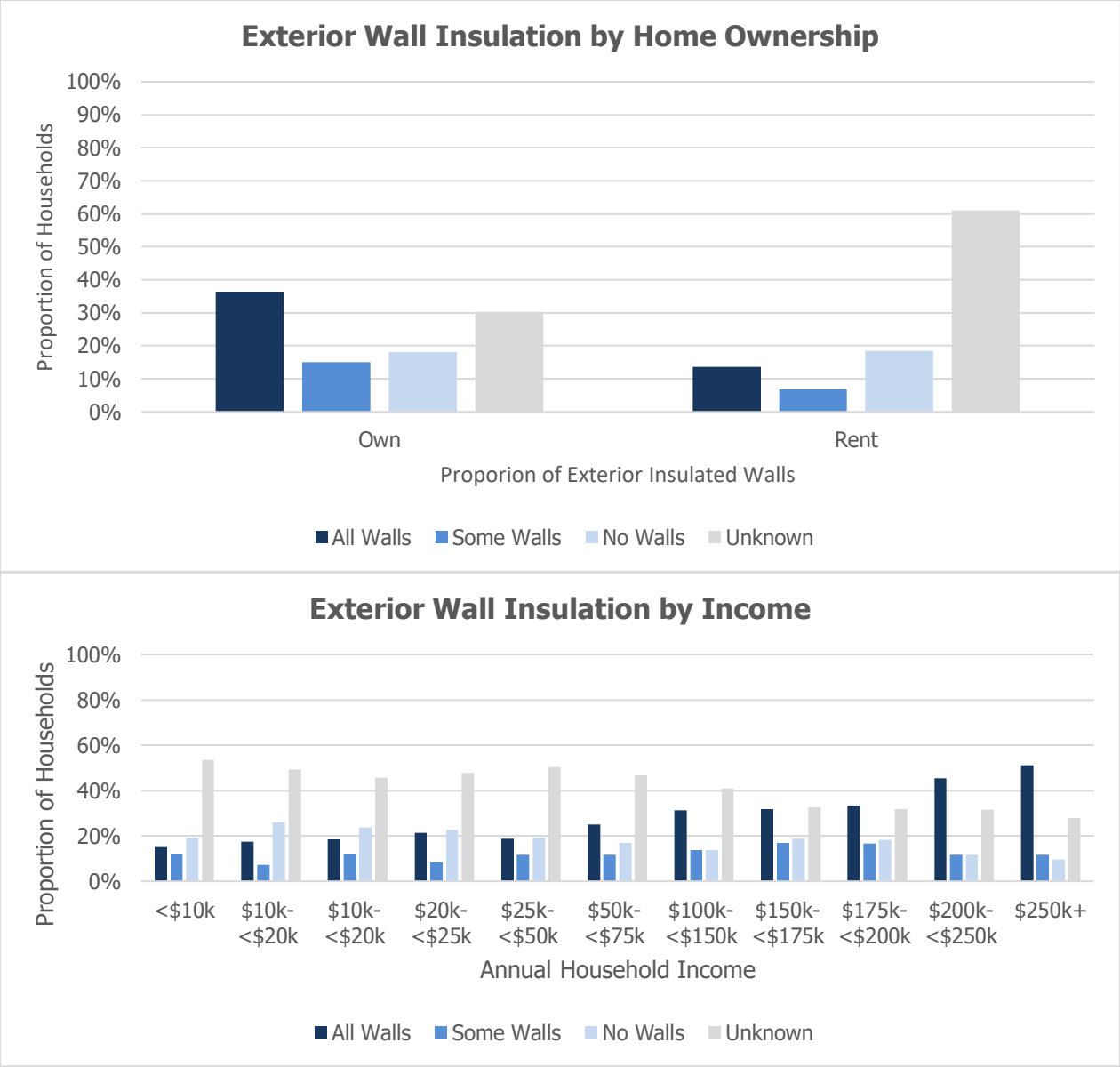

Figure 23. Exterior Wall Insulation of Homes in Los Angeles by Demographic (Data: RASS 2019)

Electric vehicles are also subject to the split incentive issue because charging infrastructure is typically installed by landlords, but benefits tenants through transportation cost savings compared to gasoline. Installing charging infrastructure for low-income residents is challenging because they tend to live in older buildings in disadvantaged communities which require more electrical and other building code updates to install. These barriers are reflected in electric vehicle adoption, as 11% of respondents who own their home have an electric vehicle, but only 3% of renters have an electric vehicle (per the LADWP subsection of the RASS survey). Disparities in electrical vehicle ownership are also reflected across in-need customer groups. Adoption of electric vehicles increases with income. Additionally, customers without a disability have an adoption rate more than twice that of customers with a disability, with 8% of households

without a resident with disability owning or leasing an electric vehicle compared to only 3% of households with a resident with a disability.

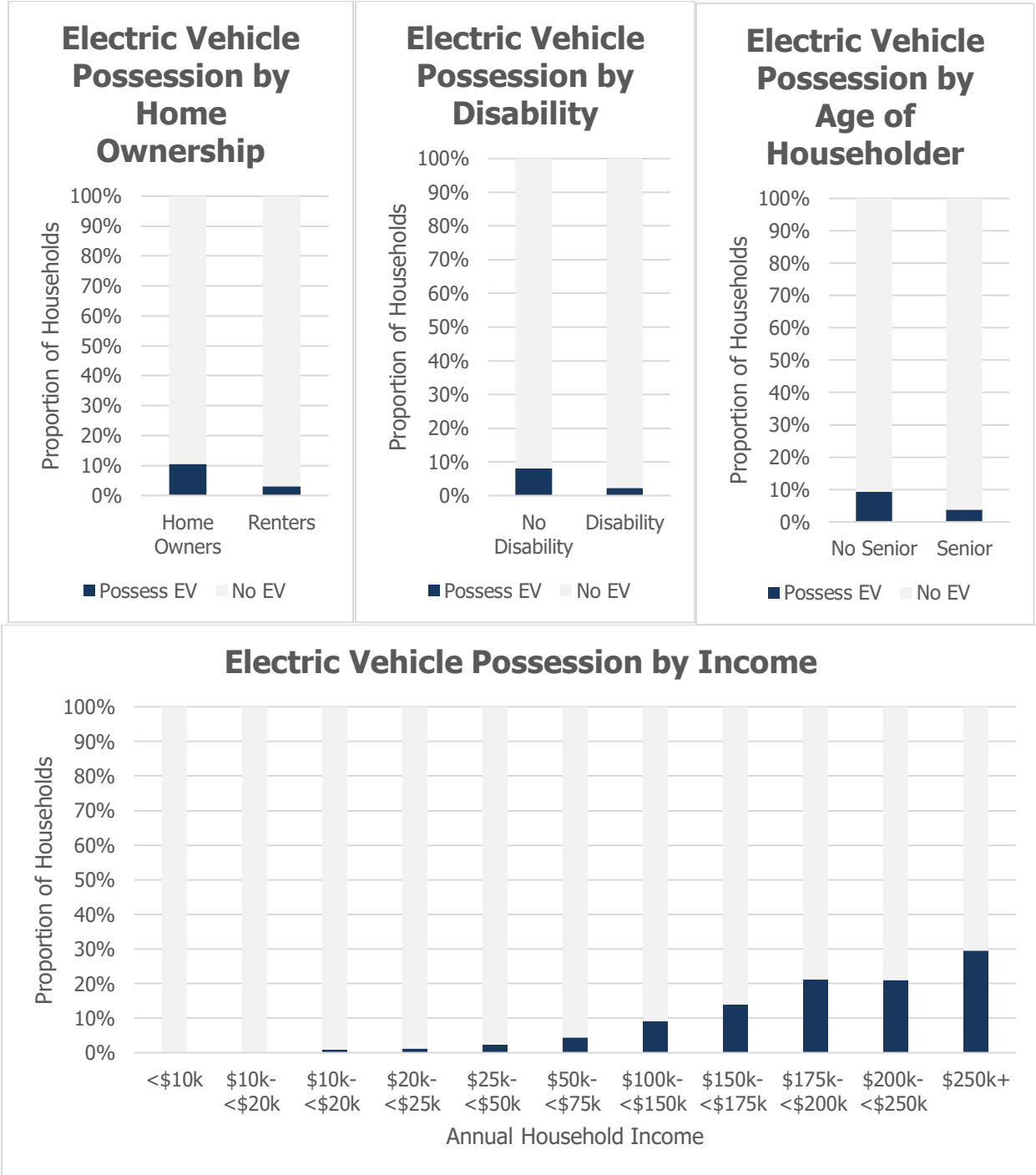

Figure 24. Electric Vehicle Ownership in Los Angeles by Demographic (Data: RASS 2019)

Traditional incentives offered by utilities to promote energy efficiency have primarily benefited homeowners due to the challenge of overcoming the split incentive problem. However, LADWP has recently launched the Comprehensive Affordable Multifamily Retrofits (CAMR) program, a novel model specifically aimed at incentivizing multifamily housing energy efficiency upgrades to overcome split incentives. This program is discussed in greater detail in the policy section of this report.

Key Takeaways: The split incentive is a key hurdle to achieving clean energy goals, leaving tenants paying higher energy costs. This disproportionately affects in-need customers, as low-income, senior, and disabled customers less likely to have insulated walls or own electric vehicles.

4.3.14 What is the ability of in-need customers to maintain thermal comfort?

Per the 2019 American Housing Survey, air conditioning access is relatively equal by household income in the Los Angeles Metro Area. Whereas 74% of households with incomes at or below 50% of the federal poverty level have AC access, 84% households above 200% of FPL have AC access. While this is a disparity, it is not large. What really matters is ability to use and the effectiveness of cooling, not just access to an AC unit.

Thermal comfort as defined by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) is "the condition of the mind in which satisfaction is expressed with the thermal environment (Djongyang et al. 2010)." Put simply, it is the goldilocks state in which people are neither too hot nor too cold. Because thermal comfort is based on human perception, it varies between individuals based on biology, psychology, behavior, and social factors (Ibid). The Department of Energy (DOE) recommends setting the thermostat temperature to 68 degrees Fahrenheit in winter and 78 degrees Fahrenheit in summer.[21] Maintaining thermal comfort much of the year depends on heating and cooling systems powered by energy. Cooling systems are typically powered by electricity while heating systems can be powered by a variety of fuels, but predominantly natural gas or electricity. Thus, customers' ability to afford their utility bill influences their ability to maintain thermal comfort.

Data from the statewide Residential Appliance Saturation Survey (RASS) reveals that household income is correlated with thermostat setting. In the winter, low-income residents in Los Angeles are more likely than high income residents to not turn the heating on, or set their thermostat below the DOE recommendation of 68 degrees. According to the data, of those in the lowest income bracket surveyed (<$10,000 annual household income), 46% had their thermostat off, or set to below the recommended temperature, while only 12% of those in the highest income bracket (>$250,000 annual household income) did so. Additionally, in the summer, low-income residents are more likely to not turn AC on than high income residents. These trends are most pronounced in the evenings, when residents are most likely to be home and awake.

[21] See https://www.energy.gov/energysaver/programmable-thermostats.

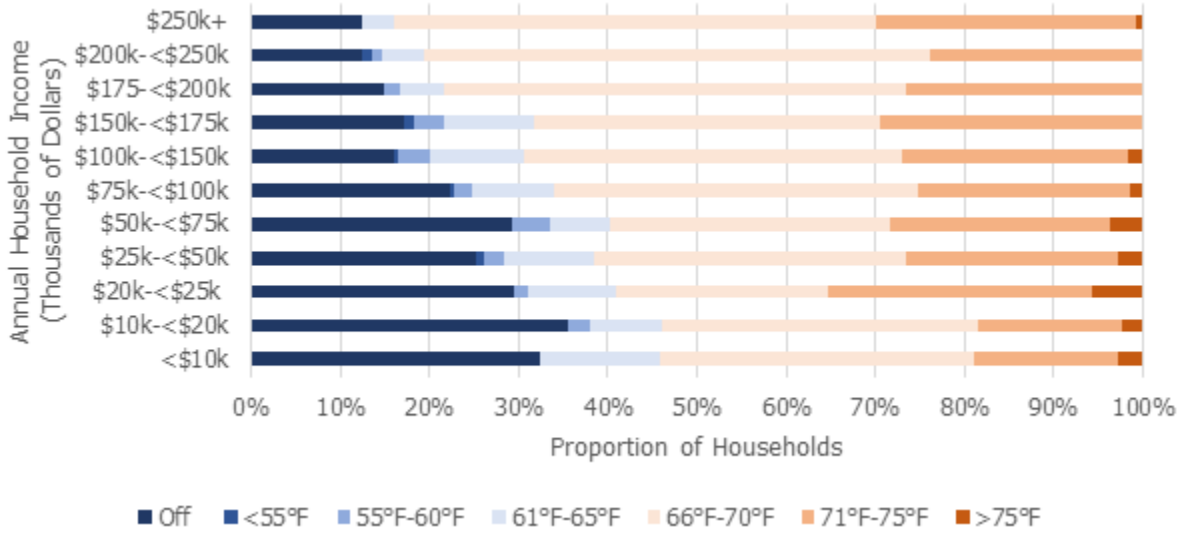

Figure 25. Evening Thermostat Setting in Winter of Los Angeles Households by Income in °F (Data: RASS)

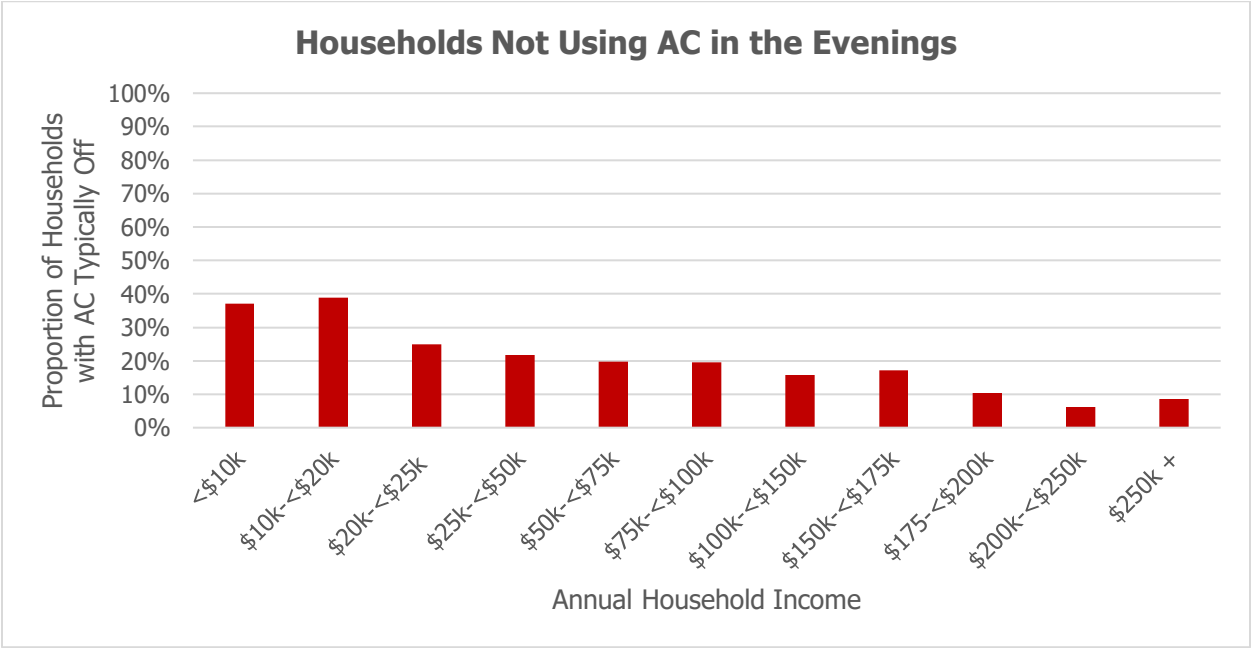

Figure 26. Proportion of Los Angeles Households with AC Typically Off During Summertime (Data: RASS 2019)

5 Energy Affordability Policies

The primary motivation of the affordability policy analysis is to sketch a strategic pathway for LADWP to improve affordability for in-need customers — or, at the very least, mitigate short-term cost impacts resulting from the LA100 transition — while simultaneously promoting equitable access to co-benefits of decarbonization. The central question undergirding this analysis is "What policy actions will most effectively help LADWP achieve affordability goals?" The policy mechanisms identified below are diverse, with some directly affecting energy costs for low-income Angelenos while others affect affordability in a secondary fashion, creating other decarbonization-related benefits simultaneously.

At the first stage of this project we identified a plethora of potential policy action areas (see Figure 28) available to LADWP. We conducted a background analysis for these areas to assess their suitability and utility to LADWP, with a focus on the following questions:

1. How do they work? What distinct mechanisms and policy structures exist in each area, and how do they differ?
2. Where have they been implemented, either by LADWP or in other service areas?
3. What barriers exist that can present challenges to enrollment?
4. What demonstrable benefits have been documented in previous implementations?

Throughout our process of analyzing policy backgrounds and examining potential strategies for LADWP to continue making progress in these areas, we have paid particular attention to the pitfalls that can reduce program efficacy. Barriers of various types can manifest at all stages of a program's execution, ranging from aforementioned enrollment challenges to administrative hurdles that are encountered well into the implementation phase. Figure 27 provides an overview of these barrier types and at what stage of a program they are typically encountered.

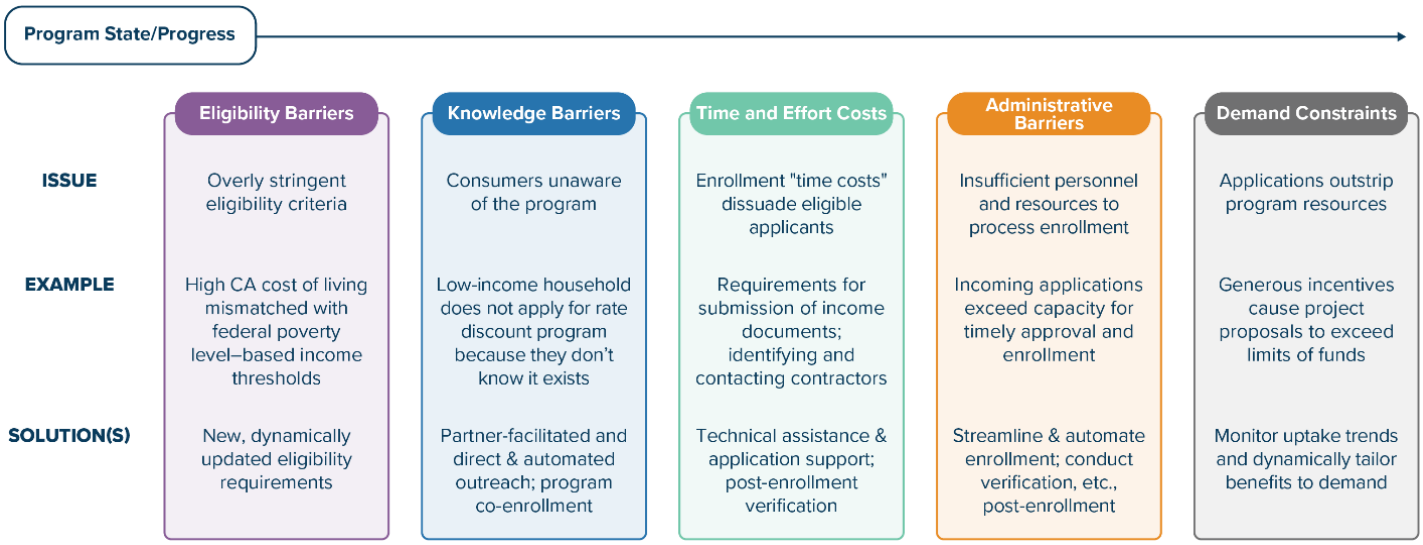

Figure 27. Types of Barriers that Reduce Affordability Policy Efficacy by Program Stage

Based on background analysis findings and with input from the LA100 Steering Committee and other stakeholders, four policy areas were selected as the most promising (see figure below).

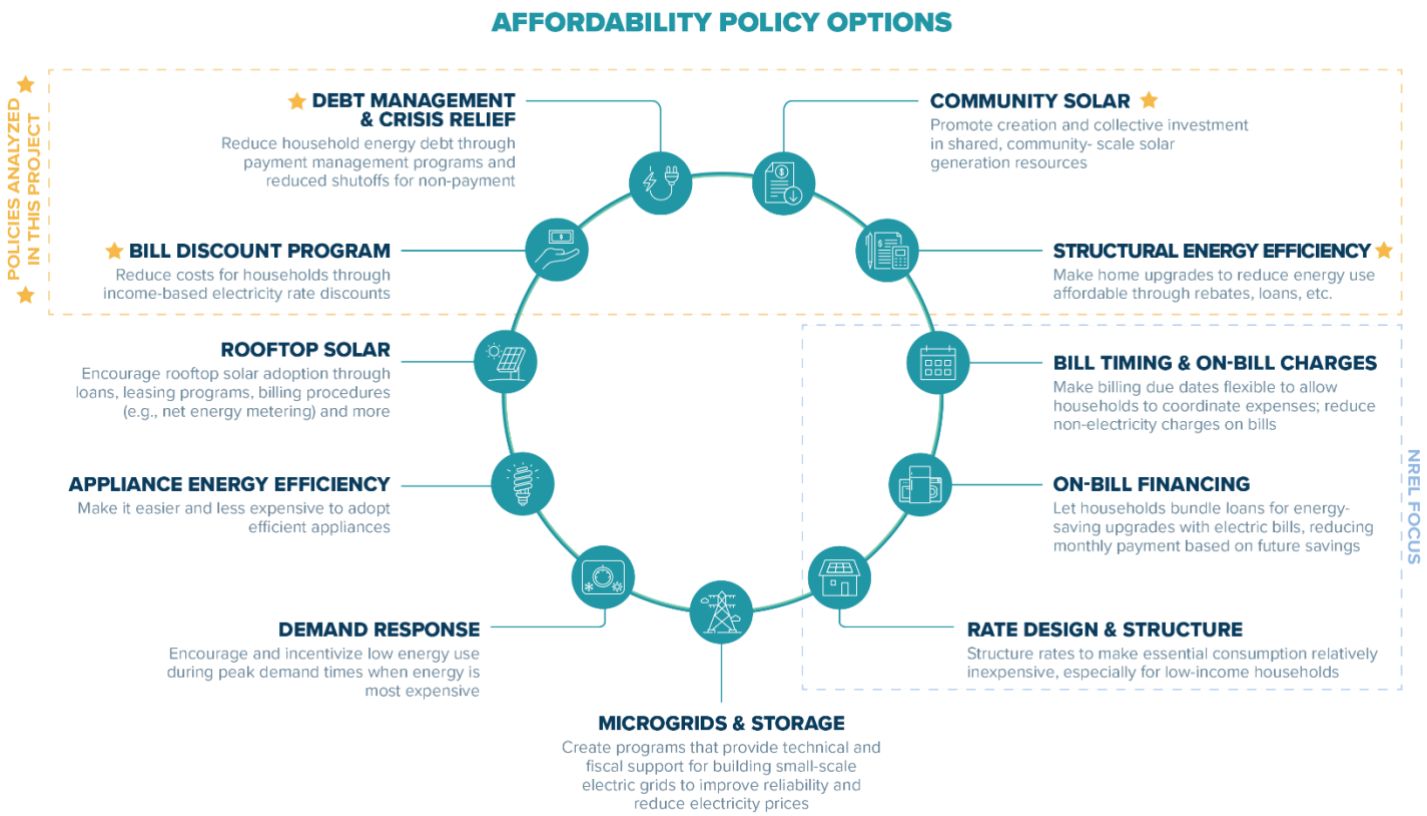

Figure 28. Energy Affordability Policy Options Identified and Selected for Analysis

Our analysis of these four areas — Discount Programs, Structural Energy Efficiency, Community Solar, and Crisis Relief — focuses on how to address current gaps in LADWP's policy toolkit, where there are opportunities to strengthen or iterate upon existing efforts, and necessary efforts to rigorously evaluate the success of these efforts. The basic logic of these four types of efforts and how they produce tangible benefits is shown in Figure 29.

A key compounding factor of this analysis is that LADWP has not been static with respect to its affordability policies while LA100 Equity Strategies research efforts were underway. In several of the areas analyzed below, the utility has implemented novel programs or revamped administrative elements of existing programs. Unfortunately, it is too early for data to be available that would allow researchers to evaluate the success of these efforts. We therefore focus a sizeable portion of our analysis on how best to gather necessary data and evaluate the affordability benefits of new or revamped programs, as well as potential pathways to use findings to appropriately improve the programs.

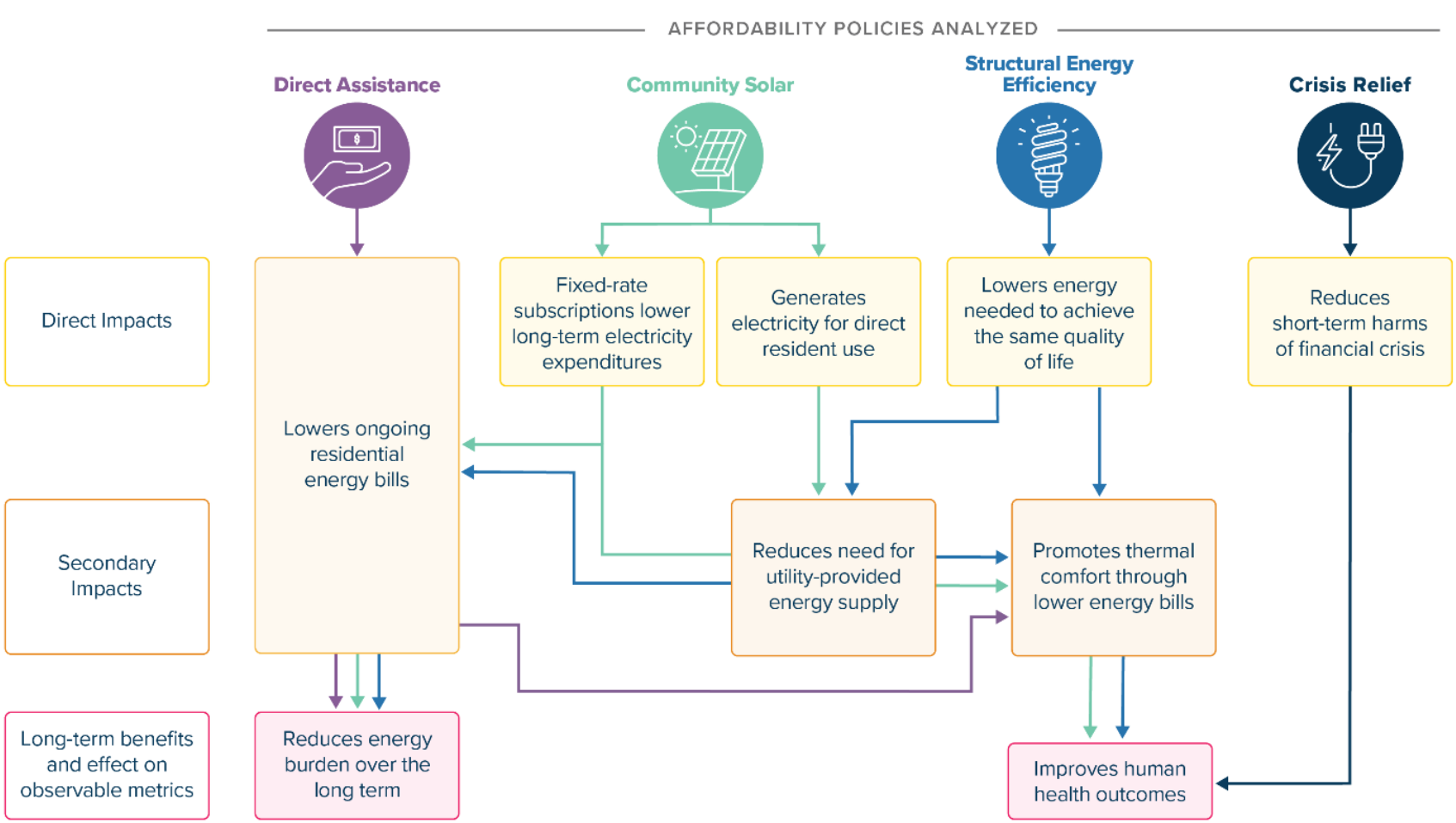

Figure 29. Logic Model of How Affordability Policies Produce Tangible Benefits

5.1 Direct Assistance Discount Programs

5.1.1 Background

Over the long term, proportionally high energy costs can exacerbate fiscal conditions for low-income households. Long-term financial strain, potentially compounded by crisis events, can create dire fiscal situations that leave a household unable to pay their energy bills and falling into arrears. Direct assistance discount programs aim to reduce these burdens through long-term fiscal aid, helping a household avoid energy debt. Available data suggests these programs are generally beneficial, but some models are understudied and call for further data collection and scrutiny. Additionally, barriers to enrollment for these programs — especially overly restrictive income eligibility thresholds and other participation requirements — limit the pool of potential beneficiaries.

5.1.1.1 Policy Mechanism

Direct assistance programs operate via fiscal mechanisms, directly affecting the amount a customer must pay for energy costs at a given point in time. They function in a proactive, long-term fashion, effectively lowering household energy bills for indefinite periods through bill discounts, direct fiscal assistance, or specialized (lower) rates for certain energy uses. This perpetual assistance lowers the likelihood of a household facing an energy bill crisis and reduces poverty, along with creating secondary benefits.

Discount programs typically use one of two approaches. The simpler is a flat discount amount — a set number of dollars — applied to customer bills each month. Such a setup essentially provides a certain amount of free energy to the beneficiary during each billing period, though the amount of energy covered by a given discount can vary depending on rate fluctuation. The other approach uses percentage rate discounts, lowering the amount a customer is billed for every unit of energy used. Although both approaches work to directly and immediately lower energy costs, the differences between them influence the incentives facing participating households. These differences, and their ramifications regarding future energy discount policy for LADWP, are the subject of the Future Policy Discussion below.

In addition to long-term economic insecurity, households can be subject to sudden, unexpected crises that forestall their ability to pay their energy bills in a timely fashion. Numerous events can impact the ability of a household — especially a low-income household with limited, if any, savings and low disposable income margins — to pay their energy bills, including loss of employment, unforeseen medical expenses, or death of the primary income-earner. In such circumstances, a household may prioritize other expenses (e.g., medical care) over paying their energy bills. When the crisis situation persists, households can fall into arrears and face risks of harmful power shutoffs. While direct assistance programs are not designed to directly address these crises, their long-term impact reduces household fiscal strain and should result in crises leading to bill delinquency occurring less frequently. Policy strategies to address crises when they occur are discussed in the Crisis Relief section.

5.1.1.2 LADWP Offerings and Other Policy Models

LADWP currently offers customers access to several direct assistance-style programs. LADWP customers are also eligible for a number of state-level and federal programs, many of which constitute more robust offerings than those made available by LADWP itself, though these are generally more oriented towards one-time assistance and crisis relief than ongoing assistance

The broadest discount program LADWP currently offers is the EZ-SAVE Program (formerly the Low Income Discount Program), which is targeted at low-income households. This program provides an $8.17 per month discount on electricity to households with income equal to or less than 200% of the federal poverty level. Customers can also access several rate discount options for particular use cases where energy is critical to customer well-being. These include the Life-Support Equipment and Physician Certified Allowance Discounts offered by LADWP, where patients requiring the use of life-critical medical equipment or who have any of several acute medical conditions, respectively, pay lower rates. Utility User Tax exemptions are available to some customers (e.g., seniors and disabled customers) through the Lifeline Rate Program administered by the City of Los Angeles Office of Finance.

LADWP also offers payment arrangements: longer term installment programs of up to 48 months (discount customers) and up to 36 months (for non-discount, including commercial customers). These arrangements require no down payment and accrue no interest or fees. The utility also offers a level pay option for customers which has the flexibility to roll in outstanding balances (24 or 36 months) to create one steady monthly payment.

At the state and federal level, administrators have discretion to use federal block grant funds from the Temporary Assistance for Needy Families (TANF) program to assist low-income households in paying their utility bills, in addition to the provision of wraparound support services using Community Services Block Grant funds. LIHEAP has provisions — most notably the Home Energy Assistance Program and the Energy Crisis Intervention Program — that help households address acute energy bill-related crises through direct bill assistance. This aid can be provided iteratively each program year.

Outside of LADWP, ratepayers have access to programs analogous to those offered by LADWP (e.g., IOU-offered rate savings and bill assistance programs) as well as the same statewide offerings (CAPP, LIHEAP). The most notable discrepancy between what is available to LADWP customers versus IOU customers — with respect to direct assistance — is eligibility for the California Alternate Rates for Energy (CARE) and Family Electric Rate Assistance (FERA) programs. Together, these two programs constitute the most significant effort to preemptively address energy affordability in the state, adopting a long-term direct assistance approach. Under CARE, the lowest-income ratepayers (those at or below 200% of the federal poverty guidelines) receive energy discounts of 30-35%, while slightly better-off but still low-income households (at or below 250% of the federal poverty guidelines) receive an 18% discount through FERA.[22] These discounts represent significant potential bill savings to low-income families and utilize a different approach from LADWP's closest analogue, EZ-SAVE. This eligibility gap constitutes the greatest area for potential strengthening of LADWP's direct assistance policy portfolio,

[22] See https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-costs/care-fera-program.

either through somehow providing access to CARE/FERA for its ratepayers or, more likely, restructuring EZ-SAVE to incorporate elements of CARE/FERA.

5.1.1.3 Barriers to Enrollment

Generally, needs-based programs like direct energy bill assistance have suffered from perverse effects brought about by the ways the programs try to ensure that benefits are only delivered to eligible recipients. Elements such as complex application procedures or requiring provision of documents (e.g., proof of income) - which are intended to steer program benefits towards the in-need recipients — have been shown to disproportionately lower accessibility of programs to the most vulnerable individuals or households. The time and effort required to participate in the program — referred to as administrative burden or "time cost" –weigh most heavily on potential beneficiaries in the most precarious socioeconomic position. Thus, on the margin, instituting participation requirements that are more stringent than necessary will lead to the *de facto* exclusion of high-need persons, undercutting overall program efficacy. Reducing time costs is an important part of the toolkit for broadening access to discount programs — an area LADWP has already made inroads on through changes to the EZ-SAVE enrollment process (discussed below).

Additionally, other discrete barriers can reduce program enrollment and participation by creating hurdles for potential applicants. These include linguistic barriers — a particularly salient issue in a city as diverse as Los Angeles — and unequal access to digital tools and resources. Further (ongoing) investment by LADWP in digital enrollment tools will be helpful in bridging this gap in the future, as will outreach efforts aimed at addressing lack of awareness among eligible households.

5.1.1.4 Policy Impacts

Available studies and assessments of direct assistance programs have shown them to have measurable benefits for low-income households, though these policy approaches seem to have been subject to less scrutiny than others. Programs that directly discount energy bills for low-income households have been shown, perhaps unsurprisingly, to lower energy bills for participating households. As of 2012, average monthly electric bill savings for households participating in the statewide CARE program were estimated at $29 (equivalent to $348 annually) (Rasumussen et al. 2014). Interestingly, because the discount is offered as a percentage off of total bill costs, and both usage and rates vary widely across the state, savings varied to an appreciable degree across utilities, from an average of $14 ($168 annually) for SDG&E to $40 ($480 annually) for PG&E.

More recently, a 2016 report prepared for the CPUC by Evergreen Economics estimated that CARE-enrolled households saved approximately $400 annually compared to households that were eligible for CARE but that were not enrolled in the program (Evergreen Economics 2016). Though we have not identified similar figures for FERA, LADWP's rate discount programs, or other direct assistance models, it seems reasonable to assume that program impact is positively correlated with the magnitude of savings offered through the program, all other factors equal.

However, stringency of eligibility requirements, ease of enrollment, and other factors affect the overall efficacy of the program. For instance, as of 2016, FERA had a 13% participation rate, in contrast with CARE's 80% rate (Sandoval & Toney 2018).

5.1.2 Future Policy Action

In terms of strengthening its affordability policy portfolio, the most straightforward path of action for LADWP in this area is to incorporate a policy model mirroring or resembling that of the state's CARE/FERA program, providing direct, rate-based assistance to low-income households. CARE/FERA is the most readily available and robust direct assistance policy model, one that is currently inaccessible to LADWP ratepayers. Thus, it makes sense to use this program as a starting point in exploring options available to LADWP when expanding its affordability program portfolio. For a discussion of further precedent for this and other discount program structures, see Appendix 1.

It should be stressed, however, that it would be useful to observe the success of existing affordability programs — particularly EZ-SAVE — in the near-term, given recent administrative changes. The move away from upfront verification of eligibility for EZ-SAVE applicants has drastically simplified the application process and promoted accessibility through curtailing the administrative burden of enrolling. Since these relatively recent (September 2021) changes, applications have increased at a steady rate, while the backlog has been eliminated. However, the program remains significantly underenrolled in comparison to the eligible ratepayer population, a state of affairs that administrators are seeking to address through ramped up communication and information dissemination campaigns.

Focusing resources and personnel on these efforts in the short-term is a prudent step, as higher penetration for EZ-SAVE and peripheral discount programs will not only increase the aggregate impact of those programs, but facilitate greater impacts by future revisions or additions to LADWP's direct assistance policy portfolio. Thus, our analysis below on how to approach said revisions or additions should be understood to be a non-immediate effort, but one that the utility should start planning for with the goal of implementing improvements in the coming years.

5.1.2.1 Benefit Form and Magnitude

In the case of direct assistance programs, the question of how benefit magnitude impacts outcomes is a straightforward one: more robust benefits (i.e., higher percentage or larger dollar amount discounts) increase affordability for recipient households more than more meager benefits, assuming behavioral response does not create a perverse scenario. Hypothetically, one could envision a scenario where discounted energy rates create an outsized consumption response such that a household's increased consumption actually outweighs the benefits of the discount, leading to an overall increase in energy bills. Though some research has suggested this may occur in other energy affordability programs (e.g., energy efficiency upgrades), no studies we are aware of have found this to occur with low-income discount programs, and in fact (as discussed in the metrics chapter) evidence to the contrary exists.

On the administrative side, the more robust the offered benefits are, the greater the non-fixed costs of the program, either in the form of disbursed funds or foregone rates. However, there do exist some variations of direct assistance benefits that carry ramifications for beneficiary behavioral incentives and energy affordability (with consequent secondary impacts on areas like public health). Three models are considered below:

1. Flat Percentage Discount Rate(s)

   The approach used by our starting policy model, CARE/FERA, is a flat energy discount rate for participating households. The lowest income households which are eligible for CARE receive a 30% to 35% discount on their electricity, while slightly higher income households can receive an 18% discount under FERA. Previous studies have estimated that, on average, the discount translates to annual energy bill savings of approximately $400 for CARE-participating households. Assuming that savings are proportional to discount magnitude between CARE and FERA would produce a rough estimate of $222 in annual savings for FERA participants.
   This model carries a number of advantages. It is straightforward and easy to understand for ratepayers while directly addressing energy affordability across a variety of use cases. For instance, once an enrollee is receiving the discount, other variables — addition of a new member of the household that increases electricity use, installation of appliances change electricity usage, or incidence of extreme temperatures, for instance — do not require additional administrative action and do not change the efficacy of the discount. Moreover, a discounted rate model that applies from the first dollar of the energy bill to the last preserves (though lessens) the fiscal incentive for households to conserve energy.

   However, the incentive to conserve at all levels of consumption also represents a weakness of the flat discount approach in certain conditions. In particular, as the incidence of extreme heat days increases due to ongoing climate change, one can envision a scenario where long periods of high temperatures force low-income households to curb their energy use for cooling due to fiscal constraints, their discounted rate notwithstanding. As a litany of research has shown, such conditions contribute to a plethora of negative health conditions. The two additional direct assistance models below are discussed as potential strategies to reduce the likelihood of low-income households being forced into this calculus.

2. Dollar Amount Discount (Variable and Non-Variable)

   In contrast to a percentage discount rate, direct assistance could take the form of a discrete dollar amount that would be annulled on a ratepayer's bill each month. Since many different iterations of such a possibility are possible, here we explore two main approaches: a non-variable monthly discount, and a variable (or conditional) discount. Compared to CARE/FERA, a non-variable monthly dollar amount discount could achieve parity in terms of magnitude of benefit by setting the dollar value to approximate typical average household savings under CARE/FERA. Taking the $400 annual average savings for a CARE household figure from above would translate to comparable households having the first $33 of their bill reduced each month. The main advantage of this approach would be to provide low-income households with a minimum electricity

consumption baseline. Below this baseline households would have no fiscal incentive to ration their energy use, avoiding scenarios (e.g., during extreme heat events) where households ration consumption to the detriment of their health.

However, this approach suffers from a number of challenges or disadvantages, though some of these are purely theoretical. Perhaps most obvious is the concern that households that would otherwise use small amounts of energy in a given month (e.g., during temperate seasons) could increase their consumption, knowing that they will not be billed up to the baseline consumption amount. Again, it is important to reiterate that studies have not found evidence of this occurring for beneficiaries of existing low-income discount programs, and should not be a source of significant concern. It is likely that existing programs providing fixed dollar discounts are so limited in their benefits, and targeted towards such fiscally insecure households, that the discount does not change the incentive to conserve based on energy costs. Additionally, energy consumption varies to some degree with household membership and composition, forcing administrators to either have the program not respond to these factors or placing administrative burden on both participants and administrators associated with updating their enrollment status and changing the amount of their discount.

One way of tailoring discounts to consumption patterns that fluctuate over the course of the year is to adopt a variable discount amount that modulates the amount of discount month-by-month based on typical consumption patterns. For instance, participating households might receive a $40 discount on their August bill while only receiving $25 in April. This model would help reduce seasonal fluctuations in energy bills, reducing financial strain during periods of especially high energy usage for low-income households (similar in motivation to LADWP's recently announced Level Pay billing program).

Another, more nuanced model could base bill discount amount on observable conditions, such as the incidence of high temperatures during a billing period. A hypothetical approach might resemble the framework below:

> Discount ($) = $0.75 per day w/ high temp 75° or higher + $1 per day w/ high temp 80° or higher (inclusive) + $1.25 per day w/ high temp 85° or higher (inclusive)

In August 2022, this (very simplistic) example formula would result in a customer bill discount of $37.50, a figure that expectedly exceeds the $33 monthly average savings figure for CARE, given that that month was particularly hot. However, it should be stressed that this example ignores many of the complexities of heat exposure and how household temperatures behave in response to real-world conditions at small scales, which can be affected by shading and presence of urban tree canopy, structural layout, and other factors. Any future effort to put such a program into practice should develop a more in-depth, expert-informed model.
However, even a well-crafted approach to variable dollar discounts will inevitably fail to capture the complex realities of life for Los Angeles' low-income households. Unanticipated crises and events will lead to fiscal strains and affordability concerns, and

a fixed dollar discount approach will do nothing to assuage these concerns or blunt their impact past the discounted amount.

Moreover, barring major modifications, adopting another fixed discount program would be redundant with EZ-SAVE and fail to meaningfully address any shortcomings with extant policy offerings (though LADWP could consider increasing the benefits offered through EZ-SAVE to reflect rising rates and cost of living, an adjustment that has thus far not taken place). Thus, further activity using this model beyond what LADWP has already accomplished through the implementation of EZ-SAVE is unlikely to be the best use of utility personnel and resources.

3. Hybrid Direct Assistance Model

Given the shortcomings and disadvantages of both approaches above, a hybridized model incorporating both conditional dollar discounts and flat discount rates is enticing for its potential ability to offer a well-rounded suite of benefits and incentive structures while mitigating the respective disadvantages of its components. One approach to bringing about such a policy would be integrating rate discounts into the existing EZ-SAVE program, reducing the need for dual enrollment by low-income households and streamlining administrative responsibilities.

Such an approach would provide either baseline or condition-specific dollar discounts on low-income households' energy bills at a magnitude lower than the amounts discussed above. Discounts in response to extreme temperatures, for instance, could help mitigate the spike in energy costs for households that would otherwise be forced to choose between unaffordable energy bills and unhealthy indoor temperatures, given known response behaviors to such events (Barreca et al. 2022). Rough examples figures might be a baseline monthly annulment of between $5 and $10 or conditional discounts (e.g., during billing periods coinciding with extreme heat events) that approach $15 to $20 at the high end (but providing limited assistance during temperate months). Of the two options, a conditional dollar discount seems preferable, as the primary motivation for incorporating this element in the hybrid approach is to reduce the likelihood that low-income households would under-consume during extreme heat events to the detriment of human health. Conditional dollar discounts also lower the (theoretical) likelihood of assistance being disbursed unnecessarily or contributing to energy wastefulness during low-demand periods. However, if EZ-SAVE was used as the status quo starting point for a new hybrid assistance model, it would be prudent to avoid changing the flat dollar discounts it offers while integrating rate discounts into its overall structure. Fragmenting the LADWP policy menu with another program *in addition* to EZ-SAVE is likely unproductive; implementing these policy strategies in the future should either be done by amending or replacing EZ-SAVE.

The bulk of the impact for the hybrid approach comes in the form of flat discount rates. Assuming that dollar discounts are conditional, discount rates can be applied at or near the magnitude with which they would be put into place under a non-hybrid policy (e.g., 25% compared to the 30% to 35% discount used by CARE). These discounts would buoy

affordability for low-income households throughout the year, regardless of conditions, being supplemented by additional dollar discounts only during periods of acute need.

While not completely negating the shortcomings of either component policy approach, a hybrid model does mitigate them to some degree. The dollar discount during periods of acute need lowers the likelihood that low-income households would under-consume due to fiscal constraints, while rate-based discounts provide generalized assistance throughout the year.

5.1.2.2 Eligibility

The next important question for LADWP is how to approach eligibility for discount programs going forward. Before delving into specifics, it is important to note that determinants of eligibility and the magnitude of benefits for a given program are not independent. Rather, given existing constraints (e.g., budget), eligibility criteria and the benefits a program provides are interdependent.

