LA100 EQUITY STRATEGIES

EXECUTIVE SUMMARY

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LA100 Equity Strategies

Executive Summary

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See individual chapters for chapter-specific citation suggestions.

Contents

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A Letter From the Board

The City of Los Angeles (LA) set an ambitious goal to achieve 100% carbon-free energy by 2035. The Los Angeles Department of Water and Power (LADWP) is the nation's largest municipal water and power utility. LADWP was established more than 100 years ago to deliver reliable, safe water and electricity to LA and currently serves more than four million residents. To understand the pathways LA can take to achieve its 100% clean energy future—and how those pathways benefit Angelenos—LADWP partnered with the National Renewable Energy Laboratory (NREL) on the **Los Angeles 100% Renewable Energy Study** (LA100), which found that LA can achieve reliable, 100% renewable power as early as 2035. LA100 revealed that all communities in LA will share in benefits of the clean energy transition, including but not limited to health benefits from improved air quality, new jobs, and resilience to climate change. LADWP plans to lead the way to a decarbonized future by 2035. LADWP further commits that as it works to achieve its clean energy future, it will leave no community behind—from affluent enclaves to working-class neighborhoods.

LA100 Equity Strategies is the natural extension of the research findings in LA100. LA's clean energy future must be one where everyone benefits from cleaner air, good jobs, economic opportunity, wellbeing, and—equally important—an equitable household and small business energy cost structure. LADWP's objectives are to make its clean energy transition happen in a reliable, resilient, accessible, and affordable way for everyone. We know equity does not happen on its own, and actions must be proposed, adopted, and implemented. Addressing historical inequities requires intentional strategies and a long-term commitment to fairness that includes comprehending past actions and redressing them as well as any current actions that have perpetuated injustices, and meeting inequity with bold action. Said another way, it means ensuring that those Angelenos who have borne a disproportionate burden of the city's carbon past must benefit equally from its transition to a carbon-free future and should not bear a disproportionate burden of the costs associated with this historic transformation of the city's energy supply. In short, LADWP's clean energy future must be "Powered by Equity."

An equitable transition to 100% clean energy has many challenges. There are many proposed solutions identified in this study. LADWP, NREL, and the University of California Los Angeles (UCLA) partnered on the LA100 Equity Strategies project to develop effective strategies for engaging communities, funding equitable technology and infrastructure investments, expanding existing clean energy and energy assistance programs, and designing new proposed programs and policies to improve and enhance equity by incorporating what community leaders and neighborhood members themselves know is needed—and firmly stated would be needed—to achieve a more equitable energy future. This innovative community-informed approach integrated robust social science research techniques with rigorous data analysis and modeling to identify potential pathways to improving energy equity in LA's energy systems.

This groundbreaking two-year study placed the interests of our city's communities first and foremost. The community-based organizations that comprised our Equity Strategies Steering Committee and the individual community members who actively participated in listening sessions represented underserved and low-income communities throughout LA. Our community contributors guided the study's work by bringing their love of their city, passion for their communities, and shared vision for a just and equitable clean energy future to the forefront of the research activities, providing analysts with continuous feedback on the research approaches, data, and outcomes. The Equity Strategies Advisory Committee brought together subject matter experts from the Office of the Mayor, city departments, City Council offices, labor unions, and environmental organizations. The year 2035 is fast approaching. We all will need to continue to work together, as we did during our study—collaborating with our residents and customers—to make our 100% carbon-free future possible and "Powered by Equity."

We strongly believe and we firmly know that "Leading with Equity" is our only true, beneficial path to our city's decarbonized tomorrow.

Cynthia McClain-Hill

President, Los Angeles Board of Water and Power Commissioners

ABOUT THIS REPORT

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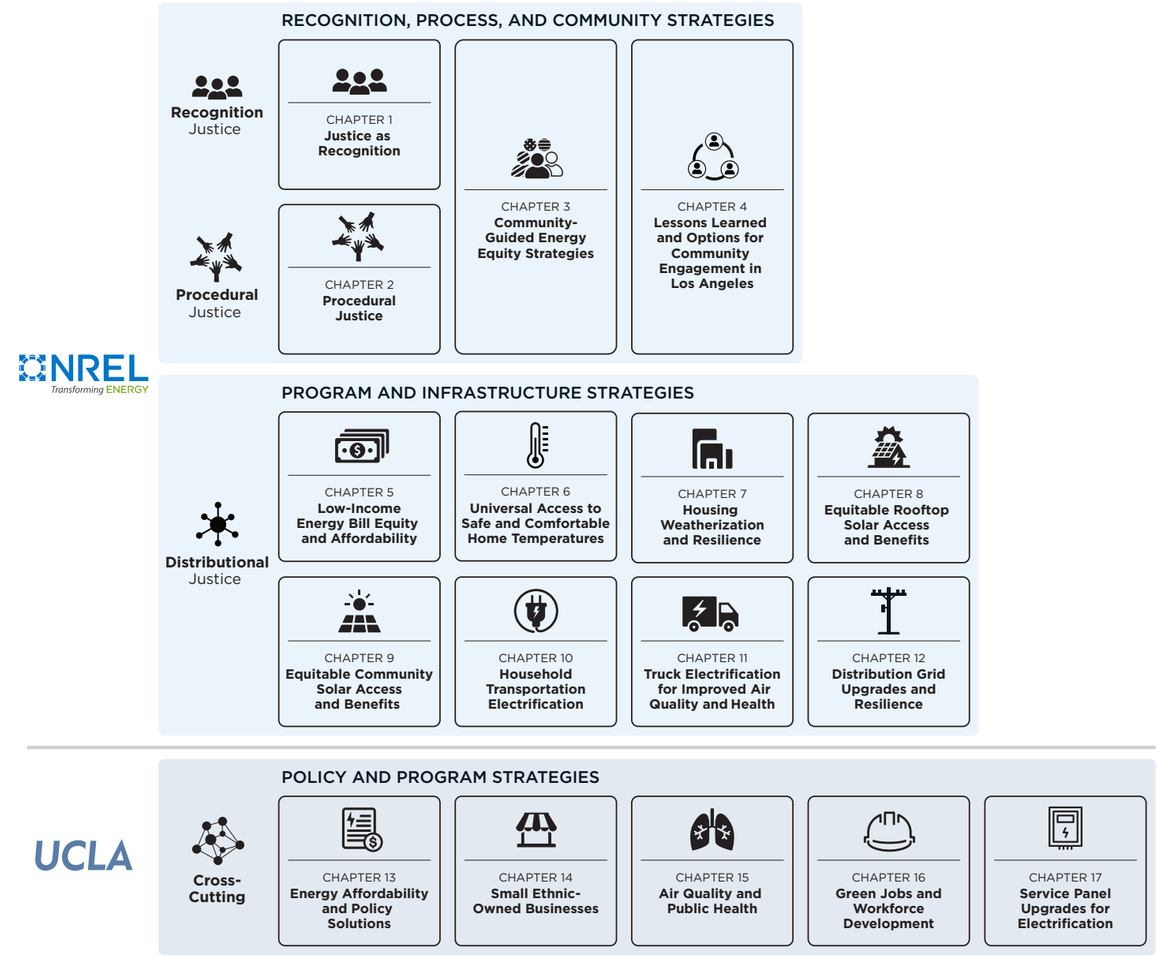
LA100 Equity Strategies is a collaborative effort between LADWP, NREL, UCLA, and Kearns & West that employs an interdisciplinary approach utilizing distinct—but connected—research efforts informed and guided by the project Steering Committee, which met monthly through the duration of the project. Chapters 1 through 4 address recognition and procedural justice through recognition, process, and community strategies, while Chapters 5 through 12 address distributional justice through program and infrastructure strategies. Chapters 13 through 17 provide policy and program strategies. Each chapter provides data, methods, tools, insights, and strategies to help LADWP make data-driven, community-informed decisions for equitable investments and program development.

This document explores the high-level conclusions from UCLA and NREL's extensive modeling, research, and stakeholder engagement through the LA100 Equity Strategies project. Links to download each chapter and a glossary of terms can be found on the study website at: **maps.nrel.gov/la100/equity-strategies**

While the study is focused on LA's energy transition, the methodology and many of the strategies developed can be adapted to other cities undertaking a just energy transition.



EQUITY STRATEGIES

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Why Equity Matters

A 100% clean energy transition requires bringing everyone along, including those who can least afford it. A successful transition requires both energy system changes—by LADWP and the City—as well as household changes like shifting to electrified transportation and homes, which many people cannot afford. The City of Los Angeles—where more than a half million people live in poverty and most households are renters—faces a particular challenge in reaching 100% clean energy if it cannot provide affordable and accessible solutions for all residents.

To date in Los Angeles, clean energy rebates, incentives, and grid upgrades have disproportionately benefited higher income, home-owning, non-disadvantaged, mostly White, mostly non-Hispanic communities.