Generally, public programs have related eligibility and benefits in an inverse manner — that is, more generous benefits are typically associated with more stringent eligibility criteria, and vice versa. However, there are two downsides that can arise from such practices:

1. All-or-nothing benefit eligibility can create negative threshold effects for those just on the outside of eligibility (e.g., those with income slightly above the cutoff for a needs-based program), depriving them of aid even when their material circumstances are almost indistinguishable from those just inside the eligibility cutoff. This can even lead to situations where beneficiaries are perversely incentivized to not take advantage of opportunities that would improve their financial situation (e.g., new employment at a higher salary) because it would render them ineligible for continued program participation, potentially resulting in a net loss.

2. Stringent eligibility requirements can often result in heavy administrative burdens — termed by some social scientists as “time costs” — on potential beneficiaries attempting to enroll. Research has shown that means testing and other strategies to restrict access to public program benefits often work against the goals of the program by reducing uptake among the most in-need households. These potential recipients also tend to be the most fiscally constrained (increasing the relative magnitude of the time cost) and information deficient.

The below discussion of eligibility considerations will include potential strategies to address the former of these concerns. Absent doing away with eligibility restrictions altogether, the latter must be addressed by streamlining enrollment processes to minimize administrative burden, and are therefore discussed in the Enrollment section below. Considerations on how to verify eligibility are also included therein.

A baseline model for direct assistance eligibility is, again, provided by the CARE/FERA model. Households with incomes at or below 200% of the federal poverty line (FPL) or below 250% of

the FPL are eligible for CARE and FERA, respectively. As of 2022, this translates to household annual income at or below $55,501 and $69,375, respectively, for a family of four. FERA's existence constitutes an effort to avoid the aforementioned danger of creating perverse fiscal incentives based on eligibility thresholds, providing a lesser, but still substantial, rate discount to households whose income puts them just outside CARE eligibility.

Working from this starting point, there are four main options available to LADWP for determining eligibility:

1. Retain EZ-SAVE Model

   The most straightforward option is to simply continue to utilize the existing EZ-SAVE eligibility criteria, based on FPL, for any future new or augmented direct assistance programs. This would have obvious advantages from an administrative standpoint, including eliminating the need to devote time and personnel towards informing and developing new criteria and avoiding potential confusion from participants or potential participants brought about by changes. Should eligibility be modified, it would be prudent to err on the side of greater leniency, and at the very least grandfather current EZ-SAVE participants in for a minimum time period if for some reason they did not qualify under newly established criteria.

2. Adopt the CARE/FERA Eligibility Model

   Another option is to use the same household income eligibility thresholds as CARE/FERA with an accompanying expansion of EZ-SAVE to incorporate a two-tier rate discount, which could be a flat dollar amount or as a percentage of the total bill. This is similar to existing EZ-SAVE eligibility in that it utilizes federal metrics — FPL — as the key determinant of whether a household qualifies. Doing so would make have the advantage of providing for consistency between LADWP's service area and that of California's IOUs and other CARE/FERA participants, such that ratepayers moving from one to the other would not experience a change in eligibility. However, in terms of overall impact on equity, there are other factors that bolster the argument for a more nuanced approach (see below).

3. Region-Based Income Eligibility Thresholds

   Reliance on federal measures of economic insecurity — namely, tying income-based eligibility to the federal poverty line — has been criticized for being unrepresentative of on-the-ground conditions in a given community. This is particularly true in California, a state where average cost of living exceeds the national average. For Los Angeles residents this disconnect is even more significant, as cost of living in LA exceeds the state average.

   For this reason, the 200% and 250% of FPL thresholds used by CARE/FERA and the FPL-based eligibility of EZ-SAVE may be overly restrictive for low-income LADWP ratepayers, as high cost of living can make households more economically insecure than their on-paper income compared to state or national averages would indicate. Setting

income eligibility thresholds that account for these regional cost-of-living disparities would help reduce the likelihood of in-need households being excluded from participation and help account for regional fluctuations in cost of living over time.

Two strategies could be used to accomplish this. The simpler approach would be for LADWP to set eligibility thresholds that are still tied to FPL, but made more generous than the CARE/FERA starting point to account for LA's high cost of living. An alternative approach would entail setting income eligibility thresholds based on regional trends. One such metric could be Area Median Income (AMI), which represents the midpoint of income distribution in a specific geographic region. AMI is already used as an eligibility metric for some benefit programs, including affordable housing. It is calculated for all California counties annually by the Department of Housing and Community Development. Unlike FPL, AMI is place-based and varies across the country and across California. Compared to an FPL-based approach, using AMI as an income threshold would better account for disparities between regional and national economic trends.

4. Benefit Function

   LADWP also has the opportunity to iterate on the direct assistance policy model in a more substantial fashion, moving beyond the simplistic two-step CARE/FERA framework to a more nuanced multi-step or "benefit function" approach. This approach is already utilized by some other utilities, including SMUD.[23] These strategies would more closely tie a household's income level to the magnitude of the benefits they receive, essentially building upon the two-tiered CARE/FERA system to avoid drastic changes in benefit magnitude at income threshold points. For instance, while the move from 199% of FPL to 201% of FPL decreases a household's discount by 12-17% under CARE/FERA, a more incremental system would have many income "bins" with smaller decreases in discount rates between each one. An apt strategy for developing such a framework would be to identify baseline discount rates and eligibility thresholds therefore, then build out the various tiers from there.

5.1.2.3 Enrollment

Designing enrollment processes for direct assistance programs requires addressing two key questions:

1. Where will responsibility reside to initiate enrollment processes?

2. How will eligibility be verified, and at what stage of the process?

Under most, if not all, policy models, ratepayers are responsible for initiating the enrollment process, even when multiple avenues for enrollment exist (e.g., in the case of CARE/FERA). Placing the onus on ratepayers introduces two potential pitfalls that could lower enrollment. Such

[23] See https://www.smud.org/-/media/Documents/Rate-Information/Rates/01_EAPR.ashx.

a setup presupposes that households are aware of the program (a knowledge barrier) and then, for the subset that are aware, requires an initial investment of time and effort to apply.

One theoretical way to circumvent these barriers would be to use available data (e.g., household income data, enrollment status in other needs-based programs) to automatically enroll households in direct assistance programs. Unfortunately, such a system is currently infeasible for LADWP to pursue. Not only would the requisite information collection be quite logistically complex, but for legal reasons, the utility cannot enroll a customer in a program like EZ-SAVE without some form of consent.

This restriction notwithstanding, there are steps that can be taken to automate some administrative processes and, more generally, minimize the time and effort cost for customers to enroll.

1. Streamline and automate processes to identify and proactively engage potential enrollees.

   Though customers cannot legally be enrolled in a fully automated fashion, steps can be taken to increase recruitment and overcome knowledge barriers using automation and technology. Ideally, a future system would take advantage of updated customer relationship management (CRM) systems — already a priority for LADWP Customer Services — to identify unenrolled but eligible ratepayers based on available data and send communiques soliciting enrollment in discount programs with little or no action by personnel being necessary. Such a system would assist in overcoming information barriers to enrollment without creating significant new administrative burdens for utility staff.

2. Create parallel enrollment pathways across programs and agencies.

   Energy discount programs do not exist in a vacuum — numerous other policies (e.g., CalFresh, Medicaid) attempt to aid low-income households cope with inequitable economic conditions and high cost of living. It would behoove LADWP to seek opportunities to cooperate with agencies administering these programs to provide LA households a chance to also enroll in energy discount programs simultaneously, such as by adding an opt-in checkbox on their application. Such efforts would be aided by adjusting eligibility criteria such that customers who are eligible for outside needs-based programs are automatically eligible for EZ-SAVE or other discount programs, reducing potential administrative burden related to verification.

5.2 Structural Energy Efficiency & Comprehensive Affordable Multifamily Retrofits (CAMR)

5.2.1 Background

Efforts to increase structural energy efficiency focus on upgrading buildings to reduce energy use. The primary mechanism for these upgrades is interior climate control, with weatherization improvements and other upgrades increasing the ability of a building to maintain homeostatic

interior temperatures, thereby reducing energy needs for heating and cooling. Retrofits and upgrades require upfront investment of capital to reap the benefits of long-term cost savings, and as such most existing policy strategies focus on providing some form of initial fiscal assistance for single-family homeowners. Once in place, structural energy efficiency upgrades have been shown to produce both energy bill savings and a variety of co-benefits.

5.2.1.1 Policy Mechanism

Improving structural energy efficiency is among the most impactful ways to reduce everyday energy costs, particularly in areas where climate necessitates heating and/or cooling of indoor spaces for large portions of the year. Weatherization — a suite of potential upgrades that better insulate a structure — can greatly reduce heat exchange between a building's interior and exterior, keeping the indoor areas cooler during warmer periods and vice versa. Gains can be augmented by parallel efforts, such as appliance electrification, which may be incorporated in a single program. Upgrades and retrofits can greatly reduce the amount of energy expended throughout the year on air conditioning or space heating.

Programs promoting structural energy efficiency generally focus on helping homeowners overcome capital-related barriers to home upgrades. For affluent or otherwise well-off homeowners with disposable cash, upgrades like air sealing, insulated windows, and other weatherization upgrades are already fiscally sound given typical payback periods and increased property values. These benefits are no different for lower-income homeowners or renters; however, such consumers are often unable to afford the one-time, upfront capital investment for upgrades or cannot pursue upgrades without the cooperation of a property owner, whose incentives may not match those of their tenants. Structural energy efficiency programs provide fiscal assistance to allow low-income households and — in newer cases — property owners to invest in upgrades and reap the long-term benefits.

Assistance can come in a few different forms, the most common being rebates or loans/financing. The latter approach is more attuned to the needs of the lowest-income consumers, as they address the dearth of upfront funds available to these households. Ideally, repayment of costs can be made with all or a portion of household energy savings resulting from the upgrades. For example, an upgrade that results in annual bill savings of $250 could have its upfront costs repaid in annual installments of $225, such that the household sees a small reduction in their bills initially which then increases substantially once the total capital costs have been recouped.

Rebates are less optimal, as this model only lowers the effective cost of the upgrades to homeowners after they have made the investment. Thus, the household (or property owner) must be able to independently cover the initial cost themselves. This model is most helpful to households that are well-off enough to be able to afford an energy upgrade investment, but not so affluent as to be confident that they can prioritize home upgrades over other cost categories or potential unexpected expenses. Rebates provide a cushion in such scenarios that facilitates on-the-fence households making the decision to upgrade, and often do not impose income eligibility requirements, making them broadly accessible.

5.2.1.2 LADWP Offerings and Other Policy Models

LADWP currently offers several robust programs that incentivize or provide financial assistance for structural home energy efficiency upgrades. The most straightforward of these is the Consumer Rebate Program (CRP), a traditional rebate approach to fiscally incentivize customers to upgrade. CRP offers LADWP residential customers rebates across five types of upgrades, two of which constitute structural retrofits: energy efficient windows, which are rebated at a rate of $2.00 per square foot; and cool roofs, rebated at $0.30 per square foot. The former represents a near-negligible amount of the upgrade cost, as energy efficient windows often cost hundreds of dollars for installation. The latter accounts for a fair fraction of cool roof costs, as solar reflective shingles typically cost $2-$3 per square foot. As a rebate program, CRP has several notable barriers to enrollment (discussed below).

LADWP's Home Energy Improvement Program (HEIP) goes beyond rebates to offer full-service upgrades to residential LADWP customers, free of charge, on a first-come, first-served basis. Once applicants are approved, they undergo a two-step process whereby LADWP identifies elements of their homes that can be upgraded (in a cost-effective manner) to improve energy and water efficiency, followed by improvements or installation performed at no cost to the homeowner. Though HEIP was among the programs temporarily suspended in response to the COVID-19 pandemic, it has been reinstated since July 15, 2021.

In a similar vein, LADWP offers customers access to the state-level GoGreen Home Energy Financing program (GoGreen) through a partnership with SoCalGas. Formerly the Residential Energy Efficiency Loan (REEL) program, GoGreen aids households in adopting a number of energy efficiency upgrades. On the structural side, these include cool roofs, various types of insulation, and energy-efficient windows. Though GoGreen does not provide cost-free upgrades as HEIP does, it has several fiscal design elements that eliminate extraneous cost categories and promote accessibility (discussed below).

In addition to the upgrade avenues available to customers through HEIP and GoGreen, LADWP also administers its own rebate-style Attic Insulation Program. However, this program is undergoing redesign and is currently suspended. Given that attic insulation is among the upgrades that can be financed through GoGreen, and the drawbacks of rebates compared to financing for low-income households, reinstating the Attic Insulation Program may be redundant with other available options.

The most innovative recent action taken by LADWP is the creation of the novel and well-regarded Comprehensive Affordable Multifamily Retrofits (CAMR) program. Debuting in May of 2022, this program aims to reduce energy burden among low-income renters — a demographic where such efforts have been historically challenging — through provision of free building assessments and retrofit assistance, such that building efficiency improvements manifest reduced utility costs for renters. In our judgement, this is the most promising policy model for fomenting structural energy efficiency gains in the near future, and thus our policy analysis below focuses on how best to evaluate and improve upon CAMR.

At the federal level, the Biden administration has requested $250 million in its 2022 budget proposal for the HUD-administered Green and Resilient Retrofit Program. The main endeavor of this program is to provide direct loan subsidies and grants to multifamily housing property owners for efficiency and weatherization upgrades, improving resiliency in the face of extreme weather events, lowering energy and water usage, and improving the quality of available housing for low-income communities.

Offerings in other service areas are generally analogous to those within LADWP's portfolio (with the exception of CAMR): the Energy Savings Assistance Program offered by Pacific Gas & Electric, for instance, resembles HEIP in providing income-eligible households with no-cost energy efficiency home improvements. Likewise, GoGreen is a standard offering among California's major utilities.

5.2.1.3 Barriers to Enrollment

Existing programs offered by LADWP and other programs manifest several barriers to enrollment, particularly for low-income households. Rebate programs like CRP are inherently less accessible to customers with low or no disposable income, as a potential upgrade adopter must be able to cover the full upfront cost before applying for and receiving a rebate.

More generally, programs in this space rely on eligible households being aware of the program and investing the time and effort to apply. CRP and HEIP both fall into this category, and as such the uptake of these programs is likely lower than their potential participation rate despite the application processes not being particularly onerous. The HEIP application is a straightforward single page, while CRP requires technical details on purchased upgrades that may be somewhat daunting to the everyday consumer without contractor assistance, accompanied by proof of purchase. Renters face additional barriers to accessing upgrade programs as well, as programs typically require permission from the owner to participate as well as a minimum participation rate (50% for HEIP) among residences in a multi-family dwelling.

GoGreen contains many provisions that effectively lower barriers to enrollment for low-income households. These include the elimination of several marginal cost categories (e.g., closing costs, prepayment penalties) that commonly accompany financing agreements, lenient credit score and income eligibility requirements, no home equity requirement, and availability of 100% financing. However, GoGreen requires significant proactivity on the part of potential recipients, requiring that the household seek out and receive a project estimate from a participating contractor and apply for financing from an approved lender. Supplementing programs with recruitment efforts and technical assistance to help households complete these initial steps may be helpful to improve utilization rates among eligible recipients.

5.2.1.4 Policy Impacts

Studies have consistently found that structural energy efficiency upgrades themselves are highly impactful, reducing energy consumption and, by extension, energy bills by significant amounts. Utility-administered energy efficiency programs have been found to reduce electricity usage by

between 5% and 7%, as of 2000 (Geller et al. 2006). Given the strides made in improving building energy efficiency and weatherization, it is likely this figure has grown in the last two decades. More recent work by researchers at Yale University created forward-looking scenarios out to 2050, finding that energy efficiency improvements could achieve consumption reductions of 9% to 16% (Gillingham et al. 2021). However, the magnitude of electricity savings can vary to a large degree depending on geography, and in some cases be much higher. A 2011 study found that residential energy efficiency upgrades in desert regions of the southwest United States could produce annual electricity savings of as much as 42.5% (Sadenini et al. 2011). In such cases the payback period for upgrades is fairly short (less than ten years) (Ibid).

Other measures contributing to home energy efficiency besides physical upgrades can also produce savings. For instance, home energy audits — inspections that help identify key sources of household energy use and identify areas to reduce consumption and improve efficiency — can help customers reduce energy consumption by an average of 5% (in combination with measures like heat pump incentives) (Alberini & Towe 2015).

Though studies examining the benefits of upgrades themselves are fairly common, less attention has been paid to assessing whether assistance programs are effective at helping reluctant or resource-limited homeowners adopt said upgrades. The research that has been conducted in this area has found that such measures are helpful, inducing low-income households to adopt energy-saving technologies and engage in energy efficiency retrofits (Schleich 2019). Evaluations of the most prominent structural energy efficiency program — the federal Weatherization Assistance Program — have found it to be highly impactful in helping eligible households perform energy retrofits, resulting in significant collective energy savings (Tonn et al. 2014).

However, structural energy efficiency programs face a number of challenges, most notably the "split incentive" problem of conflicting interests between landlords and low-income renters, wherein landlords have little economic incentive to invest in energy-saving structural upgrades since energy bills are paid by their tenants (Bird & Hernández 2012). There are opportunities to refine policy approaches to promote energy retrofits for multifamily housing (e.g., through design of incentives and financing structures to overcome the split incentive problem), as well as to institute more community-based programs (e.g., increasing the emphasis on community organization partnerships and capacity building) and to address related issues in a holistic fashion (Ibid, Reames 2016, Cluett et al. 2016). As aforementioned, LADWP's novel CAMR program is a promising policy action in this space.

Once upgrades are in place, there are notable fiscal benefits to customers as well as a plethora of generalized co-benefits. Researchers examining the fiscal impact of a limited subset of retrofit options for homes in Southern California found that households could save in excess of $200 annually (Bradshaw et al. 2016). The savings potential from more comprehensive energy efficiency retrofits is likely higher. Additionally, efforts to improve energy efficiency create secondary benefits for non-ratepayers and society writ large, the collective magnitude of which exceeds the direct energy savings benefits (Schweitzer & Tonn 2003). Among these are sizeable decreases in sectoral greenhouse gas emissions, as well as reductions in harmful local air pollutants (Gillingham et al. 2021).

5.2.2 Future Policy Action

Unlike in some other policy areas, this analysis will not identify a discrete policy gap in LADWP's current affordability portfolio that requires timely action to fill. That is because LADWP recently implemented the Comprehensive Affordable Multifamily Retrofits (CAMR) program, a groundbreaking effort to provide financial incentives for structural energy efficiency upgrades to low-income multifamily housing. Announced in late 2021, CAMR incorporates many important elements UCLA identified as priorities for structural energy efficiency policy action:

- *A focus on providing incentives and delivering benefits in multifamily residential settings*. Historically, energy efficiency programs have neglected multifamily housing due to split incentives and logistical challenges, leaving tenants — a population that tends to be lower-income than homeowners — without access to energy- and energy bill-saving upgrades. CAMR's focus on this context fits with a crucial area of high need, both from aggregate energy savings and affordability perspectives.
- *Eligibility requirements tailored to focus on low-income households*. Reinforcing the affordability benefits linked to a focus on multifamily housing, CAMR's primary eligibility criterion is based on a majority (66%) of tenant households in a participating property being at 80% or less of area median income and located in a disadvantaged community. This eligibility structure concentrates the affordability benefits of CAMR investments among the households that will benefit most, proportionally.
- *Comprehensive, multifaceted upgrade approach*. Rather than focus solely on structural energy efficiency, as traditional energy efficiency incentive programs have, CAMR lives up to its title by incorporating many types of upgrades within a project's scope. In addition to straightforward efficiency retrofits, CAMR currently provides a vehicle for electrification of appliances and installation of multifamily rooftop solar. These investments will generate additional affordability, decarbonization, and health benefits over time.
- *High quality labor requirements*. CAMR requires project contractors to pay prevailing wages based on guidance from unions and the state labor board, while also incorporating rigorous apprenticeship requirements for solar installation.
- *Provision of technical assistance, including in the pre-project stage*. Making expert advice available to potential recipients is paramount for promoting equitable access and to incentive funds.

In addition to the fact that CAMR ticks many of the most important policy feature boxes we would wish to see in an energy efficiency incentive program, the program is quite recent. At this point in time, no CAMR project has reached completion, with the furthest along (the Angeles Plaza project) still being approximately two years shy of finishing. Consequently, there is a dearth of project performance data that could be used to identify shortcomings in the program's current structure for which we might suggest corrective actions. It would also be unrealistic to recommend that LADWP make sizeable new investments of personnel time and resources in a major expansion or modification to CAMR, given the recency of the program's inception and lacking any compelling data pointing to a need for such investments.

Given these considerations, this analysis will focus on three elements we believe will be important for LADWP to monitor and which will drive decision-making for program modifications in the future:

1. What program data should be prioritized for collection and evaluation, and what potential trends would call for program modification?
2. What additional modular elements should be considered for incorporation into CAMR's portfolio in the future?
3. What miscellaneous administrative challenges may arise in the future?

5.2.2.1 Monitoring and Data Needs

One of the most crucial evaluative tasks facing LADWP in the coming years will be to assess how effective CAMR is at delivering energy savings and other co-benefits to low-income households. This question is fairly broad and abstract, but can be broken down into a few key questions and metrics, for which data will need to be collected and analyzed.

5.2.2.1.1 Project Execution Efficacy and Impacts

It will be important for LADWP to collect data on basic metrics of project execution efficacy, including project completion rate, project costs (inc. cost overruns or other anomalies), and how incentives awarded to a project compare with total costs — i.e., what portion of the project's budget are covered by incentives. The need to the latter is particularly acute, given that preliminary estimates for incentives as a portion of overall budget range from 30% to 70%. More precise, real-world data will help narrow this range and reduce uncertainty in future CAMR budgeting.

Gathering of these empirical data will be augmented by parallel collection of information on other project trends, including geographic information (i.e., project locations), project size (i.e., the number of units in the property), and demographic data for tenants in project-benefitting housing and the communities in which these properties are located. Tracking of how often technical assistance is utilized — both during the application and project stages — is also of import. It is imperative that this information be collected in a manner that allows matching to the empirical measures noted above, such that information on project costs and completion rates, for instance, can be compared with other project traits. Doing so will allow LADWP to answer a number of illuminating questions that will be helpful in identifying areas where CAMR can be improved or populations that are being underserved. A non-exhaustive sample of research questions include:

1. What factors correlate with higher or lower per-unit project costs?
2. How do technical assistance efforts and other factors influence project completion rate and other performance metrics?
3. Do trends in application rejections or project completion rates suggest particular areas or demographics that are being underserved by CAMR?

Equally, if not more, important will be data gathering focused on tenant experiences following project completion. From an affordability perspective, the ultimate measure of CAMR's success will be the measurable impact it has on tenants' bottom line. LADWP should seek to measure the magnitude of energy bill savings for tenants after project completion, and should also monitor other cost categories (e.g., rent) that might fluctuate in response. The latter will enable LADWP to identify whether steps should be taken to insulate tenants from perverse impacts (e.g., rent increases) that might accompany CAMR investments and thereby lessen its affordability benefits.

5.2.2.1.2 Long-Term Uptake and Impact Maximization

Looking ahead to the initial 5-year operating horizon and beyond, it will be crucial for LADWP to monitor trends in applications and aggregate project costs in order to accurately project uptake. Given the vast number of units that *could* fall within CAMR's eligibility criteria at some point — approximately 400,000, according to administrators — the total pool of low-income multifamily housing in Los Angeles is not a constraining factor for CAMR operations. Therefore, the ideal scenario for maximizing CAMR's impact in a given operations period, all other factors equal, is for eligibility and incentives to tailor uptake such that it closely matches the program's budget for that period. Outsized demand left unmet would be indicative of unrestrictive eligibility requirements or generous incentives that go beyond what is necessary to recruit participation on par with the program's capacity, suggesting that program structure is not efficiently promoting uptake by parties for whom incentives are the deciding factor in choosing to upgrade. Conversely, budget excesses would suggest that incentives are insufficiently robust and/or barriers to access are large enough that potential projects are not being pursued, leaving some properties un-upgraded that otherwise could be induced to retrofit through tweaks in program elements.

The levels of incentive generosity and ease of access that will achieve this outcome will not necessarily persist over time, however. As the program matures and projects reach completion, knowledge of CAMR will proliferate, likely causing interest to expand over time even if other factors remain unchanged. Administrators will need to monitor trends in measures of interest (e.g., applications submitted) to identify whether program modifications or expanding program resources are appropriate to maximize the utility's energy-saving and equity goals.

A greater uncertainty is whether the pool of potential CAMR applicants is so large that a "low-hanging fruit" phenomenon — where applications noticeably decrease over time as projects where incentives are most decisive are completed, leaving potential applicants for whom project net benefits are lower or that face other barriers — would be observed. Should administrators observe trends in applications that suggest a significant wane in applications over the program's lifespan, LADWP might consider modifying CAMR parameters to make the program more generous or easier to access in order to maintain a healthy level of activity. Efforts to forecast the impact of such changes would be aided by ongoing data-gathering on rejected applicants, as this could help develop a profile of interested parties that are currently ineligible or otherwise not good candidates for CAMR projects, but that might be candidates for projects under modified parameters in the future.

5.2.2.2 Incorporating Additional Elements

As discussed above, one of the CAMR program's greatest strengths is the multifaceted types of benefits that can be delivered within the scope of a single project — benefits that currently include traditional energy efficiency retrofits, household appliance electrification, and multifamily rooftop solar installation with accompanying virtual net metering.

As the program matures, there is potential to augment these areas of activity with additional types of upgrades. Fortunately, CAMR was developed with modularity in mind, and designed to enable easy incorporation of new elements in the future. It is worth discussing which types of upgrades should be top of mind for LADWP to incorporate into CAMR in the future — something CAMR administrators have already begun considering — and identify factors that may be pertinent in deciding how to prioritize these elements.

5.2.2.2.1 Potential Future Modules

On-site Energy Storage Capacity (e.g., batteries) are a ripe area for future incorporation into CAMR, for several reasons. At the ground level, on-site energy storage is a boon for resiliency, allowing properties to provide necessary power during blackouts or other disruptions to the grid. Based on conversations with administrators of state-level renewable energy programs, this is an area of particular interest for property owners, especially when accompanied by multifamily residential rooftop solar installation. Given that CAMR already includes solar installation among its modules, augmenting these services with accompanying storage would be a logical progression, creating synergistic benefits.

In the aggregate, promoting distributed energy storage capacity will also work towards LADWP's priorities in improving reliability, an especially timely effort as decarbonization shifts an ever-increasing portion of grid power onto reusables that can be more fluctuant in generating patterns.

Electric Vehicle Charging, though valuable to incorporate in the future, does not have as strong or unequivocal a case to be added to CAMR's portfolio. Electric vehicles remain prohibitively expensive for many low-income families (though provisions of the Inflation Reduction Act do seek to bolster the historically unhealthy used EV market, which would assist in promoting access), and policy priorities in the state and Los Angeles have increasingly focused on strategies to reduce vehicle miles traveled and promote transit access in order to reduce reliance on household vehicle ownership.

However, electric vehicles will still be a substantial component of California's efforts to decarbonize its transportation sector. The most visible and substantive of these efforts are the regulations the California Air Resources Board has adopted that will ban sales of new internal combustion engine light-duty vehicles after 2035 (though used gas-burning vehicles will persist on the market for some time thereafter). Moreover, current trends indicate that most personal EV charging occurs at owners' residences, though this imbalance may lessen over time as public and workplace charging infrastructure proliferates. Nevertheless, equitable access to clean vehicles

will necessitate expansion of charging capacity in multifamily housing contexts, especially for those with large proportions of low-income households.

5.2.2.3 Future Potential Administrative Challenges

Beyond the more technical considerations discussed above, it will be helpful for LADWP to anticipate some more abstract issues that will affect CAMR's trajectory in the future. These questions may have significant ramifications for long-term program performance, as they have the potential to drastically impact program participation and funding in the coming years.

5.2.2.3.1 Should tenants be engaged to drive uptake?

Among other challenges, it has been historically difficult for energy efficiency upgrade programs to target multifamily residential due to the challenge of securing buy-in from all of a building's residents. Some types of efficiency retrofit programs require a bare majority of residents in a given property to participate in order to move forward. However, it has been difficult for tenant-centered programs to avoid fragmented, "checkerboard" outcomes that result from a lack of 100% participation within a property.

It is unlikely that a return to this model would be effective in terms of program outcomes. However, community engagement practices that center on tenants and tenant-centered organizations could be useful in driving long-term program performance. Such efforts could focus on the myriad benefits of CAMR improvements for tenants, highlighting not only the readily evident benefits (e.g., bill savings) but also areas that may be less recognized (e.g., health benefits from improved indoor air quality), with the goal that developing tenant interest leads to tenant-driven recruitment of property owners to apply.

Whether tenant-centered engagement efforts are necessary or worth an investment of time and resources by LADWP will depend on trends in CAMR applications and disbursement of funds. If demand generally matches available funds over time, generating additional interest would be moot if the program does not have the resources to support additional projects. However, engagement of this type may be appropriate should there be signs of a decline in applications in the future or if the scale of CAMR drastically expands as part of efforts to retrofit and decarbonize LA's multifamily residential at scale.

5.2.2.3.2 How to calculate incentives over the long term?

Mirroring the methodology currently used by its spiritual predecessor, the Low-Income Weatherization Program (LIWP), CAMR currently provides incentives based on two factors: the benefitting party (i.e., tenant or property owner) and the greenhouse gas emissions offset by the upgrade. The latter will require revisiting in the coming years, as leaving the emissions-based method in place will create a scenario in which incentives are provided in progressively lower amounts — a result of continued decarbonization of the energy grid. Without revisions, it is possible, if not likely, that increasing reliance on clean energy will reduce the emissions impact

of retrofits to the extent that upgrades would not be economical for some property owners, even with incentives. Thus, leaving the current methodology in place over the long term could fundamentally undermine the performance of the program.

It will be helpful for administrators to closely monitor progress on grid decarbonization and the impacts thereof on avoided emissions provided by CAMR retrofits, identifying a threshold point by which a new strategy should be in place. The most straightforward update would be to simply convert the $MTCO_2e$ figures to a representative kWh figure, based on conditions at the time of the program's creation. There may be opportunities to iterate upon this, though, by taking into account factors such as time of use. As renewable energy becomes more prevalent, time of energy use becomes a more pressing issue — at least, outside of scenarios where robust energy storage capacity has been made available. With this in mind, LADWP could consider tying incentives not only to kWh saved, but whether those savings are likely to occur in peak or off-peak hours, with more generous incentives being made available for the former.

5.2.2.3.3 Harnessing outside funds and expanding CAMR's role in city-wide decarbonization

Assuming that CAMR's ramp-up and outcomes over the initial 5-year period are on par with administrators' goals and expectations, it will be important for LADWP to consider the program's role in the long-term effort to universally decarbonize multifamily housing in Los Angeles. Though performance data is not yet in hand, from a theoretical perspective the CAMR program is currently one of the most progressive and well-crafted policy efforts focused on multifamily housing to date. If performance metrics in a few years' time indicate that this potential is translating to real-world benefits, LADWP could expand CAMR's scale to more broadly pursue decarbonization and affordability goals.

However, such an effort would necessitate increasing the resources available to CAMR. This is evident when considering the vast gulf between the program's initial goals (3,000 units in 5 years) to the pool of eligible multifamily housing in the city (in excess of 400,000 units). Making CAMR the preeminent tool for decarbonizing these units would involve an expansion of several orders of magnitude in funding, along with intensified administrative responsibilities. It may be worthwhile for LADWP to begin identifying prospective outside funding sources that could be harnessed to expand CAMR's offerings without imposing a significant fiscal burden on the utility itself. However, the routing of substantial federal and state funds for unit-level upgrades — such as incentives, rebates and grants made available through the Inflation Reduction Act or the Department of Housing and Urban Development, or LIWP at the state level — is unlikely to run through LADWP programs such as CAMR versus directly to residents via cross-city advocacy and support efforts.

5.3 Community Solar & Virtual Net Energy Metering (VNEM)

5.3.1 Background

Outside of large-scale commercial facilities, solar energy generating capacity has largely focused on rooftop solar for households. However, rooftop solar poses many barriers in terms of costs

and homeownership that make it prohibitive for many low-income households. Community solar programs seek to develop local solar installations which can deliver benefits, in one of several forms, to ratepayers unable to independently procure solar power themselves. Since community solar projects are larger in scale than many other programs that focus on household-level considerations, related policies have generally focused on supporting development, either directly or via fiscal incentives, and regulatory action. Existing community solar programs vary widely, but have generally demonstrated success in delivering monetary savings to participating households.

5.3.1.1 Policy Mechanism

Community solar is a type of program that allows multiple stakeholders to "share" solar installations. These types of projects aim to enable access to the benefits of solar energy generation for those for whom costs or other requirements of independent adoption are prohibitive. These projects can include either situating communal solar generating capacity at off-site locations where customers can subscribe to, lease, or outright purchase shares in the site; or installing solar in multi-family housing complexes such that all occupants of the served building(s) receive a share of the benefits. Development of community solar projects can be undertaken by utilities themselves, typically when the projects serve as an investment in renewable energy generating capacity and can be geographically located to strategically reduce grid stress; by non-profit organizations, which may develop capacity in partnership with utilities or with the support of external grants or other fiscal support; or by private enterprise in states where regulations and appropriate incentives create a viable market for community solar. There are also many instances where community solar development has been driven by local government and public agencies (Solar Energy Technologies Office, N.d.).

Policy approaches to stimulate community solar development typically focus on making development economically viable through direct fiscal assistance or incentives. By definition, community solar projects exceed household-level adoption efforts in terms of scale, necessitating a policy approach focused on supporting the efforts of developers as opposed to modifying affordability concerns or adoption choices at the household level.

5.3.1.2 LADWP Offerings and Other Policy Models

LADWP's primary community solar offering is the Shared Solar Program, the pilot for which began in late 2018. This program emulates one of the classic community solar models discussed above, in this case offering eligible multifamily housing customers the opportunity to subscribe to solar energy service. This subscription is done at a fixed rate for 10 years, insulating customers against anticipated rising energy costs, although in the short-term customers pay slightly elevated rates for solar versus non-solar energy. Energy subscription magnitudes are bounded, from a monthly minimum of 50 kWh to a maximum of 100 kWh (well below the average monthly energy consumption for a LADWP household of 897 kWh, based on data available at time of writing). Development of new solar generating capacity to serve program demand is done by LADWP.

More recently, LADWP has instituted its new VNEM pilot program. This effort aims to promote low-income multifamily housing solar development in conjunction with CAMR. The VNEM pilot is the primary focus of our forward-looking analysis below, and is discussed further there.

Outside of LADWP's service area, community solar efforts in California are relatively few and recently established. Although the Sacramento Municipal Utility District (SMUD) administers a Community Solar Program, this program is more similar to traditional rooftop solar promotion efforts than to community solar models as characterized herein. As opposed to the latter, which utilize a subscription or collective ownership model to promote solar energy benefits among residential customers in circumstances that prevent independent adoption, SMUD's program focuses on facilitating rooftop solar adoption by community organizations (e.g., food banks) and newly built low-income housing through logistical support and technical assistance. However, SMUD has made recent efforts to provide new residential community solar options through their nascent Neighborhood SolarShares program.

At the state level, the California Department of Community Services & Development launched the Community Solar Pilot Program in 2018. Utilizing a straightforward direct fiscal support approach, this program provided a grant of $2.05 million to GRID Alternatives Inland Empire to develop the state's first low-income community solar project on the Santa Rosa Band of Cahuilla Indians reservation. The development's projected energy cost savings over 30 years are estimated at $5.4 million. Another offering, the Community Solar Green Tariff program, collaborates with local sponsors (e.g., non-profit organizations or local governments) in disadvantaged communities to site solar projects that then provide discounted solar electricity to proximate residents. Projects under the auspices of this program are underway or pending in numerous energy provider jurisdictions across the state; eligible jurisdictions include the state's three primary IOUs and several community choice aggregators (CCAs).

The most robust community solar implementation has occurred outside of California. Numerous states and the District of Columbia have enacted policies to support community solar development through strategies including state-sponsored development, virtual metering policies, and subsidized or free subscriptions for low-income households (Heeter et al. 2021). Currently, four states —Florida, Massachusetts, Minnesota, and New York — account for a combined 72% of national community solar capacity (Ibid). More in-depth assessment of the role of state- and utility-level policy in enabling this proliferation may be helpful in identifying strategies that can replicate this success in LADWP's service area.

5.3.1.3 Barriers to Enrollment

Community solar programs have fewer barriers to enrollment than other energy affordability policies in this analysis, especially other solar programs. Because community solar requires a centralized development with concentrated upfront costs, households themselves do not generally encounter barriers to enrollment to the same degree as with other energy affordability policies. These cost barriers are faced in the early stages of the project by the developer, not by potential subscribers. The option to subscribe to or lease community solar generating capacity eliminates prohibitively large initial expenses for low-income households. Furthermore, renters and households with unsuitable roofs for a solar installation can participate.

However, short-term solar rates may in some cases exceed traditional rates, resulting in an initial fiscal squeeze for potential participants. Households must pay higher energy bills before their fixed solar rate becomes advantageous — an additional cost some households may not be able to accommodate. This barrier can be overcome by ensuring community solar rates do not exceed households' existing rates. Strategies to accomplish this include administering programs that subsidize or offer subscriptions for free to eligible participants, providing fiscal incentives to developers to keep rates low, or conditioning public grant funds for development on matching solar rates to preexisting rates. Alternative models — most notably crediting solar energy generated directly against household energy use through virtual net energy metering — also address this barrier.

The more prominent impediment to community solar concerns the development of generating capacity itself. Along with upfront capital costs, developers require suitable land or space — a constraint that can be especially challenging in crowded urban areas with high land prices and a prevalence of local groups that oppose development. These barriers are least applicable when situating community solar within multifamily housing, where existing rooftops, carports, and other housing complex space can be utilized without new land acquisitions. From there, benefits can be readily disseminated to renters, many of whom are lower-income and who, by nature of their housing situation, cannot independently adopt rooftop solar. However, developing solar capacity in multifamily housing carries its own set of challenges, including ensuring adequate financing availability for property owners and overcoming split incentives that arise from owners not being responsible for tenant energy bills. Lack of virtual net metering capacity — a system that allows for the benefits of a single solar system to be distributed over multiple households or tenants — has also been identified as a major barrier to effective multifamily housing-based community solar in Los Angeles (Gattaciecca et al. 2019).

5.3.1.4 Policy Impacts

Assessments of community solar projects across the country have shown high potential to reduce energy bills for participating households. Bill savings vary across geographies and programs, but account for a substantial portion of household energy bills in many contexts. Because projects are highly variable in type, results, and geography, an overview of examples is provided below:

- In California, SMUD estimates that participants in its Neighborhood SolarShares Program will receive an annual net benefit of $10 per kW per year (California Energy Commission 2020).
- California's Community Solar Pilot Program's ongoing development is expected to reduce subscribers' household energy usage costs by as much as 50% (California Dept of Community Services & Development 2020).
- Under California's Community Solar Green Tariff, eligible community sponsors can receive up to 25% of a project's energy output at a 20% discounted rate (California Public Utilities Commission, n.d.).
- Colorado's Low-Income Community Solar Demonstration Project was found to reduce low-income household utility bill costs by an average of between 15% and 50%, translating to annual savings of $130 to $590 (Dobos & Artale 2017).

- Michigan's Low-Income Community Solar Program provides annual savings of approximately $350 in solar bill credits ($0.10/kWh) to participating low-income, previously weatherized households (Cherryland Electric Cooperative 2018).
- New Hampshire's Low-Moderate Income Community Solar program produced direct benefits for participating households in 2019 totaling between $20 and $53 monthly ($240 to $636 annually) (New Hampshire Public Utilities Commission 2020).
- Washington D.C.'s Solar for All program will deliver estimated benefits equivalent to an average energy bill savings of 50% to households in D.C. Housing Authority properties (Dept of Energy & Environment 2022).

Importantly, policies within the umbrella of "community solar" vary in the primary types of benefits they produce and are complementary with non-community solar policy efforts. Figure 30 showcases the general emphasis of extant LADWP community solar program benefits and contextualizes them within the broader landscape of solar policy action.

Figure 30. Community and Non-Community Solar Policy Pathways and Benefits Emphasis

5.3.2 Future Policy Action

As discussed above, LADWP has already made forays into the community solar policy space through their Shared Solar program. However, this program has not fully corrected issues of inequitable access to solar energy for low-income ratepayers, nor exhausted potential opportunities for generating additional energy from communal photovoltaic installations. Shared solar limits subscription amounts to a maximum of 100 kWh, a fraction of typical monthly household energy use. Like most other programs using a solar subscription model, Shared Solar's rates ($0.20508/kWh in 2022) may exceed eligible subscribers' current rates (the Tier 1 R-1A rate in 2022 does not exceed $0.195/kWh during any period of the year), meaning that new enrollees face the disincentive of short-term increased energy costs.

It is also important to consider energy generation — where solar energy is being generated for the Shared Solar program, and what untapped potential still exists. The solar energy supplied to Shared Solar subscribers comes from solar power plants "in or near the LA basin," per LADWP's published description of the program. Though preferable to far-flung generating sites, locating distributed solar generation at point of use is more advantageous still, minimizing transmission costs and inefficiencies.

For community solar, siting photovoltaic installations in this manner means locating projects within multifamily residential housing. Residents of multifamily housing tend to be lower income and have historically been less able to access solar energy and other affordability-focused programs, both because of eligibility restrictions and contextual barriers such as the split incentive problem. NREL modeling on community solar potential in LADWP's service area also points to multifamily housing as the most fruitful area for expansion, with residential multi-family use cases accounting for the vast majority of potential sites (21,077 out of 27,477), nearly half the capacity (2,195 MW out of 4,400 MW of total potential), and a majority of generation potential (3,329 GWh/yr out of 6,400 GWh/yr total). Rooftop solar offers the most potential capacity of any installation type, by far (2,591 MW across all land use cases, the next highest being carport solar at 947 MW).

Fortunately, LADWP has begun making inroads with policies to foment development of rooftop solar in low-income multifamily housing contexts through the implementation of its Virtual Net Energy Metering (VNEM) pilot program. VNEM allows for allocation of solar energy credits across a multi-metered, multi-unit property, thereby enabling multifamily housing residents to benefit from solar energy. Essentially, energy generated by a program-supported multifamily solar installation — which currently are intended to be integrated with CAMR projects — can be virtually allocated in shares to individual tenant households and the general property. However, this program is very new, with only one (incomplete) project under way. It will therefore be important for LADWP to be proactive in gathering data related to the program's performance, identifying trends, and strategically implement modifications or augmentations that will increase efficacy with respect to proliferating multifamily housing community solar in the near-term.

With these priorities in mind, the below analysis focuses on identifying the most important data needs, trends for which the utility should be watchful, and potential strategies that are worth future consideration to increase program performance.

5.3.2.1 Monitoring and Data Needs

At time of writing, the VNEM pilot is very new, with only one project in the works. Although the number of ongoing projects is expected to rise — particularly through coupling VNEM implementation with the Comprehensive Affordable Multifamily Retrofits (CAMR) program — this means that there is a dearth of data that would allow for a deep analysis of the VNEM pilot's performance. However, this timing also represents an opportunity for LADWP to anticipate important data needs that will aid future analysis and put procedures into place that allow this information to be gathered from the earliest stages of the program. Engaging in rigorous monitoring will benefit both the utility and researchers in identifying successful elements and lessons learned, improving implementation of related efforts in the future.

5.3.2.1.1 Access Data

At an early stage, it will be important for LADWP to develop a profile of who the VNEM pilot is effectively reaching and whether there are any notable gaps in program access and coverage. Given the nascent state of the VNEM pilot and its importance as the utility's first major foray into promoting multifamily residential community solar — a historically absent area of activity that has contributed to the exclusion of low-income households from solar energy benefits — timely identification of access gaps will be necessary to rectify said gaps earlier rather than later. Collection and monitoring of project data at the early stage should focus on answering the following questions:

- What is the breakdown of prospective projects that are standalone versus those that are part of a CAMR project, and what portion of CAMR projects *don't* incorporate solar?
- What patterns exist, if any, among properties pursuing CAMR projects *without* incorporating solar? What barriers do applicants identify as reasons for not incorporating solar?
- What traits and characteristics of properties (e.g., size and number of units, location, rental rates) are common or uncommon among project applications?
- What non-property-associated traits or characteristics (e.g., demographics, geography, resident income) are overrepresented or underrepresented among applications?

Focusing data collection and accompanying survey action on these questions as CAMR and the VNEM pilot ramp up will help identify gaps and unwanted trends early, permitting outreach efforts and program adjustments to be made in order to preclude persistent issues. While the above questions reflect an emphasis on applications — as this is indicative of how interest and action in multifamily solar is being cultivated — analysis should also extend to approved projects. Trends pertaining to which projects are actually approved and funded could assist in identifying groups being underserved due to barriers related to the application process, such as connections with contractors and technical expertise.

5.3.2.1.2 Project Data

In the mid-term, as early projects progress and reach the completion stage, LADWP's analytical focus should broaden to gather empirical data on project execution and evaluate early-stage performance. Key questions at this stage of monitoring include:

- What proportion of approved projects begin development, and what proportion are successfully completed? Does completion status correlate with any of the property and non-property traits and characteristics identified above?
- What variations are observable for absolute and per kW project costs? Are particular property or project characteristics (e.g., property size or layout, proportion of rooftop versus carport solar) correlated with higher or lower cost efficiency?

The priority of analysis at this stage should be identifying lessons learned that can be applied to future projects, thereby increasing overall impact of the program. Principles for project design and execution that are empirically linked to higher rates of completion should be structurally integrated into project design and approval process. Similarly, any steps that can be taken to improve project cost efficiency will facilitate more widespread access to the program's benefits, as a given funding pool can be stretched to back a larger number of projects and/or more ambitious projects.