Improving equity requires intentionally designed strategies and actions. The strategies developed through community guidance and robust modeling and analysis in this project provide options to support Los Angeles in achieving 100% clean energy while improving energy equity for *all* its residents.

Key Findings

Community-guided modeling and analysis identified that:

- **The current energy system is inequitable.** Underserved communities experience more burdens (e.g., high energy burdens, unsafe temperatures, electricity outages, and poor air quality) and fewer benefits, especially in access to grid upgrades, clean energy incentives, and savings. Of the LADWP residential incentives analyzed, only 23% of electric vehicles (EVs), 38% of solar, and 46% of efficiency incentives went to disadvantaged communities.
- **Lack of ability to pay energy-related costs and lack of financial capital limits communities' access** to EVs, efficiency options, jobs, training, and entrepreneurship. Limited eligibility for existing energy-related incentives, subsidies, and other aid programs further reduces access and affordability.

> **Energy equity** or **energy justice** "refers to the goal of achieving equity in both the social and economic participation in the energy system, while also remediating social,economic, and health burdens on those historically harmed by the energy system."[1]

- **Without changes in rates and solar compensation, energy inequity will increase over time.** Lower income households will pay disproportionately more for the energy system and experience fewer benefits—compared to households that can afford clean energy technologies and benefit from the savings they provide. Under existing rate and solar compensation approaches, modeled average electricity bills increase 79% for all households and 131% for low-income households by 2035 (in 2021 dollars).
- **California laws constrain rate affordability and prevent LADWP from providing robust low-income rate and bill assistance.** Current laws prevent LA from supporting low-income households with funds from higher income ratepayers, but they do not prevent low-income customers from in-effect subsidizing often higher income solar, EV, and building technology adopters. If laws are changed, rate and bill assistance reforms could triple the number of households receiving bill assistance and reduce low-income electricity bills between $14/month and $100/month depending on rate design.

LADWP RESIDENTIAL INVESTMENTS	TOTAL AMOUNT INVESTED	ALLOCATED TO DISADVANTEGED COMMUNITIES
SOLAR INSTALLATION (1999–2022)	$340M	38%
ENERGY EFFICIENCY (2013–2021)	$143M	46%
ELECTRIC VEHICLES (2013–2021)	$5M	23%
CUSTOMER DISCOUNTS (2006–2021)	$487M	68%

LADWP residential program investments (1999-2022)

- **Truck electrification substantially improves air quality and health, particularly in traffic-impacted disadvantaged communities.** Heavy-duty trucks generated 51% of LA on-road transportation nitrogen oxides and 32% of particulate matter pollution in 2022, though they made up only 5% of registered vehicles. Electrification of heavy-duty trucks, particularly the heaviest trucks like fire trucks, dump trucks, fuel trucks, and long haul tractors, would improve air quality and health more than closing in-basin LADWP fossil fuel power plants.
- **As the climate changes, universal access to home cooling will save lives.** Two hundred thirty thousand low-income households are projected to experience more than two months of exposure to dangerous indoor air temperatures annually by 2035. Multifamily building residents—who comprise 56% of the Los Angeles population and 95% of low-income renters—have the highest exposure to dangerous indoor temperatures. Adding cooling nearly eliminates dangerous temperature exposure in multifamily households, while cooling combined with efficiency is most effective in single-family homes.
- **Expanding Shared Solar can cost-effectively deliver solar bill savings to low-income households and renters.** LADWP solar net metering programs disproportionately benefit wealthier homeowners. Developing Shared Solar projects among the more than 1,800 economically viable 30 kilowatts (kW) or larger sites—totaling over 1,000 megawatts (MW) of potential—and establishing a 20% low-income discount rate will save low-income subscribers an average of $480/year. Compared to net-metered residential solar, LADWP can support five times more local solar capacity through Shared Solar for the same investment, while delivering bill savings to renters, multifamily building residents, and low-income households.
- **Distribution grid upgrades are needed to enable equitable participation in the clean energy transformation**. Although electrification of homes, universal home cooling, and electric vehicles will require distribution grid upgrades throughout the city, the traditionally smaller existing service connections and grid of low- and moderate-income customers will need proportionately larger upgrades to enable equitable access.
- **Energy equity requires continuous engagement between the utility and the community.** Community leadership in decision-making, program and policy design, and implementation will lead to more equitable outcomes and participation. Community members suggested a promotora-type approach to employ community members to deliver tailored training and education that informs ratepayers about options and benefits of programs and technologies, and to support program implementation.

What Are Equity Strategies and How Do You Use Them?

Equity strategies are options for LADWP, the City, and community members to consider for implementation and evaluation. Moving from strategy options to action will require significant work from LADWP and the City—in collaboration with community members—to assess tradeoffs, set priorities, identify lead- and partner-organizations, and allocate resources for implementation and evaluation. This project provides community-guided, data-driven strategy options as a starting point, but there is much more work to be done.

> Achieving 100% clean energy will require long-term utility-community partnerships, program coordination across sectors, LADWP, and City departments, and inclusive policy making—beyond this project.

Photo from Chris Yarzab, Flickr

1 Initiative for Energy Justice. "The Energy Justice Workbook." https://iejusa.org/wp-content/uploads/2019/12/The-Energy-Justice-Workbook-2019.pdf.

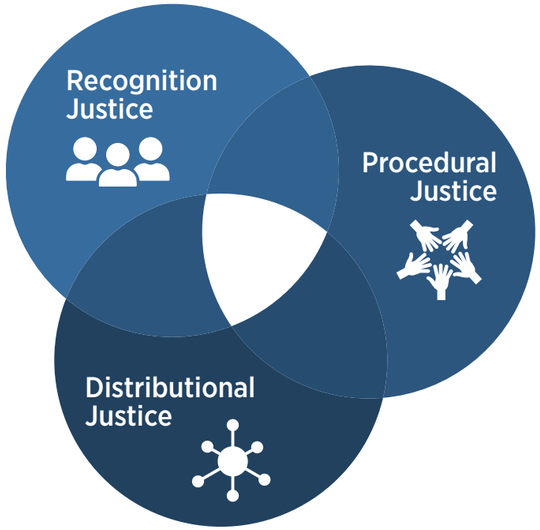
Framework

LA100 Equity Strategies is groundbreaking in its methodology that centers equity throughout the project. The project integrated community engagement and guidance with robust modeling and analysis organized around three tenets of justice:

Recognition justice: Seeks to understand and address past and current energy inequities within LA.

Procedural justice: Ensures Angelenos are actively engaged partners throughout the project, co-design the analysis, and shape the resulting equity strategies.

Distributional justice: Ensures a just and equitable distribution of benefits and burdens of the clean energy transition.



The three tenets of justice

Community Stakeholder-Driven Approach

The teams started by identifying and engaging with leaders of community-based organizations, and then with community members, to understand their aspirations and challenges and identify solutions to meet the energy needs of their communities.

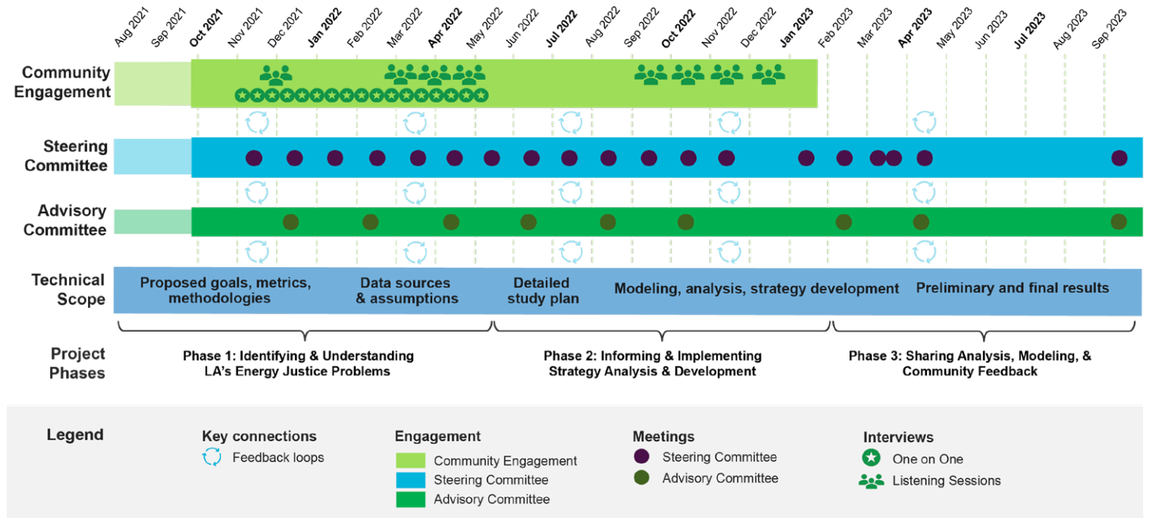
- A Steering Committee, composed of leaders from 14 community-based organizations who are active in energy and environmental justice, met monthly throughout the duration of the project to provide guidance to the analysis teams. They also collaborated in the design of listening sessions with their community members to elicit community knowledge.
- An Advisory Committee, including representatives from City of Los Angeles departments, the Mayor's office, City Council Members' offices, unions, and local organizations, met bi-monthly. Their purpose was to share program and policy knowledge and to facilitate cross-sector interagency coordination.
- NREL conducted 15 community listening sessions to gather and analyze information on the challenges Angelenos face with regards to the energy transition and their visions and aspirations for their families and communities.[2]