5.3.2.1.3 Outcome Data

As VNEM pilot projects reach completion, it will be imperative for LADWP to transparently measure the success of the program using empirical outcome data representative of the real-world benefits reaching low-income ratepayers. These measures constitute the most important tool for gauging success of the program in terms of its affordability impacts, and should focus on the following lines of inquiry:

- What are the observable impacts of solar installation on tenants' energy bills in the years following project completion, both in absolute and proportional terms?
- Do tenant energy savings match project commitments regarding the split of energy between tenants and common areas?
- Can observable trends or correlations be identified between any project or property traits and characteristics and long-term reductions in tenant energy bills?
- Do outcomes with respect to other (non-bill) affordability metrics improve for tenants following solar installation? What are the magnitudes of these benefits?
- How do payback periods — in terms of overall bill savings across both tenants and property owners — vary across projects? Can trends or patterns be identified that would suggest lessons learned to maximize the economics (I.e., minimize payback period) of future projects?

In the interest of consistency and thoroughness, — that is, incorporating post-completion data from *all* projects — it will be important for data collection plans and resources to be readied prior to the first VNEM pilot project completion. Wherever possible, preparations and commitments should be made ahead of time, including:

- Information sharing agreements with property owners on energy generation and bill savings data.
- Surveys and methods for gathering outcome data from tenants for both bill and non-bill metrics, post-project.

5.3.2.2 Potential Augmentations or Modifications

As initial VNEM pilot projects reach completion and as more projects are initiated, LADWP will face numerous choices on how to expand, adjust, or augment the program to increase efficiency and maximize benefits. In some cases these choices will be made in response to new data, using conclusions from the data gathering and analysis strategies identified above to refine the program's approach based on experience and lessons learned. Others are considerations that can be made relatively independent of incoming project and outcome data, but which may still have significant ramifications for the long-term goal of expanding low-income multifamily solar access in Los Angeles. We refer to the former as *responsive* changes, and the latter as *independent* changes.

5.3.2.2.1 Potential Scenarios and Responsive Changes

Depending on the results of the analysis and data gathering discussed above, LADWP can consider administrative or structural modifications to the VNEM pilot in order to address issues as they arise. It is difficult to predict the multitude of scenarios that might lead to changes being appropriate, and it is important to stress that sweeping changes should not be made based on limited or anecdotal findings from the first few VNEM pilot projects. However, one can reasonably envision some areas in which data findings would justify changes:

1. Generalized lack of interest and low application pipeline volume.
   The novelty of the VNEM pilot makes it too early to predict trends in interest and applications especially given that the ramp-up of CAMR is cultivating new interest and is expected to drive additional uptake in the future. However, that does not fully preclude the possibility of interest failing to meet expectations, either due to underperforming interest in CAMR (the incentives from which are crucial to making many multifamily solar projects affordable) or because a low proportion of CAMR projects incorporate solar elements.
   Responding to such a scenario would warrant additional efforts to identify barriers, and potentially implement changes to the program's elements in order to alter incentives for property owners. Should engagement reveal that knowledge or expertise barriers are preventing owners from incorporating solar into their projects, it would be appropriate to increase emphasis on communication with applicants and explore strategies to connect them with contractors or other technical experts.
   However, if low uptake is attributed to unfavorable economics, administrators will need to consider adjustments to solar incentive magnitudes or the tenant-owner energy split (how generated solar energy is divided between tenants and owners). Experience at the state level has shown that the latter can noticeably influence program interest. According to administrators at the Solar on Multifamily Affordable Housing (SOMAH) program,

that program's higher energy-to-tenant requirements (51%) compared to its predecessor, the Multifamily Affordable Solar Housing (MASH) program, has resulted in a marked decline in applications. Although delivering more benefits to property owners at the expense of tenants works against affordability priorities and therefore merits careful consideration, this option remains as a policy knob LADWP can tune to balance project numbers and benefits in order to maximize overall impact.

Another factor that could lead to low volume of VNEM solar projects is lower-than-ideal throughput of the CAMR program, to which the VNEM pilot is currently heavily linked. Because the pilot is designed such that CAMR incentives are necessary to make projects economical in most cases, an underperforming CAMR program would impede the expansion of multifamily solar in Los Angeles. Independent of steps taken to rectify performance issues on the CAMR side in such a scenario, administrators could consider restructuring the VNEM pilot to make incentives more generous when projects are pursued independent of retrofits. This would effectively create a parallel track within the VNEM program with different incentive levels when multifamily solar projects are pursued in isolation. However, there are potential pitfalls to this approach, including lower efficiency in terms of affordability impacts per funding dollar when energy efficiency retrofits are not included, and lowering uptake of CAMR for the subset of property owners for whom solar is the primary interest and would otherwise pursue a more multifaceted CAMR project were the parallel VNEM track unavailable. LADWP should carefully evaluate the risk of these pitfalls if and when a decoupling of CAMR and VNEM is under consideration.

2. Underperforming affordability gains for tenants.

   Should post-project evaluation show that multifamily solar is delivering low levels of affordability benefits for tenants, LADWP may wish to consider measures to tilt the balance of projects more in favor of tenants. Unfortunately, options for how to do so are limited, the main one being requiring a higher proportion of solar energy generated to go towards offsetting tenants' energy usage. However, the zero-sum nature of the solar energy division for a project means that any movement in favor of tenants will lower the fiscal benefits for property owners, thereby disincentivizing potential participants on the margin.

   As aforementioned, the experience of state-level administrators indicates that these tradeoffs are notable, with the more tenant-oriented SOMAH program having a lower application volume than its predecessor, MASH. Thus, any adjustments LADWP makes to the tenant-owner energy split for VNEM projects should be incremental in nature and take into account how well-balanced application volume and program resources are.

   Limited affordability gains for tenants could also occur, in the aggregate, due to rent responses to structural upgrades (either solar alone or accompanied by CAMR efficiency retrofits). Multifamily solar and energy efficient units are marketable as amenities, and as such property owners may seek to extract value from renters benefiting from these upgrades. The greater the magnitude of the rent response, the lower the affordability benefits for low-income renting households. In the most extreme case, a landlord that increases rent by an amount equal to average tenant energy bill savings would erase any

overall affordability benefits; in such a scenario, LADWP would effectively be subsidizing landlords' capital investments as they entirely privatize fiscal benefits.

In the interest of promoting equity and affordability, LADWP should closely monitor rent rates for properties following project completion along with tenants' energy bills, assessing the net fiscal benefits for tenants. Should these gains be nonexistent or underwhelming, action may be warranted to protect tenants against rent increases for properties benefiting from project incentives.

5.3.2.2.2 Independent Changes

Apart from the strategies that LADWP can consider taking to address the potential scenarios discussed above, other actions are available to build upon the current VNEM pilot framework. The goals of these augmentations are multifaceted, but generally work to more widely promote multifamily solar in Los Angeles, increase associated affordability benefits for low-income households, and maximize co-benefits.

1. Lay groundwork for VNEM expansion.
   A key lesson learned from state-level administrators of California's efforts to expand multifamily residential community solar is the challenge posed by insufficient smart metering capacity and outdated billing procedures. These systems are necessary to enable broadening of VNEM within Los Angeles, and will require planning and foresight to implement such that they do not become a bottleneck that restricts access to community solar among ratepayers.
   As the VNEM pilot progresses, LADWP should use it as a learning opportunity to identify necessary general upgrades for billing systems. Additionally, widespread community solar will require generalized smart metering capabilities. LADWP should craft a strategy for smart metering ramp-up within its service area, taking into account reasonable timelines and costs and addressing potential interconnection issues. Engaging in these efforts early — while the VNEM program is still in the pilot stage — will position the utility well to translate lessons learned from the pilot into high-impact, broader efforts.

2. Develop standalone multifamily solar program framework.
   In the above subsection, we discussed developing a parallel VNEM track as a strategy to spur multifamily solar development in a scenario where interest in the CAMR program (and the VNEM pilot component along with it) does not meet LADWP's goals. However, this scenario does not need to occur for the utility to explore expanding the VNEM pilot into a standalone program that is not dependent on CAMR's incentives and simultaneous energy efficiency retrofits to be fiscally attractive to property owners.

   The clearest reason for developing an independent program to incentivize multifamily residential community solar is to achieve greater penetration, particularly among beneficiaries for whom existing models are not a good fit. It is reasonable to assume, for instance, that some subset of multifamily housing properties exists where owners are not interested in comprehensive efficiency retrofits, but would be interested in pursuing a

fiscally sensible on-site solar installation. The lack of interest in retrofits could be because the property is already reasonably efficient or because the barriers associated with a retrofit project (e.g., time, effort, capital) are too great. Regardless, a multifamily solar program that is viable when conducted independently could be a conduit to reaching these properties.

However, it would behoove LADWP to weigh the potential gains of a parallel multifamily solar track with the tradeoffs, namely, the administrative burden of developing and running the secondary program and potential efficiency losses (in terms of impact per dollar of funding) resulting from splitting solar from CAMR. A key piece of information that would inform whether these costs are worthwhile is whether there is a sufficiently large pool of multifamily housing properties that would pursue solar absent retrofits such that LADWP should make a concerted effort to target those properties.

3. Integrate incentives for on-site storage to pursue resiliency goals.

   As the VNEM pilot matures, LADWP can consider incorporating new elements into the program in order to advance its policy goals through a more comprehensive framework. In the context of multifamily solar, the most obvious first component with which to augment the program is on-site battery storage capacity. On-site storage offers advantages for landlords and tenants in terms of resiliency and energy reliability, elements that coincide with LADWP's broader grid stability goals. Inclusion of incentives for storage may also help drive interest in the program in the future; state-level SOMAH administrators have communicated that the level of interest in storage is such that its inclusion (which SOMAH currently lacks) would result in an increase in application volume.

5.4 Shutoffs & Crisis Relief

5.4.1 Background

Alongside structural financial challenges, in the short term, high utility bills can exacerbate or cause a crisis for low-income households. Numerous unforeseen events can impact the ability of a household — especially a low-income household with limited, if any, savings and low disposable income margins — to pay their energy bills. These can include loss of employment, unforeseen medical expenses, or death of the primary income-earner.

Even before the pandemic, customers enrolled in discount programs were a small proportion of customers being disconnected, and disconnection rates were lower for LADWP than among comparable neighboring energy utilities.[24] As noted in our previous work, however, even a very small percentages of LADWP customers affected translates to a large number of customers (González et al. 2021). Moreover, the need to quicky pay a large utility bill is particularly problematic for LADWP customers given the number of combined services they pay on a bill,

[24] See presentation by George Rofail, LADWP Chief Customer Officer. "Update on Customer Bill Assistance and Collections History." September 27, 2022.

and its bimonthly frequency for most customers.[25] In such circumstances, a household may have to prioritize other expenses (e.g., medical care) over paying their utility bills. When the crisis situation persists, households can fall into arrears and face risks of harmful shutoffs.

Shutoff prevention and associated crisis relief programs aim to reduce these burdens through short-term interventions that help a household climb out of utility debt or be protected from its consequences without reducing the debt amount. These interventions and programs have grown rapidly in the last decade, and to an even greater degree during the COVID-19 pandemic.

The basic prevalence of shutoffs due to non-payment of LADWP residential customers before the COVID-19 pandemic was illustrated in a September 27, 2022 staff presentation[26] at a Board of Commissioners meeting, and corroborated by our own analysis of arrearage and shutoff data shared by LADWP staff (see appendix for additional results) as well as by a Strategic Concepts in Organizing and Policy Education (SCOPE) analysis.[27]

Between January 2017 and January 2020:

- 77.4k residential[28] customers were shut-off at least once for power and/or water.
- 53.3k residential customers were shut-off at least once for power only.
- 11.8k residential customers were shut-off at least once for water only.
- 12.3k residential customers were shut-off for both water and power at least once.

The city of Los Angeles is nearly evenly split between CalEnviroScreen-designated disadvantaged communities (DACs, n=529) and non-DACs (n=517). As illustrated below, DAC communities were much less likely to have no shutoffs[29] in the period 2017-2019, and were also slightly more likely to have customers with multiple shutoffs.

[25] We note that there are opt-in level pay and extended payment arrangement options available to customers, with more flexible options planned to be offered, but still that many vulnerable customers are not aware of how to take advantage of these offerings.
[26] See presentation by George Rofail, LADWP Chief Customer Officer. "Update on Customer Bill Assistance and Collections History." September 27, 2022.
[27] See https://scopela.org/download-form-lights-on-water-flowing/.
[28] We show some statistics on non-residential customer shutoffs in the appendix but generally these numbers are much lower than for residential customers.
[29] On the other hand, as shown in a figure in the appendix, the median power bill owed amount tended to be slightly lower among residential customers in DAC communities than in non-DAC communities.

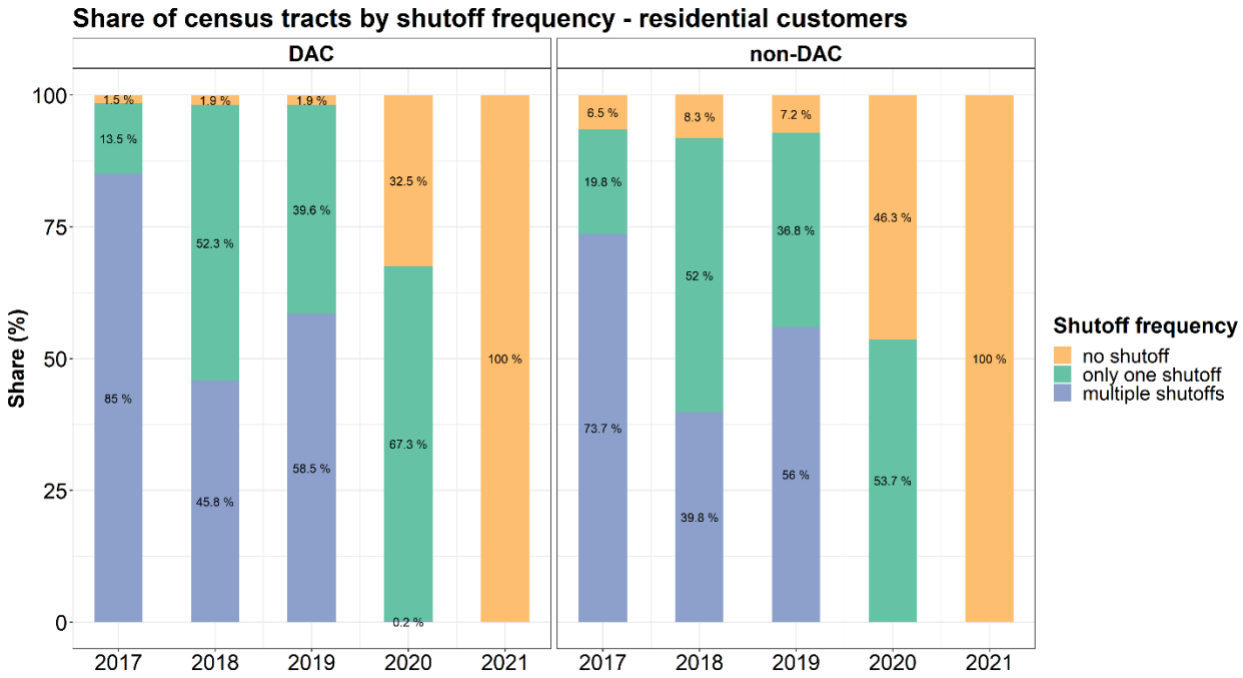

Figure 31. Residential Shutoff Frequency by Census Tract Disadvantaged Status, 2017-2021

Moreover, lower income communities, especially communities of color, experienced higher instances of shut-offs and percentages of community members who have been shut-off at least once. Similarly, residential arrears increased among low income, historically underserved communities and especially among communities of color during the pandemic (see Figure 32 below), despite massive unprecedented relief dollars offered from a combination of city, state and federal government channels to address low-income customer arrearages (González et al. 2021).

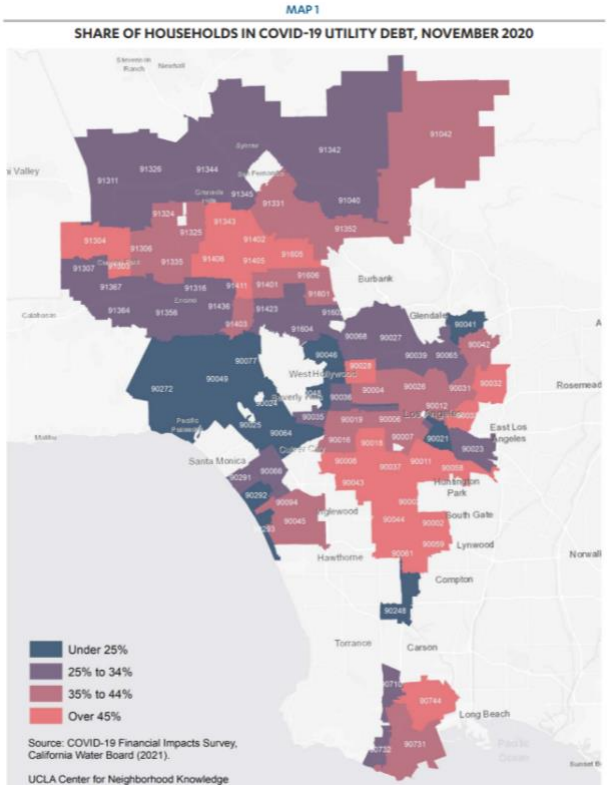

Figure 32. Prevalence of Residential Arrears in Los Angeles, Nov 2020[30]

5.4.1.1 Policy Impacts

The effectiveness of shutoff prevention and crisis relief interventions is understudied, particularly in the medium to long-term, and suggest the need for further data collection and scrutiny. As further discussed below, this is especially true for the City of LA given that LADWP's Board of Commissioners passed an unprecedented, unanimously adopted motion[31] on November 8, 2022 directing staff to halt the practice of water and power shutoffs as a debt collection tool for residents enrolled in its EZ-SAVE and Lifeline discount programs.

Available studies and assessments of both crisis relief and direct assistance programs have shown them to have measurable benefits for low-income households, though these policy approaches seem to have been subject to less scrutiny than others (Barecca et at., 2022). Empirical data is harder to come by concerning crisis relief programs. Many examples of arrearage management plans (AMPs)[32] — the most prominent policy approach in this space —

[30] Adapted from Gonzalez et al., 2021.

[31] See https://ladwp-jtti.s3.us-west-2.amazonaws.com/wp-content/uploads/sites/3/2022/11/15133047/N.17-Shutoffs-Motion.pdf.

[32] One of the most extensive evaluations of any utility crisis relief program is a 2021 evaluation of the AMP offered by the Potomac Electric Power Company (Pepco), a utility operating in Washington, D.C. and Maryland. This program was found to be highly successful across multiple measures. Among the findings of the evaluation were that AMP participants expressed high levels of satisfaction with the program (e.g., expressing the belief that it is

are relatively recent in their adoption, being put into place either in response to recent recommendations from public agencies or in response to the COVID-19 pandemic. This recency limits the availability of data on program efficacy, as there has been relatively little time for programs to achieve their enrollment potential and post-implementation data gathering has not yet occurred in a robust fashion. One potential avenue for future study would be to evaluate shutoff frequency by utility service area pre- versus post-adoption of crisis relief policies. Evaluations of utility AMPs in California and of state-administered efforts, already underway, will be helpful in the coming years.

5.4.1.2 Policy Mechanism

Utility bill crisis relief policies usually fall into one of four major categories[33]: legal protections around due procedure of shutoff notice, transaction and restoration; payment extension provisions; arrearage management plan (AMP) programs; and direct shutoff protection policies.

First, LADWP has committed[34] to extending the legal protections, enshrined in California SB 998 (2018),[35] to customers of water utilities serving over 200 connections, to all of its residential customers for both water and power service. These protections include but are not limited to the provision of publicly accessible written policies on shutoff transaction, 60-day minimum from delinquency to shutoff transaction, and a minimum 7-day shutoff notice period.

Most moderate to large utilities, including LADWP, have had payment extension plans on the books for some time; these plans do not reduce payment due but do give the customer more time to pay. AMPs and direct shutoff policies are more recent phenomena and actually reduce debt burden or eliminate it altogether.

AMPs offer residential customers who have fallen behind on their energy bills the opportunity to reduce energy debt. Such arrangements typically provide some amount of debt forgiveness or

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easier to pay their bills post-enrollment) and sizeable reductions in the average magnitude of arrears for participants (from $1,451 to $554) over a 12-month period.

[32] Collection actions were also less frequent for AMP enrollees.[32] However, some metrics suggested lower benefit than expected, including lower percentages of forgiven arrears (63% average) than estimated based on participation time (81%). See for more information: Applied Public Policy Research Institute for Study and Evaluation (APPRISE) (2021). Pepco Arrearage Management Program Evaluation. Public Service Commission of the District of Columbia. Accessible at https://edocket.dcpsc.org/apis/api/Filing/download?attachId=125040&guidFileName=8c21786b-5711-4060-b921-a253088c3ff6.pdf.

[33] Outside of these models, examples do exist of ad hoc programs often offered by non-profit organizations that allow eligible households to request one-time bill payments or bill relief when facing short-term financial distress, allowing them to avoid falling into arrears as a result of a brief crisis. However, this assistance offering is not stable or well catalogued at scale. For an example, see https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/assistance/docs/ab401_appendices.pdf.

[34] See presentation by George Rofail, LADWP Chief Customer Officer. "Update on Customer Bill Assistance and Collections History." September 27, 2022.

[35] See https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB998.

financial assistance for bill payments, often with conditions regarding the on-time payment of new bills or contribution of partial bill payment over time.

Finally, direct shutoff protection policies identify either temporary or permanent conditions under which a customer that is in arrears cannot have its electricity shut off due to non-payment. Some recent universal but temporary shutoff protections include suspending shutoffs during excessive heat and freeze warnings issued by the National Weather Service, and not shutting off customers on Fridays.[36] We also note that some direct shutoff protection policies for customer segments have been informally practiced by utility staff for much longer.

5.4.1.3 LADWP Offerings and Other Policy Models

Historically, LADWP has provided several payment plan and payment extension options to residential customers behind on their bills, a measure which can preempt potential shutoffs. LADWP has also expanded these options in recent years, as noted in its September 2022 staff presentation, including introducing a level pay option.[37] Payment plans vary in length and the percentage of the delinquent balance that the first payment must cover. Example options which LADWP has offered to its low-income discount enrolled customers now extend the term of payment up to 48 months. Payment extensions are typically more short-term, extending a customer's balance due date to the next date of meter reading. However, these options do not include debt forgiveness; customers still pay the entirety of their bill over time.

In contrast, the (also quite recent) California Arrearage Payment Program (CAPP)[38] and the longstanding federally funded Low Income Household Energy Assistance Program (LIHEAP), as well as the one-off CARES utility assistance allocation in February 2021,[39] contain elements that reduce the energy debt burden of residential customers. CAPP — implemented in response to the significant uptick in of California ratepayers in arrears during the COVID-19 pandemic — directly credited the energy bills of ratepayers with energy debt, placing a priority on residential ratepayers and especially on those facing imminent risk of shutoff. LIHEAP has provisions — most notably the Home Energy Assistance Program and the Energy Crisis Intervention Program — that help household address acute energy bill-related crises through direct one-time bill assistance and addressing imminent shutoff risks, respectively.[40] States also have discretion to use federal block grant funds from the Temporary Assistance for Needy Families (TANF) and Community Services Block Grant programs to assist low-income households in paying their utility bills.

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[36] See presentation by George Rofail, LADWP Chief Customer Officer. "Update on Customer Bill Assistance and Collections History." September 27, 2022.
[37] See https://www.ladwpnews.com/new-ladwp-billing-option-level-pay-lets-customers-spread-out-their-bills-and-pay-a-set-amount-each-month/.
[38] This is paralleled by the CWWAPP on the water and wastewater sides of the LADWP bill.
[39] See https://www.ladwpnews.com/la-city-ladwp-utility-cares-grant-program-awards-more-than-33-5-million-in-grants-to-more-than-67000-angelenos/.
[40] For instance, see https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/assistance/docs/ab401_appendices.pdf).

In terms of accessibility, the California Arrearage Payment Program (CAPP) presents the best example[41] of policy design to minimize participation barriers, eliminating the need for customers to apply to receive assistance entirely. This accessibility is enabled in large part by the fact that eligibility is entirely determined based on information readily available to a potential beneficiary's utility, namely, whether a customer has energy bill balances 60 days or more past due that accumulated during a particular period of time.

One type of crisis relief intervention that LADWP has not offered to address utility debt, presumably due to legal constraints detailed in Section 3 above, is an arrearage management program (AMP) that forgives past-due utility debt for qualifying households. This contrasts with energy investor-owned utilities (IOUs) regulated by the California Public Utilities Commission, which initiated new AMP programs at scale to forgive past-due utility debt for qualifying residential customers in February 2021 in response to the COVID-19 pandemic.[42] In the first 10 months of the AMP programs, 18% of eligible customers were enrolled in AMP and $15 million in debt had been forgiven.

5.4.1.4 Direct Shutoff Protections and November 2022 LADWP Board of Commissioners Motion

In March 2020, Governor Newsom instituted a broad utility shutoff moratorium due to the COVID-19 pandemic,[43] and similar (albeit usually shorter) moratoria were instituted in many states in the U.S. in completely unprecedented fashion on the basis of health and safety. While the energy utility portion of the moratoria officially expired in 2021, both LADWP and the major IOUs in California have effectively refrained from instituting shutoffs through at least the summer of 2022.[44] This is remarkable given that outside of California, permanent shutoff moratoria for low-income residential customers have only observed in a few major U.S. water utilities, including Baltimore and Chicago, and were announced during the pandemic.

In September 2022, LADWP staff announced their intention to resume shutoffs due to non-payment beginning in November 2022, starting with large commercial customers and re-instituting for residential discount program-enrolled customers in September 2023. Alongside this announcement, academics and advocacy groups presented evidence on the prevalence,

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[41] We note that the CARES allocation also had a remarkably high participation rate, with 67,315 of 76,486 applicants approved for this assistance.

[42] See more here: https://innovation.luskin.ucla.edu/wp-content/uploads/2022/06/Supporting-Household-Access-to-Complex-Low-Income-Energy-Assistance-Programs.pdf. To qualify for AMP, a household must meet the following requirements: Be enrolled in CARE or FERA (low-income rate assistance programs); Owe more than $500, and have that debt be more than 90 days past due; and Make on-time payments for a year (California Public Utilities Commission, 2020). Households who meet these qualifications and successfully enrolled in AMP would have "1/12 of their eligible utility debt [forgiven] after each on-time payment of [their] current bill. After 12 on-time payments of individual monthly bills, the debt is fully forgiven (up to $8,000 percustomer)" (Southern California Edison, 2022a).

[43] See https://www.gov.ca.gov/wp-content/uploads/2020/03/3.16.20-Executive-Order.pdf?emrc=9c4359.

[44] See https://liob.cpuc.ca.gov/wp-content/uploads/sites/14/2022/12/Item-04_Joint-Investor-Owned-Utilities-Status-Reports.pdf?emrc=26fca0.

effects of, and recommendations for shutoff protections. Citing those presentations, a long-term direct shutoff protection was officially enshrined by LADWP in November 2022, with an unprecedented, unanimously adopted motion on November 18, 2022. This motion directed staff to halt the practice of water and power shutoffs as a debt collection tool for residents enrolled in its EZ-SAVE and Lifeline discount programs.[45] Generally, this decision echoes the change in public sentiment coming out of the pandemic that is incumbent on the utility or its creditors to provide convincing evidence regarding major revenue impacts rather than on proponents of continued shutoff protections to demonstrate minimal impacts.

The Commissioner stated a lengthy justification for the motion[46] but in summary that:

> "The department has learned a lot through COVID, and through the series of events and persistent calls for equity. And based on what we have learned, we think that it is critically important that we take steps necessary to protect and to support all of our residents, including those that are income challenged, and steps that are concrete and that contribute to their quality of life."

There were two key findings which were cited as providing assurance for the passage of this motion. Both of these were corroborated by internal LADWP staff analysis as well as by UCLA research of available sources, including LADWP customer data. The first was regarding the fiscal impact of instituting a shutoff moratorium on discount program-enrolled customers. This does not seem to be plausibly justified on a revenue recovery basis, given that discount-enrolled customers generally represent such a small share of existing LADWP residential and overall power unit revenue (see Figure 33 below).

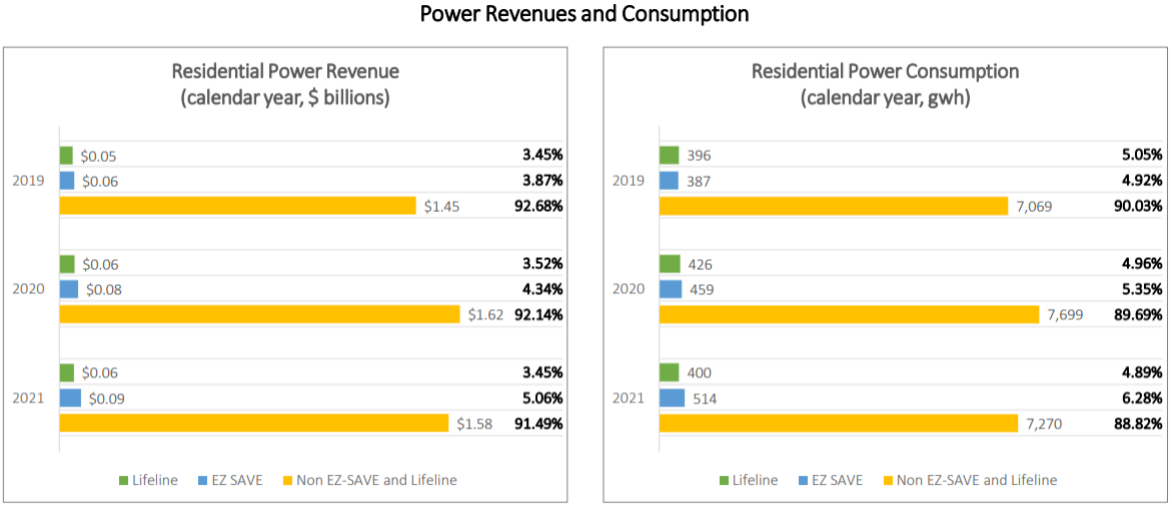

Figure 33. Residential Power Revenues and Consumption by Discount Program Enrollment Status, 2019-2021[47]

[45] See presentation by George Rofail, LADWP Chief Customer Officer. "Update on Customer Bill Assistance and Collections History." September 27, 2022.
[46] The full discussion can be viewed here: https://www.youtube.com/watch?v=vvW1QXuJVZw.
[47] Adapted from presentation by George Rofail, LADWP Chief Customer Officer. "Update on Customer Bill Assistance and Collections History." September 27, 2022.

Even if overall revenue risk is low, inability to collect payment and a high volume of bad debt can affect utility credit ratings and thus their ability to affordably borrow for necessary capital improvements. There are multiple other relevant financial metrics of concern which could indicate sizable fiscal impacts of shutoff prevention.

To be clear, we are not asserting that there is no fiscal impact of a shutoff moratorium. We note that during the universal customer shutoff moratorium, per the power system's audited financial statements, uncollectibles have risen from $28 million in 2019 to $113 million in 2022, or about 0.7% to 2.5% of total operating revenue.[48] However in a review of recent available Fitch bond rating analyses and LADWP's annual financial reports[49] since the onset of the pandemic, total revenues (including residential customer revenues) have continued to rise. Moreover, neither a concern regarding uncollectibles nor a general present or future concern regarding revenue impacts of a moratoria has been raised in self-characterized overall financial conditions in these documents. This may be in part because, as a 2021 Fitch analysis notes and is echoed in Class C-E investor presentations,[50] "Uncollectible accounts are recoverable via pass-through adjustment factors."[51] In fact, a recent independent Fitch review characterized LADWP as having "very strong revenue defensibility characteristics."[52] Contrary to industry and scholarly expectations at the outset of the pandemic, these findings fit generally with a lack of documented evidence of large fiscal effects of shutoff moratoria or more lenient post moratoria policies on the self-assessed or market-assessed fiscal condition of large utilities.

The second key finding was that there is no present evidence that there is widespread bill payment shirking, or a pervasive phenomenon of customers paying less or not at all because they are protected from shutoffs, among discount program-enrolled customers. While it is intuitive to have this concern, and LADWP does and certainly will experience some customers misusing the protections of a shutoff moratorium, there is again no evidence of widespread shirking.

In fact, as illustrated in an LADWP staff analysis summarized at its September 2022 Board meeting, "the majority of discount customers have remained current through the moratorium".[53] Moreover, Lifeline program enrolled customers in particular have been characterized as "the lowest risk customer segment" as they have been found to pay and pay on-time (see Figure 34 below). These findings directly mitigate concerns about widespread bill payment shirking among low-income customers who will be protected by the permanent shutoff moratorium, and

[48] LADWP most relevant financial reports for the power and water systems are housed here: https://www.ladwp.com/ladwp/faces/wcnav_externalId/au-fr-audfinstatements?_adf.ctrl-state=wk9e8mvvc_4&_afrLoop=657193919701165.

[49] We also draw on the summary 2021-2022 briefing book reporting financials through 2021. See https://www.ladwp.com/ladwp/faces/ladwp/aboutus/a-financesandreports/a-fr-reports?_adf.ctrl-state=17syjcvjjb_4&_afrLoop=1184983424410647.

[50] See https://www.ladwp.com/ladwp/faces/ladwp/aboutus/a-financesandreports/au-f-invrel/au-fr-invpres?_adf.ctrl-state=eblbo2mz6_33&_afrLoop=660283968082924.

[51] See https://www.fitchratings.com/research/us-public-finance/fitch-rates-los-angeles-ca-water-rev-bonds-aa-outlook-negative-25-05-2021.

[52] See https://www.fitchratings.com/research/us-public-finance/los-angeles-department-of-water-power-california-19-10-2022.

[53] Calculation generated by CSD staff based on FSO and CSD data and made available to UCLA as part of the LA 100 Equity Strategies project.

undermine the often biased, racist and classist anecdotes regarding the undeserving poor which are raised by shutoff protection opponents.

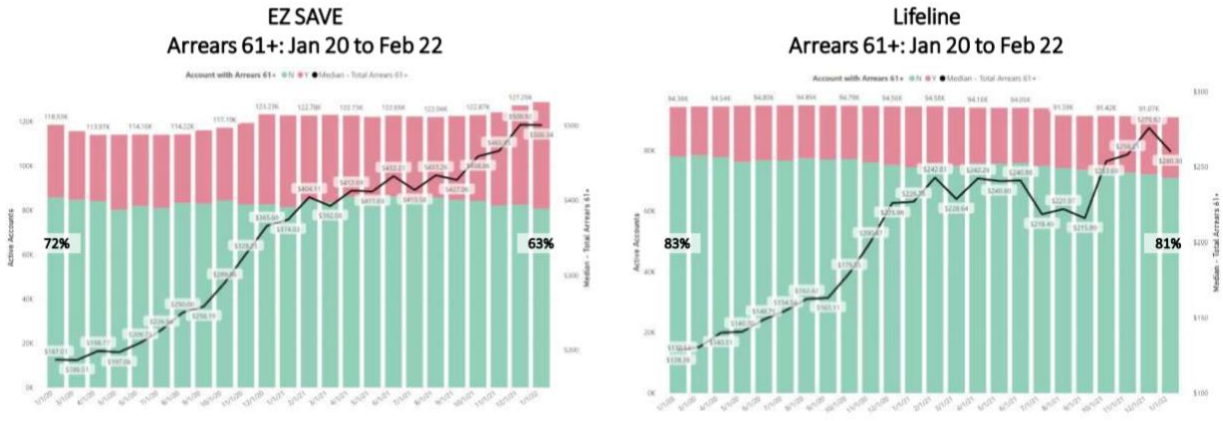

Figure 34. Proportion of EZ-SAVE and Lifeline Accounts in Arrears, 2020-2022[54]

Finally, we note that concerns regarding instituting long-term shutoff moratoria could be legally motivated. As discussed prior in Section 3, both Proposition 26 and 218 pose challenges to publicly owned utilities in any special consideration of any customer class, including a shutoff moratorium for customers enrolled in existing discount programs. However, legal challenges to this specific policy seem unlikely for at least two reasons. First, more widespread shutoff moratoria, formal and informal, have now been in place since March 2020 without notable legal opposition, including after the expiration of the statewide mandate. A very limited shutoff moratoria has also been in place for Physicians Certified Allowance Discount (PCAD)-enrolled customers of LADWP on a health basis for some time.

Second, and relatedly, the widespread declaration of utility shutoff moratoria on health and livelihood grounds has now also been empirically demonstrated to be effective at limiting COVID-19 infections and saving lives.[55] This presents a new ethical and evidential hurdles to legal opposition, which tends to be raised by small special interest groups, to perceived customer cross-subsidies of this specific nature, as elimination of these protections can be interpreted as violating other, broader mandates of utility and health and safety codes.

[54] Proportion of accounts in arrears decreased over the period, but median total arrears increased.
[55] For instance, see https://www.nber.org/papers/w28394 and Zhang, X., Warner, M. E., & Grant, M. (2022). Water shutoff moratoria lowered COVID-19 infection and death across US states. American Journal of Preventive Medicine, 62(2), 149-156.

5.4.1.5 Potential Gaps and Evaluation Needs of the November 2022 Motion

There is one important potential gap, several immediate causes for additional monitoring and evaluation safeguards, and numerous open questions critical to ensuring that the November 2022 policy is effectively and equitably implemented over time.

5.4.1.5.1 Potential Gaps

The biggest potential gap in the permanent moratorium is that it only applies to customers enrolled in discount programs, rather than all eligible customers. This means that the moratorium protections will only be as successful as discount program enrollment efforts, which currently are well below 80% much less 100%, a shortcoming that has been recognized by and is attempting to be rectified by the customer service department. This is also true in other cases where additional layers of eligibility requirements create potentially unnecessary impediments to access for households that would benefit from assistance.

In particular, existing AMPs narrow their potential pool of beneficiaries through multiple, coinciding eligibility requirements. At the state level, CAPP limits eligibility to households at least 60 days past due on energy bills and only addresses arrears created during the approximately 15-month period starting at the beginning of the COVID-19 pandemic, leaving aside the multitude of other challenges facing low-income households both pre-pandemic and post-June 2021 that can cause them to fall into arrears. Utility-administered programs can be even more restrictive, with requirements that include enrollment in CARE/FERA, minimum arrears balance and age (e.g., $500 or more and 90 days old for IOU-administered AMPs), and minimum time as a utility customer.

We cover this issue more fully in our discount program policy analysis above, including ways in which LADWP could go beyond its existing efforts such via streamlining EZ-SAVE enrollment and cultivating parallel enrollment processes with discounts and other needs-based programs.

5.4.1.5.2 Additional Monitoring and Evaluation Safeguards

In conjunction with the institution of the permanent moratorium, LADWP could consider including some or all of the following measures as safeguards for perceived, if not real, potential abuse of the program:

1. Limiting high-level bounds on consumption for discount-enrolled and moratorium-protected customers, a la the CARE program's upper limit on discounts applying to 400% of average residential consumption.[56]
2. Targeted audits of extremely high consumption among discount customers, where (rarely) relevant.[57]

[56] For instance, see https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/assistance/docs/ab401_appendices.pdf.
[57] Another measure which could be available to LADWP to apply to its water customers in cases of high consumption while being protected under a moratorium is flow restrictors. This technology is controversially being used by some utilities, including Phoenix and East Bay Municipal District, in cases of customer inability to pay in

3. Experimentation with the effectiveness of messaging sent to different customer classes, including discount-enrolled customers, encouraging them to pay their bill according to their ability and in line with their peers.
4. Although it may not be necessary, a very targeted percentage of income payment plan (PIPP) could be considered to encourage some level of revenue collection for customers already protected under the moratoria.

5.4.1.5.3 Open Questions

There are also numerous important open questions, both obvious and obscure,[58] regarding the impact of the November 2022 moratorium which we encourage LADWP and partners to further explore. We also previously set out some guidance for evaluating the answers to these questions in our separate analysis of shutoff metrics.

Large questions (and potential data sources) which should be evaluated in the next 2-3 years include (but are not limited to):

1. What is the income, consumption, and arrears profile of residential customers who are eligible but not currently enrolled in discount programs? (Customer connection survey)
2. What is the consumption level for residential customers after they are shutoff? For example, is there evidence they reduce consumption to avoid another shutoff? (2017-2020 LADWP data)
3. What is the expected degree of shirking and potential rebound effect[59] for protected customers? (Will have to be observed post November 2022)
4. What does LADWP project in terms of the level of arrearages and number of shutoffs by currently unprotected customer classes and segments as the reinstitution of some shutoffs is rolled out? (2017-2020 LADWP and current arrearage data)

5.4.2 Future Complementary Policy Design

As noted in the SCOPE report, the November 2022 motion did not cover all populations of potential concern by protecting discount-program enrolled shutoff moratoria. Namely, it is important to establish guidelines, if not firm targets, for shutoff reduction or elimination for other residential customers, especially those with moderate incomes but above 200% of the Federal Poverty Level, as the IOUs' FERA program accounts for. Small business customers who may either rely on residential or commercial LADWP accounts also merit further consideration for shutoff protections, as detailed further in Chapter 14 of the report.

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lieu of shutoff since the covid-19 pandemic. However, this is not necessarily recommended and is not feasible on the power side of non-payment concerns.

[58] For instance, what are the legal and revenue ramifications for the non-LADWP services (sewer and trash) potentially on protected customers' bills now that a water and power moratoria has been extended?

[59] We note that the burden of proof for a substantial rebound effect is high given that currently enrolled discount customers have been shown to consume less water and power average than other residential customers. For instance, see City of Los Angeles. 2019. "Exploring 2018 Residential Water and Power Bills."

Second, a permanent, legal means to continue to provide debt relief funds, ala an AMP intervention, will be important both for low-moderate income and potentially small business customers not protected by the moratoria as well as for customers enrolled discount-enrolled programs protected under moratoria, but whose debt levels continue to accumulate. This type of program may need to rely opportunistically on non-ratepayer city, state or federal funds.

5.4.2.1 Administrative considerations

The administrative burden and associated staffing impacts of the permanent extension of a partial shutoff moratorium are unclear. Presumably, it should extend a lowered, but non-zero burden on customer service and field staff who have historically manually implemented shutoff and restoration procedures predating the initial moratorium in 2020. On the other hand, as noted above, the partial moratorium puts more pressure on administrative procedures to ensure enrollment in discount programs. At the same time, these enrollment procedures have become less dependent on staff processing.

There will be an additional need for staff time to ensure institution of safeguards regarding perceived potential abuse of the permanent moratoria. There will also be some need for more permanent analysis support of and reporting on the effectiveness of the moratorium and associated recent crisis relief policies.

6 Energy Affordability Metrics

It is important to track energy affordability metrics because knowing how customers experience challenges paying utility bills can help inform policy decisions to enhance affordability. Metrics can indicate where programs are working, and where gaps exist that still need to be filled. Electricity affordability does not look the same for all in-need customers, and tracking a series of metrics can shed light on the different ways in-need customers experience their utility bill.

LADWP already tracks some affordability metrics, namely enrollment levels in discount programs. These metrics are reported in the "LADWP Rates and Equity Metrics Semi-Annual Report." In addition, LADWP collects data on other metrics, including customer satisfaction, annually through the Loyola Marymount University Public Opinion Survey. This mechanism could play an important park in tracking equity metrics, as survey questions can be very effective at gauging customer experience. Other metrics can be tracked using data already collected internally by LADWP.

The following section describes three types of energy affordability metrics: Indoor Thermal Comfort, Energy Insecurity, and Discount Program Participation. Each section details a number of options for measuring each metric, a survey of existing data sources or precedents, and an analysis of the benefits and drawbacks of each option. The following analysis is intended to inform decisions about which metrics make the most sense to track to inform affordability policy.

6.1 Indoor Thermal Comfort Metric

6.1.1 Motivation and Background

"Thermal comfort" refers to households' ability to keep their indoor dwelling space at a comfortable temperature. This includes both cooling in the summer and warming in the winter. The need for heating and cooling to maintain thermal comfort is place-based and depends on the relative climate of the location. In Los Angeles, hot summers and mild winters, combined with increasing temperatures, mean access to cooling is becoming a greater concern. Inability to maintain thermal comfort can occur during extreme weather events, or on a regular basis. Households with insufficient thermal comfort suffer health and welfare impacts. An inability to keep households cool can reflect a lack of outdoor shade and ambient cooling in the neighborhood, barriers to paying electricity bills to operate cooling technologies, lack of access to or functional use of air conditioning, fans or other temperature-modulating attributes of the home such as a lack of insulation.

Thermal comfort is an affordability issue when it stems from a household forgoing or reducing use of cooling or heating technology in order to save money on utility bills. Inability to afford utility payments can cause households to maintain unhealthy indoor air temperatures. Doing so poses a significant public health hazard because heat stress leads to an increase in hospitalizations and mortality.

Little global guidance exists on thermal comfort in terms of a maximum acceptable temperature. The World Health Organization's standard for comfortable and healthy indoor temperature is between 64-75°F for the general population, and a minimum of 68°F for infants, elderly, and those with significant health problems (WHO Environmental Health in Rural and Urban Development and Housing Unit 1990). However, 2018 World Health Organization Housing and Health Guidelines note that additional research is needed to identify a maximum acceptable indoor temperature (WHO 2018). Additionally, the maximum acceptable indoor temperature would vary between locations, as it is influenced by climate. The National Renewable Energy Laboratory (NREL)'s 2017 Residential Indoor Temperature Study found that the average residential thermostat temperature during periods of active cooling is 75°F, which may indicate that the maximum acceptable indoor temperature is higher than 75°F (NREL 2017). Average temperature was also found to vary depending on climate, and average cooling temperatures of connected thermostats was 76.4°F in the hot-dry climate zone (which includes California).