Data-Informed Strategies

- Modeled hourly electricity and gas usage for 50,000 households representing the diversity of 1.57 million LADWP customers across 100 household and building characteristics
- Input from 100+ community members, 14 community-based organizations, and 32 city agencies
- 50 TB of data across many temporal and spatial dimensions.

LADWP's Strategic Long-Term Resource Plan (SLTRP) is an energy roadmap that estimates the quantity and type of resources needed to meet 100% carbon-free electricity by 2035. The 2022 SLTRP projected system costs were used to model strategies for a more affordable and equitable transition.

2 Participating organizations for the Steering Committee and Advisory Committee are acknowledged at the end of this report with information on the neighborhood-specific community listening sessions.



Timeline and framework for LA100 Equity Strategies

Steering Committee members identified five priorities for equitable energy transitions. Each equity strategy option addresses one or more of these community-identified priorities:

Inclusive community involvement

Affordability and burdens

Access to and use of energy technologies, programs, and infrastructure

Health, safety, and community resilience

Jobs and workforce development

Engaging Communities in the LA100 Equity Strategies Project

- 19 Steering Committee meetings
- 9 Advisory Committee meetings
- 15 neighborhood-specific community listening sessions (Spanish and English)

Based on community engagement and the LA100 analysis, NREL identified potential focus areas for strategy development, from which Steering Committee members—with LADWP input—prioritized the following:

- Low-income energy bill affordability
- Housing weatherization, resilience, and access to safe home temperatures
- Community and rooftop solar and storage
- Equitable household transportation electrification
- Truck electrification for improved air quality and health outcomes
- Distribution grid upgrades for resilience and access.

NREL conducted modeling and analysis to identify potential strategies for more equitable distribution of the benefits and burdens of the clean energy transition and quantify the potential costs and benefits of each strategy.

Key Strategies

NREL developed a range of strategy options for improving equity in LA's transition to 100% clean energy. The full list of strategies can be found in the chapters on **maps.nrel.gov/la100/equity-strategies**.

Here we highlight key strategies in recognition and procedural justice and in distributional justice. We categorize the strategies into three types:

- **Foundational strategies:** Prerequisites for successful implementation of other strategies.
- **High-impact strategies:** Could have substantial impact on achieving a more equitable clean energy transition.
- **Low-hanging fruit strategies:** May be easier to implement because they meet four criteria.
  - › **No legal change required:** These strategies likely fall within the bounds of existing regulations.
  - › **LADWP controls implementation:** LADWP (rather than another city agency, the private sector, or the state) holds decision-making authority over these strategies.
  - › **Builds on existing LADWP programs:** These strategies adjust or expand existing LADWP programs, rather than starting new programs.
  - › **Low cost:** These strategies are expected to have minimal expense.

Recognition and Procedural Justice	Foundational	High-Impact	Low-Hanging Fruit
Implement a collaborative platform for continuous engagement. (1) Formalize LA100 Equity Strategies' partnerships into long-term agreements to maintain a continuous feedback loop with community partners, and (2) allocate dedicated personnel and resources to co-design, implement, and evaluate energy equity programs.	●	●	●
Co-develop programs and services and improve transparency and continuity. Rely on dedicated personnel and the collaborative platform to engage residents in ongoing, consistent, transparent, and community-adapted outreach and communication that builds trust, buy-in, and a continuous feedback loop for decision-making.	●	●	●
Provide tailored outreach and education through local trusted messengers. Build on Community Partnership Grants and Science Bowl to (1) inform ratepayers about programs and technologies and (2) incorporate energy-related resources into community science and the community health workers (promotoras) educational methods.	●	●	●
Provide debt relief and prevent the accumulation of debt through utility bill management procedures and debt relief programs to address a primary barrier to energy affordability.		●	
Expand workforce development programs that provide equitable access to tailored training and high-road jobs (i.e., jobs that provide family-sustaining living wages, comprehensive benefits, and opportunities for career advancement). These are crucial in the cross-cutting priority area of jobs and workforce development.	●	●	●

Distributional Justice	Foundational	High-Impact	Low-Hanging Fruit
Affordable and Equitable Rates			
Implement simplified tiered or time-of-use rates and replace solar net metering with net billing.* Under current rate and solar compensation approaches, average electricity bills increase more for low-income households than average households by 2035. Rate reforms reduce low-income electricity bills $15/month by 2035, even when low-income bill assistance programs are eliminated. Switching to net billing reduces the cost shift from solar adopter (typically higher income) to non-adopter (typically lower income) that occurs with net metering.	●	●	
Implement robust low-income bill assistance programs. Implementing low-income assistance programs that meet state standards for other utilities reduces LA's low-income household monthly bills by 22% compared to continuing current approaches.		●	
Explore income-based fixed charges. This rate approach reduces low-income electricity bills by more than $110/month and eliminates high electricity burdens for all customers by 2035.		●	
Implement low-income customer on-bill tariffs for energy efficiency. Leveraging Inflation Reduction Act (IRA) funds and on-bill tariff financing to install heat pump water heaters or enhanced insulation can reduce energy bills without upfront costs, credit checks, or homeownership for 150,000 and 72,000 low- and moderate-income customers respectively.			●
Housing Weatherization and Safe Home Temperatures			
Provide heat pump incentives in the Cool LA Program and auto-enroll low-income incentive recipients in bill assistance programs to mitigate energy burdens. More than 30% of extremely low-income households in Los Angeles lack access to cooling. Heat pumps have high capital costs but provide up to 29% more energy-efficient cooling compared to window-unit air conditioners. Providing low- and moderate-income** households incentives can support equitable access to cooling. Bill assistance can help offset increased energy bills for households adding cooling.			●
Expand direct installation of cooling in low-income households without cooling, prioritizing multifamily buildings. An estimated 230,000 low-income households in LA lack access to cooling and are projected to experience over two months of exposure to dangerous indoor temperatures by 2035. Multifamily renters have the most dangerous heat exposure in LA, particularly in utility outages. Access to cooling is the most effective intervention to reduce exposure for low-income multifamily residents.		●	●
Partner with the Housing Authority to provide cooling and weatherization in public housing and implement mechanisms to mitigate rent increases and displacement associated with LADWP-supported upgrades elsewhere. Renter protections, "right to return" if renovations temporarily displace renters, and mechanisms to prevent short-term rent increases for multifamily rental properties receiving utility-supported upgrades could avert rent increases and displacement for non-public housing receiving low-income-qualified cooling and weatherization interventions.		●	●

* The current practice of net metering credits customers for excess solar generation exported to the grid at higher retail rates and allows excess generation credit to apply at other times of the month or sometimes year. Net billing compensation is set at the avoided cost of energy at the time it is delivered to the grid.

** Households with income levels lower than 80% of the Area Median Income (AMI). **https://www.huduser.gov/portal/datasets/il.html**

Distributional Justice	Foundational	High-Impact	Low-Hanging Fruit
Local Solar and Storage			
Establish a low- and moderate-income (LMI) Shared Solar subscription rate. Enrollment in the Shared Solar Program currently requires a premium payment to achieve long-term savings. Implementing a reduced subscription rate for LMI customers and increasing the monthly subscription cap can reduce energy bills for LMI customers by an annual average of $480 per household.		●	●
Substantially expand Shared Solar capacity at identified economically viable ≥30 kW public and multifamily sites and allocate 50% of new capacity to LMI subscribers. LADWP solar net energy metering programs disproportionately benefit wealthier homeowners. Expansion of Shared Solar capacity with a discounted LMI rate would enable LMI, renter, and multifamily building households to access bill savings from solar energy and take this benefit with them if they move within the city.		●	
Develop Shared Solar on economically viable ≥30 kW multifamily sites in low-income tracts eligible for 50% investment tax credit (ITC). NREL identified 607 economically viable sites totaling 255 MW of potential capacity that could expand equitable access to solar bill savings.		●	
Household Transportation Electrification			
Expand at- and near-home EV charging access for low-income multifamily building residents and include low-voltage charging outlets. By 2035, approximately 20% of EV owners in LA are predicted to lack at-home charging access, 80% of which will be multifamily building residents. Adding 50,000 charging ports in identified areas without sufficient charging infrastructure would enable more equitable access to EVs. Including e-bike charging options, sidewalk improvements, and lighting improve community-prioritized safety and accessibility.	●	●	
Provide vouchers or charging subscriptions for public EV charging for low-income households through partnerships with charging network providers or free access to LADWP-owned charging infrastructure. Adopting EVs decreases vehicle fuel cost burdens, yet public charging can cost an average of $300/year more for households without home charging access. Lower-income households are especially sensitive to price differences.			●
Establish EV car-share, e-bike, and e-scooter programs in transportation disadvantaged communities to realize cost savings of 7% and reductions in travel time of up to 30% for households who do not own vehicles. Expanding infrastructure to support e-bike programs and use—particularly in the Panorama City, North Hills, Reseda, Winnetka, and Boyle Heights neighborhoods with low vehicle ownership rates and low transit access—would improve safety.		●	●
Increase LADWP used EV low-income incentive from $2,500 to $4,000, add a purchase price cap of $25,000 for all rebates, shift to point-of-sale discounts, and establish e-bike and e-scooter rebates. LADWP's investments in residential vehicle electrification and charging were the most inequitable of the programs analyzed, with 77% of residential rebates going to non-disadvantaged communities. Owning a standard model used EV can reduce median income LA household costs by about 3%. Increasing the low-income used EV incentive could increase used EV adoption among LMI households by 50,000 vehicles by 2035.		●	