Minimum temperature standards have historically been enshrined in housing codes through habitability requirements, which require residences be kept warm enough. Under consideration in California is an extension of this concept to maximum temperature thermal comfort policies to ensure residences are kept cool enough. While no standards currently exist for private residences, maximum temperature standards have been established for other specialized settings, such as assisted living facilities and childcare facilities. These may be enforceable more broadly across residential settings, although current monitoring and enforcement of compliance is not universal (DeShazo et al. 2021).

Policy does exist on maximum temperatures for some specialized facilities. In assisted living facilities, California law requires rooms to be cooled to a comfortable range between 78°F and 85°F, or at least 30 degrees below outdoor temperature in extreme heat. For skilled nurse facilities, federal law requires these facilities cooled to between 71°Fand 81°F. Childcare facilities must be kept between 68°F and 85°F, according to Community Care Licensing regulations. Regulations for maximum indoor air temperature are under-development at time of writing, but recent drafts indicate requiring employers to initiate progressive heat safety protocols when indoor air temperatures exceed 82°F and 87°F.

Similar policies for residential homes are beginning to be explored. For instance, implementation of the concept of a maximum indoor thermal comfort metric or standard was recently considered in the California State Legislature. During the 2022 legislative session, AB2597 (Bloom) was proposed to create mandatory building standards for safe maximum indoor air temperature in newly constructed residential buildings, but was unsuccessful in being passed (Bloom et al. 2022). A study was still commissioned as part of a legislative trailer bill (SB 126), with language stipulating that:

> "On or before January 1, 2025, the Department of Housing and Community Development shall submit policy recommendations to the Legislature that are designed to ensure that residential dwelling units can maintain the recommended maximum safe indoor air temperature. The recommendations shall take into account state climate goals, the extreme heat plan, regional temperature differences, and various methods for reducing indoor air temperatures, including, but not limited to, technical feasibility, building and site electrical system limitations, cost barriers, electric utility capacity

limitations, state and federal statutory requirements, and other relevant factors."

There is also considerable momentum at the city level on support for ensuring indoor thermal comfort. On the local level, a motion has been proposed in the LA City Council to investigate ways to ensure households are able to maintain safe living conditions in the face of increasing common heat events. The motion calls on LADWP to "report back on resources and programs to help assist low-income households during extreme heat events." The motion was approved by the Housing Committee on October 12, 2022 and the city council officially adopted the report on October 21, 2022.

Multiple departments of the City of Los Angeles have also begun to develop robust strategies and efforts addressing extreme heat, which go beyond LADWP's traditional jurisdiction. The city established a Climate Emergency Mobilization Office (CEMO) within its Department of Public Works in 2020 and the City Council established a motion regarding extreme heat preparedness and related-deaths reporting in 2021. The director of CEMO, Marta Segura, was appointed as LA's first chief heat officer and tasked with working coordinating a response to extreme heat and implementing a citywide heat action plan (De Marco 2022).

LADWP has also introduced measures to make it easier for low-income customers stay cool during heat waves. For example, LADWP is offering a $225 rebate on window air conditioners for customers enrolled in a discount program, which covers 80% of the upfront cost. LADWP is also offering an option to spread high summer utility costs over the rest of the year. In addition, as discussed at length in the Policy section, LADWP has launched the Comprehensive Affordable Multifamily Retrofit, which aims to improve energy efficiency in multifamily residential buildings. These rebates are intended to assist renters in accessing benefits that existing rebate programs for energy efficiency upgrades have largely delivered to homeowners (Healy 2022).

In addition to the need for policy support around a maximum temperature standard establishment and enforcement, there are practical nuances in the methodology of applying the metric of indoor thermal comfort. For example, should the metric be targeted at assessing everyday comfort or focus on extreme events? Moreover, the set of contributing factors to this metric is complex. There are many factors that influence what indoor temperature feels comfortable for individuals, including age, sex, health, level of adaptation to the climate, level of insulation provided by clothing, and activity level.

Thermal comfort is an important electricity affordability metric to track because of the risk associated with extreme temperatures. Knowing to what extent customers are being exposed to unhealthy conditions to save money on utility bills could help shape policies to make essential cooling more accessible. The following sections discuss several mechanisms for measuring thermal comfort.

6.1.2 Potential Indoor Thermal Comfort Metrics

While this field is relatively new, and new methods are emerging rapidly, several methods exist for measuring thermal comfort in indoor, residential settings. We explore four potential options for establishing thermal comfort as an affordability and broader energy equity metric for LADWP in detail explored below. The metric options analyzed are as follows:

- Self-Reported Thermal Comfort
- Self-Reported Thermostat Setting
- Externally Measured Thermostat Setting
- Energy Equity Gap

Each potential metric is primarily evaluated based on its implementation feasibility by drawing on existing or potential data sources, as well as the benefits and drawbacks of using each metric regarding its utility in informing policy. The table below compares each metric option along eight key dimensions. The table is followed by an in-depth analysis of each potential metric and a final synthesis and recommendation for adoption and implementation.

Table 12. Thermal Comfort Metrics Overview

Metric	Mechanism	Measure	Existing Data Source	Baseline	Target	Benefits	Drawbacks	Feasibility
Self-Reported Comfort	Survey	Proportion of households that report any frequency of thermal discomfort in the last year.	None	20% of households nationwide reported some frequency of thermal discomfort in the last year.	Less than 5% of in-need households reporting any frequency of thermal discomfort in the last year.	Captures individual differences in thermal comfort, which can vary based on age, health, and gender.	Comfort is very subjective and it may be politically infeasible to set goals around personal preferences.	High: this information is not collected by existing mechanism but could be added to the LMU survey.
Self-Reported Thermostat Temperature	Survey	Proportion of households that report thermostat temperatures >78 during the cooling season.	RASS	Almost 40% of households in the lowest income groups have AC turned off during summer.	Less than 5% of in-need households reporting thermostat settings >78 or off.	Thermostat setting is less subjective than comfort level and data is already collective.	Self-reporting may not be completely accurate.	High: This data is already collected in some from through the RASS Data.
Externally Measured Indoor Temperature	Smart Thermostat	Proportion of households where the thermostat is set > 78.	None	N/A	Less than 5% of in-need households with Smart Thermostat settings >78 or off.	Measures temperature directly instead of relying on self-reporting.	Most in-need households do not have existing Smart Thermostats and so would need to be installed as part of the program. There may be privacy concerns around collecting data from people's homes.	Low: There would be a high initial lift to gain consent for and install thermostats, but simple data collection thereafter.
Energy Equity Gap	Electricity consumptio n data and temperature	Inflection point in use of cooling systems by income bracket.	LADWP Meters		Less than 1 degree difference between high-income customer AC use and in-need customer AC use	Direct measure that relies on existing data collected by LADWP	As electricity consumption rather than AC use, confounding variables may be measured.	High- Data is already collected, some effort required each year to determine inflection points

6.1.3 Self-Reported Thermal Comfort

The first potential metric is the proportion of LA City households self-reporting they cannot keep their indoor space cool. This can be assessed either on a routine or extreme event basis. This is a relatively new metric derived from the extreme heat literature and serves as a proxy for one of the most essential electricity needs in the LA area: maintaining healthy indoor temperatures to prevent heat related illness.

6.1.3.1 Data Collection Mechanism

Self-reported thermal comfort could be measured through a survey question asking LADWP customers how frequently household indoor air temperature is uncomfortable. One example of a similar mechanism is the US Census Household Pulse Survey[60]. The US Census Household Pulse Survey collects data related to the social and economic effects of coronavirus on US households, including data related to energy insecurity and thermal comfort. Data related to rates of thermal discomfort is collected in "Standard Error Housing Table 4. Household Energy Use and Spending in the last 12 Months, by Select Characteristics: United States."

Using similar survey questions would allow LADWP to compare results to the Household Pulse Survey data and develop a baseline. One advantage of the Household Pulse Survey data compared to the American Community Survey or RECs is that data was collected frequently during the COVID-19 pandemic, although the survey is not guaranteed to continue in future years. The Household Pulse Survey question reads, "Household kept home at a temperature that felt unsafe or unhealthy" followed by what frequency — "did this occur almost every month, some months, 1-2 months, or never."

LADWP could include a similarly framed question in its own survey of customers. A downside of this phrasing is that the term "unsafe or unhealthy" may cause some households that are experiencing uncomfortably warm conditions not to report, if the conditions are not obviously unsafe. Additionally, adding language around saving money could better identify residents for whom electricity rates are the cause for thermal discomfit. The variation below could be a more informative and accessible way to phrase the survey question.

An alternate survey question could read: ""Household kept home at a temperature that felt uncomfortably warm during the summer to save money on electricity" followed by what frequency — "did this occur almost every month, some months, 1-2 months, or never."

6.1.3.2 Potential Data Sources

While the US Census Household Pulse Survey is useful as a model, it cannot serve as an actual data source for this metric because it does not collect data specifically at the LA City scale. Currently no sources collect data on this question in Los Angeles. However, a similar question

[60] See https://www.census.gov/data/experimental-data-products/household-pulse-survey.html.

could be added to existing surveys issued in the City of Los Angeles, such as the LMU Public Opinion Survey.

6.1.3.3 Self-Reported Thermal Comfort Baseline

While there is currently no data on self-reported thermal comfort specifically within the LADWP service area, the Household Pulse Survey collects self-reported thermal comfort data on a national scale. Nationally, about 5% of households reported thermal discomfort every month, 8% reported thermal discomfort some months, and 4% reported thermal discomfort one or two months in the last year. Altogether, almost 20% of household reported experience thermal discomfort in the past 12 months. See figure below.

This data is not representative of LADWP service area and should not be used as such. The mild climate of Los Angeles, along with many other physical and social characteristics of the City will likely make the self-reported thermal comfort baseline in the City of Los Angeles unique. However, the Household Pulse Survey data can be used as a starting point of comparison.

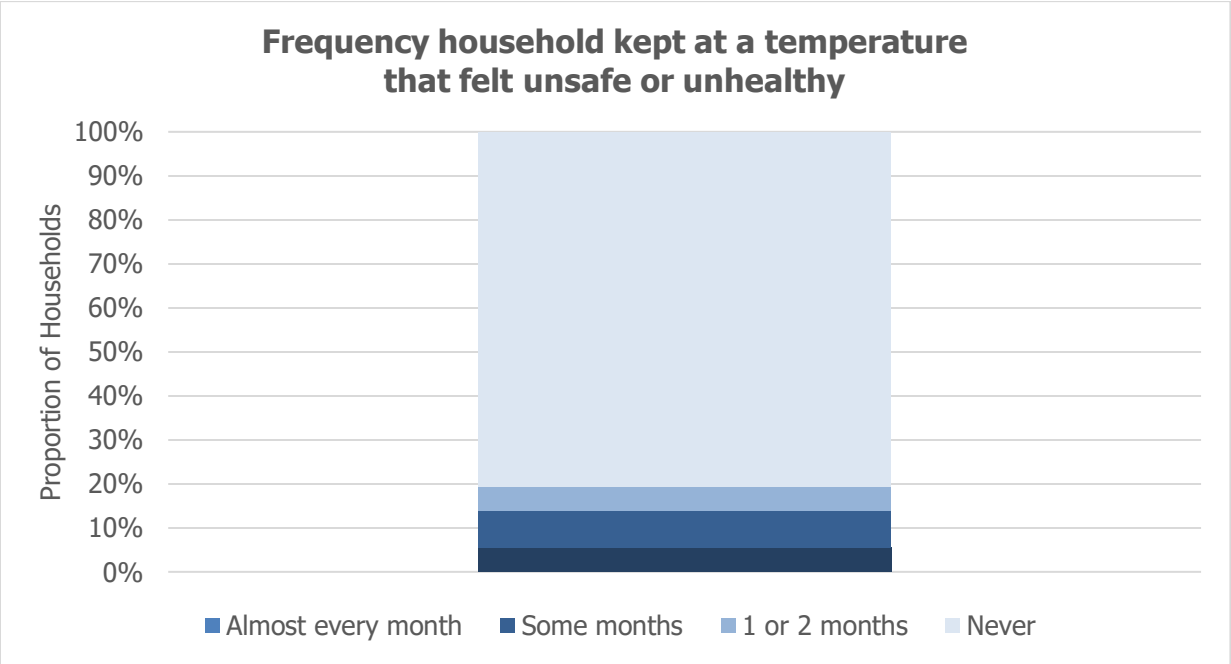


Figure 35. Proportion of Households Facing Thermal Discomfort (Data: US Census Household Pulse Survey)

6.1.3.4 Potential Targets Based on Self-Reported Thermal Comfort

LADWP could aim for a target less than 5% of households reporting ever maintaining uncomfortably warm temperatures to save money. This metric should be true of all income groups such that no income bracket has more than 5% of households who self-report experiencing thermal discomfort.

Alternatively, a baseline number of households experiencing thermal discomfort could be established, and then a target could be set to reduce that baseline number by 80% over 3 years.

6.1.3.5 Benefits of Using Self-Reported Thermal Comfort

Self-reported thermal comfort has the advantage of measuring comfort, rather than temperature, which accounts for differences in individual experiences of heat. It measures success according to the outcome of how residents feel rather than the output of the thermostat. Additionally, it is inclusive of households that use varied methods of cooling, such as fans or room AC. Implementation and tracking feasibility are high if consistent survey data is collected, and this may be carried out in the City of LA broadly. As aforementioned, one option would be for survey questions to be added to the existing Loyola Marymount University LA Public Opinion Survey[61].

6.1.3.6 Downsides of Using Self-Reported Thermal Comfort

Due to the complex set of factors influencing thermal comfort, perceived burden may equally reflect factors outside of LADWP control as those within it. Additionally, it may not capture sufficient data related to the energy equity gap, as it does not directly measure differences in thermal comfort between high- and low-income households. However, the survey data could be compared between high- and low-income households to understand the difference in frequency of thermal discomfort.

6.1.4 Specific Threshold Temperature

An alternative measure for assessing thermal comfort is households' self-reported thermostat temperature setting. Instead of using the more subjective measure of "comfort" this metric assesses households' ability to maintain an indoor air temperature below a specified maximum threshold. This data is collected through existing surveys including the California-wide Residential Appliance Saturation Survey (RASS) and the nationwide Residential Energy Consumption Survey (RECS).

6.1.4.1 Data Collection Mechanism

This metric could be evaluated through a survey question. The question could ask what frequency homes were kept at a temperature over a certain temperature, or at what temperature homes were typically kept. One potential threshold is 78 degrees, which is the indoor set point recommended for government buildings (DDOE 2021). Households will likely need some degree of cooling when outdoor temperatures exceed 78 degrees in order to limit risk of mold and allergen build up and heat-related illness (Cong et al. 2022). If the CA State Legislature develops a standard for safe maximum indoor air temperature, that temperature could be used as the threshold.

[61] See the Los Angeles Public Opinion Survey conducted by Loyola Marymount University at https://academics.lmu.edu/studyla/studies/losangelespublicopinionsurvey/.

- Example Survey Question 1: “Household kept home at temperature above 78 degrees to save money” followed by what frequency - “almost every month, some months, 1-2 months, or never.”
- Example Survey Question 2: “What temperature is household thermostat typically set to during the cooling season (summer)?”- Off, >78 degrees, 73-77 degrees, 68-72 degrees, <68 degrees.”
- Example Survey Question 3: “What temperature is the household thermostat typically set to *on uncomfortably hot days when someone is home?*””- Off, >66 degrees, 68-70 degrees, 71-74 degrees, 75-78, 79-82degrees, 82-85, >86 degrees.”

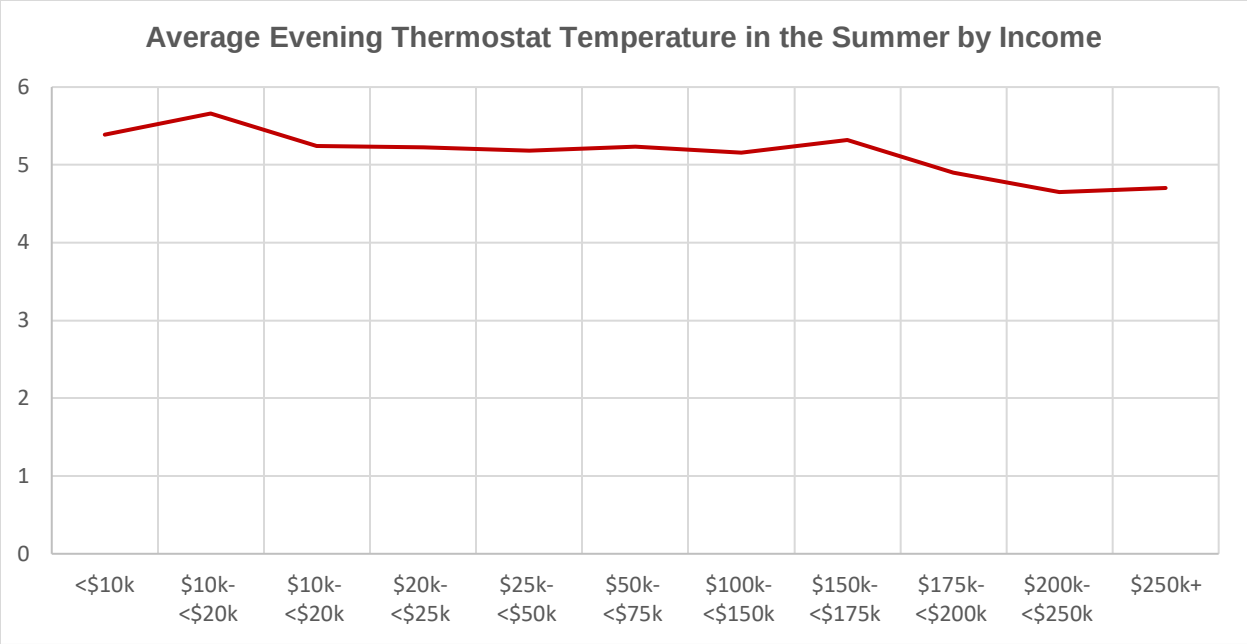
6.1.4.2 Potential Data Sources

The RASS collects data on residential appliance use, including thermostat setting, across California. This data can be subdivided to look at just the LADWP service area, providing a baseline for self-reported thermostat temperatures. The survey collects data for Morning, Day, Evening, and Night thermostat settings. As a baseline, Evening thermostat settings could be used, as these are the times when residents are most likely to require cooling and be home. This data looks at households that reported using central air-conditioning and does not include residents who use room air-conditioning or lack air-conditioning.

6.1.4.3 Baseline

A baseline for self-reported thermostat setting of LADWP customers can be derived from existing RASS data. One potential baseline could be the current reported average thermostat setting. Average thermostat setting decreases slightly with income, and so it may be a good measure of what degree households are setting higher thermostat temperatures to save money. A baseline could be the difference in average thermostat setting between high-income and low-income groups. Current data indicates that there is a difference of between 0.7 and 1 temperature brackets, which corresponds to approximately a 2.1 to 3 °F temperature difference.

Another potential baseline metric is the proportion of households that keep air conditioning off or above 80°F in the evenings. Again, the data shows that the proportion of households keeping AC off decreases as income increases, indicating that lower income households may be doing so as a money saving measure. A baseline measure could be the difference in the proportion of households keeping AC off between low-income and high-income groups, which according to current data is about 20 percentage points.



Temperature Brackets (°F): 2: <68 3: 68-69 4: 70-73 5: 74-76 6: 77-79 7: >80

Figure 36. Average Evening Thermostat Temperature by Income Brackets[62] (Data: RASS 2019)

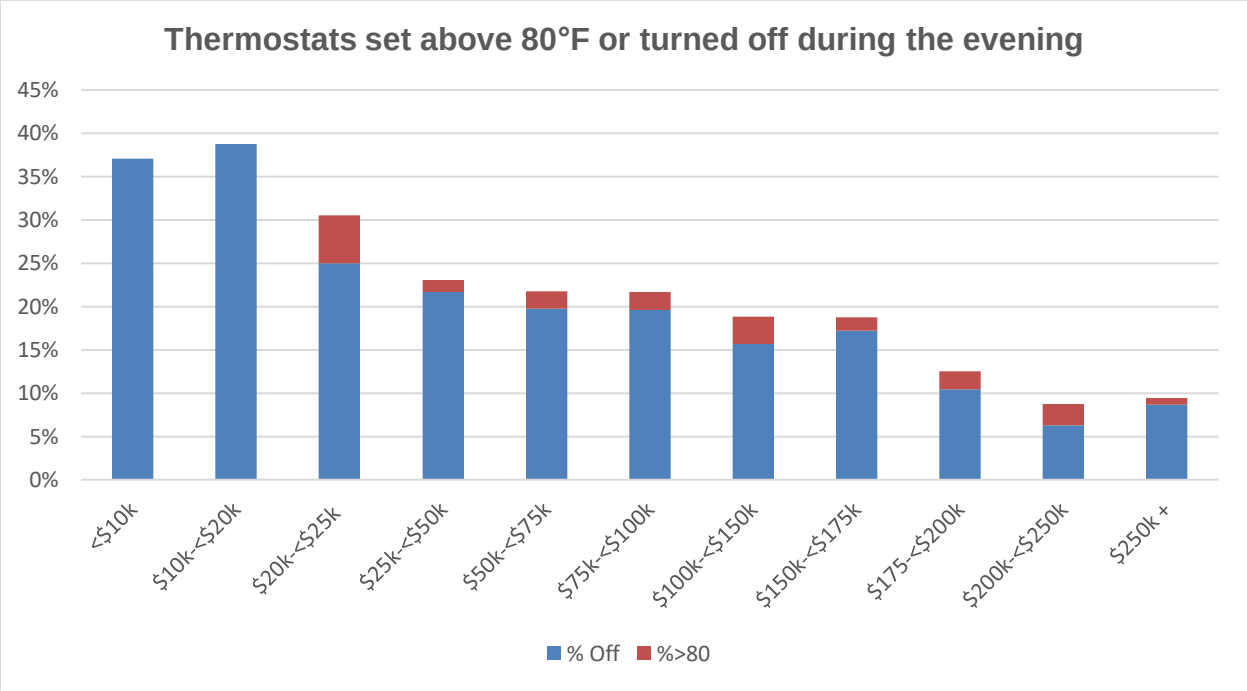


Figure 37. Proportion of Households in LADWP Service Area with Thermostat set Above 80 °F or Turned Off During the Evening (Data: RASS 2019)

[62] Average thermostat setting decreases as income increases. Income groups less than $175,000 have an average thermostat temperature between 74 and 79 degrees. Income groups greater than $175,000 have an average thermostat setting between 70 and 76 degrees.

6.1.4.4 Potential Target based on Self-Reported Temperature Threshold

One potential target is for less than 10% of in-need LADWP customers to report a summer thermostat greater than 78 degrees during. This threshold was chosen because it is the proportion of very high-income households who reported keeping the thermostat off or above 80 degrees. This target is simple and does not depend on LADWP's definition of in-need customers, which may change with policy overtime.

Another target would be for less than 10% of LADWP in-need households to report a summer thermostat setting 78 degrees during evening. By focusing on in-need customers, this metric is better able to measure the proportion of households that choose to set higher thermostat temperatures due to income related restrictions.

A third metric would be for the proportion of in-need or low-income households setting a thermostat temperature above 78 degrees to be less than 1% below the proportion of high-income households setting a thermostat temperature above 78 degrees. This target centers equity by measuring whether high- and low-income customers have the same ability to maintain a safe and healthy indoor temperature.

6.1.4.5 Benefits of using Self-Reported Temperature Threshold

One benefit of this metric is it is less subjective than asking about comfort. Establishing a temperature threshold gives a point of reference for what temperature is "unhealthy" and thus responses will vary less according to personal interpretation. This will ensure people who set their thermostat above the threshold, who may not know the limit for unhealthy temperature are included. Likewise, it means that those who set their thermostat within the healthy limit who may report discomfort for reasons not related to safety, such as narrow personal preference will not influence the metric.

Another benefit of this metric is that this data is already being collected at the LADWP scale through the Residential Appliance Saturation Survey (RASS). This study is carried out periodically by the California Energy Commission with surveys being carried out in 2003, 2009 and 2019. This will allow LADWP to establish a baseline from recent data and compare LADWP service area to other regions in California.

Implementation and feasibility are high because LADWP has an established avenue for collecting survey data more regularly through the LMU Public Opinion Survey.

6.1.4.6 Drawbacks of using Self-Reported Temperature Threshold

A potential downside to this method is that dry-bulb indoor temperatures given by typical thermostats may not be an adequate reflection of thermal comfort. Many other factors, including indoor relative humidity, air flow, and occupational factors such as the age, gender, clothing, and behavior of household members, influence thermal comfort levels (Alhamayani et al. 2021).

Including questions that assess perceived thermal comfort such as the Household Pulse Survey questions above would help alleviate this downside.

Another drawback is that this metric does not take into account actual air temperature, which can vary across Los Angeles. In cooler parts of the city, it may be possible to keep the thermostat off during the summer and maintain temperatures below the recommended 78 degrees, while in hotter parts of the city, keeping the thermostat off may expose residents to unsafe conditions. Additionally, it does not capture when residents are home and in need of cooling. Many residents may keep the thermostat off during periods where they are out of the house for work or other reasons. Over 20% of residents in the highest income group keep the thermostat above 80 degrees during the day and almost 10% do so in the evening, perhaps on account of these factors. Thus, electricity rates are likely not the only reasons households may keep the thermostat at a higher temperature and so a goal close of no households with a thermostat setting above 78 degrees may not be desirable. These concerns can be addressed to a degree by using a more specific survey question. See Example Survey Question 3 above.

Another drawback is residents can only self-report temperature if they have a thermostat to begin with. This metric leaves out households who use alternative methods of cooling, or lack access to methods of cooling.

6.1.5 Energy Equity Gap

The energy equity gap is a concept that measures energy self-limiting behavior through the lens of thermal comfort (Cong et al. 2022). It measures households' inability or unwillingness to consume enough energy to reach thermal comfort. It is defined as the difference in inflection temperature — the outdoor temperature at which a household starts using its cooling system as spring temperatures progress to summer temperatures — between low and high-income groups. A household's inflection temperature can be estimated using daily electricity consumption and outdoor temperature data.

6.1.5.1 Potential Data Sources for Energy Equity Gap

To calculate the Energy Equity Gap, LADWP would need daily electricity consumption of a sample of households as well as income information for the households. The data collection mechanism would be daily meter reads of a sample of households, household income, and recording daily temperatures. The data would then be analyzed to calculate the inflection point of households in different income groups.

6.1.5.2 Baseline Energy Equity Gap

No current baseline data exists for the Energy Equity Gap in Los Angeles. However, a baseline for the Energy Equity Gap in LADWP service area could be calculated by plotting the daily electricity consumption per household of a neighborhood by the daily temperature in the

neighborhood for the summer months. LADWP could gather this data from daily meter reads of a sample of households and temperature logs from weather tracking organizations.

6.1.5.3 Potential Target for Energy Equity Gap

A potential target for this metric would be to have a less than 1 degree difference in inflection point between low-income and high-income neighborhoods. That would indicate that in-need customers are able to turn on cooling systems at the same temperature as higher income customers and do not need to self-limit use of cooling systems during hot weather to save money on utility bills.

6.1.5.4 Benefits of using Energy Equity Gap

A benefit of this method is that it can help identify households at risk of inability to reach comfortable indoor temperatures, and possibly at risk of heat-related illness. One study, conducted in Arizona, found households with an inflection point over 78 degrees as candidates for policy intervention, and particularly households with both low income and above average inflection points. Another benefit of this metric is that LADWP may already has access to the data needed. Additionally, this metric does not rely on survey data, which means it will be less subject to bias from voluntary responses. Additionally, it will be possible to achieve a larger sample size and get a more representative picture.

6.1.5.5 Drawbacks of using Energy Equity Gap

One drawback to this method is that it requires some amount of modeling/calculation to identify household inflection points based on outdoor temperatures. Additionally, the data collection requirements are more intensive than other metrics. Another drawback of this method is that it does not account for geographic variations across the City in terms of income and temperature. For example, given a certain temperature for the City of Los Angeles, the actual temperature experienced by the different regions of LA can vary considerably. For example, communities on the Westside of Los Angeles tend to be cooler in temperature and higher income. Thus, the temperature inflection point may be skewed lower for high income households and higher for low-income households. Some of these drawbacks could be addressed with smart thermostat data of actual indoor temperature, which is becoming increasingly accessible.

6.1.6 External Measurement of Indoor Temperature

Similar to the self-reported thermostat setting sub metric, a potentially more accurate way to measure thermostat setting is to use smart thermostats to directly report settings to LADWP. While this metric avoids the biases and ongoing costs involved in an annual survey, it has much higher upfront implementation costs and barriers.

6.1.6.1 Data Collection Mechanism

Smart thermostats are Wi-Fi enabled thermostats that can be controlled remotely and track temperature and energy use. LADWP is already investing in smart thermostats because they allow LADWP to adjust thermostat temperatures when there is a spike in electricity demand to avoid power outages. As of September 2020, 13,982 residential households were enrolled in the LA Power Savers program, which offers incentives for customers who enroll smart thermostats in the LADWP's energy management program (LADWP 2020). Data from these existing smart thermostats could be used as a sample, ideally in order to supplement survey data.

6.1.6.2 Potential Data Source for Direct Measurement of Indoor Temperature

Data would be collected from smart thermostats connected to LADWP around Los Angeles. Household income would also be useful as part of the analysis of this data, which could be collected for the sample group via survey. If the metric is limited to discount program customers, income information for discount enrollment may be used.

6.1.6.3 Direct Measurement of Indoor Temperature Baseline

A baseline for direct measurement of indoor temperature baseline can be derived from existing smart thermostats linked to LADWP through the Power Saver program. However, this existing data is likely not representative of the Los Angeles population as the programs requires customers to already have a smart thermostat installed, likely more prevalent in the higher-income portion of the population.

6.1.6.4 Potential Target for Direct Measurement of Indoor Temperature

One potential metric would be to set a maximum goal for the proportion of households with thermostat temperatures set to a specific temperature threshold on days that are uncomfortably warm. For example, less than 10% of households have the thermostat set to above 78 degrees during a heat wave.

6.1.6.5 Benefits of Direct Measurement of Indoor Temperature

Direct Measurement of Indoor Temperature is not influenced by regional variation in temperature or bias in self-reporting and so is the most accurate representation of conditions faced by LADWP customers. With more accurate data, LADWP can make better informed decisions about how to make electricity more accessible for maintaining thermal comfort. Another benefit of this metric would be that the necessary roll out of smart thermostats for data collection would have co-benefits with LADWP programs to reduce peak power demand.

6.1.6.6 Drawbacks of Direct Measurement of Indoor Temperature

Direct measurement using smart thermostats can be challenging to implement as it requires a rollout of smart thermostats and the collection of waivers to collect thermostat data. This initial rollout would have a much higher up-front cost than other data collection methods, such as surveys. Another concern with smart thermostats is that there may be resistance to adoption over privacy concerns. Residents may be uncomfortable with LADWP collecting data about their thermostat use or having the power to control their home thermostat remotely. Furthermore, thermostat data alone does not give an insight into how heat is experienced by residents. For example, residents may be out at different times of day for work or other responsibilities and thus set the thermostat to higher temperatures than if they were home.

6.1.7 Synthesis & Recommendations

The goal of adopting and monitoring this metric is to measure the proportion of customers who experience thermal discomfort because they are limiting electricity use to save money. The metric can be used by LADWP and interested parties to track the effectiveness of affordability policies and broader city heat equity efforts.

As electricity affordability is the objective of this study, the metrics should focus on when thermal discomfit is due to inability to pay for electricity. This can be illustrated by comparing behavior of high-income brackets, to whom electricity bills are less likely to be a limiting factor in electricity use, to low-income brackets. While Energy Equity Gap most explicitly measures discrepancy in cooling behavior based on income, this kind of comparison can be accomplished with any of the sub-metrics discussed above, as long as income information is also collected.

Self-Reported Thermal Comfort is the only potential metric that measures customer experience. The issue trying to be addressed is whether customers can maintain indoor air temperature that is safe and comfortable for them to carry out everyday activities. There is variation for what temperature range this is true for different segments of the population. For example, older adults and children are less able to regulate body temperature, and therefore may have a narrow range of thermal comfort than young and middle-aged adults. Thus, directly asking customers if they keep households at an uncomfortable indoor air temperature to save money is the most straightforward way to gauge customers' ability to maintain thermal comfort.

However, the Self-Reported Thermal Comfort potential metric is vulnerable to subjectivity in how customers interpret "comfort" in the survey question. Having numerical temperature data is useful in understanding if thermal comfort is being under or over reported based on the consensus of a safe and healthy temperature range is. Thermostat data can be used to fill in this gap. Rather than aiming for a specific temperature, the goal for this sub-metric should be for low- and high-income households to report similar thermostat settings. This can be accomplished by comparing the distribution of thermostat settings across all income groups.

Direct Measurement and Self-Reported Thermostat Setting do not measure thermal comfort, rather they measure at what temperature households set their thermostat. Because the thermally comfortable temperature range varies on an individual basis and thermostat setting depends on residents' actives, these are indirect measures that would need be used in conjunction with other

sub-metrics to ascertain comfort. Furthermore, these two potential metrics rely on a single technology — central air conditioning — to achieve thermal comfort, when households may use a variety of cooling techniques including fans and evaporative coolers. Yet, they may result in the most specific data, as thermostat setting may be easier for customers to report accurately rather than recalling frequency of discomfort. Direct measurement of indoor air temperature specifically is likely to result in the most accurate data, however it also has the highest barriers to implementation. The quality of data recorded from direct measurement is likely comparable to self-reported thermostat setting, which is much easier to measure. This assumption can be tested by comparing existing smart thermostat data to survey responses. Given the high barriers to smart thermostat implementation, self-reported thermostat setting is a more realistic sub-metric for the near term.

Energy equity gap is a promising potential metric because it takes into account both customer behavior, temperature at which AC is turned on, and income as a limiting factor by comparing high- and low-income inflection points using quantitative data. However, this is still an emerging field of study and there is little precedent for how this would be calculated in Los Angeles. More academic research into how this metric could be applied to the Los Angeles area should be conducted before adopting this metric into policy.

Given the above discussion of considerations, we recommend using the self-reported thermal comfort and self-reported thermostat setting sub-metrics in conjunction. The two metrics work well together because they can both be asked through the same survey mechanisms and together, they collect both qualitative and quantitative data. Using both in tandem balances personal experience with objectivity and gives lived experience context to numerical data points.

Measuring customer ability to maintain thermal comfort can be used to make a number of policy decisions. One solution could be to make electricity rates more affordable, for example by increasing discounts for in-need customers, so that the cost of running air conditioning to remain cool is not prohibitive. Another policy reaction could be to increase energy efficiency offerings such that it requires less electricity to maintain thermal comfort. These policy options are discussed more in depth in the following section.

6.2 Energy Insecurity Metric

6.2.1 Motivation and Background

"Electricity insecurity" is a term used variously in academic literature to refer to a number of dimensions of energy affordability, but for the purposes of this analysis we use the term specifically to measure the extent to which paying for an electricity bill constrains households' ability to pay for other essential goods or services, such as food, housing, or healthcare, which are core to health and welfare, and vice versa. The energy insecurity concept, and associated metrics, thus has overlap with other metrics and is subject to a set of factors far outside of LADWP's control. For example, thermal comfort can be an element of energy insecurity if it is not achieved because payment for sufficient levels of other essential goods are services are being prioritized.

Energy insecurity has traditionally been framed as the "heat or eat" dilemma facing families who must decide between paying for utilities to stay warm in the winter or for groceries (Bhattacharya et al. 2003). Much of the research on energy insecurity has been conducted on a national scale, where traditionally heating in the winter has of greater concern than cooling in the summer. This analysis focuses on the electricity portion of energy insecurity because it is the service LADWP provides. It also focuses on cooling rather than heating because most air conditioning units use electricity, while heating units may run on a variety of energy sources, including gas, as well as because of LA's warm climate.

The cost of electricity insecurity is more far-reaching than just a utility bill. Inability to access basic utilities has physical, social, and economic well- being implications for individuals, families, communities and cities. One study found that water shutoffs in Philadelphia had a ripple effect on costs related to healthcare, mental health, housing loss, and family separation (Miller & Rhyan 2022). Energy insecure households have been found to experience weight loss in the winter (Hernández et al. 2014). Trade-offs impact health and well-being, especially amongst children and the elderly. One study found that children in households reporting energy insecurity were more likely to face food insecurity, be hospitalized, be in poor health, and face higher development risks (Cook et al. 2008).

Energy insecurity is closely tied to the concept energy burden, the portion of household income that is spend on utility bills. The higher the energy burden, the less income a household must spend on other essentials. Energy insecurity is exacerbated by several factors including utility prices and home energy efficiency. Low- income households are more likely to face higher energy costs on account of inadequate insulation, stemming from lack of resources to make energy efficient upgrades and lack of authority to upgrade rental units (Hernández 2013). In the case of LADWP customers, because up to four services (power, water, trash, and wastewater) are provided on a single bill, but only two (power and water) have traditionally been billed by consumption level and subject to shutoffs due to non-payment, energy insecurity may be intertwined with water insecurity.

The concept and impacts of energy insecurity have been well documented recently, especially since the onset of the covid pandemic, but there are few precedents in terms of policy-relevant or adopted metrics. One challenge is that the list of relevant essential goods or services is somewhat subjective and differs across some existing instruments. This may suggest that the most feasible option for collecting relatively consistent data on household energy insecurity are survey questions that allow household members to report when trade-offs have been made between paying their electric bill and other essential services as an aggregate.

6.2.2 Potential Energy Insecurity Metrics

There is limited precedent in measuring energy insecurity as defined in this study. The only practical way to understand the extent to which households are forced to make tradeoffs between utilities and other essential services is to ask customers through a survey. However, within a survey there are a number of ways questions can be framed to measure energy insecurity.

Potential metrics are evaluated based on their benefits and drawbacks as metrics to inform policy and their feasibility to be implemented. The three potential metrics which we analyze in detail below are:

- Self-Reported Essential Services Tradeoffs
- Prioritization Order of Essential Bill Pay
- Forgoing or Reducing Essential Services

The table below compares each metric option along seven key dimensions. An in-depth analysis of each potential metric is then detailed below, and we then provide a final synthesis and recommendation for adoption and implementation.

Table 13. Energy Insecurity Metrics Overview

Sub-Metric	Mechanism	Question	Existing Data Source or Precedent	Target	Benefit	Drawback	Feasibility
Self-Reported Trade Offs	Survey	"How frequently in the las 12 months did your household forgo expenses for basic household necessities, such as food or healthcare, to pay electricity bills?"	None	Less than 1% of households reporting forgoing basic household expenses to pay electricity bills.	Straight forward question. Captures trade-offs in both directions (forgoing utility bill or forgoing other services).	Unclear which way trade-off is happening, as well as whether utility bill or other essential services are forgone.	High- only one questions, could easily be added to existing survey mechanism, such as LMU public Opinion Survey.
Forgoing or Reducing Other Essential Services	Survey	"What frequency in the last year did the household reduce or forgoe household essentials to pay utility bills?"	Residential Energy Consumption Survey	Less than 5% of households report forgoing household necessities to pay utility bills	Thorough list of questions is better able to parse out the nuance of energy insecurity	Longer survey may elicit less responses.	Medium: Multiple questions survey questions could be added to existing mechanism, but risks making survey long and burdensome
Prioritization of Essential Bill Pay	Survey		Lewis Center for Regional Studies: Los Angeles County Quality of Life Index Survey	Average satisfaction of at least 8 for satisfaction of payment for utilities.	Satisfaction question very subjective. Hard for LADWP to influence	Satisfaction question very subjective. Hard for LADWP to influence Does not capture ability to pay for essential services.	High- data already collected through Luskin Quality of Life Survey

6.2.3 Self-Reported Essential Services Tradeoffs

The simplest method of collecting data on energy insecurity would be a survey question asking household members to report the frequency with which they had to make tradeoffs between paying the electric bill and other essential services.

Example Survey Question: "Did your household make tradeoffs between paying electric bill and other essential services such as food or healthcare", combined with a potential question regarding frequency - did this occur "almost every month, some months, 1-2 months, or never.

6.2.3.1 Potential Data Sources & Baseline for Self-Reported Essential Services Tradeoffs

There are no existing studies or data sources documenting what proportion of households make trade-offs between electricity and other essential services using this language. Therefore, it is impossible to estimate a baseline for LADPW customers experiencing electricity insecurity using this metric before an initial survey is published.

6.2.3.2 Target for Self-Reported Essential Services Tradeoffs

Due to the lack of baseline data, it is difficult to gauge a feasible target for this metric. An idealistic target would be 0% of households making tradeoffs between electricity bills and other essential services. However, achieving this target would extend beyond just consideration of utility costs, but also food costs, housing costs, and healthcare costs to name a few. A more feasible goal may be less than a threshold of 5% of households making trade-offs between essential goods, for example, but this threshold should be based on baseline survey data when available.

6.2.3.3 Benefits of Self-Reported Essential Services Tradeoffs

Benefits of this measure include allowing survey participants to identify what constitutes essential services without pre-determining a list that could be incomplete. Additionally, within the scope of a single question, this sub metric is able to identify both whether households are forgoing paying utility bills for other household services, or forgoing household services to pay the utility bill. Finally. implementation would be achievable, as the survey question could likely be incorporated into existing surveys, such as the LMU Public Opinion Survey.

6.2.3.4 Drawbacks to Self-Reported Essential Services Tradeoffs

This sub metric does not indicate which services are being forgone. Knowing what kinds of tradeoffs households are making can be important in informing policy. Nor does this question indicate whether it is utilities or other essential services that are being sacrificed in the tradeoff. While this metric is useful in its simplicity and generality, it lacks specificity that may be useful.

6.2.4 Forgoing or Reducing Essential Services

6.2.4.1 Data Collection Mechanism

The US Energy Information Administration's Residential Energy Consumption Survey (RECS) collects data on the number of households experiencing energy insecurity, and reports the number of houses experiencing the following:[63]

- Any household energy insecurity
- Reducing or forgoing food or medicine to pay energy costs
- Leaving home at unhealthy temperature → thermal comfort metric
- Receiving disconnect or delivery stop notice → disconnection metric
- Unable to use heating equipment
- Unable to use air-conditioning equipment

Using a similar set of survey questions to identify the number of households experiencing energy insecurity in LA would allow for comparison with RECS data and would provide more robust and specific coverage of different aspects of energy insecurity than a single survey question. However, in the interest of being able to keep surveys short and manageable, it may be beneficial to reduce the number of questions to one or two that can serve as a proxy for overall energy insecurity.

The first survey question, outlined below, would serve as a good proxy for overall energy insecurity. This question reveals the aspect of energy insecurity that can be hidden in other metrics. Additionally, the second survey and third survey question can be measured through thermal comfort and disconnection metrics discussed in other sections of this report. For these reasons, the following analysis refers only to the portion of energy insecurity reported in the RECS referring to reducing necessities to pay energy costs.

Example Survey Question: "In the past year, how many months did your household reduce or forego expenses for basic household necessities, such as medicine or food, in order to pay an energy bill?"

1 — Almost every month; 2 — Some months; 3 — 1 or 2 months; 4 — Never

6.2.4.2 Baseline for Forgoing or Reducing Essential Services

The Residential Energy Consumption Survey gathers data on energy insecurity across the US. While the data cannot be broken down to specifically LADWP service area, it is broken down by region. In the Pacific region, which includes Los Angeles, about one fifth of households report reducing or foregoing household necessities in order to pay an energy bill. When the nation-wide data is broken down by income, a clear pattern emerges. Low-income households are distinctly

[63] See RECS 2020 Table HC11.1 Household energy insecurity.

more likely to experience energy insecurity than high-income households. This trend indicates that the metric is tied to affordability.

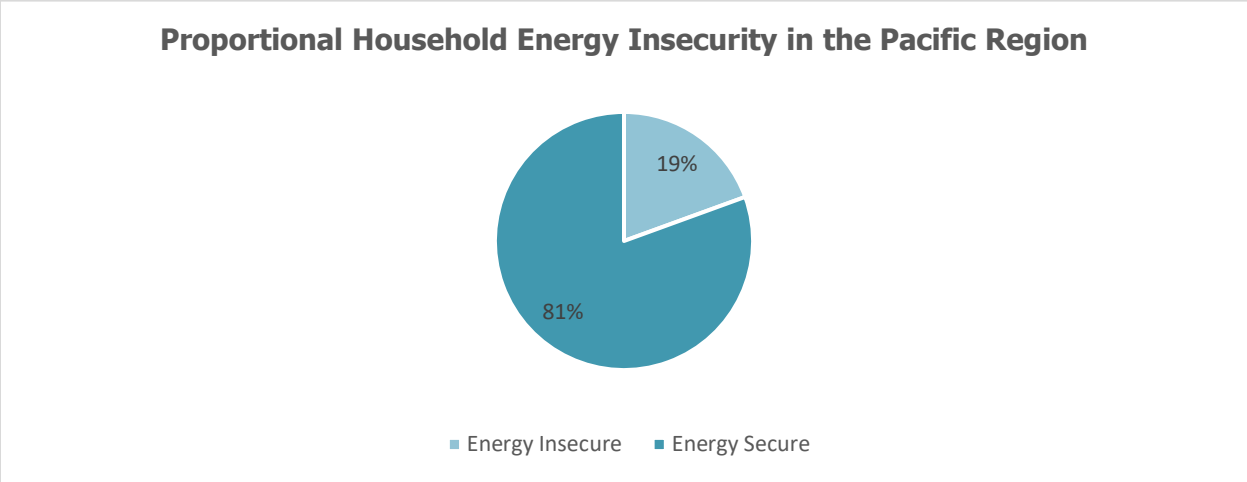


Figure 38. Households Foregoing Necessities to Pay Utility Bills in the Pacific Region (Data: RECS 2020)

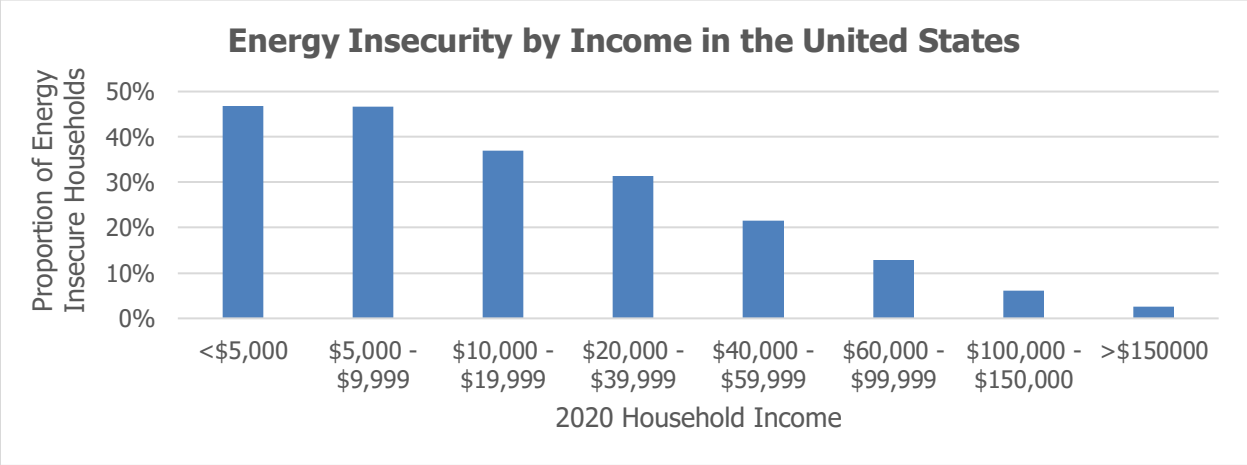


Figure 39. Proportion of Households Reducing or Foregoing Necessities to Pay Utility Bills by Income (Data: RECS 2020)

6.2.4.3 Target for Forgoing or Reducing Essential Services

One goal could be less than 5% of households report forgoing other household necessities to pay for electricity. This corresponds roughly with the rate the highest income groups report forgoing household goods to pay for electricity. Another goal could be 0% households reporting forgoing other household necessities to pay for electricity. This is a more ambitious goal, however, given the metric it may make sense to aim to eliminate the need for trade-offs entirely.