Distributional Justice	Foundational	High-Impact	Low-Hanging Fruit
Truck Electrification for Air Quality and Health			
Establish goals, a timeline, and a budget for electrification of LADWP's heavy-duty truck fleet, with a heavy-heavy-duty truck carve-out. Heavy-duty trucks in LA generate 51% of on-road transportation emissions of nitrogen oxides and 32% of particulate matter, which contribute to premature death and disease, particularly among disadvantaged communities. Heavy-heavy-duty trucks like fire trucks and dump trucks generate more than five times the near-road pollutant concentrations of other heavy-duty trucks. Traffic-impacted disadvantaged communities benefit 25% more from truck electrification than non-disadvantaged communities.			●
Establish a citywide 2035 heavy-duty truck electrification target, a City-owned fleet truck electrification target, and purchase incentives. A goal of approximately 28,000 electrified Class 3-8 trucks in LA by 2035 aligns with state policies. More ambitious heavy-duty truck electrification would contribute proportionally to cleaner air and improved health outcomes.		●	●
Establish citywide charging infrastructure targets aligned with truck electrification goals. Collaborate with city and regional agencies like Southern California Area Governments to optimally locate charging infrastructure. Charging infrastructure needs to meet truck electrification targets: • 1,900–3,300 truck chargers by 2025 • 5,400–9,600 truck chargers by 2030 • 14,000–24,000 truck chargers by 2035.	●		●
Distribution Grid Upgrades and Resilience			
Incorporate equity as a metric in prioritizing grid infrastructure investments. Load growth and technology uptake has been more prevalent in wealthier neighborhoods, resulting in inequitable grid investments. Incorporating equity metrics into upgrade prioritization—by using metrics such as grid stress, level of anticipated distributed energy resource (DER) adoption, and demographic data—is crucial to overcoming the inequities seen in current and projected grid stress and corresponding reliability.	●		●
Upsize transformer capacity by two to three times when replacing service transformers to accommodate electrification and DERs, particularly those serving customers with low capacity (<125A) service. Equitable access to vehicle electrification, home cooling, rooftop solar, and storage can require increased customer power needs that could be stymied by distribution service transformer limitations. Transformers are being replaced and upsized by factors of 1.6–2x. Load and DER changes may require 2–3+x increases.	●		●
Implement community-specific, equitable resilience strategies. Disadvantaged communities have historically lower grid resilience during disaster events, although this varies by neighborhood. Backup generation (such as photovoltaics + storage) and microgrids—supporting critical infrastructure such as hospitals, shelters, grocery stores, convenience stores, and banking—can increase resilience in neighborhoods where NREL analysis identified low resilience scores.		●	●

A DEEPER DIVE: RECOGNITION AND PROCEDURAL JUSTICE

Photo from Getty Images 1479873003

LA community members repeatedly stressed that equity is about making—and following through with—a commitment to prioritize historically underserved and overburdened communities in decision-making for LA's energy transition. To achieve this, the strategies in this section address historic inequities (i.e., recognition justice), and foster inclusive community involvement in the decision-making process (i.e., procedural justice). Recognition and procedural justice principles are interconnected and form the foundation for ensuring more equitable distribution of benefits and burdens (i.e., distributional justice).