6.2.4.4 Benefits of Forgoing or Reducing Essential Services

An important benefit of this metric is that it specifically measures a concern for electricity affordability that may be hidden in other metrics. As other metrics measure activity directly related to utilities, they may miss how utility bills impact other aspects of customers lives. Household affordability is a balancing act of which utilities are a single component. For example, if a household chooses to use air conditioning in the summer and pay the utility bill at the expense of purchasing nutritious food, neither the thermal comfort nor the disconnection metrics would capture the household.

6.2.4.5 Drawbacks to Forgoing or Reducing Essential Services

This metric does not include households that forwent energy needs such as heating or cooling to afford other household necessities. For example, households that choose not to use air conditioning to afford groceries, will not be indicated by this metric. However, such a household would be indicated in the thermal comfort metric.

6.2.5 Prioritization of the Order of Essential Bill Pay

6.2.5.1 Data Collection Mechanism

The UCLA Quality of Life Index Survey[64] can provide some insight into the level of satisfaction or dissatisfaction residents feel with regards to cost of energy, and the prioritization of essential services for affordability. In the 2022 survey, the following two questions were asked:

1. How satisfied are you with: *(on a scale of 1-10)*

    - What you pay for housing- mortgages or rents.
    - What you pay for transportation, including gasoline and other costs.
    - What you pay for basic utilities such as electricity, natural gas, and water.
    - What you pay for food and basic household goods.
    - What you pay in taxes.

2. What is most important to you? *(prioritized from 1-5)*

    - What you pay for housing- mortgages or rents.
    - What you pay for transportation, including gasoline and other costs.
    - What you pay for basic utilities such as electricity, natural gas, and water.
    - What you pay for food and basic household goods.
    - What you pay in taxes.

[64] See https://ucla.app.box.com/s/8e3tz1s8wm92uamvkh4fpo907ge42k0x.

The answers to these questions can be reviewed and compared to previous years to understand how utility bills are changing compared to other essential services.

6.2.5.2 Data Sources and Baseline for Prioritization of the Order of Essential Bill Pay

This data is already collected for the area through the Luskin Quality of Life Index Survey (QLI). The QLI is conducted annually by the Lewis Center for Regional Policy Studies across Los Angeles County. The survey records whether respondents report living in the City of Los Angeles and thus can be subdivided based on LADWP service region.

Satisfaction of what customers in the City of Los Angeles pay for utilities is 5.06, according to the 2020 QLI survey. All income groups had very similar levels of satisfaction, indication that satisfaction as measured by this survey may not be closely tied to ability to pay.

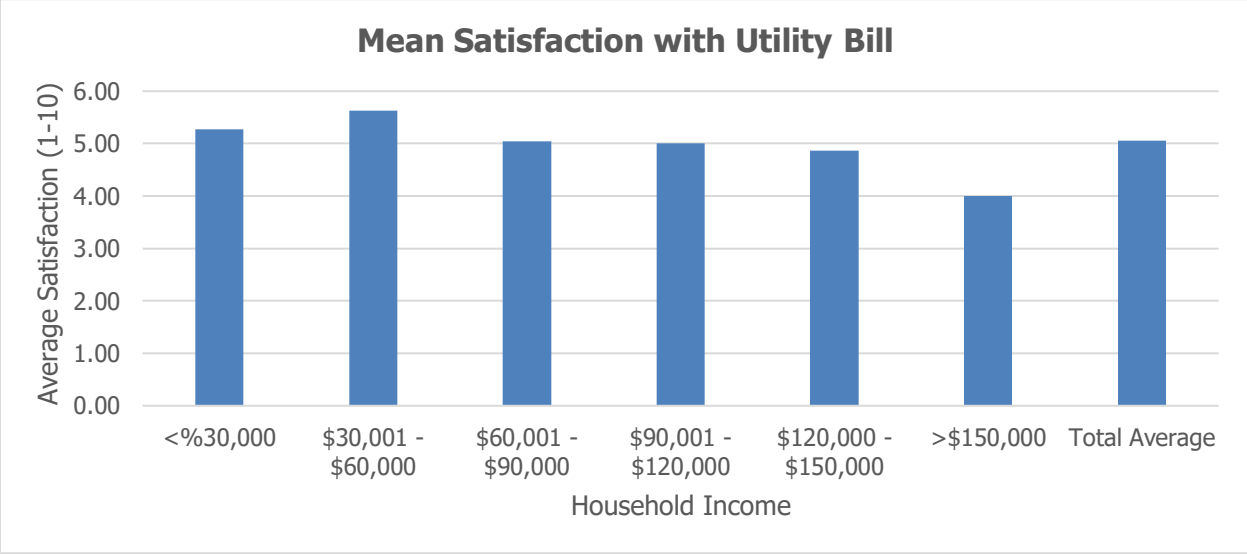


Figure 40. Utility Service Payment Customer Satisfaction by Income Bracket (Data: 2020 Quality of Life Index Survey, UCLA Lewis Center for Regional Studies)

6.2.5.3 Target for the Prioritization of the Order of Essential Bill Pay

A target for the first question could be a customer satisfaction score of at least 7 for utilities. However, as discussed above, it is unclear whether there is a relationship between affordability and satisfaction. Thus, policies to improve electricity affordability may not directly impact this metric. A target for the second question is not applicable, because LADWP has no influence over what services are most important to people and so this measure cannot be changed through policy. Additionally, customers priorities regarding services is tied to individual circumstances, and so a goal for prioritizing a single service across all customers would not be beneficial.

6.2.5.4 Benefits of the Prioritization of the Order of Essential Bill Pay

This indicator begins to address how households prioritize essential services. By listing specific services, it can give a clearer idea of what households are sacrificing in order to pay their utility bill, or what services households are sacrificing paying their utility bill for.

6.2.5.5 Drawbacks to the Prioritization of the Order of Essential Bill Pay

This metric does not assess whether households need to make tradeoffs. The wording of the first question is subjective in measuring satisfaction rather than ability to pay. Customers may be dissatisfied with the cost of services even if they are able to afford them.

Similarly, the second question asks about prioritization rather than ability to pay. A customer may rank utilities as the least important service but may not need to think about making tradeoffs between services in their daily lives. Utilities are ranked as a higher priority for higher income groups. However, this does not necessarily indicate that they are of less concern for lower income groups, but perhaps rather more so that other essential services are of more concern. Additionally, change in the second metric does not indicate improvement in affordability. Prioritizing utilities above other essentials does not reflect a greater ability to afford utilities, but rather a change in circumstances to make utilities more important than food.

6.2.6 Synthesis & Recommendations

Electricity insecurity can be invisible because households that regularly use and pay electricity bills may not be identified as in need of assistance, even if they must forgo other essential services in order to do so. Households that forgo paying the utility bill in order to afford other household essentials would also be reflected in part in data on households experiencing thermal comfort, threat of disconnection and utility disconnection. Therefore, understanding the proportion of households that sacrifice essential goods and services in order to afford the utility bill is essential to fill out a holistic picture of energy affordability.

The only practical way to gather direct information about trade-offs households make to pay the utility bill on time is to ask households directly through a survey, but one can also estimate a rough proxy for this by looking at customers who are in arrears but are below a shut-off threshold. A question(s) relating to energy insecurity could be added to existing LADWP survey mechanisms such as the LMU Public Opinion Survey. In deciding the question(s) to be included in this survey there are tradeoffs between brevity, specificity, and accuracy. The magnitude of customers who trade off paying the utility bill to afford other necessity can be estimated by looking at customers who are in arrears, but below the shut off deadline.

While knowing which services are being forgone is important in crafting holistic solutions to address this issue, this is likely beyond the jurisdiction of LADWP, and would require extensive coordination with other city departments as well as other levels of government. Thus, if a household that is making utility payments reports forgoing groceries to do so, LADWP can help alleviate insecurity by adjusting utility payments, but does not have the power to alleviate insecurity by adjusting grocery payments.

Therefore, for the purpose of this metric in assessing electricity affordability, we assess that understanding whether tradeoffs are occurring is more salient than understanding which tradeoffs are occurring. We recommend LADWP consider adopting a simple survey question similar to that asked on the Residential Energy Consumption Survey, which asks with what frequency households forgo other essentials to pay the utility bill, such as the below.

"How frequently in the last 12 months did the household forego household essentials, such as food, transportation, or healthcare in order to pay the utility bill?"

- Often- 10-12 months per year
- Frequently 6-10 months per year
- Sometimes- 3-6 months per year
- Rarely 1-2 months
- Never

Energy insecurity is an important metric to consider in policy decisions, because it helps to understand if policies are reaching those customers for whom electricity is unaffordable. Customers in need of crisis relief or bill discounts, or energy upgrades may be currently paying electricity bills at the expense of other essentials. Knowing about customers who face this dilemma can help inform eligibility for affordability policies.

6.3 Discount Program Metric

6.3.1 Motivation and Background

Discount programs are a widely used mechanism by utilities to provide financial assistance to low- income customers. The major Investor-Owned Utilities (IOUs) in California offer bill discounts through the California Public Utilities Commission (CPUC) established California Alternative Rates for Energy (CARE) program. In addition, the Family Energy Rate Assistance (FERA) provides a smaller discount to customers who have marginally higher income than the CARE income thresholds. LADWP currently offers two major bill discount programs: EZ-SAVE and Lifeline. Despite the widespread use of direct assistance discount programs, little research has been done into how well existing programs achieve affordability goals (Pierce et al. 2021).

As discussed in greater detail in our policy analysis section below, EZ-SAVE offers a bill discount for qualified low-income customers. Previously the Low-Income Discount Program (LIDP), it was recently modified to make it easier for customers to enroll. Now, customers do not have to provide verification of income at enrollment but may be asked to do so at any point while enrolled in the program. Customers may apply online through their LADWP account or by mailing or faxing an application to LADWP. The Lifeline Rate program offers discounted rates for income qualified senior and disabled customers as well as an exemption from the User Utility Tax (Los Angeles Office of Finance, n.d.). Because the program includes a tax exemption it is hosted in the LA Office of Finance. To qualify, customers submit proof of income, proof of billing and address, and proof of age or disability by mail, in person, email, or fax to the LA Office of Finance.

These programs are the primary established avenue LADWP provides financial assistance to low-income customers and therefore a key factor in ensuring electricity affordability. A whole new program or new way of delivering benefits is not required to improve electricity affordability. Rather, the success of these existing programs should be measured in order to adjust the framework and administration of the programs as necessary. There are three main dimensions of these programs to be measured: eligibility, enrollment, and benefits. Eligibility refers to who is qualified to enroll in these programs, which is typically determined by income and household size but can include factors such as age and medical condition or disability. Enrollment refers to what proportion of eligible customers sign up to receive the discount. Barriers such as program awareness, stringent verification requirements, and inaccessible program administration can reduce the proportion of eligible customers who enroll in discount programs. Benefits refers to the degree the discount program alleviates the financial burden of utility bills of low-income customers.

Table 14. Discount Program Enrollment Metrics Overview

Sub Metric	Measure	Target	Baseline	Data	Benefits	Drawbacks	Feasibility
Enrollment	Percent of eligible households enrolled in EZ Save and Lifeline.	80% of eligible customers enrolled in EZ Save and Lifeline.	29% of eligible customers enrolled in EZ Save and 62% of eligible customers enrolled in Lifeline.	ACS poverty and population data by tract.	Easy to calculate. Measure of impact of program.	Does not consider outcomes of discount programs (i.e., whether enrollment alleviates affordability concerns).	High: readily available data
	Distribution of income of enrollees.	At least proportional enrollment of lowest eligible incomes.	Unknown.	Collected by survey.	Able to determine whether the most in-need customers are being reached by the discount programs.	Would require additional survey collection.	Medium/Low: requires survey data collection, may be subject to response bias.
Benefits	Percent of enrolled customers reporting an inability to maintain thermal comfort.	0% of enrolled customers report an inability to maintain thermal comfort.	No existing baseline.	Affordability metrics survey results.	Measures outcome of how successful discount programs are at achieving electricity affordability.	Higher data collection needs. Would need to be based on sample population. Only measures affordability for enrolled customers- does not consider eligible but unenrolled customers or ineligible customers.	Medium: requires collecting data on another affordability metric as a benchmark for success.
	Percent of enrolled customers in arrears.	0% of enrolled customers in arrears.		LADWP arrears data.	Uses existing data. Ties benefits of discount program to a tangible easy to measure outcome.	Does not gauge whether customers are still restricting basic electricity usage to prevent falling into arrears.	High: uses existing LADWP arrears and enrollment data.
Eligibility	Percent of low-income household eligible for EZ Save or Lifeline discount programs.	100% of low-income households in Los Angeles as defined by CDHC qualify for discount program.	65% of low-income customers (80% AMI) are eligible for EZ Save or Lifeline (200% FPL).	HUD Low and Income Summary Data.	Addresses electricity affordability for customers who to not currently qualify for discount programs but are considered low-income.	Does not consider outcomes of eligibility, e.g., whether expanding eligibility will increase proportion of enrolled customers.	High: readily available data.

6.3.2 Enrollment as a Metric

There are two potential metrics for measuring the success of enrollment in discount programs. The first is the proportion of eligible customers enrolled. This gives a sense of the program's penetration effectiveness — to what degree it is successful at reaching intended recipients. The second is the income distribution of enrolled customers. This gives a sense of which groups of eligible customers are being reached, and which groups are being missed.

6.3.2.1 Target for Enrollment Metric

A potential target for proportion of eligible customers enrolled could be 80% enrollment in the EZ-SAVE and Lifeline programs among qualified customers. California's flagship Investor-Owned Utility (IOU) administered discount program, California Alternative Rates for Electricity (CARE), has relatively high enrollment levels of 93% to >100% of eligible customers, varying by utility. In 2008, CPUC decision D.08-11-031 set a goal of 90% enrollment of eligible customers across the IOUs (D. 21-06-015). As of 2019 PG&E and SDG&E had exceeded that goal, and SCE came close with 88% of eligible households enrolled (Ibid). Pre-Coronavirus, the goal for these utilities was to maintain their enrollment or achieve slightly better levels. However, during the pandemic, enrollment increased greatly, and as of early 2022 the penetration rates for the investor-owned utilities were near, at, or above 100% (CPUC 2022). This is in part because eligibility is based on income self-declaration, with little verification or auditing of these claims.

A target for the distribution of in-need customers should be that the lowest income customers should be enrolled in discount programs at a rate at least that proportional to the income distribution of eligible customers. For example, if customers below 50% poverty level make up X% of eligible customers, then they should make up at least X% of discount program enrollees.

6.3.2.2 Baseline for Enrollment Metric

Currently, 29% of eligible customers are enrolled in EZ SAVE and 62% of eligible customers are enrolled in Lifeline. This is significantly less than CARE enrollment across the entire service area of all three IOUs. Locally, 99% of eligible Southern California Edison customers in Los Angeles County are enrolled in the CARE program. Enrollment in the Family Electric Rate Assistance Program (FERA), an 18% bill discount for households whose income slightly exceeds CARE eligibility requirements, is significantly lower than that of CARE and Lifeline, and slightly lower than EZ-SAVE enrollment.

Table 15. Proportion of Eligible Customers Enrolled in Discount Programs by Utility and Program[65]

	Utility			
Program	**LADWP[66]**	**SCE[67]**	**SDG&E[68]**	**PG&E[69]**
Lifeline	62%			
EZ Save	29%			
CARE[70]		111%	107%	108%
FERA		14%	25%	25%

There is currently no baseline for the distribution of income of participants. While this information is collected during enrollment, LADWP does not save this information after approving applications.

6.3.2.3 Data for Enrollment Metric

Estimates of total eligible households can be obtained by using tract-level American Community Survey poverty and population data to estimate the proportion of individuals below 200% of the poverty level. This can further be broken out into Lifeline and Low-income eligibility by multiplying the number of income-qualified accounts by the proportion of the population over 62 or with a disability. Note, this methodology may undercount the number of low-income customers eligible for the Lifeline program, because poverty rates are higher for older adults than other age groups (Danielson et al. 2022). The number of eligible accounts can then be compared to the number of enrolled accounts.

To understand the distribution of in need customers by poverty level, income and household size data are required. This information is currently self-reported as part of the discount enrollment process, and thus can be calculated for enrolled customers. To determine how reflective these results are of the customer base, they would have to be compared to the distribution of poverty in Los Angeles. The Census Bureau Current Population Survey Annual Social and Economic Supplement tables report proportion of families by Federal Poverty Level. In California in 2021, 12.3% of the population was below 100% of the Federal Poverty Level and 15.3% of the population was between 100-199% the Federal Poverty Level.[71]

6.3.2.4 Benefits of Enrollment Metric

Discount program enrollment is a convenient metric because it is easy to measure and LADWP already collects this data. It is also a useful metric because even programs with significant

[65] Figures for IOUs represent statewide data.
[66] Data from Koh, Joseph. FUSE Fellowship End of Year discussion.
[67] Data from CPUC 2022 (see reference).
[68] Data from CPUC 2022 (see reference).
[69] Data from CPUC 2022 (see reference).
[70] Data from CPUC 2022 (see reference).
[71] Data from KFF 2021, available at https://www.kff.org/other/state-indicator/distribution-by-fpl.

benefits and broad eligibility are only as successful as the number of customers enrolled. For subsequent reforms to be impactful, customers need to be enrolled in the program to begin with.

Discount program distribution is an important metric because it illustrates equity within enrollment and may highlight groups that are left behind even as overall enrollment levels increase.

6.3.2.5 Drawbacks of Enrollment Metric

Enrollment is not the most nuanced metric, as it does not measure outcomes on household energy affordability. Knowing the proportion of households enrolled in discount programs does not effectively evaluate whether those discount programs are successful in alleviating the cost burden of electricity bills to allow households to meet their basic energy needs.

Distribution of customers among tiers of Federal Poverty Level can be a difficult metric to measure because it requires both income and household size to calculate. While this information is currently self-reported by customers as part of the enrollment process. If LADWP were to stop collecting this data the process for tracking this metric would be more complicated and likely need to rely on survey data.

6.3.3 Benefits as a Metric

There are two potential metrics to measure the impact of discount program benefits. One would be to measure electricity use-based metrics of affordability, such as thermal comfort, to understand if discount program enrollees are still constrained in basic electricity use. Another metric would be to measure financial metrics, such as rate of arrears among enrolled customers.

6.3.3.1 Target for Benefits Metric

A target for benefit levels could be based off another affordability metric being measured. For example, if thermal comfort is measured, a metric for benefit levels could be “no customers enrolled in discount programs report maintaining unsafe or uncomfortable indoor temperature to save money on utility bills.” This would be a subset of the general thermal comfort metric reporting, as it would only look at the proportion of customers enrolled in a discount program.

A financial target could be “0% of customers in arrears one year after enrolling in the discount program.” This would ensure that discount programs are meeting the financial needs of customers such that they do not have to go into debt to meet their basic electricity needs.

6.3.3.2 Baseline for Benefits Metric

The level of benefit provided to customers varies both within LADWP and in comparison to IOU-administered programs. The discount provided by Lifeline is comparable to that of CARE,

while the less generous EZ-SAVE discount is more comparable to the discount provided by FERA. However, FERA is intended to serve low-income customers who make slightly more than the CARE income limits, whereas only customers who make less than the CARE threshold are eligible for EZ-SAVE.

Table 16. Average Monthly Discounts by Program and Utility

	LADWP		IOUs	
Program	**EZ-SAVE[72]**	**Lifeline[73]**	**CARE[74]**	**FERA[75]**
Average Monthly Discount	$8.17	$17.71 + UUT	30-35%	18%

Because the EZ-Save and Lifeline discounts are offered as a flat dollar discount off of each bill, while CARE and FERA are offered as a percentage discount off of each bill, it is useful to calculate the average percentage afforded by LADWP's programs for comparison (see Table 17). From fiscal years 2019-2021, the average discount offered by the Lifeline program (not including the UUT exemption), was 42.4%. The average discount offered by the EZ-Save program over the same time period was 16.9%.

Table 17. Lifeline and EZ-SAVE Discounts as an Average Percentage off of Bills, FYs 2019-2021[76]

Program	Fiscal Year 2019	Fiscal Year 2020	Fiscal Year 2021	Overall Average
Lifeline	43.0%	43.1%	41.1%	42.4%
EZ-Save	17.6%	17.0%	15.9%	16.9%

Discount program customers have a higher rate of arrears than non-discount program customers. Nearly one-third of discount programs customers have arrears aged 61 days or more, compared to 20% of non-discount program customers. Thus, even with the financial assistance of discount programs, utility bills may still exceed in-need customers' ability to pay.

6.3.3.3 Data for Benefits Metric

The average bill discount for LADWP programs can be calculated using customer bill data by finding the percent difference between the average bills of customers enrolled in the programs and those not enrolled. The discount level of CARE and FERA programs is set at the rates listed

[72] From 2008 Los Angeles Electric Rate Ordinance (Ord. No. 180127) https://www.ladwp.com/cs/idcplg?IdcService=GET_FILE&dDocName=OPLADWP009439&RevisionSelectionMethod=LatestReleased.
[73] Ibid.
[74] See https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-costs/care-fera-program.
[75] Ibid.
[76] Values do not include historical water discounts or utility user tax.

in the table by Public Utilities Code Section 739.1.[77] LADWP also has existing data on whether customers in arrears are enrolled in a discount program.

6.3.3.4 Benefits of Benefits Metric

The measure of enrolled customers' ability to maintain thermal comfort is important because it tracks discount programs' ability to meet energy affordability outcomes. In doing so, it can track progress towards the overall goal of ensuring in-need households are able to meet their basic electricity needs.

The measure of enrolled customers in arrears is important because it tracks the continued financial impact of enrolled customers. If customers enrolled in the discount program still fall into debt for their basic electricity needs, it is an indication that the benefits of the discount program do not provide enough support to make electricity affordable for in- need customers.

6.3.3.5 Drawbacks

There are legal bounds on the extent to which LADWP can increase discount program benefits. As discussed in-depth in the Baseline Affordability section, Proposition 26 restricts local government ability to raise rates beyond the "reasonable cost of providing service" which curtails their ability to raise more revenue to fund discount programs that provide higher benefits. Additionally, more robust benefits only help those who are currently eligible and enrolled and thus miss in-need populations that are ineligible or face barriers to enrollment.

6.3.4 Eligibility as a Metric

Eligibility measures who is able to enroll in discount programs and receive benefits. It is typically based on income, but some programs may include factors such as age and medical condition. This analysis focuses on metrics for setting an income threshold for eligibility.

6.3.4.1 Target for Eligibility Metric

A target for discount program eligibility could be for 100% of low income as defined under state law (80% AMI) to be eligible for financial assistance. This would bring LADWP policy in line with state policy. Unlike Federal Poverty Level, Area Median Income is a locally based threshold that is calculated every year, and thus takes into account the high cost of living in Los Angeles and adapts annually.

[77] See https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-costs/care-fera-program.

6.3.4.2 Baseline for Eligibility Metric

Eligibility for EZ Save is currently determined by income, the upper bound being 200% of the Federal Poverty level. These income limits are more restrictive than the CARE income limits used by IOUs to determine eligibility for discount programs. In addition to income amounts, what is included as income contributes to household eligibility. Non-cash benefits like Cal-Fresh and Medi-Cal may contribute to these thresholds, depending on how income is defined by the organization. Both EZ-SAVE and CARE income thresholds are more restrictive than the 80% area median income (AMI) definition used by the California Department of Housing and Community Development.

Table 18. Eligibility Income Thresholds for Discount Programs and AMI by Household Size, 2021

Household Size	EZ-SAVE	Lifeline	CARE	FERA	80% AMI
1	$34,840	$47,650	$36,620	N/A	$66,250
2	$34,840	$47,650	$36,620	N/A	$75,700
3	$43,920	$47,650	$46,060	$57,575	$85,150
4	$53,000	$47,650	$55,500	$69,375	$94,600
5	$62,080	$47,650	$64,940	$81,175	$102,200
6	$71,160	$47,650	$74,380	$92,975	$109,750
7	$80,240	$47,650	$83,820	$104,775	$117,350
8	$89,320	$47,650	$93,260	$116,575	$124,900

6.3.4.3 Data for Eligibility Metric

Income thresholds for all state-defined income levels are published annually by the California Department of Housing and Community Development.

6.3.4.4 Benefits of Eligibility Metric

Expanding benefits to all low-income customers could provide support for customers who may be restricting electricity use over affordability concerns, but do not currently qualify for discount programs. Additionally, expanding eligibility can mitigate creating perverse incentives whereby a small increase in income disqualifies customers from substantial discounts. One way to do this would be through a tiered system like CARE/FERA, where customers who make slightly more than the CARE threshold are still eligible for a smaller discount.

6.3.4.5 Drawbacks of Eligibility Metric

Expanding eligibility without increasing funding for financial assistance could result in fewer benefits available for everyone. Expanding eligibility should be done in a way that does not reduce benefits for the most in-need customers.

6.3.5 Synthesis and Recommendations

It is important to track discount program metrics because discount programs are the main mechanism through which LADWP can influence improvement in other affordability metrics. Improving electricity security or thermal comfort depends on reducing the financial stress of utility bills on in-need customers. The Lifeline and EZ-SAVE programs are the primary established means through which LADWP can provide in-need customers with financial assistance. Therefore, the success of these programs directly impacts LADWP's ability to achieve the other affordability metrics outlined in this report.

The reverse is also true: other affordability metrics reflect the success of the discount programs. For example, if enrollment numbers in the discount program are high, but a significant portion of customers are reporting an inability to maintain thermal comfort, the metric would reflect that the discount program is not serving the in-need population to the extent they need to be served.

Enrollment should be the first metric for evaluating the success of discount programs. The impact of the other two metrics, benefits and eligibility, are only as significant as the enrollment levels. Setting benefits at a rate that addresses affordability is only meaningful if eligible customers are enrolled in the program to take advantage of the discounts. Likewise, expanding eligibility only increases access to discounts if those who are eligible enroll in benefits.

There is a trade-off between lowering barriers to enrollment and verifying enrollment eligibility. Imposing a high burden of proof for eligibility increases administrative costs to run the program and discourages customers from applying. Complicated enrollment processes impose the greatest barriers to the most in-need customers because filling out forms, gathering documents, and contacting agencies creates the highest obstacles for customers who most lack the time, capacity, and resources to navigate bureaucratic procedures. However, not verifying eligibility may result in an increase in customers benefiting for the program who are not eligible.

In an effort to increase discount program enrollment, LADWP no longer requires income verification to apply for EZ-SAVE as of September 2021. Instead, some verification is conducted after enrollment through targeted audits. The first round of verification audits since the change are underway at time of writing. Audits are conducted on small samples of customers which third party data indicates may be ineligible. The most recent Equity Metric reports since this change have not yet been published, and so it is not yet possible to quantify the effect of reduced verification on enrollment; however anecdotal data point to a steady increase in enrollment since the elimination of upfront verification.

LADWP already tracks enrollment in the Lifeline and EZ-SAVE discount programs. Furthermore, LADWP already sets goals for enrollment in these programs and regularly establishes outreach strategies. As of the September 2021 Equity Metrics Semi Annual report, the goal was to increase customer enrollment in the Low-Income Program (now EZ SAVE) by 10%. Shifting the target from measuring an increase in customer participation, to measuring proportion of eligible customer enrollment would reframe the target in terms of the overall goal of increasing electricity affordability for in-need customers. LADWP should continue to track enrollment in these programs and establish enrollment targets relative to the proportion of eligible customers.

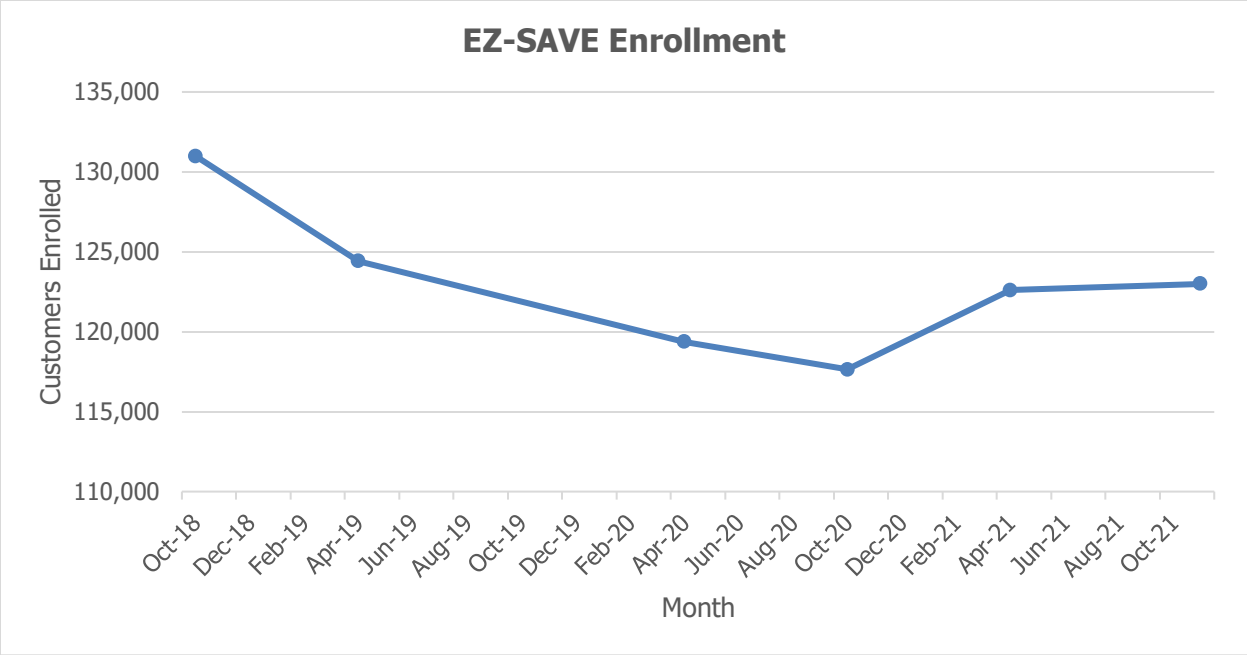


Figure 41. Enrollment in EZ-SAVE Discount Program, Oct 2018-Oct 2021 (Data: LADWP Semi Annual Equity Metrics Reports)

This metric most directly informs policy actions related to discount programs. The policy section below discusses a variety of options to consider in the design of these discount programs. Changes to the structure of the discount program have the potential to increase the benefit they provide to in-need customers. These policy designs should be considered in line with how well they enact progress on the metrics outlined above.

6.4 Crisis Relief Metric

6.4.1 Motivation and Background

Unforeseen events impacting households with limited savings and disposable income can result in financial crisis, preventing customers from being able to afford electricity. Loss of employment, or death or sickness in the family may require reprioritizing expenses above paying the utility bill. This can cause a financial and health crisis for households (see Figure 42). Shutoff prevention and associated crisis relief programs aim to reduce the acute burden of a crisis through short-term interventions that help a household climb out of utility debt, or be protected from its consequences without reducing the debt amount, respectively.

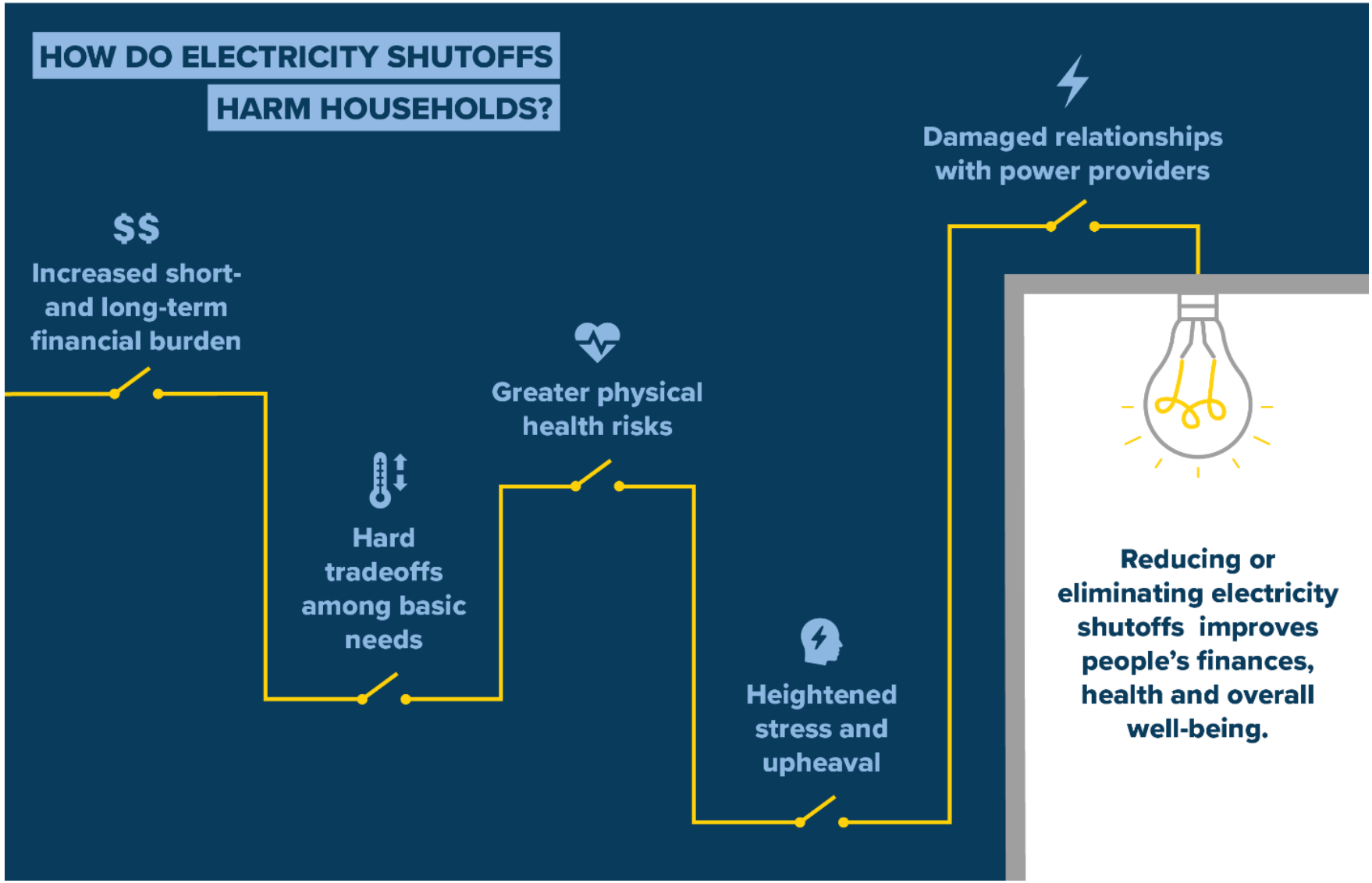


Figure 42. Household Harms Caused by Electricity Shutoffs

Utilities do not actively want to shut off their customers from service as the process of shutoff notice, transaction, and restoration incurs a staffing cost on the utility and damages its relationship with customers. To that end, some level of ad hoc crisis interventions have been put in place — traditionally by utilities and non-profit organizations — but metrics and accountability for certain crisis relief outcomes have generally been scant. The standards for substantial crisis relief interventions have grown rapidly in the last decade as utility affordability has grown as a concern, even more so during the COVID-19 pandemic, and numerous associated temporary relief programs have emerged (Sainato 2021). As shutoff moratoria have been phased out, major utilities have generally been expected to substantially reduce or eliminate shutoffs and provide debt relief are the tenets (Yerrapotu 2022). However, few have provided firm commitments on outcome metrics and long-term support programs, as opposed to input efforts and time bound funding allocations, to date.

As discussed in detail in our Crisis Relief policy analysis, LADWP has recently become an exception to this rule by establishing a long-term direct shutoff protection policy in November 2022. This Board of Commissioners motion directed staff to halt the practice of water and power shutoffs as a debt collection tool for residents enrolled in its EZ-SAVE, Lifeline, and other related programs.[78]

A permanent, universal moratorium on shutoffs is the easiest and most progressive metric to employ. Given the extension of a permanent, but limited moratorium to vulnerable customers by LADWP, it is both easier in some respects and harder in others to set new crisis relief metrics compared to other affordability metric areas. In light of this policy, there is no need to open-endedly explore potential crisis relief metrics which LADWP should commit to. The most important metric for crisis relief is to enroll as many eligible customers as possible in its discount programs and now-associated shutoff protections — a relatively straightforward approach.

This, however, is not the only crisis relief metric that LADWP should or could employ, as it has acknowledged in recent Board meetings and advocates have argued.[79] In fact, the establishment of a permanent limited moratorium makes it harder to set additional crisis relief metrics, as it is impossible to compare pre and post universal moratorium shutoff rates and thus set a historical baseline for shutoff limitation targets. Even without the establishment of a permanent limited moratorium, however, one could reasonably argue that using pre-COVID-19 pandemic data wouldn't have been a useful baseline given the change in ancillary policies and intentions by the utility since the onset of the pandemic, and the gap in time (from at least 2019 to 2023).

6.4.2 Certain and Potential Crisis Relief Metrics

We focus on four potential crisis relief metrics. One is fully analyzed above in the discount program metric section, and we analyze three additional potential metrics below. We note that the primary data for setting baseline metrics and transparently reporting on metric achievement can only be accomplished with customer data internally available to LADWP itself. Data for the

[78] Presentation to LADWP Board of Commissioners (September 27, 2022). Update on Customer Bill Assistance and Collections History Presented by George Rofail, Chief Customer Officer, LADWP.
[79] See https://scopela.org/download-form-lights-on-water-flowing/.

2017-2020 period has been collected and recently analyzed and should be easily (compared to other affordability metrics) collected and reported upon in the future. We also note that advocacy groups and coalitions such as RePower LA do and should continue to play an important role as a watchdog on LADWP shutoff practices and in ground truthing administrative data reporting, particularly in vulnerable communities.

We note that LADWP has recently instituted some recent temporary but universal shutoff protections include suspending shutoffs during excessive heat and freeze warnings issued by the National Weather Service, and not shutting off customers on Fridays. While these protections are new and progressive, they are quite limited and thus we do not further analyze or discuss them.

We also do not further analyze or propose metrics at this time for same-customer shutoff frequency or duration, which both convey the severity of a crisis event. These dimensions of crisis relief were of concern in the pre-pandemic period and remain so now. However, it is unclear how to establish relevant baselines for these shutoff dimensions without data on the first wave of new shutoffs, and we expect same-customer shutoff frequency should be substantially lower given LADWP's commitment to individual consultations with customers not protected by the permanent, limited moratoria. We do present some data on shutoff frequency and duration in the Appendix of our crisis relief policy analysis for reference, and encourage the monitoring and establishment of baseline metrics of these shutoff dimensions within the next two years. We also encourage an eventual duration metric of 90% or more of shut-offs lasting less than 24 hours, rather than the 2017-2020 figure of around 50%.

The table below outlines the four crisis relief metrics analyzed in this study: Discount Program Enrollment, Uncovered Residential Shutoffs, Uncovered Small Business Shutoffs, and Bill Debt. These metrics were chosen based on their realistic feasibility to track as well as their nuance at measuring crisis relief in light of the permanent, limited moratorium.

Table 19. Crisis Relief Metrics Overview

Sub-Metric	Measure	Target	Baseline	Data	Benefits	Drawbacks	Feasibility
Enrollment in Discount Programs	Proportion of eligible customers enrolled in discount programs	100% enrollment of eligible customers in discount program	62% of eligible Lifeline and 29% of eligible EZ SAVE customer enrolled	Customer accounts enrolled in discount programs	Co-beneficial with informing discount program policy	Minimal-already implemented	High-already tracked and reported
Uncovered Residential Shutoffs	Proportion of uncovered residential customers receiving shutoffs	Annual disconnection rate of <1% uncovered residential customers	Needs to be established post-universal moratoria, about 70,000 over four years pre-universal moratoria	Shutoffs on customer accounts	Sheds light on gaps in current shut off moratoria policy	Difficult to differentiate between household that are eligible but not enrolled and not eligible for discount programs	High-shutoffs already tracked
Uncovered Small Business Shutoffs	Proportion of uncovered small business customers receiving shutoffs	Annual disconnection rate of <1-2% uncovered small business customers	None	Shutoffs on small business accounts	Tracks a potentially in-need customer group not historically considere d	No existing definition for small business account or historic data on small business accounts	Medium-need to first establish definition for small business accounts
Bill Debt	Median unpaid customer utility bill debt	Reduce median bill debt to below 2019 baseline	Median customer debt in 2019	Median customer debt	Can inform debt relief policies	No existing bill debt threshold to target	High- bill debt data already tracked

6.4.3 Enrollment in Discount Programs

The most important metric for crisis relief, in light of the comprehensive protections of LADWP's permanent limited moratoria policy, is enrollment in discount programs. We recommend a target of at least 80% eligible customer enrollment in the utility's discount programs. Secondary consideration could be given to enrollment in LIHEAP, LIHWAP and LADWP's payment assistance programs (payment arrangements or pay plans). Please see the Enrollment as a Metric subsection in the Discount Program Metrics analysis above for more details.

6.4.4 Uncovered Residential Customer Shutoff Reduction Target

As discussed above, LADWP's major discount programs only provide assistance to households with incomes at or below 200% of the Federal Poverty Level. Given that only about 38% of LADWP's residential customer base could enroll in discount programs which provide permanent moratorium protections, and only about 14% currently are enrolled, there is clearly a need for shutoff protections for other residential customers uncovered by the moratorium (Koh 2021). This is especially true for moderate-income residential customers. Moreover, while enrollment in discount programs has grown since the onset of the COVID-19 pandemic and will likely continue to grow, we note that only about 10% of residential customer shutoffs before the pandemic were on discount program-enrolled customers.

The metric for non-discount program enrolled customers must thus set an aggressive goal of reducing both the absolute number of and relative proportion of annual shutoffs from a 2023 baseline. As noted above, given the lapse in time and change in culture and policy, it would be too lenient to establish a baseline using data on the number of customers not enrolled in discount programs who were shut off before the universal utility moratorium was temporarily established in 2020.

One potential target metric could be a rolling annual disconnection rate of less than 1% of all uncovered customers, which would equate to only around 12,500 customers per year, based on November 2021 numbers (Koh 2021). Even though this would improve markedly on pandemic-era numbers, however, it may be only a modest improvement over pre-pandemic conditions. It may be appropriate to adopt even more ambitious standards (e.g., <0.5% shutoff rate among unenrolled customers), informed by more recent shutoff data. An eventual goal of eliminating residential customer shutoffs entirely should also be considered in a gradual fashion. A next step toward this goal would be to eliminate residential shutoffs in the top 20% of DACs, as per recent LADWP board meeting discussions.

6.4.5 Uncovered Small Business Customer Shutoff Reduction Target

Another potentially vulnerable customer segment to give special shutoff protection consideration to is currently uncovered small business customers. This segment of customers has been highlighted in recent LADWP board meeting discussions and the SCOPE report on shutoffs.[80] The need for attention to broader small business customer just transition and affordability support efforts is also detailed further in Chapter 14 by UCLA scholars.

As noted in the baseline affordability analysis of this chapter, LADWP distinguishes between residential, commercial, industrial, and municipal customers. Within commercial accounts the utility internally distinguishes three tiers, based on electricity consumption: Premier (largest), major, and all others. Commercial accounts have a higher service charge, which is a flat fee assessed every month, but a lower charge per kilowatt hour than residential accounts. Likewise, large commercial accounts are assessed a higher service charge, but lower per kilowatt hour charge than small commercial accounts. Commercial accounts are also all charged a facility charge, which is determined by the highest demand (in kilowatts) in the previous year. Large

[80] See https://scopela.org/download-form-lights-on-water-flowing/.

commercial accounts are also charged a standard demand, based on the highest demand (in kilowatts) over the billing period, along with more complex demand and power quality charges.

The eventual metric for small business customers not enrolled in discount programs must set an aggressive goal of reducing both the absolute number of and relative proportion of shutoffs from a near term baseline. However, there are multiple complexities here compared to setting metrics for the broader pool of uncovered residential accountholders. First, some small business owners are relying on residential customer accounts, but we do not know exactly how many. Moreover, some of these are enrolled in discount programs and thus do not need additional protections in light of the permanent, limited moratorium policy, but again, we do not know how many. Relatedly, LADWP has not historically identified small business accounts, as it classifies commercial accounts based on electricity consumption rather than size of business. Thus, LADWP does not know how many small business accounts exist and therefore we cannot produce estimates of how many such customers experienced shutoffs in the period 2017-2020, or have arrearages now.

In short, the first goal should be to establish a small business account definition in the next year and then establishing a baseline (and potential historical) analysis of shutoff prevalence and arrearages. From that baseline, a potential target metric could be a rolling annual disconnection rate of less than 1-2% for all uncovered, small business customers, with the eventual goal of eliminating all shutoffs for this customer group.

6.4.6 Reduced Bill Debt

Last, but not least, regardless of shutoff protection metrics, attention must be paid to reducing customer arrearages, or unpaid debt, on their utility bills. Growing customer power bill debt can be conceptualized as part of electricity insecurity — especially in the period predating the universal shutoff moratorium — a potential affordability metric discussed above. Electricity insecurity measures the extent to which households must make trade-offs between essential services. Customers with limited financial resources — both households and small businesses — may prioritize paying other essential bills over their LADWP bill, thus leading to mounting utility debt. Without the threat of a shutoff, utilities may fall down the list of essential services that households prioritize. For example, some households may have prioritized paying the utility bill during warm summer months to be able to run the air conditioning, forgoing sufficient food to do so. With the moratorium now in place, these households may instead choose to prioritize paying for food over the utility bill, increasing their utility debt.

However, establishing reasonable, universal baseline and bill power debt reduction metrics is incredibly challenging for LADWP for several reasons. First, as discussed above in numerous sections of this report, customers are likely to view paying the entire LADWP bill as an affordability challenge. The power component of the bill cannot be paid separately from the other bill components, limiting workaround options for fiscally strained ratepayers. Second, there are few, if any, utilities which have set out and committed to explicit bill debt reduction targets, beyond the general goal of reducing overall debt and the number of accounts in arrears.

Third, utility bill debt levels have risen significantly since the moratorium, as illustrated in the LADWP staff presentation to the Board in September 2022 (see Figure 43 below). This was due in part to economic hardships experienced by customers, as well as the lack of a requirement to pay bills to maintain service while the universal shutoff moratorium persisted. Notably, this rise in debt held after accounting for unprecedented COVID relief funds made available by one-off city, state, and federal government crisis relief efforts to address low-income utility customer arrearages.

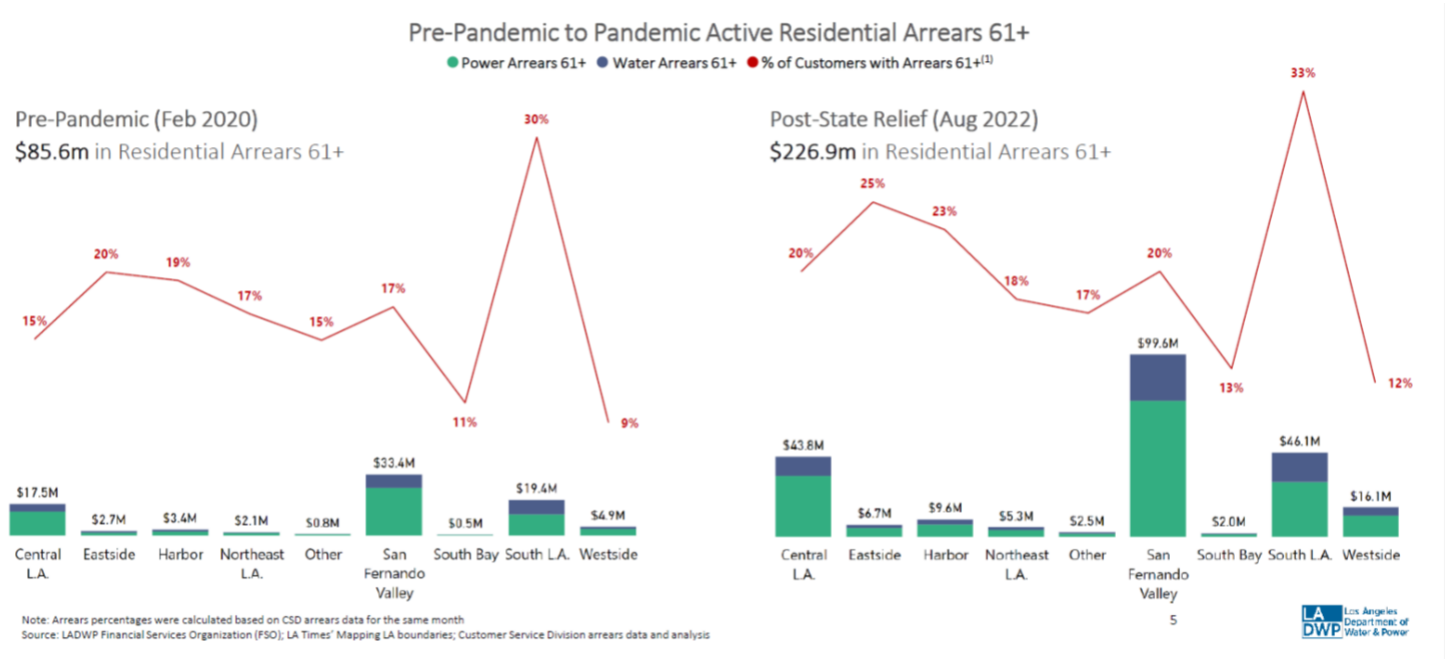


Figure 43. Comparison of Utility Arrears 61+ days Pre-Pandemic vs. Post-State Relief by Region

It remains to be seen whether and to what extent customer utility debt levels will rise or fall in the near term now that the universal moratorium has lifted, shutoffs have yet to resume but a timeline has been announced, and a permanent, limited moratorium has been instituted. It is safe to assume that debt levels for customers under the permanent moratoria will grow or persist unless they continue to receive targeted relief or discount program offerings are made more generous (as discussed above), whereas customers under renewed threat of shutoff will be less likely to accumulate debt going forward, leaving aside any changes in economic conditions and LADWP bill increases.

Accordingly, we do not make a firm recommendation for a bill debt metric at this time, but urge the setting of a baseline in the next year and a near-term bill debt reduction metric in the next two to three years. Ideally this metric would be to reduce bill debt to at or below 2019 levels. Perhaps more important than aggregate debt, from an affordability standpoint, is the extent of bill debt experienced by individual customers. Therefore, a potential goal could be to reduce median customer debt to below a pre-pandemic baseline. The realistic setting of such a goal requires not only the institution of affordability policies highlighted in our analysis, but also a permanent, legal means to continue to provide debt relief funds to LADWP customers. In the absence of legal reforms, direct bill debt relief efforts may need to rely opportunistically on non-ratepayer

city, state or federal funds. These sorts of currently unstable and ad hoc funding sources are unlikely, however, to lead to substantial progress in reducing bill debt below 2019 levels.

6.4.7 Synthesis and Recommendations

While we generally recommend gradually moving toward a permanent, universal shutoff moratorium for all vulnerable customers, accompanied by reliable associated debt relief assistance, we focus here on four potential crisis relief metrics. One metric is certain and implementable now, whereas the others require degrees of additional analysis before finalizing.

The most important metric for crisis relief, in light of the comprehensive protections of LADWP's permanent limited moratorium policy, is enrollment in discount programs. We recommend setting a target of 80% eligible customer enrollment immediately.

For uncovered residential customers, we recommend setting a potential target metric of a rolling annual disconnection rate of less than 1% of all uncovered customers within the next two years. This would currently equate to about 13,000 customers per year.

For non-covered small business customers, a baseline of this customer group must first be established. Subsequently, we recommend setting a potential target metric of a rolling annual disconnection rate of less than 5% of all uncovered, small business customers within the next year.

Finally, setting a reasonable bill debt reduction metric requires additional research, given the rise in debt and numerous countervailing factors affecting debt levels since the onset of the COVID-19 pandemic. Consequently, to the extent legally feasible, we recommend setting a target metric to reduce customer bill debt to at or below 2019 levels within the next two to three years.

7 Conclusion

The transition to 100% renewable energy presents a unique opportunity for LADWP: a chance for timely, transformative action to tackle the climate crisis and create myriad benefits for all Angelenos while also serving as a model agency for other utilities across the country. Achieving the 2035 transition goal selected by the Board and the accompanying affordability and equity goals is a massive undertaking, however, and will require staff and stakeholders to commit to the ongoing work of policy implementation and modification, data gathering and evaluation, and community engagement necessary for success.

The legal landscape analysis provided here is of foundational importance in these efforts, as it dictates to a significant degree the options available to LADWP in several critical affordability-related areas. Legal constraints affect the utility's ability to craft progressive rate structures. Although its status as a municipal utility does offer LADWP some freedoms not enjoyed by IOU counterparts, it exposes the utility to the limitations of Propositions 26 and 218. These propositions have and will continue to be the most notable legal challenges facing LADWP where rates, revenues, and affordability are concerned. They are not insurmountable, though, and strong efforts should continue to be made to circumnavigate the limitations they present.

Efforts to improve energy affordability are well-aligned with current real-world conditions. As shown in our Baseline Affordability Analysis, energy costs are a notable area of concern for LA's in-need households. Many coinciding factors influence this status quo: the high cost of living in Los Angeles generally, underwhelming penetration and benefits of existing fiscal aid programs, and the real-world harms of constraining energy costs, to name a few. In-need households also face access inequities that compound these issues, having lower rates of knowledge about and access to electrified and energy-saving technologies like electric vehicles and battery storage. LADWP will need to mount tandem efforts to make energy more affordable for customers in the most dire fiscal situations while simultaneously addressing the inequitable access issues that have persisted over time.

Our analyses of Energy Affordability Metrics and Policies lay out an approach to do this, emphasizing actions that focus on areas of greatest disparity and potential improvement and measures of success aligned with real-world impacts. Robust metrics are critical for LADWP to honestly assess whether it is meeting its equity and affordability goals as the LA100 transition progresses, fomenting self- and public accountability and informing iterative action to improve upon policies and address shortcomings and gaps. Policy actions are the path to achieving those goals.

As detailed in the metrics section, we recommend action in three of the four analyzed areas. As discussed in the Energy Insecurity Metric subsection, the term "energy insecurity" is somewhat nebulous. The most pertinent aspect is assessing whether customers are trading off paying energy bills versus other expenditure categories, which can be accomplished via a survey question. Beyond that, we cannot recommend specific, empirical measures of energy insecurity for LADWP to adopt.

In the other three metric categories, we recommend metrics and targets that directly tie to policy efficacy (for Discount Programs and Crisis Relief) or real-world secondary benefits of energy

affordability (Thermal Comfort). The respective goals of 80% enrollment among eligible customers in discount programs and an annual disconnection rate of less than 1% among households uncovered by the shutoff moratorium are feasibly measurable with data available to LADWP and have clear links to energy costs and quality of life, respectively. Thermal comfort (with recommended targets of self-reported discomfort and thermostat settings above 78°F each less than 5%) serves as a suitable second-order metric focused on energy-related outcomes, with clear links to quality of life and public health.

On the policy front, our near-term recommendations are heavily influenced by the dynamism that has characterized LADWP's recent approach to affordability and equity. The recent administrative changes to streamline enrollment in the utility's flagship discount program, EZ-SAVE, the recent institution of the CAMR and VNEM Pilot programs, and the enactment of a limited shutoff moratorium are all too novel to be able to assess their efficacy in a data-driven fashion. For this reason, we recommend the near-term focus be on establishing robust data collection and evaluation strategies to gauge the success of these changes and new programs, with the long-term goal being identifying trends and best practices and scaling programs up, informed by data and lessons learned. In some cases, there are specific policy levers that can also be considered, such as expanding on EZ-SAVE's existing framework to incorporate rate-based discounts. Specific data needs and potential pathways forward are articulated in the Energy Affordability Policies section.

8 Appendices

8.1 Appendix 1: Direct Assistance Precedent — State, Utility, and Municipal Discount Programs

Many states and municipalities have in place legislation or regulations addressing electricity affordability — although the structure and level of support required by these programs varies greatly by region. For some states that underwent electricity industry restructuring in the 1990s and early 2000s, specific provisions to protect vulnerable consumers from burdensome electricity rates were implemented. And while other states did not go through this process, and are thus lacking comprehensive affordability requirements, in many of these cases individual utilities — both public and private — have implemented their own. Some of the common structures for these discounts, including flat percentage discounts, tiered discounts based on income, and percentage of income payment plans, are explored below.

8.1.1 Structure 1: Flat Percentage Bill Discount

A standard structure for creating affordable electricity rates for low-income households is a percentage discount applied to the entire electricity charge or bill. This structure has also been adopted by utilities in states without restructured electricity sectors, as well as municipal utilities that are not regulated by their state. The following examples, summarized in Table X, highlight these simplest programs — which offer a single percentage off of bills to any customer that falls within the eligibility guidelines.

Table 20. Examples of Flat Discount Percentages for Low Income Customers

	Burbank Water and Power	LADWP (EZ-Save)	Arizona Public Service	Massachusetts IOUs	Seattle City Light
Monthly Bill Discount	12%	17-18%[81] (average)	25%	32-42%	60%

8.1.1.1 California — Burbank Water and Power (Municipal Utility)

Burbank Water and Power, one of LADWP's neighboring municipal utilities, recently introduced a low-income discount rate in response to rising electricity costs and the financial pressures of the Covid-19 pandemic. This program, called the Burbank Utility Service Subsidy (BUSS) program, offers a 12% discount off monthly electricity bills to income-eligible customers (Burbank Water and Power 2022). While this discount is on average smaller than that offered by LADWP, it should be noted that the income requirements for BUSS are much more inclusive, starting at a maximum income of $69,580 annually for a household of one — almost double that of EZ-Save's maximum for one household member.

[81] Does not include historical water discounts.

8.1.1.2 Massachusetts — IOUs

Massachusetts is an example of a state that introduced broad consumer protections in response to electricity sector restructuring. Similar to the CARE program in California, Massachusetts General Law requires that the state's distribution companies offer discounted rates to low-income households (M.G.L. c. 164, Section 1F(4)(i)), and these programs are also offered as percentage discounts on electricity bills.

Eligibility as established in this legislation must be set at or above 200% of the FPG, although individual utilities have their own eligibility guidelines. The discount program for Eversource Electric, which covers portions of both eastern and western Massachusetts, is available to residents who make below 60% of the State Median Income, adjusted by household size, and provides a 42% discount on electricity bills (Eversource 2023). The state's other major IOU, National Grid, offers a 32% discount to customers whose household income is 200% of the FPG or less (National Grid 2022). Both of these programs are subsidized by surcharges on customer bills.

8.1.1.3 Arizona — Arizona Public Service (IOU)

Arizona is an example of a state that has not undergone electricity industry restructuring. As a result, neither Arizona statutory law nor the state's electricity regulator, the Arizona Corporation Commission (ACC), have put forth a specific standard for low-income assistance for the state's utilities.

That being said, Arizona Public Service (APS), Arizona's largest electric utility, offers the Energy Support Program to customers whose income is at or below 200% of the FPG (Arizona Public Service 2021). These customers receive a 25% discount off their total electric bill, and this discount is funded by a surcharge on other APS customers' electricity bills (Ibid).

8.1.1.4 Washington — Seattle City Light (Municipal Utility)

Seattle City Light, the municipal utility serving 480,000 customers and over 900,000 residents in the city of Seattle, offers a 60% discount to income-qualified customers under its utility discount program (UDP) (Seattle City Light 2020). This program is codified in the Seattle Municipal Code Section 21.49.040, which prescribes the program's eligibility, enrollment, and benefits (Seattle Mun. Code § 21.49.040).

Households making less than 70% of the state median income are considered eligible for the 60% electricity discount and for a 50% discount on water and trash bills (Seattle City Light n.d.). Seattle City Light also collaborates with affordable housing providers to streamline program enrollment with a simplified application (Ibid).

8.1.2 Structure 2: Bill Discount with Income-Based Tiers

An alternative to offering a single discount percentage to all households at or below a specific cutoff level is to provide varying discounts to low-income households based on the level of need. Many utilities, including California's IOUs, offer some form of this income-based tiered discount.

8.1.2.1 California — IOUs (CARE/FERA)

The CPUC oversees California's privately owned electric and natural gas utilities' energy affordability program, called California Alternate Rates for Energy (CARE). The general guidelines for CARE, and the Commission's responsibilities for implementing and maintaining it, are outlined in Public Utilities Code Section 739.1 (CA Pub. Util. Code § 739.1). These guidelines include that regulated electric utilities with more than 100,000 customers must offer discounts of between 30% and 35% off of total bills, and that CARE should be offered to all customers with incomes below 200% of the federal poverty guideline (FPG) levels.

California's IOUs also offer the Family Electric Rate Assistance (FERA) program, which was established in 2004 to provide discounts for larger households with incomes just above the CARE cutoff. The program guidelines are outlined in Public Utilities Code Section 739.12, and include that households are eligible for the program if they have more than three members and have an income ranging from 200%-250% of the FPG levels (CA Pub. Util. Code § 739.12). FERA offers an 18% discount off electricity bills, providing a step-down for families whose incomes are slightly above the CARE cutoff.

Table 21. California IOU Low-Income Discount Programs, CARE and FERA

Program	Eligibility	Benefit
CARE	<200% FPL	30-35%
FERA	200%-250% FPL, 3+ members in HH	18%

8.1.2.2 Connecticut — IOUs

Amid high and rising electricity prices in Connecticut, the Connecticut Public Utility Regulatory Authority (PURA) recently developed a new discount rate structure for low-income bill assistance (Brown 2022). Connecticut's IOUs, Eversource and United Illuminating (UI), have been given until early 2024 to implement these new rates, which will be available to households with incomes below 60% of the state median income (SMI) (Connecticut Public Utilities Regulatory Authority 2022).

The program discount is split into two categories: a 10% discount on electricity bills for customers whose household incomes are between 160% of the FPG and 60% of the SMI, and a 50% discount for customers whose household incomes are below 160% of the FPG (see Table 22). This program will be funded through a system benefits charge (SBR) applied to customer bills (Ibid).

Table 22. Connecticut IOU Low Income Discount Offerings for Electricity Bills[82]

Tier	Income-Eligibility	Discount Level
1	Up to 60% SMI	10%
2	Up to 160% FPG	50%

8.1.2.3 New York — IOUs

New York state offers the Energy Affordability Program (EAP) to its low-income residents. This program, which is administered through each of regulated utilities, was established by the New York Public Service Commission (PSC) in 2016 with the specific aim to limit low-income families' energy costs to 6% of their income (New York Public Service Commission 2021). Although each utility has the option to set its own benefit levels, the structure of this assistance has materialized as an income-based, tiered discount on electricity and gas bills (see Figure 44 for two examples).

The PSC has an ongoing docket addressing energy affordability for low-income customers, through which it is continually working with the state's regulated utilities to improve the EAP.[83]

Energy Affordability Program Discounts

Low Income Levels	Tier Description	Electric (Non-Heat Discount)	Electric (Including Heat Discount)	Gas (Non-Heat Discount)	Gas (Including Heat Discount)
Tier 1	Regular HEAP grant **<$535** or another eligible income qualifier	$30.22	$30.22	$5.60	$99.03
Tier 2	Regular HEAP grant **≥$535 and <$576**	$40.04	$40.04	$5.60	$123.64
Tier 3	HEAP grant **≥$576**	$58.43	$70.65	$5.60	$142.03
Tier 4	Energy bills paid by public assistance	$51.39	$56.58	$5.60	$134.99

Effective December 11, 2022

Tiers	Electric Heat	Electric Non-Heat
Tier 1	$7.01	$7.01
Tier 2	$17.05	$17.05
Tier 3	$35.42	$35.42
Tier 4	$28.38	$28.38

Figure 44. New York's Con Edison EAP Discounts[84] (left) and National Grid EAP Discounts[85] (right)

8.1.2.4 New Hampshire — IOUs

New Hampshire's regulated utilities offer the Electric Assistance Program (EAP), which provides low-income customers with a monthly discount ranging from 8% to 76% off of the first 750kWh of their bill, depending on income and household size (New Hampshire Public Utilities

[82] See https://www.dpuc.state.ct.us/2nddockcurr.nsf/8e6fc37a54110e3e852576190052b64d/cd198950921e4b93852588e000512853/$FILE/171203RE11-101922.pdf.
[83] See https://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=14-M-0565&submit=Search+by+Case+Number.
[84] See https://www.coned.com/en/accounts-billing/payment-plans-assistance/help-paying-your-bill.
[85] See https://www.nationalgridus.com/Upstate-NY-Home/Bill-Help/Energy-Affordability-Program.

Commission 2021). Customers with incomes up to 200% of the FPG are eligible (Ibid). It was first established amidst the state's electricity industry restructuring in 1997 (Order No. 22,514, 82 New Hampshire Pub. Util. Comm. 122 (1997)) and expanded to the newly privatized Public Service New Hampshire (PSNH), previously the state's largest public utility, in 1999. Although not advertised as such, this program is specifically referred to as a "percentage of income" payment program in the 1999 PSNH restructuring document (State of New Hampshire 1999).

The EAP is funded through a "system benefits" charge on customers' bills and is available to the customers of the state's IOUs: Eversource, Liberty Utilities, and Until, as well as New Hampshire Electric Co-op — but not to the state's municipal utilities' customers (New Hampshire Public Utilities Commission 2020). The state has an EAP oversight board that is tasked with tracking its management and success (Ibid).

2021 EAP Income Eligibility Guidelines by Discount Tier*

Household size	76%	52%	36%	22%	8%
1	≤ $ 9,660	> $ 9,660 but ≤ $12,880	> $12,880 but ≤ $16,100	> $16,100 but ≤ $19,320	>$19,320 but ≤ $37,696
2	≤ $13,065	> $13,065 but ≤ $17,420	> $17,420 but ≤ $21,775	> $21,775 but ≤ $26,130	> $26,130 but ≤ $49,295
3	≤ $16,470	> $16,470 but ≤ $21,960	> $21,960 but ≤ $27,450	> $27,450 but ≤ $32,940	> $32,940 but ≤ $60,894
4	≤ $19,875	> $19,875 but ≤ $26,500	> $26,500 but ≤ $33,125	> $33,125 but ≤ $39,750	> $39,750 but ≤ $72,493
5	≤ $23,280	> $23,280 but ≤ $31,040	> $31,040 but ≤ $38,800	> $38,800 but ≤ $46,560	> $46,560 but ≤ $84,092
6	≤ $26,685	> $26,685 but ≤ $35,580	> $35,580 but ≤ $44,475	> $44,475 but ≤ $53,370	> $53,370 but ≤ $95,691
7	≤ $30,090	> $30,090 but ≤ $40,120	> $40,120but ≤ $50,150	> $50,150 but ≤ $60,180	> $60,180 but ≤ $97,866
8	≤ $33,495	> $33,495 but ≤ $44,660	> $44,660 but ≤ $55,825	> $55,825 but ≤ $66,990	> $66,990 but ≤ $100,040

Figure 45. New Hampshire EAP Eligibility and Bill Discount Percentages[86]

8.1.3 Structure 3: Percentage of Income Payment Plans (PIPPs)

Some states explicitly aim to limit household spending on energy, or energy burden, to a certain percentage through Percentage of Income Payment Plans (PIPPs). Going a step further than most discrete tiered discounts, these programs completely subsidize electricity bills (typically up to a certain threshold or amount of usage) when bill costs go beyond a certain percentage of a household's income. Some examples of states offering PIPPs, or similar structures under a different title, can be found in Table 23.

[86] See https://www.puc.nh.gov/consumer/Consumer-EAP-Income-Eligibility-Guidelines-By-Discount-Tier-FPG-Current-Year.pdf.

Table 23: Summary of Percentage of Income Payment Plan Programs

State	PIPP Energy Burden Goal (Percent of Income)	Eligibility	Funding
Colorado	6%	60% SMI/185% FGP	Fixed monthly customer fee
Illinois	6%	200% FPG	LIHEAP
Nevada	State median income % spend on energy (2.29% in FY2023)	150% FPG	LIHEAP & fixed monthly customer fee
New Jersey	4%	400% FPG	Fixed monthly customer fee
Ohio	5%	175% FPG	Fixed monthly customer fee

8.1.3.1 Colorado PIPP — IOUs

Colorado's regulated utilities offer a percentage of income payment plan to households whose income is at or below 185% of the FPG or 60% of the SMI, with the goal of limiting energy spending to 6% of a household's income (Colorado Public Utilities Commission n.d.). This program is codified in both Colorado statutory law and Colorado PUC regulations, including the 185% FPG eligibility limit (Howat et al. 2020).

As of a 2020 National Consumer Law Center report, the PIPP programs in Colorado's largest IOUs, Black Hills Energy and Xcel Energy, had relatively low enrollment — both around 1% (Ibid). This is due largely to the limited funding that has been available for the programs, which is collected through a fixed monthly customer charge. This charge was previously capped at $0.31 per customer per month, however a 2021 Colorado house bill introduced an additional $0.75 per customer per month to help fund the state's assistance programs (Col. Gen. Assembly HB 21-1105 (2021 Reg. Session)).

8.1.3.2 Illinois PIPP — IOUs

The Illinois legislature introduced the state's PIPP program in 2009 after a 2004 Affordable Energy Plan laid the foundation for expansion of the state's LIHEAP programs (305 ILCS § 20). Although administered through the LIHEAP program, which receives some funding through federal block grants, the Illinois PIPP (and LIHEAP) programs are primarily funded through a small monthly customer charge called Supplemental Low-Income Energy Assistance Fund (SLEAF), which was established in 1998 (Bachenberg et al. 2020).

Illinois' largest IOUs, ComEd and Ameren Illinois, now offer the PIPP program for households with incomes below 150% FPG. The program covers electricity bill costs that exceed 6% of household income by paying the difference directly the utility, up to $150 per month in total for gas and electricity bills (Illinois Legal Aid Online 2018).

8.1.3.3 Nevada Energy Affordability Program (Fixed Annual Credit) — IOUs

Nevada also offers a program that, although not explicitly called a percentage of income payment plan, subsidizes low-income customer bills when they exceed the state median income-percentage spent on energy (Nevada Fund for Energy Assistance and Conservation 2022). In FY2023 this state median percentage was 2.29%, and households with incomes up to 150% of the FPG were eligible (Ibid).

Like other states, this program is called the Energy Assistance Program (EAP). The way that it operates is to offer a fixed annual credit (FAC) of up to $240 to cover customer bills that exceed the determined percentage of their income. This financial assistance can go directly to either a customer's heating provider, cooling provider, or be split between the two. The FAC is funded primarily through the Nevada Fund for Energy Assistance and Conservation, which receives its funding through a Universal Energy Charge (UEC) on customers' bills, both of which are established in the Nevada Revised Statutes (NRS) 702.150 through 702.160 (NRS §§ 702.150-702.160). However, federally allocated LIHEAP funds can also be used to fund customer FACs, including in non-regulated utilities where customers do not pay a UEC on their monthly electric bill (Nevada Fund for Energy Assistance and Conservation 2022).

8.1.3.4 New Jersey Universal Service Fund — IOUs

New Jersey offers a PIPP-like program, called the Universal Service Fund (USF), to support households with incomes up to 400% of the FPG that are spending at least 2% of their income on electricity and 2% of their income on gas for heating (New Jersey Department of Community Affairs 2023). The USF pays the difference between 4% of a household's income and their total electric and/or gas bills, up to $2,160 annually (New Jersey Board of Public Utilities n.d.). The USF program is funded through a societal benefits charge added to regulated utility customer bills (Ibid).

This program was a result of the state's 1999 electric industry restructuring legislation, which directed the New Jersey Board of Public Utilities to develop a program to protect low-income consumers (LIHEAP Clearinghouse 2016). The USF program officially began distributing financial aid in FY2004 (Ibid).

8.1.3.5 Ohio PIPP Plus — IOUs

The PIPP Plus program — a revamping of Ohio's original PIPP program, which had been in place since 1983 — was established by the state's legislators in 2010 (Bachenberg et al. 2020). PIPP is and has been a robust financial assistance option in Ohio; as of 2009, 230,000 customers utilized PIPP for electricity bill assistance (Ibid).

Ohio's PIPP aims to limit household energy spending to 5% of household income, and it is available to customers of regulated utilities whose income is at or below 175% of the FPG (Office of Ohio Consumers' Council n.d.). As established in Ohio Revised Code Sections 4928.51 and 4928.52, Ohio's PIPP funds are distributed through the Universal Service Fund,

which is funded through a Universal Service Rider billed to customers in regulated utilities (Ohio Rev. Code §§ 4928.51-52).

8.1.3.6 California PUC PIPP Pilot —IOUs

A 2021 CPUC Decision under Rulemaking 18-07-005 directed California's IOUs to each develop PIPP pilot programs, which they are currently in the process of implementing (Wang 2021). The guidelines for these PIPP pilots direct that they be offered to customers at or below 200% FPG and at risk of disconnection, with different bill caps depending on poverty level (Ibid). The specific bill caps, which range from 2% with a $12 minimum to 4%, are shown in Figure 46 below.

Table 1: 2020 Proposed PIPP Bill Caps

Income by Percentage of Federal Poverty Line	Bill Cap
0-50%	2% with a $12 minimum
51-100%	2.5%
101 – 150%	3%
151 – 250%	4%

Figure 46. California Public Utilities Commission Proposed Bill Caps, 2021 PIPP Pilot[87]

The CPUC has a goal of 15,000 total enrollees in the PIPP pilot programs, which will run for a duration of 48 months. Progress on these pilots is being monitored through quarterly Low Income Oversight Board meetings (California Low Income Oversight Board 2021).

8.2 Appendix 2: Secondary Metrics Analysis

In the first stage of our research we considered a wide array of potential energy affordability metrics, prior to focusing on the four categories detailed in the main body. The landscape, first-stage analysis conducted on these metric areas is provided below.

8.2.1 Electricity Use Intensity (EUI)

"Electricity use intensity (EUI)" typically refers to the electricity delivered to a building divided by the area of the building. However, households of color, lower-income households, and older householders use less energy, but have a higher energy use intensity, thus reflecting inefficiencies in housing and infrastructure quality (Bednar et al. 2017).

[87] See https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M412/K735/412735667.PDF.

8.2.1.1 Potential Metric(s)

The potential metrics for this concept are unclear, beyond that they should be measured in kWh/sq ft by HH type, and compared to baseline/goal thresholds (Reames 2016).

"Generally, a lower EUI signifies relatively efficient performance. The EUI is defined as the quantity of energy used in producing a given level of service, expressed as energy consumed per unit of output. The heating EUI (kBtu/m2) was calculated for each RECS observation by dividing the total annual heating consumption (kBtu) by the housing unit square area (m2)."[88]

8.2.1.2 Example Goal

An example goal in support of this concept is reducing the EUI for low-income households from its baseline level.

8.2.1.3 Magnitude of Impact Addressed

The magnitude of impact addressed for this concept is medium.

8.2.1.4 LADWP Implementation Ability

The LADWP implementation ability for this concept is low, as use intensity is affected by a number of factors, and unless LADWP takes on the full scope of the housing-energy infrastructure transition challenge. In fact, EUI likely mostly reflects constraints and inequities which are explicitly beyond LADWP's historical purview.

8.2.1.5 Mechanical and Tracking Feasibility

The implementation and tracking feasibility of this metrics is medium, as it may be derived or constructed from the UCLA Energy Atlas.

8.2.1.6 Downsides

The main downsides to this metric are first that it is difficult to understand and explain. Additionally, is a weak concept for affordability unless used in combination with other assistance programs. Furthermore, it also does not incorporate income or other measures of household need. Without also incorporating these measures of household need, EUI may not identify customers most in-need of financial assistance.

[88] See Reames 2016 for more information.

8.2.1.7 Precedent

This concept has been proposed by Dr. Tony Reames (now at DOE) and colleagues, but not been proposed much less employed by a utility or regulatory agency as far as we are aware of.

8.2.2 Household-Based Energy Budget

"Household-based energy budget" refers to allotments of low cost or free electricity allocated to customers based on customer-specific characteristics, such as lot size or household size, and conservative consumption standards. The price of the basic consumption budget for residential ratepayers is kept low, while rate tiers above that stagger upwards aggressively to ensure conservation.

8.2.2.1 Potential Metric(s)

A primary potential metric is setting a residential rate structure which sets a budget for each residence adjusted based on their necessary level of consumption. The budget could be determined by household characteristics including household size, medical needs, and housing unit size.

A secondary potential metric is ensuring that the lowest tier of the rate structure is very affordable and set at a level above the high end of necessary in need household consumption level.

8.2.2.2 Example goal

This metric would apply to all residential ratepayers as it would be embedded in the rate structure, so there is no further goal except timeline around implementation of a revised rate structure with additional computational needs.

An opt-in budget-based rate structure is possible, but not advisable.

8.2.2.3 Magnitude of Impact Addressed

The magnitude of impact addressed is high.

8.2.2.4 LADWP Implementation Ability

The LADWP implementation ability is high for the secondary approach, unclear although seemingly moderate on the primary approach.

LADWP's tiers already vary depending on where you live: their service territory is divided into Zone 1 and Zone 2, which have different usage allowances, and by season, so ability to have more complex rate structure is possible.

8.2.2.5 Mechanical and Tracking Feasibility

The implementation and tracking feasibility are currently low as it requires integration of parcel or other household data (including refreshment).

8.2.2.6 Downsides

One downside of this approach is that it would require~~s~~ rate re-design with high data input needs in order to calculate a consumption budget for each household.

Furthermore, it may be computationally difficult to directly measure income or 'need' beyond household size or medical disability. If the budget is incorrectly calculated without taking into consideration all relevant factors, customers may need to pay a higher rate tier to cover basic needs, making electricity less affordable.

Oftentimes the budget is also set too high, and thus effectively cross-subsidizes higher income residential ratepayers (Beecher 2012).

8.2.2.7 Precedent

Water budget rates employed by special districts in Southern California (Irvine Ranch Water District, Moulton Niguel) are the best direct precedent, which exemplify how this concept can be Proposition 218-compliant (Baerenklau et al. 2014, Harmon et al. 2021).

LADWP's current Tier 1 rates (Per 2015-2020 rate request materials) are an example of the secondary concept, but might be refined.

8.2.3 Percentage of Income Payment Plan (PIPP)

Percentage of Income Payment Plans (PIPPs) serve to reduce energy burden by capping the percentage of low-income household income that goes towards electricity expenditures.

8.2.3.1 Potential Metric(s)

Potential metrics for defining in-need customers based on energy burden include:

- Absolute Value Approach: customers as those with energy bills greater than 4-6% of household income.

- Population Percentile Approach: customers with the highest 10% energy burden.
- Variance Approach: customers with energy burden at least one standard deviation above the mean.

8.2.3.2 Example Goal

Example goals include:

- 80% enrollment in PIPP
- Provide a layman's example of how this works

8.2.3.3 Magnitude of Impact Addressed

The magnitude of impact addressed for customers by a PIPP is the highest of all proposed concepts because it limits expenditure firmly to a percentage of household income.

8.2.3.4 LADWP Implementation Ability

The LADWP implementation ability appears to be low, especially due to limitations imposed by Proposition 26 (detailed below), but other public utilities in the U.S. have implemented on the water side.

8.2.3.5 Mechanical and Tracking Feasibility

The mechanical and tracking feasibility of this concept is low, given few precedents and high data and database requirements.

8.2.3.6 Downsides

The main downside to this concept is that it would not be compliant with Proposition 26, a voter approved initiative passed in 2010 that redefines taxes to encompass all government revenue measures, unless a measure fits one of seven exceptions. Unlike Proposition 218, which required voter approval of new taxes and fees, Proposition 26 makes no specific exception for gas and electric services provided by a municipality. This means unless electric and gas service provided by a municipal government meet the requirements for one of the outlined exceptions, the rates charged constitute a tax. Proposition 26 carves out an exception for "a charge imposed for a specific government service or product provided directly to the payor that is not provided to those not charged, and which does not exceed the reasonable costs to the local government of providing the service or product." Thus, if electric service were to be provided to low-income households who were not charged for the service based on their PIPP, electric rates would no longer fall under the exception and instead be a tax. Additionally, if rates were increased for non-

in-need customers to subsidize the PIPP program beyond a reasonable cost of providing service, the rates would again be considered a tax.

It is also likely the most expensive for the utility if enrollment is high, as admin costs are also likely to be high based on existing examples. In addition, the cost of the program is likely to be highly volatile as it subject to both volatility in utility costs and household income trends.

Another challenge is that it creates a need to verify or trust household income reporting.

8.2.3.7 Precedent

In October 2021, the California Public Utilities Commission approved PIPP programs to be implemented by Investor-Owned Utilities (CPUC 2021). At time of writing, the utilities have submitted an advice letter to the CPUC for approval. Gas and electric charges for customers below 200% of Federal Poverty Level will be capped at 4% of households monthly income, based on income level (Ibid). For customers between 0% and 100% FPL, the bill cap is $37. For customers with incomes between 101% and 200% FPL, the bill cap will be set at $109. Eligibility for the pilot program includes customers who are enrolled in the California Alternate Rates for Energy (CARE) and who live in zip codes with high disconnection rates or who experienced two or more disconnections in the 12 months preceding the disconnection moratorium (Ibid). The pilot is planned to run for four years and include 150,000 customers (Ibid).

The Philadelphia Water Department has also already implemented this concept. An initial study by Mack et al. (2020) explores this issue in the context of Philadelphia's Tiered Assistance Program (TAP), where eligible households are charged a flat rate instead of a volumetric rate regardless of their consumption level. In their survey of TAP recipients, 25% of recipients were unsure about how their water usage may have changed, 42% stated they used the same amount of water, 32% stated they used less, and only 1% stated that their water usage increased. The finding that customers used less despite seeing a flat rate could be explained by the program's structure, which credits reductions in water usage directly to TAP customers' accounts for debt repayment. This program's structure still incentivizes prudent water use despite flat rates and may be an example of effective recurring bill assistance. However, in-progress analysis of TAP suggest that enrollment is low and administrative costs are very high.

8.2.4 Rating of Electricity Service Based on Cost

“Rating of electricity service based on cost” refers to whether low-income households rate their electricity service as ‘poor’ based on ‘cost of billing.’

8.2.4.1 Potential Metric(s)

This can be measured as the number of in-need households rating their service as 'poor' on the basis of cost as opposed to other service attributes.

8.2.4.2 Example goal

Reducing relative number of households with 'poor' rating due to cost of billing among in need.

8.2.4.3 Magnitude of Impact Addressed

The magnitude of impact addressed for this metric is low, except on perception/felt need front.

8.2.4.4 LADWP Implementation Ability

The LADWP implementation ability is medium. LADWP can reduce cost of billing but constraints and preferences on the consumer end are beyond its control.

8.2.4.5 Mechanical and Tracking Feasibility

The implementation and tracking feasibility of this metric is high, if consistent survey data collected. The LMU survey, conducted annually, has collected this information in the past.

8.2.4.6 Downsides

One downside to this metric is that it reflects perceived burden, rather than empirical burden. Another downside is that progress on this metric could be contingent on factors outside of LADWP's control.

8.2.4.7 Precedent

The Loyola Marymount University (LMU) 2020 Household Survey asked questions directly related to this metric, which could be used to establish a baseline.

8.3 Appendix 3: Secondary Policies Background Analysis

As mentioned above, eight policy areas were initially identified for broad, landscape analysis. Four of these were selected for further analysis and exploration, based on the judgment of researchers with input from the LA100 Steering Committee. The background information for these main policies appears above, while that for the four policy areas not selected for further study is included below.

8.3.1 Appliance Energy Efficiency

Energy efficient appliances have been a high-profile part of efforts to reduce energy consumption and save ratepayers money for years. The fundamental logic of these efforts is straightforward: replacing older technology such as lighting, refrigerators, laundry machines, and other fixtures with newer versions that can accomplish the same tasks with less electricity lowers household energy needs. However, the cost of these efficient models can be quite steep, especially for low-income households who would benefit the most from their adoption. Thus, policy efforts have generally focused on lowering costs through rebates and other fiscal incentives, free upgrades, and technical assistance, though historically these policies have disproportionately benefitted non-disadvantaged households. Appliance energy efficiency upgrades have generally been beneficial in terms of energy savings, but evidence suggests these may have been overestimated due to factors like behavioral response.

8.3.1.1 Policy Mechanism

Energy efficient appliance programs promote energy savings by encouraging consumers to purchase and install such appliances via lowering barriers to adoption. These appliances include lightbulbs, washing machines, refrigerators, and others that use less electricity to operate than typical models. At their most rudimentary, these programs seek to decrease the time and effort investment required by consumers to find desirable appliance upgrades. Provision of tools — online product catalogues or marketplaces, for instance — centralizes information for consumers and assists them in finding energy-saving appliances in a relatively painless fashion, facilitating adoption by otherwise information-deficient households or households on the adoption margin.

More robust mechanisms involve lowering the fiscal cost to consumers of adopting energy-efficient appliances, an approach that can be paired with the aforementioned information tools. In this case, the product-finding tool can both enable consumers to purchase an energy-saving appliance while simultaneously applying program-backed discounts or integrating the process for awarding rebates. These tools can also function as portals for consumers who buy energy-saving appliances from third parties to apply for rebates after the fact. Lowering the effective cost of these appliances boosts the efficacy of programs at promoting energy-saving appliance adoption among marginal households, but is especially important for low-income households, where lack of disposable income and inability to afford sizeable short-term expenses may be prohibitive. Another similar, but improved, approach is providing financing for appliance purchases to eligible consumers, entirely negating the need for large, upfront cash expenditures. Ideally,

consumers utilizing such programs would make loan repayments at a rate based on the energy savings resulting from appliance installation.

8.3.1.2 LADWP Offerings and Relevant Policy Models

LADWP currently administers or offers three notable programs related to energy efficient appliances: the Efficient Product Marketplace (EPM), a Refrigerator Exchange Program, and the GoGreen Home Energy Financing program (GoGreen) through its partnership with SoCalGas.

The EPM functions both as a straightforward information-providing product catalogue and as a rebate delivery mechanism to lower costs of adoption. It currently offers product information — including energy efficiency scores[89] — across an expansive number of appliances and other items. These categories include miscellaneous home and office devices (e.g., air purifiers, power strips, lighting), laundry appliances, electronics, heating and cooling devices, kitchen appliances, and generators. Functionality of the marketplace is refined, allowing users to easily search products based on vendor, features, brands, and other technical specifications, with energy-efficiency scoring being prominently displayed.

Compared to the overall suite of featured products, the rebate side of the EPM is relatively narrow in scope. Rebates are only available for a few product types: light bulbs, power strips, laundry washers, televisions, window-mounted air conditioners, smart thermostats, and refrigerators. Among these, the magnitude of available rebates versus per-unit appliance costs varies significantly. For low-cost upgrades such as energy-efficient light bulbs, rebates can often reduce per-unit costs by ~30-50% or more ($2.50 per unit rebate versus common price ranges of $4 to $10). For more expensive appliances though, such as highly energy efficient refrigerators and air conditioners, rebates typically only cover ~10-20% of the cost. Rebates are $75 and $50 for refrigerators and air conditioners, respectively, whereas prices for models with energy efficiency scores of 90+ (the top 10% of models in terms of efficiency) usually exceed $800 and $400, respectively. In such cases, consumers seeking to upgrade would still be faced with upfront costs of several hundred dollars, an expenditure that is beyond the capacity of many low-income households.

The Refrigerator Exchange Program (REP) helps address the cost barriers faced by low-income households to upgrade to an energy-efficient refrigerator, one of the costliest appliances to replace. Under this program, LADWP will replace a working, 10 or more-years-old refrigerator with one of two Energy Star rated models at no cost to the owner. However, this program has narrower eligibility requirements than many low-income-focused programs, discussed in Barriers to Enrollment below. REP was reopened as of November 2021 following suspension in response to the COVID-19 pandemic.

GoGreen, a versatile energy efficiency financing program, includes several types of appliance upgrades among its eligible projects. These include both mainstream appliance types (e.g., refrigerators and freezers, air conditioners, smart thermostats, lighting) and less frequently used

[89] The proprietary Enervee Score®, which provides model-specific scores based on relative efficiency among market offerings, with the highest-scored being the most energy-efficient.

products (e.g., air purifiers, ovens and cooktops, laundry washers and dryers). The eligible products covered by GoGreen are significantly more varied than those eligible for a rebate through the EPM. As a 100% financing program, GoGreen enables access to energy-efficient appliances that would be upfront-cost-prohibitive for many households, even after rebates are taken into account. GoGreen's financing program relies on third-party, approved loaners. Over the entirety of the program's existence, the median loan term has been 120 months at 5.48% interest, but these figures have declined significantly recently despite median loan sizes slightly increasing (California Alternative Energy and Advanced Transportation Financing Authority 2022).

Outside of LADWP, other utilities in the state administer programs that, while similar in approach to existing LADWP offerings, are more expansive than or improve upon what is available to LADWP customers. Examples of such programs include appliance electrification incentives offered by Sacramento Municipal Utility District, Southern California Edison's Energy Savings Assistance Program (ESAP), and similar appliance energy efficiency program offerings from PG&E and SDG&E. The former is a rebate-style program focused on electrifying major gas-reliant home appliances: stoves and cooktops, water heaters, and HVAC systems. While narrower in focus than LADWP's EPM, the magnitude of rebates offered by SMUD for electrification is significantly greater. SMUD offers rebates of up to $750, $2,500, and $3,000 for customers switching from gas to electric cooktops, water heaters, and HVAC systems, respectively. These can be further supplemented by incentives made available through the TECH Clean California initiative, with which SMUD collaborates on electrification efforts. The resulting rebates are sufficient to cover all or a significant portion of the cost of electrified appliances, in contrast to the relatively small rebates available to LADWP customers through the EPM. Though electrification is distinct from more general appliance efficiency priorities, electrified appliances often offer efficiency (if not necessarily cost) advantages over their gas counterparts, in addition to producing many health and environmental co-benefits.

SoCal Edison's ESAP is somewhat analogous to LADWP's REP in that it provides no-cost (or, in some cases, low copayment) energy efficient appliance upgrades to eligible low-income customers. However, ESAP offerings go well beyond refrigerators, also providing access to air conditioning systems, laundry washers, lighting fixtures, and smart thermostats, among others. The expansive offerings of such free upgrade programs suggest that there is potential for LADWP to increase the number of appliance categories from which to offer no-cost upgrades to its low-income customers.

Another program example — notable for its design elements that aim to overcome the split incentive problem facing multifamily housing property owners — is the Southern California Regional Energy Network's (SoCalREN) Multifamily Program. Through this program, SoCalREN provides energy audit services, technical assistance, and fiscal incentives to lower information and cost barriers to multifamily property upgrades. Potential upgrades include appliances like energy-efficient lighting, both in residential units and in common areas where property owners pay for energy use. Importantly, SoCalREN emphasizes the economic benefits to property owners from implementing these upgrades, including direct energy savings, increased property values, and tenant recruitment.

8.3.1.3 Barriers to Enrollment

As in many other areas, one of the key enrollment challenges across many appliance-focused programs is their reliance on customers to be knowledgeable of the program and to have the capacity to proactively apply. All the program models discussed above — both those administered by LADWP and by other entities — necessitate potential enrollees to apply to the program, often requiring provision of eligibility-related information and/or additional proactive steps. The challenge is compounded in the case of programs with limited funds that are administered on a first-come-first-served basis, as it may lead to situations where customers become aware of a program's existence only to be unable to take advantage of its provisions in the current administrative cycle.

Beyond the information barrier, appliance rebate programs suffer from the typical challenge associated with all rebate models: that low-income households must still front the entire initial upgrade cost. This is the case when households purchase efficient appliances from a third-party vendor and later apply for a rebate through LADWP's EPM, for instance. However, marketplace tools like the EPM lower this barrier when customers utilize the tool for the purchase itself by applying the rebate as a discount at the time of purchase. Marketplace tools, combined with universal rebate policies, also facilitate ease-of-use by not imposing any eligibility requirements and thereby eliminating the need for customers to submit proof of income or other documentation.

Unfortunately, other programs such as the REP and GoGreen have significantly higher barriers to enrollment. The REP has peculiarly narrow eligibility requirements for low-income customers, basing eligibility not on an income threshold directly, but conditioning it on a customer already participating in one of several other LADWP programs. In multi-residential contexts, only affordable housing facilities with 50% or more of residents meeting income requirements are eligible. A more flexible approach is showcased by SCE's ESAP, which qualifies customers based either on their enrollment in any of a number of public assistance programs (not solely utility-administered ones) or based on household income. Customers still need to provide documentation (e.g., proof of income) in such cases.

In contrast, the GoGreen program has minimal eligibility requirements, but potential enrollees must invest time and effort in seeking out and engaging a partnering contractor, as well as taking subsequent steps to take advantage of the program's financing options. Provision of tools to connect interested customers to partnering contractors and lenders can lessen the difficulty — perceived or real — for customers to take initial steps.

More generally, renters in multifamily housing may encounter barriers to replacing large appliances such as refrigerators for ownership reasons. Such appliances are often provided — and owned by — landlords, meaning renters cannot unilaterally replace them with a higher efficiency model. As in the realm of structural energy efficiency, the "split incentive" problem creates a hurdle to improving appliance energy efficiency in multifamily properties. Although the property owner may own the large appliances included in the units, they typically do not pay the energy bills for the usage of those appliances, and thus do not have an economic incentive to invest in higher-efficiency models.

8.3.1.4 Impact of Policy Approaches

It is difficult to provide a succinct overview of how energy efficient appliance upgrades impact household energy consumption and bill savings due to a number of factors. The primary driving reason is that few studies assess savings at the household level, and those that do rarely translate their findings into consumption or bill percentiles. Moreover, impact of upgrades varies significantly across appliance types, and in some cases human behavior acts as a confounding variable. There are, however, several appliance types where extant research shows unequivocal energy savings resulting from upgrades.

For context, it should be noted that the energy consumption profile of the typical Californian household is different from the national average. Thanks to the relatively mild climate enjoyed in much of the state (which is especially true of LADWP's service area), Californian households generally use less electricity overall, and especially less electricity for space heating and air conditioning, than the national average (Household Energy Use in California, n.d.). It is also important to note that, within LADWP's service area, low-income areas tend to be generally hotter and experience more extreme heat events, which necessitate expending more energy for cooling (Hoffman et al. 2020). This means that the relative impact of appliance efficiency upgrades on household energy bills will generally be larger in California and especially for low-income households, both proportionally and in terms of absolute energy savings, than in other regions, though improvements to water and space heating efficiency still have significant potential. However, California's historic strength in pursuing energy efficiency goals means that marginal improvements may require greater effort to achieve compared to other states, as many of the "low-hanging fruit" improvements have already been implemented.

With these region-specific considerations into account, national and climate zone-specific data from the U.S. EIA's residential energy survey suggests that air conditioning is a large electricity draw for households in LADWP's service area (U.S. EIA 2018a, U.S. EIA 2018b). Other major sources of electricity use include space and water heating, refrigerators, lighting, electronics, and clothes dryers (Ibid). Programs focused on improving energy efficiency for these types of appliances will therefore generally be the most impactful in terms of absolute energy savings and consequent bill reductions for customers.

In straightforward terms of energy consumption, high-efficiency models (e.g., products certified under the ENERGY STAR program) of these major electricity-consuming appliances offer appreciable savings when used the same amount as older analogues. Compared to older or non-certified models, ENERGY STAR air conditioners consume 20-50% less electricity, refrigerators 9% less, and laundry washers 25% less (Energy Star 2022). Efficient lighting is especially impactful, reducing energy usage by as much as 90% compared to standard light bulbs (Ibid). The ENERGY STAR program claims that systemic adoption of certified energy-efficient products can result in $450 in bill savings (presumably annually, though language is ambiguous), per a 2020 Lawrence Berkeley National Laboratory report (Energy Star n.d.). However, at time of writing, we have been unable to access and review this report. Electrification of natural gas appliances (e.g., heat pump replacements for water and space heating, induction cooktops) is also highly advantageous, reducing household operational costs by as much as 50% owing to massive efficiency increases (PGE n.d., Dennis 2015).

Modeled energy savings may be overestimated, though, as recent research has raised questions about whether engineering-based estimates of energy efficiency gains reflect real-world results. A recent report from the California Public Utilities Commission found stark differences between claimed energy savings from programs upgrading residential HVAC systems and actual energy savings; the most egregious case occurred when examining direct installation of smart thermostats, where only 6% of the claimed energy savings were realized (DNV Energy Insights USA, Inc. 2022). More broadly, researchers from National Taipei University and UCLA used years of data from Southern California Edison to examine electricity consumption patterns in households that participated in energy efficiency upgrade programs, finding that in most cases energy savings are significantly smaller than estimated (Chuang et al. 2022). Certain appliance upgrades — notably pool pumps and refrigerators — still provide large energy savings, but other areas like lighting were found to provide almost no savings at all (Ibid).

Given the demonstrable advantages of energy efficient appliances (aforementioned concerns about lower real-world energy savings notwithstanding), the question follows as to whether incentives, rebates, financing, and other programs are effective at facilitating adoption, particularly by resource-constrained households. Fortunately, multiple studies have found that financial incentives or assistance do increase the degree to which households adopt energy-saving appliances (Schleich 2019, De la Rue du Can et al. 2014). This is especially true for the most efficient appliances and latest technology, which may have higher costs and/or lower market penetration (Ibid). However, there may be some variation in the efficacy of these policies among different types of appliances; some research suggests that rebates for ENERGY STAR appliances increase sales and market share for some types (e.g., clothes washers) but are not particularly effective at doing so for others (e.g., refrigerators and dishwashers) (Datta & Gulati 2014). There are also equity-related considerations related to participation in such programs, as studies have shown that certain demographics (e.g., lower-income households, non-homeowners) have historically been less likely to do so (Pigman et al. 2021). Regarding LADWP's efforts in this area, analysis has found that most energy efficiency incentive programs have disproportionately benefited non-disadvantaged communities and "majority White, non-Hispanic, owner-occupied, and affluent households" — i.e., those where energy burden is less of a concern (Romero-Lankao et al. 2022).

8.3.2 Demand Response

Periods of especially high electricity consumption, or peak demand, can decrease electricity reliability and increase general costs through straining energy infrastructure. The goal of demand response programs is to reduce the magnitude of these peaks — and thereby their direct and indirect costs — through prompting voluntary reductions in consumption by ratepayers and more robust efforts that harness smart technology or offer fiscal incentives to beget more significant reductions. Available evidence suggests the various iterations of these programs are effective, often achieving double-digit percentile decreases in energy consumption by participants during demand response events. However, barriers to enrollment have hindered participation, especially among low-income households.

8.3.2.1 Policy Mechanism

Demand response programs focus on reducing peak loads via reducing electricity consumption during high-demand hours, thereby lowering the chance of rolling blackouts and other negative consequences of grid strain. The most straightforward method for doing so is simply through alerting ratepayers to periods of especially high demand and requesting they reduce usage. However, many programs augment or go beyond relying purely on voluntary modification of consumption behaviors. Two of these supplementary approaches are common: utility usage controls and fiscal incentives, between which there is a slight overlap. Demand response programs produce energy affordability advantages through directly reducing customers' energy usage and, in the case of programs that offer fiscal incentives, providing monetary rewards for lowering peak use.

The former harnesses the power of smart technology to enable a utility to remotely reduce a household's electricity consumption during periods of high demand. This is most commonly done using smart thermostats, but offerings are expanding to encompass other technologies such as electric vehicle chargers with remote modulation capabilities. Under such an arrangement, a demand response enrollee would allow their utility to access their installed smart thermostat, such that during demand response events or "high-use seasons" (i.e., hot days and months, when air conditioning usage creates significantly higher electricity demand than other times of the year) the utility can adjust a home's thermostat settings up to a specified number of degrees. Such arrangements typically provide the option for customers to manually override remote adjustments should they wish to defer participation for a given event, relinquishing their incentives. The consequent reduced electricity usage directly results in household bill savings. Additionally, most utility-administered demand response programs offer some standalone fiscal incentive for enrollment, such as sign-up bonuses, annual bonuses, bill credits, or cash (equivalent) rewards.

Participation in programs that rely on remote utility control (or participation in smart technology-augmented program elements) requires a household to have a compatible smart thermostat. Fortunately, many utility-run programs that provide fiscal assistance for the purchase of energy-efficient appliances include smart thermostats among their portfolio (discussed further in Barriers to Enrollment below).

On the purely fiscal side, households can be incentivized to reduce energy usage and save money through demand response approaches that don't rely on smart technology.

Additionally, variable pricing and time-of-use rates can shape customer usage behavior in a manner similar to demand response programs. Since these approaches manifest entirely through rate structures, they are discussed in the Rate Structure Design policy summary.

8.3.2.2 LADWP Offerings and Relevant Policy Models

LADWP's primary demand response offering is its Power Savers program, a straightforward iteration of the "direct control with incentives" model described above. Enrollees in Power Savers allow LADWP to adjust their eligible smart thermostat by up to 4°F for up to four hours between 1 pm and 10 pm from June 1st through October 31st. This being a warm period of the

year, energy savings from this program manifest primarily through lower usage of air conditioning, lowering both grid-wide aggregate and household-level electricity usage during high-demand hours. Households enjoy energy bill savings commensurate with their reduced usage, the magnitude of which may be greater if the utility uses time-of-use rate structures. It is worth noting that, in contrast, with many other similar programs, the notification system Power Savers uses to inform participants about an ongoing adjustment is rudimentary, relying solely on the smart thermostat display and accompanying app notifications (as opposed to alerting participants directly, e.g., via SMS).

In addition to these energy savings, enrolled LADWP customers receive additional fiscal incentives to enroll in Power Savers. However, these incentives come in a somewhat peculiar form: Amazon gift cards. Enrollees receive $125 in this form for each smart thermostat in their home (up to two) upon program acceptance, and $60 per annum per thermostat thereafter. The gift card method of delivering these incentives is less straightforward than other options (e.g., cash, bill credits), and cannot be directly saved by households. It is possible that, given the large portfolio of goods available from Amazon, customers could use the gift card incentives for necessity purchases (e.g., food, clothing), offsetting other expenditures. However, behavioral research has shown that consumer spending behavior is medium-sensitive, such that the overall impact of incentives on reducing energy burden would likely be more beneficial if given in an alternate form (White 2006).

Similar program offerings are readily available to ratepayers outside of LADWP, with illustrative examples including the Clean Power Alliance's Power Response Program (PRP) and Southern California Edison's Smart Energy Program (SEP) and Summer Discount Plan (SDP). All three of these program examples are somewhat analogous to LADWP's Power Savers program and contain similar elements. However, each has features that differentiate it therefrom and showcase potential ways Power Savers or other future LADWP demand response strategies could be refined. The SEP is most similar in its functionality to Power Savers, operating via remote smart thermostat control. However, SEP provides fiscal incentives for enrollment in a more straightforward and impactful manner through bill credits, and expands the period of operations to the entire year (though most events occur in the summer months). The SDP also utilizes a bill credit fiscal incentive system while using a slightly different technical model: remote control of enrollees' central air conditioning units themselves via a device that connects to the unit. The SDP also provides a spectrum of enrollment options, providing customers with several options that trade off severity of shutoffs and ability to override air conditioning shutoffs for greater fiscal incentives.

CPA's PRP showcases areas where demand response programs go beyond indoor climate adjustments. In addition to utilizing smart thermostats to remotely control enrollee electricity utilization (or prompting them to do so), PRP extends to ChargePoint electric vehicle chargers and Sunnova solar energy storage systems. Respectively, enrollees' electric vehicle charging draw may be reduced or time-shifted during a demand response event, and utilization of their home solar battery may be increased during an event to reduce demand on the grid. Though adoption trends indicate electric vehicles and residential solar have historically been less utilized by low-income households, adoption is likely to increase as costs lower and as the state continues to pursue its decarbonization goals. Incorporation of features focused on these

technologies into demand response policies is thus likely to become more relevant to low-income households in the future.

Demand response is not limited to smart technology-dependent approaches, however. Traditional demand response measures like FlexAlert and OhmConnect provide timely information to consumers that periods of especially high demand are occurring, with the goal of prompting energy-saving behaviors that reduce peak demand and lower customers' energy consumption (and, therefore, their energy bills). Some programs, such as the aforementioned PRP, incorporate both these general elements in addition to technology-dependent approaches. In some cases, as with FlexAlert, programs rely on voluntary actions taken by consumers in response to the alert without additional incentives. However, information can be supplemented with fiscal incentives to increase the energy-saving response during periods of high load. The OhmConnect program uses such a model, crediting participants with rewards that can be redeemed in various ways (including cash) to increase the fiscal incentive beyond the direct impact participation has on a customer's energy bill.

Importantly, the lack of a non-technology-reliant program like FlexAlert for LADWP's customers constitutes a barrier to enrollment, as it leaves households on the margin (those that do not possess the required technology for Power Savers participation but who would be responsive to a program that prompts voluntary reductions) without a demand response option.

8.3.2.3 Barriers to Enrollment

Generally, participation in demand response programs is hindered by lengthy enrollment processes and some complex prerequisites. Sign-up and registration can sometimes take several weeks to more than a month to complete, and in some cases may require repeated communications between a household and the program administrator. For programs where household energy consumption data is fed back to the program, participants must facilitate connecting their utility data to the administrator, a process which can be complicated and difficult. Third-party (as opposed to utility-run) demand response programs are especially prone to these challenges, and (perhaps unsurprisingly) these barriers have historically hindered participation by low-income households the most. Digital access issues can also affect participation ability, as data exchange for smart thermostats relies on the hardware and bandwidth necessary to maintain a steady internet connection.

For programs that rely on smart thermostats and other technology, an additional major barrier is whether households possess the equipment required for participation — in most cases, some type of smart thermostat. Fortunately, these devices are relatively low-cost compared to other major types of energy efficient appliances, with many models available for less than $200 and some as cheap as $50, although purchasing these may still be cost-prohibitive for low-income households. These costs can be reduced by appliance energy efficiency programs (e.g., rebates) available from many utilities, including via the LADWP efficient products marketplace. Combined with the fiscal incentives offered for enrollment, the payback period for households investing in a smart thermostat in order to participate in a demand response program is short, potentially near-instantaneous. However, the overall magnitude of benefit for demand response participation is somewhat low, with recent research finding that payoffs are insufficiently high or

salient with low-income households to make them invest the time and effort to enroll, even when provided with a free smart thermostat.

Additionally, programs that provide fiscal incentives in addition to bill savings for customers that conserve energy during a demand response event (e.g., OhmConnect) require that participating households have a smart electricity meter. Currently, LADWP has not installed smart meters anywhere within its service area, making its customers unable to participate in any third-party or future LADWP incentive-augmented demand response without widespread investment in new hardware.

Other hardware required for participation in some of the program examples provided above — central air conditioning, electric vehicle charging, or solar power generation and storage capability — represent sizeable investments in comparison with smart thermostats. It is unlikely, however, that participation in a demand response program would be the primary incentive for a household to adopt these technologies, and as such it would be inaccurate to characterize them as posing a barrier to enrollment. Inclusion of these technologies in demand response represents a value add for households that have adopted them and utilities that can harness them to reduce grid strain. However, access to these devices do still constitute a barrier to participation for households on the margin.

8.3.2.4 Impact of Policy Approaches

Assessing the impacts of demand response programs from an energy burden perspective is made difficult by the relative dearth of studies examining how such programs impact consumption at the household level. Additionally, some research that would otherwise be applicable is focused on geographic areas with climates that differ greatly from California. Since the primary mechanism of the programs discussed above is to reduce climate control-related electricity usage, results from regions where this constitutes a significantly different portion of household consumption may not necessarily be representative of realized savings for LADWP customers participating in smart thermostat-reliant programs.

These shortcomings in available literature aside, the consensus of applicable research is that demand response programs are effective at reducing both overall energy consumption by households and peak loads on the grid. Efficacy estimates vary across studies and regions, but various studies have found that household energy savings during a demand response event are substantial enough to translate to a 10-15% reduction in annual energy usage (Torriti et al. 2010). Peak loads are also reduced by demand response programs, with some studies pegging the reduction at approximately 10% (though it should be reiterated that in both cases, these figures are geography-sensitive) (Gyamfi & Krumdieck 2011). Additional savings for customers can manifest over time, as there is evidence that demand response programs lead to lower overall electricity rates (York et al. 2019). These benefits extend even to customers who do not participate in the demand response program (Ibid). Since electricity supplied during periods of peak consumption is expensive and periods of high demand contribute to higher infrastructure and maintenance costs, lowering peak demand creates a generalized cost-lowering effect for the utility that can be passed on to its customer base. Benefits also accrue beyond ratepayer savings through avoided generation, reduced transmission and distribution costs, and other non-fiscal

benefits (e.g., reduced pollution via less frequent use of dirty backup power sources) (Ibid, Gyamfi & Krumdieck 2011). Research has also found that demand response policies are more effective in areas of increased urbanization with renewable energy policies or targets, suggesting that this strategic approach may be well-suited to additional development and implementation in LADWP's service area (Srivastava et al. 2018).

Perhaps the most relevant work in this policy area comes from a 2020 study prepared for the California Energy Commission by the UCLA Luskin Center for Innovation, examining the performance of demand response programs in California. Researchers found that customers reduced energy consumption during a demand response event by an average of 18% (Gattaciecca et al. 2018). However, a number of variations were identified, most notably 1) that consumption reductions were greater (21%) during demand response events on hot days, and 2) that customers with automation devices (e.g. smart thermostats) used significantly less energy during demand response events (47%) than those without them (13%) (Ibid). These results suggest that the current emphasis of some existing program models on harnessing automated devices to reduce consumption during high-demand warm periods is well-placed, though it does not necessarily circumscribe expansion of demand response programs to other applications and times.

8.3.3 Microgrids

Microgrids are small-scale energy grids typically implemented at the scale of critical infrastructure facilities or small communities. Although primarily beneficial for increasing energy reliability, there is evidence that microgrids can reduce energy consumption and produce cost savings in some residential contexts. Unlike many household-level policy strategies, microgrids act as a public good, necessitating action on the part of local institutions and sizeable capital investment — barriers that may be particularly difficult to overcome unassisted for remote, rural communities where microgrid benefits are greatest.

8.3.3.1 Policy Mechanism

Microgrids enable communities or facilities to generate energy locally or on-site and distribute it through a small-scale energy grid. These small-scale grids typically connect to the broader electrical grid, but are capable of disconnecting in the event of power outages, natural disasters, or other disruptions. In addition to these reliability benefits, microgrids may enable utilization of local energy resources that are not conducive to integration into the broader electrical grid for reasons such as scale or unreliability.

From an energy affordability perspective, microgrids are advantageous due to the inherent efficiency benefits they offer. Because microgrids distribute electricity from local generation sources to proximate users, they significantly reduce energy losses occurring during transmission and distribution stages. This increased efficiency, combined with potential economic advantages of local energy resources (e.g., avoided transmission energy losses, lower transmission infrastructure costs), can translate to lower energy costs for microgrid-capable communities.

Because the comparative energy efficiency advantages of microgrids will be greatest for communities located far from traditional grid power sources — where transmission and distribution energy losses will be greatest — they are most impactful in remote, rural areas. However, there is the potential for microgrids to lead to increased household energy bills of installation costs are high and passed on commensurately, or if microgrid tariffs — currently under consideration by the CPUC — are implemented. Reliability benefits are also most readily evident in rural areas, which are often served by a single major transmission line.

8.3.3.2 LADWP Offerings and Relevant Policy Models

LADWP is currently working to implement microgrids to serve several different types of public facilities, but has no programs in place aimed at facilitating or incentivizing adoption of microgrids for residential customers. However, other California utilities do offer models for supporting microgrid interconnection. Southern California Edison, for instance, allows developers to apply for interconnection for four distinct configurations of microgrid (Southern California Edison 2022).[90] In some cases this is accompanied by programs providing fiscal incentives, technical assistance, or other supports for microgrid adoption.

One such program example is Pacific Gas & Electric's Community Microgrid Enablement Program (CMEP), which is aimed at assisting eligible communities to develop microgrids through technical support and some fiscal assistance. Participating communities are provided with evaluative and technical assistance and expertise by CMEP personnel, helping them to identify best-fit solutions. Additionally, CMEP provides up to $3 million in funding per project towards utility equipment required for the microgrid establishment, covering hardware including isolation devices, microgrid controllers, and fault protection devices.

On the more nascent side, the California Public Utilities Commission (CPUC) authorized the creation of the Microgrid Incentive Program in January 2021. This effort, undertaken in response to 2018 legislation directing the CPUC to collaborate with other agencies in developing microgrid-related policies, has a $200 million budget for statewide efforts to deploy microgrids and improve other infrastructure (with a $15 million project cap). The stated goal of the program is to increase energy reliability and clean energy availability, reduce greenhouse gas emissions, and improve public safety in vulnerable communities. However, the minutiae of the program — including eligibility criteria, application processes, and project cost-effectiveness requirements — are still in development. Launch is expected in late 2022.

8.3.3.3 Barriers to Enrollment

Unlike other policy approaches reviewed, microgrid adoption is not a household-level effort, but constitutes a public good necessitating efforts by communal entities (i.e., local governments). Many of the same general barrier types that exist for household-level efforts still manifest in this context, though, including informational and capital barriers. Smaller rural communities where

[90] These configurations include: non-export, isolated operations, momentary parallel operations, and NEM interconnection with eligible paired storage. For more information, see: https://www.sce.com/partners/partnerships/Microgrids-for-Developers

microgrids are most beneficial tend to have fewer resources — both fiscal and in terms of human capital — to call upon, meaning that technical assistance components of existing program models are especially important. However, fiscal assistance components of existing programs are limited in their extent. Although programs like CMEP cover the costs of required utility equipment, no monies or financing options are provided to cover costs incurred by a community for building or upgrading energy generation and storage capacity or necessary local distribution and transmission improvements.

Additionally, microgrid-enabling programs have conditioned eligibility on the presence of "critical facilities" being within the served area. As defined by the CPUC, critical facilities encompass a variety of sectors and infrastructure types related to the provision of crucial services, including communications, emergency services, public health, and water systems. Although understandable as a criterion for prioritizing resources, such requirements circumscribe the ability of communities without such facilities to adopt microgrids for purposes of energy efficiency, reliability, and cost savings.

8.3.3.4 Impacts of Policy Approach

In terms of microgrid performance itself, a number of studies have found that microgrids may be an effective way to reduce energy consumption and create household savings in certain contexts. An important caveat, however, is that microgrids are relatively understudied as an energy-saving tool compared to other policy approaches. Moreover, the impact of a microgrid on community energy savings is dependent on geographic location, climate, and other variables such as prevalence of local renewable energy sources and the implementation of other energy saving policies.

Among studies that have attempted to quantify the energy saving potential of microgrids, several have examined different microgrid configurations (including direct current, multi-home, and peer-to-peer), finding they deliver varying degrees of energy savings. At the high end, a modeling of multi-home microgrids produced estimates of 18% peak demand savings and overall cost savings of 13% (Zhang & Papageorgiou 2013). At the lower end, a study of direct current microgrids estimated resulting household energy savings of 5% when those households also participated in net metering programs (Dastgeer et al. 2019). Other research examining the benefits of accompanying policy approaches have found that energy savings can be accentuated by combining microgrids with demand response policies, home energy management systems, and renewable energy (e.g., home solar panels), which generally produce greater energy savings and/or lower costs (Zunnurain et al. 2018, Inam et al. 2015).

8.3.4 Rooftop Solar & Net Energy Metering

Rooftop solar and accompanying net energy metering programs have been a staple of energy decarbonization efforts for years, both in California and beyond. Under such programs, residential solar adopters are rewarded for investing in home rooftop solar through net energy metering, which enables a utility to track a solar owner's power generation and pay them for electricity their panels generate in excess of their consumption. In addition to these post-adoption

financial incentives, many programs provide aid in various forms to facilitate adoption, helping to overcome the high upfront costs of solar installation (an especially pertinent barrier where low-income households are concerned). The benefits of rooftop solar are substantial in the long-term, producing sizeable monthly bill savings and tens of thousands of dollars in benefits on multi-decadal time scales.

8.3.4.1 Policy Mechanism

Rooftop solar, as the name would imply, entails installing photovoltaic solar panels on residential rooftops. The electricity these panels generate partially or fully offsets household energy use, thereby lowering the amount of energy a utility supplies to a ratepayer and lowering their energy bills. When a household generates solar electricity in excess of their usage, net energy metering (discussed in greater detail below) allows a household to be paid for feeding this electricity into the grid

Existing programs aimed at promoting rooftop solar adoption generally work via one of two mechanisms aimed at promoting adoption: lowering upfront barriers to adoption, or post-adoption cost-saving incentives. Programs in both groups function via the use of fiscal instruments, either effectively lowering the initial installation costs of rooftop solar or providing post-adoption benefits that lower payback periods and improve long-term fiscal outcomes for adopters.

Upfront adoption aids take various forms, including direct funding aid (e.g., the SASH/DAC-SASH and SOMAH programs, cash incentives) or loans for customers seeking to install rooftop solar. Various solar leasing models also exist: customers may lease a solar system from their utility or lease their rooftop to the utility or a third party for solar installation. Similarly, under power purchase agreements, customers pay for energy produced by a utility-owned and installed solar rooftop system. In both cases, the goal is creation of a net fiscal surplus (i.e., the customer pays less to lease the solar system than they would otherwise pay for avoided non-solar energy consumption, or the utility generates solar energy whose value exceeds they cost paid a rooftop-leasing customer).

The primary post-adoption incentive for rooftop solar is via net energy metering (NEM). Under NEM, customers generating electricity from a privately owned rooftop solar system are billed only for the difference between the energy they consume and the amount their system produces, and in some cases may receive a rebate should their system's production exceed consumption for the billing period. NEM thus lowers energy bills for rooftop solar adopters, producing long-term cost savings. Other fiscal instruments such as tax credits can also be provided after a homeowner has installed solar generating capacity.

8.3.4.2 LADWP Offerings and Relevant Policy Models

LADWP has enacted several programs in the rooftop solar space. Like many utilities, it offers NEM to residential solar adopters as a financial incentive, and has also piloted a virtual NEM program focused on incentivizing multifamily housing owners to adopt rooftop solar. It also

offers power purchase agreements to potential commercial-scale solar generators through the Feed-in Tariff (FiT) program, whereby LADWP contracts with a developer to purchase solar energy for up to 20 years. FiT has been supplemented with the FiT+ pilot program, which focuses on new solar installations in particular areas that are accompanied by energy storage capacity.

LADWP also offers a rooftop leasing program for customers, with available monthly payments of $20 to $50. However, this program has been suspended since April 2021 in response to the COVID-19 pandemic. The utility's direct fiscal incentive offering, the Solar Incentive Program, was sunset in at the end of 2018 after it was observed that residential solar adoption rates had risen precipitously with relatively little uptick in applications for rebates, suggesting incentives were not a major driver of new solar installation. LADWP does host a "Solar Marketplace" tool designed to connect customers to third-party solar installers—another common offering from utilities—but does not offer in-house installation programs.

Outside of LADWP, some utilities (e.g., SMUD) still offer direct cash incentives for residential installation. Other program models—including customer-side power purchase agreements (wherein the customer purchases solar energy for a set rate) and solar system leasing—are available in other service areas, but currently have no analog among LADWP's offerings. Also of note is the fact that LADWP is not among the utilities whose customers are eligible for high profile, state-level low-income solar programs (i.e., SASH, DAC-SASH, MASH, and SOMAH). This absence of a low-income solar installation program constitutes a marked gap in programs available to LADWP's low-income customers.

8.3.4.3 Barriers to Enrollment

For homeowners pursuing private installation of rooftop solar on their home using their own funds, enrollment barriers are minimal. Although installation often requires a permitting process and connection to the grid, along with enrollment in the customer's utility NEM program, installers typically assist with these steps (Hobbs et al. 2013). Leasing models can provide additional advantages in lowering barriers, as the utility or third-party leaser handles operations, maintenance, and financing (Ibid). Installation contractors will also typically help customers take advantage of other fiscal incentives, such as utility cash incentives.

Enrollment requirements for programs enabling solar adoption vary, but generally include a few elements. To be eligible homeowners must often show that their home is located within a particular geographic area. For instance, utility programs are only open to customers within their service area (or within the service area of partnering utilities for some third-party programs). Programs focused on low-income households (e.g., SASH) may also require potential participants to provide proof of eligibility for multiple factors, including income and an "affordable housing" designation for their home. Residence of owner is also a common requirement, a stipulation that restricts adoption by owners who rent their property even when they would like to enroll and when the resident can facilitate the process.

On the technical side, programs will commonly require an inspection to ensure that the roof is structurally capable of supporting solar installation and to assess whether factors like shading are

an issue. Though sensible, these inspections still constitute a barrier to adoption, especially for low-income households that may not be readily able to take time away from work or work from home. Homeowners must also supply detailed technical information on their electrical system, which may be challenging without the assistance of a contractor or other expert.

8.3.4.4 Impact of Policy Approaches

The impact of programs promoting rooftop solar has been generally positive, with demonstrable benefits for both upfront and post-adoption measures. At the pre-install stage, programs and policies that remove barriers to installation and provide fiscal incentives for solar adoption have been shown to be effective at increasing residential solar prevalence (Brown et al. 2020, Matisoff & Johnson 2017). Cash incentives for homeowners awarded on a per-Watt basis are especially useful (Ibid). This holds true even for low-income households, which historically have faced greater barriers than more affluent households in residential solar adoption and thus lagged behind (Lukanov & Krieger 2019). Environmental justice-minded efforts, including programs that intentionally work to address information, logistical, and language barriers, are also valuable in promoting and facilitating solar adoption in low-income communities (Ibid).

Some programs, notably California's SASH/DAC-SASH and MASH programs (Single-family Affordable Solar Homes, Disadvantaged Community-SASH, and Multifamily Affordable Solar Housing, respectively), have been particularly effective at installing solar for low-income households (Powers 2017). These programs combined have installed dozens of MW of solar generation capacity since their creation (Hallock & Kinman 2015). The success of the MASH program is especially notable, given that multifamily housing has historically lagged in solar installation and accounts for a significant amount of unrealized rooftop generation potential.

However, despite these successes, outright ownership of residential solar has still been outside the comfort zone of many Californian households. Instead, leasing models have surged in popularity in recent years, accounting for a majority of new residential solar systems (Hobbs et al. 2013, Garskof 2016). Leasing solar systems is an attractive option for homeowners without access to sufficient capital to self-fund system installation and who are unable to access or unaware of fiscal assistance options, or who are reluctant to take on the responsibility of owning and maintaining a solar system (NREL 2009). Lease payments are generally tailored to save a customer 10%-20% of their pre-installation electricity bill (Hobbs et al. 2013). The bulk of the benefits manifest over the long-term, though, as lease costs stay fixed while electricity prices are projected to rise (NREL 2012). Rooftop leasing, in contrast, functions essentially as a fixed income boost for the homeowner for the duration of the lease.

Benefits from NEM after adoption have been a crucial driver of rooftop solar expansion, given the importance of energy bill savings to customers (Fikru 2019, Bassett 2016). NEM programs are also the most impactful financial incentive mechanism, producing greater energy bill savings than alternative compensation models (Darghouth et al. 2011). Multiple studies have also found that—when all cost categories are accounted for—NEM policies create net benefits even to ratepayers that do not adopt rooftop solar (Cook & Cross 1999, Muro & Saha 2016). There are concerns, however, that NEM policies are insufficiently refined, and that more comprehensive design and rate-setting strategies would better maximize the public good of these programs

(Brown et al. 2021, Baker 2019). The “cost-shift” phenomenon has also become an issue of contention, both in California and other areas, where utilities and some stakeholders are critical of the way in which NEM compensation structures have created a situation in which solar adopters (which tend to be more affluent) are effectively subsidized by non-adopters (NRDC 2022). In LADWP’s service area, NREL analysis of NEM programs has found that they are supporting solar energy capacity in non-disadvantaged, White, non-Hispanic, non-renting, and affluent contexts to a disproportionate degree (Romero-Lankao et al. 2022).

The success of these programs in helping residential solar proliferate begs the question as to how impactful these systems are for consumers. A 2019 study found that residential solar adopters in California enjoyed an average actual monthly savings of $159.75 (Fikru 2019). Moreover, it was found that realized energy bill savings consistently exceed savings historically estimated with models (Ibid). Payback periods for customer-owned residential solar in the state are consistently less than ten years, with 20-year net savings measuring tens of thousands of dollars (EnergySage 2022). Savings for leased solar over this same period are estimated by industry at $10,000 to $15,000 (NREL 2012).

8.4 Appendix 4: Additional shutoff and arrearage results from 2017-2020

As noted above, aggregated 2017-2020 arrearage and shutoff information at both customer- and census tract-levels were requested from LADWP and queried by CCSC for the purpose of our analysis. We present high-level findings which inform metric and policy selection in the main text of this chapter, but note additional findings of interest below.

As Figure 47 shows, the median values of tract-level total power bill arrearages were much lower for commercial and industrial customers than for residential customers throughout the four-year period. In all of our analyses, commercial and industrial customers also appeared to be shutoff much less frequently than residential customers.

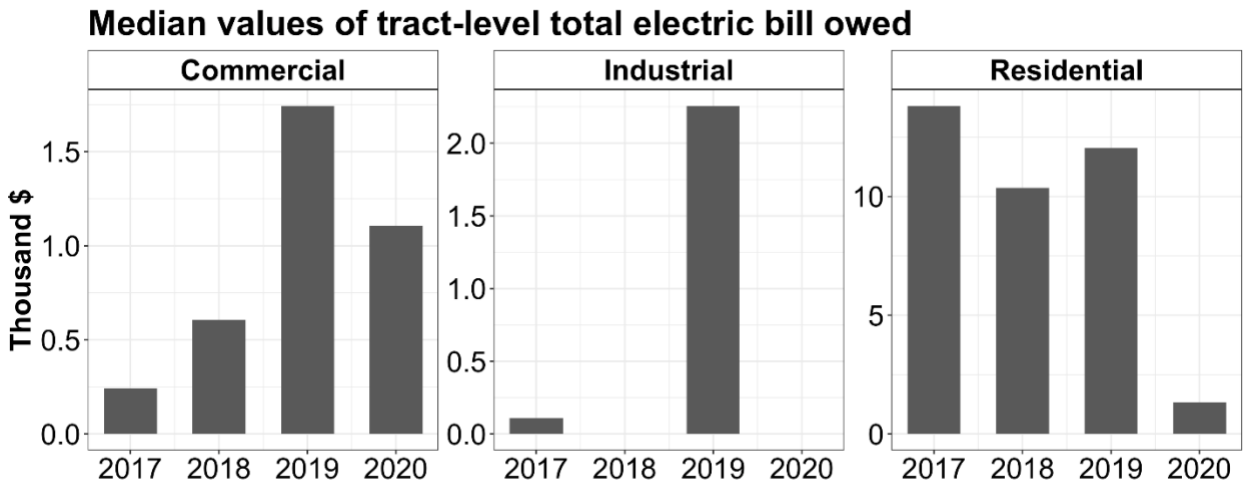


Figure 47. Median Tract-Level Electric Bill Owed Values by Sector, 2017-2020

Overall, as Figure 48 below shows, median values of tract-level arrears are similar between, but slightly higher in non-DAC versus DAC-communities. Both moreover, show fairly steady levels in 2019, with rapid increases in 2020 and 2021, but greatly falling levels in 2022, reflecting the arc of the COVID-19 pandemic. A similar pattern is found in average values of arrears, but with much higher observed levels, in keeping with our previous analyses of very high utility debt levels clustered in few accounts (González et al. 2021).

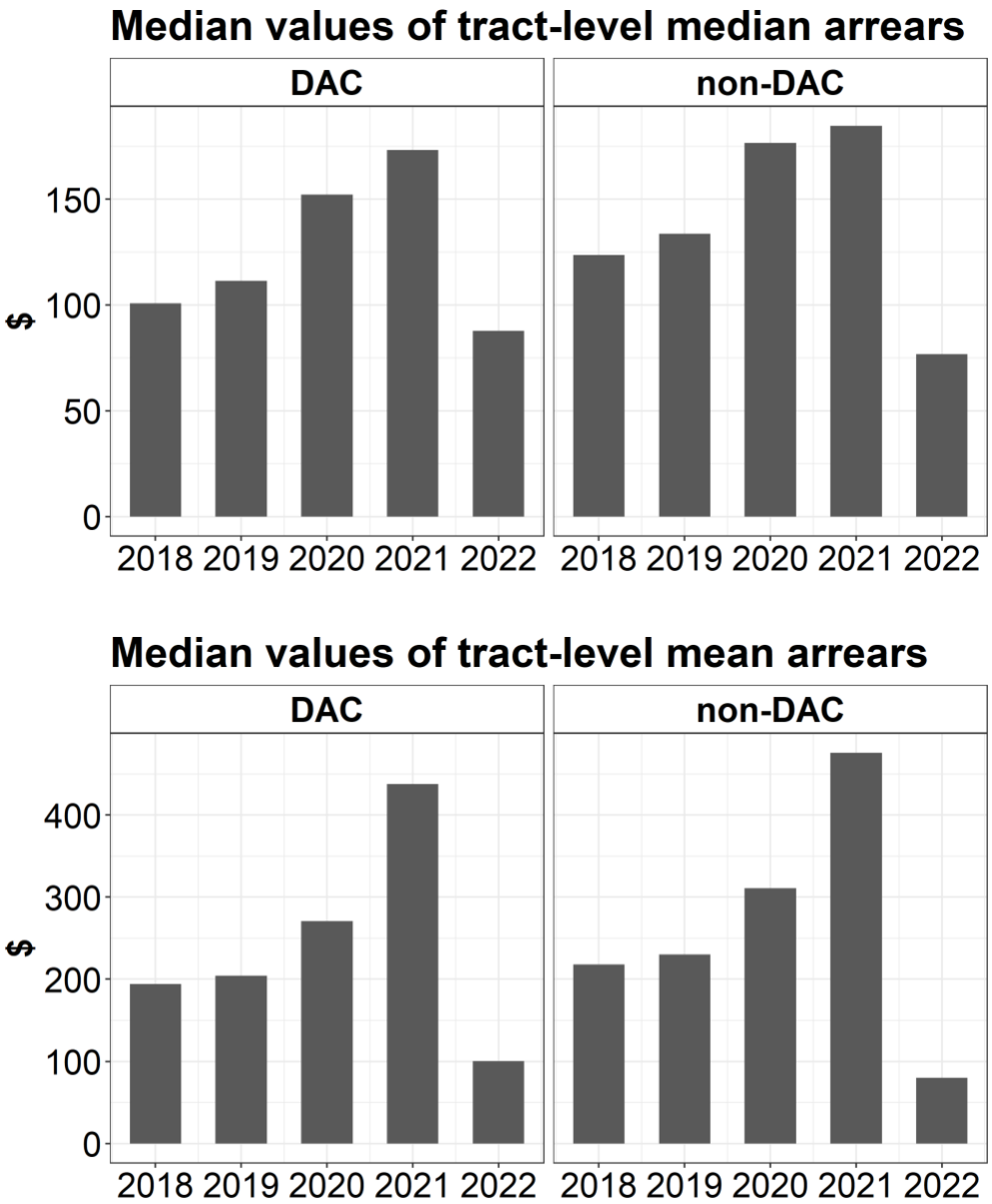


Figure 48. Median Tract-Level Median and Mean Arrears Values by Disadvantaged Status, 2018-2022

As Figure 49 shows, there is a great deal of variability in the duration of shutoffs. While shutoff levels are higher for DAC tracts, the relative breakdown of duration between DAC and non-DAC tracts is similar. About half of shutoffs last a day or less, a substantial proportion last 1-2 days, but long-term shutoffs are rare compared to a relatively high proportion of shutoffs where service is never restored, presumably mostly in cases where the customer has vacated the building without service.

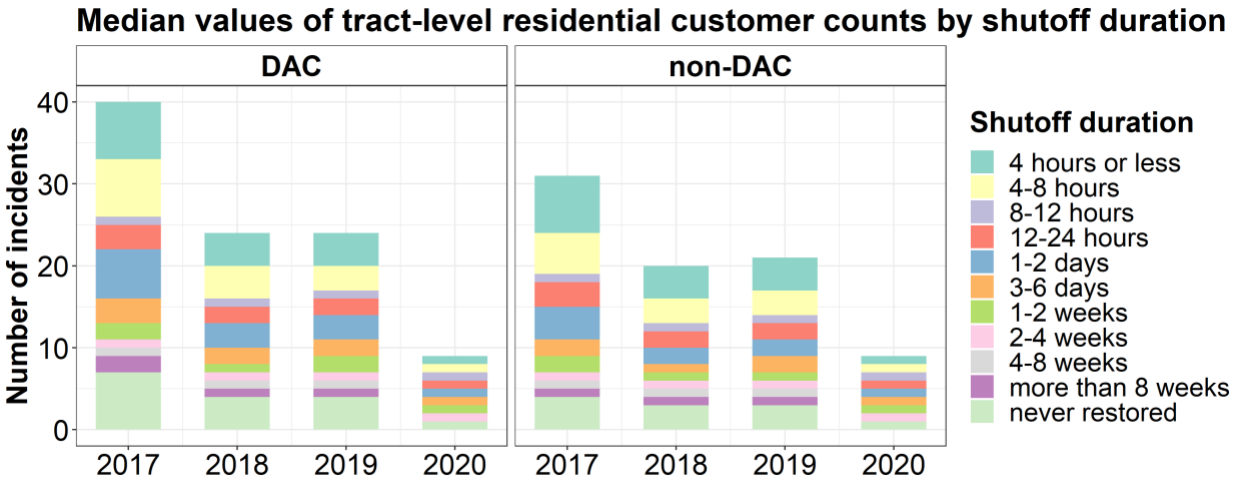


Figure 49. Median Tract-Level Residential Shutoff Incident Counts by Shutoff Duration and Disadvantaged Status, 2017-2020

8.5 Appendix 5: Customer Billing-Data Preparation and Management

8.5.1 California Center for Sustainable Communities (CCSC) Data Preparation

LADWP shared a variety of customer-level billing, revenue, and disconnection data with UCLA for the LA100 Equity Strategies project. There were many steps required in preparing these data for analysis. Most of these steps were completed by the California Center for Sustainable Communities (CCSC), including utilizing their Energy Atlas platform to securely quantify billing data, manage the transfer of data between LADWP and UCLA, and curate, store, geocode, and query the data to support this affordability research. The CCSC has been instrumental in UCLA's data analysis across the various Equity Strategies research categories.

The datasets that were requested from DWP and queried by CCSC for this work included: 1) aggregated arrearage and shutoff information at both customer- and census tract-levels, 2) discount-customer billing data for the period that was shared for this project (2018-2021), 3) electricity rates and discounts for the corresponding period, and 4) census-tract level energy use data for quantifying energy burden and the revenue impact of alternative discount program structures.

While the CCSC completed all of the processing and aggregation for the arrearage and shutoff data (see subsection 8.5 below for more information on the findings from this process), the aggregation and analysis of discount program and revenue data was completed by the authors of this chapter. Some manipulation and assumptions were required to present these data in a useful manner, which are outlined in the subsections below.

8.5.2 Discount Program Bill-Level Details and Assumptions

8.5.2.1 Customer Data Overview — Revenue and Bill Costs

Analyses of the discount programs — including Lifeline, EZ-Save, Life Support, and Physicians Certified Assistance Discount (PCAD) — were completed with a comprehensive list of 4.7 million discount-program customer bills coming from 2018 to 2021. Each bill was represented as a datapoint, and included relevant characteristics including the census tract, discount program, energy use in kWh, bill cost in $, arrears in $, and bill date range. These datapoints were transferred for analysis via comma-separated values (CSV) files. The majority of processing for the data was then completed in the R Studio environment over a remote desktop, which is a part of the protocol implemented by the CCSC for data security and privacy purposes.

Processing of discount program bills began with investigation into revenue and bill subsidy aggregations and averages. In order to differentiate by fiscal year, which was chosen as the relevant time frame to match LADWP's budgeting and reporting processes, bills (typically spanning two months) were prorated to create approximate daily energy use and bill dollar amount. Thus, only days in the year of interest were included in aggregate annual values. This decision relies on the assumption that energy use is consistent throughout each two-month billing cycle.

8.5.2.2 Data Limitations — Revenue and Bill Costs

One challenge in conducting these analyses was that DWP data billing and usage data are stored across databases, which need to be consolidated and cross-referenced in order to fulfill the research-based data requests necessary for this work. Specifically, the billing data that were utilized did not include invoiced bill amounts, but instead the *amount collected* by the Department from each customer from a certain billing cycle — which doesn't include any arrears. These values were useful, and were used, for reporting the true revenue contribution of discount program customers (see Section 4.3.6 for this analysis).

However, because arrears are recorded and stored yearly (as opposed to bi-monthly), it was difficult to map the total invoiced value of a bill from any billing cycle — and therefore to understand the complete revenue and customer impacts of these bills.

8.5.2.3 Theoretical Bill Value (Invoice) Calculation

One option to address this challenge when investigating discount program costs/benefits is to assume that arrears are negligible and use the customer revenue as the bill value. However, this strategy is not necessarily rigorous, is not suited for some purposes of revenue analysis, and creates challenges for quantifying the average percentage discount offered by DWP's programs — as well as for toggling this discount to assess other structures. The alternative to this strategy is to calculate the theoretical bill cost. This can be accomplished using the total kWh consumed for that billing cycle multiplied by the kWh rate, plus the bimonthly base charges, from the billing time period. This is the process that was undertaken for the majority of discount-program-related tables and graphics included in this chapter.

There are three underlying categorizations that were required to accurately generate total bill amounts. These were: the date of the bill, so that appropriate tariff and adders could be utilized; the climate zone, which determines the usage at which a bill moves into a higher bill tier; and what tier the usage would fall under, which determines the per kWh and power access charge applied to that bill. Bills were first assigned a climate zone by matching the census tract to a zip code and matching that zip code to a climate zone via a publicly available CSV file from LADWP. Using that climate zone value (either Zone 1 or Zone 2), bills were assigned a tier value, reflecting the three-tier structure used for electricity bills. Lastly, using shared data on past tariff and adder values from LADWP, which was uploaded into R Studio, bills were assigned a tariff date and appropriate per kWh and power access charge values based off of that date.

This process resulted in a theoretical total value for each bill, not including any discounts. These values could be used to identify the percentage discount offered by EZ-Save or Lifeline (see Section 5.3.3.2), as well as to calculate theoretical costs of alternative or increased subsidies.

8.5.2.4 Assumptions — Revenue and Bill Discounts

It is important to note that all of the revenue calculations presented in Sections 4.3.6 and 4.3.7 are only representative of the revenue and subsidies offered by *Power System* payments. This

means that they do not include any financial assistance provided by LADWP's water rates discount (which is funded by Water System surcharges) or the exemption from the Utility Users Tax (which is funded by the City). Thus, the total bill discounts seen by customers — as well as LADWP's and the City's financial assistance — are on the whole larger than what is presented here.

8.6 Appendix 6: 4-Question Indicator Metric

One metric, known as the 4-question indicator system, is used in affordability literature and touches upon thermal comfort, energy insecurity, and crisis relief as a composite metric. While it did not fit neatly into any one of the metric categories described above, it merits further discussion in this appendix due to its real-world applications and cross-cutting nature.

8.6.1 4-Question Indicator System

The 4 Question Indicator System has been used in prior studies related to energy insecurity and health.[91] It is based on a four-question survey which asks if during the past 12 months a household: 1) received a shut-off notice; 2) used a cooking stove for heat; 3) went without heat due to inability to pay; 4) experienced an interruption in utility service due to non-payment. Based on responses to the 4 questions, households are categorized as energy secure (no to all), moderately energy insecure (yes to a shut-off threat), or extremely insecure (yes to foregoing heat, using a stove for heat, or experiencing a shut-off).

Example Adapted Survey Question: "During the past 12 months, has your household: 1) received a shut-off notice; 2) went without air conditioning due to lack of access 3) went without cooling due to inability to pay; 4) experienced an interruption in utility service due to non-payment.

8.6.1.1 Data Sources & Baseline for 4-Question Metric

The Children's HealthWatch (formerly the Children's Sentinel Nutrition Assessment Program) currently uses this metric in the "energy security" section of their annual survey aimed as assessing child health. This survey has been issued every year since 1998. The results for this survey are not publicly available and thus cannot be used to establish a baseline. Additionally, this data is not likely to be representative of LADWP customers, in part because the survey emphasizes heat as a utility tradeoff, whereas in Los Angeles the tradeoff is often cooling-related. Additionally, the survey focuses on households with children, which may not be representative of Los Angeles. Finally, the survey is conducted on the national scale, which may reflect different tradeoffs than those experienced in Los Angeles.

8.6.1.2 Target for 4-Question Metric

A relevant target should be based on baseline data. However, without baseline data, a proposed target could be 0% of households experience extreme energy insecurity and less than 5% of households experiencing moderate energy insecurity.

[91] Hernandez and Siegel, 2019. Cook et al. 2008.

8.6.1.3 Benefits of 4-Question Metric

One benefit of this indicator system is that it has been validated in large studies — between 2001 and 2006, it was included in Children's HealthWatch, which assessed 9,721 children who attended emergency rooms and primary care clinics throughout the United States. These series of questions are perhaps the most common way energy insecurity is measured. However, the definition of energy in security in studies that use this indicator varies slightly from the definition used in this report. Additionally, in order to be relevant to the LA area, the questions would need to be adjusted to fit the climate (to address heat events rather than cold).

Another benefit to this indicator is that it identifies households not only experiencing acute energy hardship, but also those on the brink of experiencing energy hardship. This metric would indicate the proportion of households that are in need of assistance before they are subject to unsafe conditions.

8.6.1.4 Drawbacks of 4-Question Metric

This metric does not really measure "energy insecurity" as defined as the impact of the utility bill on constraining ability to pay other household bills and vice versa. None of the questions relate to bills other than the utility bill. While these questions are important in gauging a household's ability to pay the utility bill, it does not gauge whether to pay that bill the household is forgoing other expenses. For example, a household could answer no to all the questions above but be behind on rent payments in order to pay utility bills. The metrics captured by this mechanism are addressed by other metrics, such as information on disconnection, or metrics on thermal comfort, as discussed above.

8.7 Appendix 7: Information on Originally-Planned, LCI-Led Survey

In the initial phases of the LA100 ES project in 2021, UCLA LCI planned to deploy a 21–22-minute (~50 question maximum out of survey bank of 150+ questions) survey and secure 2,500 LADWP customer responses, which are socioeconomically representative of the population of the City of Los Angeles. Accordingly, LCI developed a bank of 290 survey questions as well as a shorter 50 question instrument, in English and Spanish. We also vetted 4 survey firms for potential deployment.

This survey was envisioned to cover topics key to understanding energy burden and insecurity across the service territory, with a focus on topics that are not (able to be) covered from other existing data sources. However, as articulated in Section 2.2. of this chapter, in conjunction with LADWP and stakeholders, we ultimately determined that a new survey-centered approach had limited utility and feasibility at this time, as well as considerable budget tradeoffs, and so discarded this approach.

Despite not deploying the survey in full, it still had several uses. First, some of the questions were used NREL-led listening session focus groups. Second, the survey question bank and instrument was delivered to LADWP for further use in ongoing customer outreach efforts and potential future surveys, including informing the Customer Connections survey. Moreover, development of the survey question bank and instrument informed our discovery and analyses of other primary data sources. Several key themes from the LCI Survey which were unanswered by other sources, including on building and transport electrification expenditures, may be worth returning to in the future stages of LA100 ES.

9 References

Abcarian v. Levine, 972 F.3d 1019 (9th Cir. 2020)

Abcarian v. Levine, 972 F.3d 1019 (9th Cir. 2020)

Alberini, Anna, Charles Towe. 2015. "Information v. energy efficiency incentives: Evidence from residential electricity consumption in Maryland." *Energy Economics* 52(S1), S30-S40. DOI: https://doi.org/10.1016/j.eneco.2015.08.013.

Alhamayani, Abdulelah D., Qiancheng Sun, Kevin P. Hallinan. 2021. "Estimating Smart Wi-Fi Thermostat-Enabled Thermal Comfort Control Savings for Any Residence." *Clean Technologies* 3(4), 743-760. https://doi.org/10.3390/cleantechnol3040044.

American Public Power Association. 2022. "2022 Public Power Statistical Report."

Arizona Public Service. 2021. "Rate Rider E-3 - Residential Service - Energy Support Program." https://www.aps.com/-/media/APS/APSCOM-PDFs/Utility/Regulatory-and-Legal/Regulatory-Plan-Details-Tariffs/Residential/Limited-Income-Plans/e3_ResidentialEnergySupportProgram.ashx?la=en.

Bachenberg, Abigail, Anyssa Ball, Ruqiya Egal, Nat Feikes, Liam Ferris, Bliss Han, Andrew Javens, Maya Mazumder, Christy Mo, and Matthew Park. 2020. "Percentage of Income Payment Plan (PIPP) Report." George Wiley Center & Brown University. https://www.rilegislature.gov/Special/comdoc/House%20Finance/05-13-2021--H5809--George%20Wiley%20Center.pdf.

Baer, Walter S., Edmund Edelman, James Ingram III, and Sergej Mahnovski. 2001. *Governance in a Changing Market: The Los Angeles Department of Water and Power*. Rand.

Baerenklau, K.A., K.A. Schwabe, A. Dinar. 2014. "The residential water demand effect of increasing block rate water budgets." *Land Economics* 90(4), 683-699.

Baker, Shalanda H. 2019. "The Energy Justice Stakes Embedded in the Net Energy Metering Policy Debates." *Beyond Zero-Sum Environmentalism (Krakoff et al., eds., Environmental Law Institute 2019)*. Northeastern Public Law and Theory Faculty Research Paper Series No. 350-2019. Accessible at https://papers.ssrn.com/sol3/Papers.cfm?abstract_id=3400405.

Barreca, Alan, R. Jisung Park, Paul Stainier. 2022. "High temperatures and electricity disconnections for low-income homes in California." *Nature Energy* 7, 1052-1064. https://doi.org/10.1038/s41560-022-01134-2.

Bassett, Luke. 2016. "Net Energy Metering: Growth and Accountability in the Distributed Solar Market." *Center for American Progress*. Accessed Feb 10, 2022 at https://www.americanprogress.org/article/net-energy-metering/.

Bednar, D.J., T.G. Reames, G.A. Keoleian. 2017. "The intersection of energy and justice: Modeling the spatial, racial/ethnic and socioeconomic patterns of urban residential heating consumption and efficiency in Detroit, Michigan." *Energy and Buildings* 143, 25-34.

Beecher, Janice A. 2012. "The ironic economics and equity of water budget rates." *Journal – American Water Works Association* 104, no. 2: E73-E81.

Bhattacharya, J., T. DeLeire, S. Haider, J. Currie. 2003. "Heat or eat? Cold-weather shocks and nutrition in poor American families." *American Journal of Public Health*, 93(7), 1149-1154.

Bird, S., & D. Hernández. 2012. "Policy options for the split incentive: Increasing energy efficiency for low-income renters." *Energy policy*, 48, 506–514. https://doi.org/10.1016/j.enpol.2012.05.053.

Bloom, Richard, Eduardo Garcia, Robert Rivas, María Elena Durazo, Robert M. Hertzberg, Henry I. Stern. 2022. "AB-2597 Dwelling unit standards: safe indoor air temperatures." https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202120220AB2597.

Bradshaw, Jonathan L., Elie Bou-Zeid, Robert H. Harris. 2016. "Greenhouse gas mitigation benefits and cost-effectiveness of weatherization treatments for low-income, American, urban housing stocks." *Energy and Buildings* 128, 911-920. DOI: https://doi.org/10.1016/j.enbuild.2016.07.020.

Brown, Andrew. 2022. "Eversource, UI will cut electric rates for some, but not until 2024." Connecticut Mirror. https://www.ctpublic.org/news/2022-11-22/eversource-ui-will-cut-electric-rates-for-some-but-not-until-2024

Brown, Marilyn A., Anmol Soni, Melissa V. Lapsa, Katie Southworth. 2020. "Low-Income Energy Affordability: Conclusions from a Literature Review." *Oak Ridge National Laboratory*. ORNL/TM-2019/1150. Accessible at https://info.ornl.gov/sites/publications/Files/Pub124723.pdf.

Brown, Marilyn A., Jeffrey Hubbs, Vincent Xinyi Gu, Min-Kyeong Cha. 2021. "Rooftop solar for all: Closing the gap between the technically possible and the achievable." *Energy Research & Social Science* 80, 102203. DOI: https://doi.org/10.1016/j.erss.2021.102203.

Burbank Water and Power and Power. 2022. "Burbank Utility Service Subsidy (BUSS) Program." https://burbankwaterandpower.com/images/administrative/downloads/BWP_BUSS_Application_v06-29-22.pdf.

California Alternative Energy and Advanced Transportation Financing Authority & California Hub for Energy Efficiency Financing. 2022. GoGreen Home Energy Financing Program: Monthly Data Summary through February 28, 2022. Office of the California State Treasurer. Accessible at https://www.treasurer.ca.gov/caeatfa/cheef/monthlyreel/2022/202202.pdf.

California Department of Community Service & Development. N.d. "Low Income Home Energy Assistance Program." *CA.gov.* Accessed 7 February 2022.

California Department of Community Services & Development. 2020. "Low-Income Weatherization Program (LIWP) Impact Report." Accessible at https://www.csd.ca.gov/Shared%20Documents/LIWP-Impact-Report-November-2020.pdf.

California Energy Commission. 2020. "California Energy Commission approves first community solar proposal under 2019 Energy Code." *CEC*. Accessed Apr 11, 2022 at https://www.energy.ca.gov/news/2020-02/california-energy-commission-approves-first-community-solar-proposal-under-2019.

California Low Income Oversight Board. 2021. "Percentage of Income Payment Plan (PIPP) Pilot - Quarterly Meeting Presentation." https://liob.cpuc.ca.gov/wp-content/uploads/sites/14/2021/12/Item-7-PIPP-Pilot-Presentation-V2.pdf.

California Public Utilities Commission (n.d.). "Solar in Disadvantaged Communities." *CPUC*. Accessed Mar 27, 2022 at https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/solar-in-disadvantaged-communities.

California Tax Foundation. 2021. "Local Tax Trends in California: A Survey of Ballot Measure Elections From 2010-2020."

Cherryland Electric Cooperative. 2018. "Cherryland Pilots Low Income Solar Program." Accessed Apr 11, 2022 at https://www.cherrylandelectric.coop/2018/02/cherryland-pilots-low-income-solar-program/.

Chuang, Yating, Magali A. Delmas, Stephanie Pincetl. 2022. "Are Residential Energy Efficiency Upgrades Effective? An Empirical Analysis in Southern California." *Journal of the Association of Environmental and Resource Economists* 9(4). DOI: https://doi.org/10.7910/DVN/OZTRXJ.

Citizens for Fair Reu Rates v. City of Redding, 182 Cal. Rptr. 3d 722 (Cal. Ct. App. 2015).

City of Los Angeles. 2019. "Exploring 2018 Residential Water and Power Bills."

City of Los Angles. N.d. "The Office of Public Accountability (OPA)." Accessed 7 February 2022.

Cluett, Rachel, Jennifer Amann, Sodavy Ou. 2016. "Building Better Energy Efficiency Programs for Low-Income Households." *American Council for an Energy Efficient Economy*. Accessible at https://www.southeastsdn.org/wp-content/uploads/2019/11/Building-Better-Efficiency-Programs-for-Low-Income-Households.pdf.

Cohen, Malia M., Second District, San Francisco, Antonio Vazquez, Mike Schaefer, Fourth District, San Diego, and Betty T. Yee. 2018. "California Property Tax - An Overview." www.boe.ca.gov/members/board.htm.

Cong, Shuchen, Destenie Nock, Yueming Lucy Qiu, Bo Xing. 2022. "Unveiling hidden energy poverty using the energy equity gap". *Nature Communications* 13, 2456. https://doi.org/10.1038/s41467-022-30146-5.

Connecticut Public Utilities Regulatory Authority. 2022. "Pura Investigation into Distribution System Planning of the Electric Distribution Companies-New Rate Designs and Rates Review."

Cook, C. and J. Cross. 1999. "A case study: The economic cost of net metering in Maryland: Who bears the economic burden?" *Solar 99 Conference, Portland, ME, 6/12/1999-6/16/1999.* Accessible at https://www.osti.gov/biblio/20050744.

Cook, J. T., D.A. Frank, P.H. Casey, R. Rose-Jacobs, M.M. Black, M. Chilton, S.E. de Cuba, D. Appugliese, S. Coleman, T. Heeren, C. Berkowitz, D.B. Cutts. 2008. "A brief indicator of household energy security: associations with food security, child health, and child development in US infants and toddlers." *Pediatrics*, *122*(4), e867-e875. https://doi.org/10.1542/peds.2008-0286.

CPUC. 2021. "CPUC Acts to Ensure Essential Utility Services for Customers at Risk of Disconnections." *California Public Utilities Commission.*

CPUC. 2022. "Joint IOU Report of the CARE< FERA and ESA Programs." *California Public Utilities Commission.* https://liob.cpuc.ca.gov/wp-content/uploads/sites/14/2022/03/Item-09-IOU-CARE-ESA-Status-Reports_2.pdf

Danielson, Caroline, Patricia Malagon, Sarah Bohn. 2022. "Poverty in California." *Public Policy Institute of California*. https://www.ppic.org/publication/poverty-in-california/.

Darghouth, Naïm R., Galen Barbose, Ryan Wiser. 2011. "The impact of rate design and net metering on the bill savings from distributed PV for residential customers in California." *Energy Policy* 39(9), 5243-5253. DOI: https://doi.org/10.1016/j.enpol.2011.05.040.

Dastgeer, Faizan, Hassan Erteza Gelani, Hafiz Muhammad Anees, Zahir Javed Paracha, Akhtar Kalam. 2019. "Analyses of efficiency/energy-savings of DC power distribution systems/microgrids: Past, present and future." *International Journal of Electrical Power & Energy Systems* 104, 89-100. DOI: https://doi.org/10.1016/j.ijepes.2018.06.057.

Datta, Souvik, Sumeet Gulati. 2014. "Utility rebates for ENERGY STAR appliances: Are they effective?" *Journal of Environmental Economics and Management* 68(3), 480-506. DOI: https://doi.org/10.1016/j.jeem.2014.09.003.

DDOE. 2021. "Energy tips for institutional and government buildings." https://doee.dc.gov/service/energy-tips-institutional-and-government-buildings.

De la Rue du Can, Stephane, Greg Leventis, Amol Phadke, Anand Gopal. 2014. "Design of incentive programs for accelerating penetration of energy-efficient appliances." *Energy Policy* 72, 56-66. DOI: https://doi.org/10.1016/j.enpol.2014.04.035.

De Marco, Heidi. 2022. "Los Angeles to launch 'extreme heat campaign' Friday, says city's first heat officer." *Los Angeles Times*. https://www.latimes.com/environment/story/2022-06-30/los-angeles-first-heat-officer-climate-change-saving-lives.

Dennis, Keith. 2015. "Environmentally Beneficial Electrification: Electricity as the End-Use Option." *The Electricity Journal* 28(9), 100-112. DOI: https://doi.org/10.1016/j.tej.2015.09.019.

Department of Energy & Environment. 2022. "Renewable Portfolio Standard Expansion Amendment Act of 2016 & Solar for All Annual Report." Accessible at https://doee.dc.gov/sites/default/files/dc/sites/ddoe/service_content/attachments/FY%202020%20SFA%20Annual%20Report.pdf.

DeShazo, J.R., Lolly Lim, Gregory Pierce. 2021. "Adapting to Extreme Heat in California: Assessing Gaps in State-Level Policies and Funding Opportunities." *UCLA Luskin Center for Innovation*. https://innovation.luskin.ucla.edu/wp-content/uploads/2021/10/Adapting-to-Extreme-Heat-in-California.pdf.

Djongyang, Noël, René Tchinda, Donatien Njomo. 2010. "Thermal comfort: A review paper." *Renewable and Sustainable Energy Reviews*, Volume 14, Issue 9, Pages 2626-2640, ISSN 1364-0321, https://doi.org/10.1016/j.rser.2010.07.040.

DNV Energy Insights USA, Inc. 2022. "Impact Evaluation of Residential HVAC Measures Residential Sector – Program Year 2020." *California Public Utilities Commission.*

Dobos, Hillary, Emily Artale. 2017. "Insights from the Colorado Energy Office Low-Income Community Solar Demonstration Project." *Colorado Energy Office*. Accessible at https://lpdd.org/wp-content/uploads/2020/12/Insights-from-the-CEO-Low-Income-Community-Solar-Demonstration-Project.pdf.

Eck v. City of Los Angeles, 41 Cal.App.5th 141, 253 Cal. Rptr. 3d 883 (Cal. Ct. App. 2019)

ENERGY STAR. 2022. "Energy Efficient Products for Consumers." Accessed Feb 28, 2022 at https://www.energystar.gov/products.

ENERGY STAR. N.d. "ENERGY STAR Impacts." Accessed Feb 28, 2022 at https://www.energystar.gov/about/origins_mission/impacts.

EnergySage. 2022. "California solar panels: local pricing and installation data." Accessed Feb 9, 2022 at https://www.energysage.com/solar-panels/ca/.

Evergreen Economics. 2016. "Needs Assessment for the Energy Savings Assistance and the California Alternate Rates for Energy Programs." *California Public Utilities Commission*. CALMAC ID: SCE0396.01. https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/energy-efficiency/iqap/2016-linafrvol1.pdf.

Eversource. 2023. "2023 Summary of Western Massachusetts Electric Rates."

Fikru, Mahelet G. 2019. "Estimated electricity bill savings for residential solar photovoltaic system owners: Are they accurate enough?" *Applied Energy* 253, 113501. DOI: https://doi.org/10.1016/j.apenergy.2019.113501.

Fournier, Eric Daniel, Robert Cudd, Felicia Federico, and Stephanie Pincetl. 2020. "On Energy Sufficiency and the Need for New Policies to Combat Growing Inequities in the Residential Energy Sector." *Elementa: Science of the Anthropocene* 8 (January): 24. https://doi.org/10.1525/elementa.419.
Galperin, Ron. 2020. "City Utility Discount Programs." *LA City Controller*.

Garcetti, Eric. 2015. "Executive Directive No. 7 – Sustainable City pLAn." *City of Los Angeles.*

Garcetti, Eric. 2020. "Executive Directive No. 25 – L.A.'s Green New Deal: Leading by Example." *City of Los Angeles.*

Garskof, Josh. 2016. "The Real Cost of Leasing vs. Buying Solar Panels." Consumer Reports. https://www.consumerreports.org/energy-saving/real-cost-of-leasing-vs-buying-solar-panels/.

Gattaciecca, Julien, Kelly Trumbull, J.R. DeShazo. 2019. "Lessons Learned From FiT150 and Recommendations for Program Expansion." UCLA Luskin Center for Innovation, Regents of the University of California Los Angeles. Accessible at https://innovation.luskin.ucla.edu/wp-content/uploads/2019/10/Lessons_Learned_from_FiT150.pdf.

Gattaciecca, Julien, Kelly Trumbull, Samuel Krumholz, Kelley McKanna, and J. R. DeShazo. 2020. University of California, Los Angeles. 2020. Identifying Effective Demand Response Program Designs for Residential Customers. California Energy Commission. *University of California, Los Angeles*. Publication Number: CEC-500-2020-072.

Geller, Howard, Phillip Harrington, Arthur H. Rosenfeld, Satoshi Tanishima, Fridtjof Unander. 2006. "Policies for increasing energy efficiency: Thirty years of experience in OECD countries." *Energy Policy* 34(5), 556-573. DOI: https://doi.org/10.1016/j.enpol.2005.11.010.

Gillingham, Kenneth T., Pei Huang, Colby Buehler, Jordan Peccia, Drew R. Gentner. 2021. "The climate and health benefits from intensive building energy efficiency improvements." *Science Advances* 7(34). DOI: https://doi.org/10.1126/sciadv.abg0947.

González, Silvia R., Paul M. Ong, Gregory Pierce, and Ariana Hernandez. 2021. "Keeping the Lights and Water on: Covid-19 and Utility Debt in Los Angeles' Communities of Color." UCLA Centers for Neighorhood Knowledge and Luskin Center for Innovation.

Graham v. Sacramento Mun. Util. Dist., C083712 (Cal. Ct. App. Dec. 27, 2018)

Greenlining. 2019. "Equitable Building Electrification: A Framework for Powering Resilient Communities."

Guerra, Fernando J., Brianne Gilbert, Mariya Vizireanu, Alex Kempler. 2019. "DWP Report: 2019 Los Angeles Public Opinion Survey Report." *Thomas and Dorothy Leavey Center for the Study of Los Angeles*. Loyola Marymount University, Los Angeles, California.

Guerra, Fernando J., Brianne Gilbert, Max Dunsker, Mariya Vizireanu. 2020. "LADWP Data Brief: 2020 Los Angeles Public Opinion Survey Report." *Thomas and Dorothy Leavey Center for the Study of Los Angeles*. Loyola Marymount University, Los Angeles, California.

Gyamfi, Samuel, Susan Krumdieck. 2011. "Price, environment and security: Exploring multi-modal motivation in voluntary residential peak demand response." *Energy Policy* 39(5), 2993-3004. DOI: https://doi.org/10.1016/j.enpol.2011.03.012.

Hahnel, Carrie, Arun Ramanathan, Jacopo Bassetto, Andrea Cerrato, Maria Echaveste, Christopher Edley, Bill Fulton, et al. 2022. "Unjust Legacy How Proposition 13 Has Contributed to Intergenerational, Economic, and Racial Inequities in Schools and Communities."

Hallock, Lindsey, Michelle Kinman. 2015. "California's Solar Success Story." *Environment California Research & Policy Center and Frontier Group*. Accessible at https://environmentcalifornia.org/sites/environment/files/reports/CA_Solar_Success_scrn_FINAL_7-7-2015.pdf.

Hanna, Thomas M., Johanna Bozuwa, and Raj Rao. 2022. "The Power of Community Utilities." The Democracy Collaborative & the Climate and Community Project.

Harmon, K.M., M. Mukherjee, D. Atwater. 2021. "Evaluating water savings from budget-based tiered rates in Orange County, California." *Water Economics and Policy* 7(02), 1-32.

Healy, Jon. 2022. "How to get a low-cost A/C unit and other help from LADWP to beat the next heat wave." *Los Angeles Times*. https://www.latimes.com/environment/story/2022-09-16/dwp-rebates-for-air-conditioners-how-to-apply.

Heeter, Jenny, Kaifeng Xu, Gabriel Chan. 2021. "Sharing the Sun: Community Solar Deployment, Subscription Savings, and Energy Burden Reduction." *NREL* (NREL/PR-6A20-80246). Accessible at https://www.nrel.gov/docs/fy21osti/80246.pdf.

Hennessy, Michael, and Dennis M. Keane. 1989. "Lifeline Rates in California: Pricing Electricity to Attain Social Goals." *Evaluation Review* 13 (2): 123–40. https://doi.org/10.1177/0193841X8901300202.

Hernández, Diana, Yumiko Aratani, Yang Jiang. 2014. "Energy insecurity among families with children." *National Center for Children in Poverty, Columbia University*. https://doi.org/10.7916/D89G5JX8.

Hernández, Diana. 2013. "Energy insecurity: a framework for understanding energy, the built environment, and health among vulnerable populations in the context of climate change." *American Journal of Public Health*, 103(4), e32-e34. https://doi.org/10.2105%2FAJPH.2012.301179.

Hobbs, Andrew, Elinor Benami, Uday Varadarajan, Brendan Pierpont. 2013. "Improving Solar Policy: Lessons from the solar leasing boom in California." Climate Policy Initiative. https://www.climatepolicyinitiative.org/publication/improving-solar-policy-lessons-from-the-solar-leasing-boom-in-california/.

Hoffman, Adam W., John D. Bakker, Ryan T. Dunn Colantuono, Highsmith & Whatley, Benjamin P. Fay Jarvis, Fay & Gibson, Daniel S. Hentschke, et al. 2021. "Propositions 26 and 218 Implementation Guide." League of California Cities.

Hoffman, Jeremy S., Vivek Shandas, Nicholas Pendleton (2020). The Effects of Historical Housing Policies on Resident Exposure to Intra-Urban Heat: A Study of 108 US Urban Areas. *Climate* 8(1), 12. DOI: https://doi.org/10.3390/cli8010012.

Homsy, George C. 2018. "Unlikely Pioneers: Creative Climate Change Policymaking in Smaller U.S. Cities." *Journal of Environmental Studies and Sciences* 8 (2): 121–31. https://doi.org/10.1007/s13412-018-0483-8.

Household Energy Use in California. *EIA*. Accessible at https://www.eia.gov/consumption/residential/reports/2009/state_briefs/pdf/ca.pdf.

Howat, John, Karen Lusson, and Olivia Wein. 2020. "Utility Bill Affordability in Colorado Reforms to Protect Low-Income Consumers from Increasing Rates." National Consumer Law Center. https://www2.ed.gov/policy/highered/reg/hearulemaking/2021/codoraholdharmreportfin.pdf

Humphreville v. Ciy of Los Angeles. 2020. Los Angeles County Super. Ct. No. BS174384.

Illinois Legal Aid Online. 2018. "Setting up Utilities in the Percentage of Income Payment Plan." 2018. https://www.illinoislegalaid.org/legal-information/setting-utilities-percentage-income-payment-plan.

Inam, Wardah, Daniel DeWitt Strawser, Khurram K. Afridi, Rajeev J. Ram, David J. Perreault. 2015. "Architecture and System Analysis of Microgrids with Peer-to-Peer Electricity Sharing to Create a Marketplace which Enables Energy Access." *2015 9th International Conference on Power Electronics and ECCE Asia* (ICPE 2015-ECCE-Asia).

Koh, Joseph. 2021. "Fuse Corp Fellowship: Year 1 Discussion." *LADWP*.

KPMG. 2021. "DEPARTMENT OF WATER AND POWER OF THE CITY OF LOS ANGELES POWER SYSTEM: Financial Statements and Required Supplementary Information, June 30, 2021 and 2020." https://www.ladwp.com/cs/idcplg?IdcService=GET_FILE&dDocName=OPLADWPCCB786916&RevisionSelectionMethod=LatestReleased.

LADWP Data Brief. 2021. "Los Angeles Public Opinion Survey." Thomas and Dorothy Leavey Center for the Study of Los Angeles, Loyola Marymount University, Los Angeles, CA.

LADWP News. 2020. "LADWP Customers Save Energy and Money with Smart Thermostats." *LADWP*. https://www.ladwpnews.com/ladwp-customers-save-energy-and-money-with-smart-thermostats/#:~:text=As%20an%20incentive%2C%20LADWP%20provides,the%20end%20of%20the%20season.

LADWP News. 2021. "Los Angeles City Council Approves Landmark Initiative." *LADWP*. https://www.ladwpnews.com/100-percent-carbon-neutral-power-by-035-los-angeles-city-council-approves-landmark-initiative/

LADWP News. 2022. "LA Board of Water & Power Commissioners Approve Policy to End Water and Power Shutoffs for Low-Income Residential Customers Unable to Pay their Utility Bill." *LADWP*. https://www.ladwpnews.com/la-board-of-water-power-commissioners-approve-policy-to-end-water-and-power-shutoffs-for-low-income-residential-customers-unable-to-pay-their-utility-bill/

LADWP. 2013. "Renewables Portfolio Standard Policy and Enforcement Program."

LADWP. 2015. "Putting Customers First: Water & Power Rates Request 2016-2020 Frequently Asked Questions."

LADWP. 2020. "FY 2020-21 Prelim Budget." http://clkrep.lacity.org/onlinedocs/2020/20-0390_misc_04-02-2020.0001.pdf

LADWP. 2021. "2020-21 Facts & Figures."

LADWP. 2022. "Power Strategic Long-Term Resource Plan."

League of California Cities. 2019. "Propositions 26 and 218 Implementation Guide."

LIHEAP Clearinghouse. 2016. "State PBF/USF History, Legislation, Implementation - New Jersey." 2016. https://liheapch.acf.hhs.gov/dereg/states/njersey.htm.

Los Angeles CAO. 2022. "Appendix A: City of Los Angeles Information Statement, as of September 22, 2022." https://cao.lacity.org/debt/Appendix%20A%2009-22-2022.pdf

Los Angeles Office of Finance. N.d. "Lifeline – Utility Users Tax Exemption for Seniors and Individuals with Disabilities." Accessed January 2023. https://finance.lacity.org/tax-education/tax-exemptions/lifeline-utility-users-tax-exemption-seniors-and-individuals

Los Angeles Office of the City Clerk. 2012. "City of Los Angeles Initiative, Referendum & Recall Petition Handbook."

Lukanov, Boris R., Elena M. Krieger. 2019. "Distributed solar and environmental justice: Exploring the demographic and socio-economic trends of residential PV adoption in California." *Energy Policy* 134, 110935. DOI: https://doi.org/10.1016/j.enpol.2019.110935.

Matisoff, Daniel C., Erik P. Johnson. 2017. "The comparative effectiveness of residential solar incentives." *Energy Policy* 108, 44-54. DOI: https://doi.org/10.1016/j.enpol.2017.05.032.

Miller, G. & C. Rhyan. 2022. "Cost of Water Insecurity in Philadelphia." *Altarum Institute*.

Muro, Mark, Devashree Saha. 2016. "Rooftop solar: Net metering is a net benefit." *Brookings*. Accessed Feb 10, 2022 at https://www.brookings.edu/research/rooftop-solar-net-metering-is-a-net-benefit/.

National Grid. 2022. "Service Rates." 2022. https://www.nationalgridus.com/MA-Home/Rates/Service-Rates.

Nevada Fund for Energy Assistance and Conservation. 2022. "Nevada Fund for Energy Assistance and Conservation State Plan." https://dwss.nv.gov/uploadedFiles/dwssnvgov/content/Energy/The%20Nevada%20Fund%20for%20Energy%20Assistance%20and%20Conservation%20State%20Plan%202023%20Final_Signed.pdf.

New Hampshire Public Utilities Commission. 2020. "Low-Moderate Income Community Solar Costs and Benefits Report." Accessible at https://www.puc.nh.gov/Home/Commission-Reports/20200601-LMI-Costs-And-Benefits-Legislative-Report.pdf.

New Hampshire Public Utilities Commission. 2021. "Electric Assistance Program." https://www.puc.nh.gov/consumer/electricassistanceprogram.htm.

New Hampshire Public Utilties Commission. 2020. "New Hampshire Electric Assistance Program." 2020. https://www.puc.nh.gov/consumer/NHEAP-brochure.pdf.

New Jersey Board of Public Utilties. n.d. "New Jersey Home Energy Programs." https://www.nj.gov/dca/divisions/dhcr/faq/usf.html#q1.

New Jersey Department of Community Affairs. 2023. "Universal Service Fund." 2023. https://www.nj.gov/dca/divisions/dhcr/faq/usf.html#q1.

NRDC. 2022. "California's Rooftop Solar Net Metering Program." *NRDC*. Accessed Feb 10, 2022 at https://www.nrdc.org/experts/nrdc/californias-rooftop-solar-net-metering-program.

NREL. 2009. "Solar Leasing for Residential Photovoltaic Systems." *National Renewable Energy Laboratory*.

NREL. 2012. "Lease Option Increases Rooftop Solar's Appeal, Study Says." *National Renewable Energy Laboratory*. https://www.nrel.gov/news/press/2012/1759.html.

NREL. 2017. "Residential Indoor Temperature Study." *National Renewable Energy Laboratory*. NREL/TP-5500-68019. https://www.nrel.gov/docs/fy17osti/68019.pdf.

Office of the Ohio Consumers' Counsel. n.d. "Know the Facts: PIPP Plus." https://www.occ.ohio.gov/factsheet/pipp-plus.

OPA/ Ratepayer Advocate. 2019. "Exploring Year 2018 Residential Water and Power Bills." City of Los Angeles.

PGE, N.d. "Company Information." Accessed April 14, 2023 at https://www.pge.com/en_US/about-pge/company-information/profile/profile.page.

PGE. N.d. “Energy efficiency central heat pumps.” Accessed Feb 28, 2022 at https://www.pge.com/en_US/residential/save-energy-money/resources/everyday-tips/savings-programs-energy-efficiency-central-heat-pumps/savings-programs-energy-efficiency-central-heat-pumps.page.

Pierce, Gregory, Ahmed Rachid El-Khattabi, Kyra Gmoser-Daskalakis, and Nicholas Chow. 2021. "Solutions to the problem of drinking water service affordability: A review of the evidence." *Wiley Interdisciplinary Reviews: Water* 8, no. 4 (2021): e1522.

Pigman, Margaret, Jeff Deason, Sean Murphy. 2021. “Who is participating in residential energy efficiency programs?” *Lawrence Berkeley National Laboratory*. Accessible at https://eta-publications.lbl.gov/sites/default/files/ee_program_participation.pdf.

Powers, Melissa. 2017. “An Inclusive Energy Transition: Expanding Low-Income Access to Clean Energy Programs.” *North Carolina Journal of Law & Technology* 18(4), Article 3. Accessible at https://scholarship.law.unc.edu/ncjolt/vol18/iss4/3.

RAP. 2011. “Electricity Regulation In the US: A Guide.”

Rasumussen, Tami, Carol Edwards, Brenda Gettig, Mary O’Drain, Ava Tran. 2014. “Understanding the Needs of Low Income Customers: Comprehensive, Robust Results from a Needs Assessment Study.” *ACEEE Summer Study on Energy Efficiency in Buildings*. https://www.aceee.org/files/proceedings/2014/data/papers/2-1088.pdf.

Reames, Tony Gerard. 2016. “A community-based approach to low-income residential energy efficiency participation barriers.” *The International Journal of Justice and Sustainability* 21(12), 1449-1466. DOI: https://doi.org/10.1080/13549839.2015.1136995.

Reames, Tony Gerard. 2016. “Targeting energy justice: Exploring spatial, racial/ethnic and socioeconomic disparities in urban residential heating energy efficiency.” *Energy Policy* 97, 549-558.

Romero-Lankao, Paty, Nicole Rosner, Meghan Mooney, Jane Lockshin. 2022. “LA100 Equity Strategies Deliverable 143, Preliminary Results of Analysis, Factors Influencing Current Inequities.” *National Renewable Energy Laboratory*.

Sadenini, Suresh B., Todd M. France, Robert F. Boehm. 2011. “Economic feasibility of energy efficiency measures in residential buildings.” *Renewable Energy* 36(11), 2925-2931. DOI: https://doi.org/10.1016/j.renene.2011.04.006.

Sainato, Michael. 2021. “‘I have never felt so hopeless’: millions in US fear utility shutoffs as debts rise.” *The Guardian*. https://www.theguardian.com/us-news/2021/oct/13/us-utility-bills-shutoffs-debt-covid-coronavirus.

San Diego Gas & Electric. n.d. “Our Company.” Accessed April 12, 2023. https://www.sdge.com/more-information/our-company.

Sandoval, Gabriela, and Mark Toney. 2018. "Living Without Power." TURN- The Utility Reform Network. http://www.turn.org/wp-content/uploads/2018/05/2018_TURN_Shut-Off-Report_FINAL.pdf.

Schleich, Joachim. 2019. "Energy efficient technology adoption in low-income households in the European Union - What is the evidence?" *Energy Policy* 125, 196-206. DOI: https://doi.org/10.1016/j.enpol.2018.10.061.

Schweitzer, Martin, Bruce Tonn. 2003. "Non-energy benefits of the US Weatherization Assistance Program: a summary of their scope and magnitude." *Applied Energy* 76(4), 321-335. DOI: https://doi.org/10.1016/S0306-2619(03)00003-5.

Seattle City Light. 2020. "Fingertip Facts." https://www.seattle.gov/documents/Departments/CityLight/FingertipFacts.pdf.

Seattle City Light. n.d. "Utility Discount Program." www.seattle.gov/light/discount.

SMUD. 2019. "Chief Executive Officer and General Manager's Report and Recommendation on Rates and Services."

SMUD. 2022a. "2021 Annual Report Fact Sheet."

SMUD. 2022b. "Electric Revenue Refunding Bonds, 2022 Series J." https://prospectus.bondtraderpro.com/$SACMUDJ.PDF.

Solar Energy Technologies Office. N.d. "Local Government Guide for Solar Deployment." *U.S. Department of Energy Office of Energy Efficiency and Renewable Energy*. Accessed Apr 25, 2022 at https://www.energy.gov/eere/solar/local-government-guide-solar-deployment.

Southern California Edison. 2019. "SOUTHERN CALIFORNIA EDISON'S SERVICE AREA."

Southern California Edison. 2022. "Microgrids for Developers." Accessed Mar 15, 2022 at https://www.sce.com/partners/partnerships/Microgrids-for-Developers.

Srivastava, Aman, Steven Van Passel, Erik Laes. 2018. "Assessing the success of electricity demand response programs: A meta-analysis." *Energy Research & Social Science* 40, 110-117. DOI: https://doi.org/10.1016/j.erss.2017.12.005.

State of California Business, Consumer Services, and Housing Agency. N.d. "Resources." *Housing is Key.*

Tonn, Bruce, David Caroll, Scott Pigg, Michael Blasnik, Greg Dalhoff, Jacqueline Berger, Erin Rose, Beth Hawkins, Joel Eisenberg, Ferit Ucar, Ingo Bensch, Claire Cowan. 2014. "Weatherization Works – Summary of Findings from the Retrospective Evaluation of the U.S. Department of Energy's Weatherization Assistance Program." *Oak Ridge National Laboratory*. Accessible at https://info.ornl.gov/sites/publications/Files/Pub51268.pdf.

Torriti, Jacopo, Mohamed G. Hassan, Matthew Leach. 2010. "Demand response experience in Europe: Policies, programmes and implementation." *Energy* 35(4), 1575-1583. DOI: https://doi.org/10.1016/j.energy.2009.05.021.

Tuttle, David, Gürcan Gülen, Robert Hebner, and Carey W. King. n.d. "The History and Evolution of the U.S. Electricity Industry." The University of Texas at Austin. http://energy.utexas.edu/.

U.S. EIA. 2018a. Residential Energy Consumption Survey (RECS): Table HC1.6 Fuels used and end uses in U.S. Homes by climate region, 2015. Accessed Feb 28, 2022 at https://www.eia.gov/consumption/residential/data/2015/hc/php/hc1.6.php.

U.S. EIA. 2018b. EIA's residential energy survey now includes estimates for more than 20 new end uses. Accessed Feb 28, 2022 at https://www.eia.gov/todayinenergy/detail.php?id=36412&src=%E2%80%B9%20Consumption%20%20%20%20%20%20Residential%20Energy%20Consumption%20Survey%20(RECS)-b2.

Wang, Alj. 2021. "Decision Authorizing Percentage of Income Payment Plan Pilot Programs - Rulemaking 18-07-005." California Public Utilities Commission. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M412/K735/412735667.PDF

Warwick, W. M. 2002. "A Primer on Electric Utilities, Deregulation, and Restructuring of U.S. Electricity Markets." U.S. Department of Energy.

White, Rebecca J. 2006. "Format Matters in the Mental Accounting of Funds: The Case of Gift Cards and Cash Gifts." DOI: https://dx.doi.org/10.2139/ssrn.948587.

WHO Environmental Health in Rural and Urban Development and Housing Unit. 1990. "Indoor environment: health aspects of air quality, thermal environment, light and noise." *World Health Organization*. p 17.

WHO. 2018. "WHO Housing and Health Guidelines." *World Health Organization*. https://www.ncbi.nlm.nih.gov/books/NBK535293/.

Wright, David. 2019. "Preliminary Fiscal Year 2019-20 Los Angeles Department of Water and Power Revenue Fund Budget Transmittal."

Wyman, Oliver. 2020. "Functional Total Cost Study." Office of Public Accountability.

Yerrapotu, Amulya. 2022. "California families need more utility debt relief." *CalMatters*. https://calmatters.org/commentary/2022/02/california-families-need-more-utility-debt-relief/.

York, Dan, Grace Relf, Corri Waters. 2019. "Integrated Energy Efficiency and Demand response Programs." *American Council for an Energy-Efficient Economy*. Accessible at https://www.dret-ca.com/wp-content/uploads/2021/04/ACEEE-Integrated-EE-and-DR-Programs.pdf.

Zhang, Di, Nilay Shah, Lazaros G. Papageorgiou. 2013. "Efficient energy consumption and operation management in a smart building with microgrid." *Energy Conversion and Management* 74, 209-222. DOI: https://doi.org/10.1016/j.enconman.2013.04.038.

Zunnurain, Izaz, Md. Nasimul Islam Maruf, Md. Moktadir Rahman, GM Shafiullah. 2018. "Implementation of Advanced Demand Side Management for Microgrid Incorporating Demand Response and Home Energy Management System." *Infrastructures* 3(4), 50. DOI: https://doi.org/10.3390/infrastructures3040050. Colorado Public Utilities Commission. n.d. "Low-Income Qualified Programs." https://puc.colorado.gov/LIprograms.

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