Recognition Justice

NREL examined historical inequities in LA, along with the corresponding causal factors, to understand how inequities have become embedded in policies, processes, and community members' experiences. NREL worked with communities to analyze broader structural factors and to co-design strategies for redressing past inequities.

The Challenges

- Poor quality and maintenance of infrastructure and housing due to decades of disinvestment and neglect
- A lack of affordable housing for renters and owners
- Barriers to making energy decisions for themselves and their communities (i.e., self-determination)
- A lack of access to financial capital for energy access, affordability, and decision-making
- Mistrust and grievances related to government agencies and policies
- A lack of accessible and useful information about resources and programs.

Key Findings

- The benefits of LADWP's programs—such as solar installation benefits, non-low-income-targeted energy efficiency programs, and EV incentives—are not equitably distributed across communities.
- Underserved Angelenos—such as low-income families, renters, and people of color—face higher energy and transportation burdens, unsafe temperatures, higher impact from extreme heat events, and other negative impacts of historical legacies that are still present in current policies and practices. Underserved communities are mostly located in South LA, East LA, San Fernando Valley, and the Harbor area. At the same time, those who benefit from LADWP investments are disproportionately higher-income, homeowner, and White populations.

NREL analyzed address-level data on beneficiaries of 16 LADWP energy efficiency, solar, and EV incentive programs, and customer discount programs to understand if socioeconomic or demographic differentiation exists in access to LADWP program and infrastructure investments. Program recipient data was aggregated by census tract to determine the number of households receiving benefits and the total dollar amount invested by LADWP for each census tract. These data were merged with CalEnviroScreen disadvantaged communities[3] and the following census tract-level socioeconomic and demographic information from the American Community Survey: race, ethnicity, income, and homeownership. This integrated data allowed NREL to determine if certain communities disproportionately received incentives and benefits provided by LADWP.

3 Defined here as census tracts designated as disadvantaged by California Senate Bill 535 (SB535).

LADWP RESIDENTIAL INVESTMENTS 1999–2022		NUMBER OF YEARS	TOTAL AMOUNT SPENT	AVERAGE AMOUNT PER CUSTOMER DAC/Non-DAC	% OF INCENTIVES Normalized by number of customers DAC/Non-DAC	WHICH COMMUNITIES DISPROPORTIONATELY BENEFITED FROM PROGRAMS? DAC /Non-DAC	Mostly Non-White /White	Mostly Hispanic /Non-Hispanic	Mostly Renters /Owners	Below /Above Median Income
SOLAR INSTALLATION (1999–2022)	Net Energy Metering Programs	22	$340,604,541	0.25 kW / 0.41 kW	38% / 62%	Non-DAC	White	Non-Hispanic	Owners	Above
	Home Energy Improvement Program	3	$3,378,869	$3 / $2	61% / 39%	DAC		Hispanic	Owners	
	Refrigerator Turn-In and Recycle Program	5	$2,667,307	0.010 refrigerators / 0.014 refrigerators	42% / 58%	Non-DAC	White	Non-Hispanic	Owners	Above
ENERGY EFFICIENCY (2013–2021)	Consumer Rebate Program	6	$93,248,144	$64 / $74	46% / 54%	Non-DAC	White	Non-Hispanic	Owners	Above
	Other Non-Low-Income-Targeted Programs	15	$36,343,548	$178 / $196	35% / 65%	Non-DAC	White	Non-Hispanic	Owners	Above
	Energy Savings Assistance Program*	5	$7,897,260	$11 / $1	92% / 8%	DAC	Non-White	Hispanic	Renters	Below
ELECTRIC VEHICLES (2013–2021)	Incentive Programs	8	$5,361,426	$41 / $64	23% / 77%	Non-DAC	White	Non-Hispanic	Owners	Above
CUSTOMER DISCOUNTS (2006–2021)	Low-Income Program*	15	$173,633,204	$195 / $64	73% / 27%	DAC	Non-White	Hispanic	Renters	Below
	Lifeline Program*	15	$313,424,782	$302 / $164	65% / 35%	DAC	Non-White	Hispanic	Renters	Below

* Low-Income Targeted

Statistical analysis of equity in LADWP residential program investments (1999-2022)

Watts, LA resident:

"In my humble opinion, we should be considered. I don't ask for free giveaways, I ask for a good job with a good salary for [the people of] the city of Watts. Because companies come and bring workers. And they don't benefit the residents [living] there. They should give jobs to every community where they work. They should give jobs to the people of the community there with good pay. And that, in my opinion, would [be the help I need]."

Procedural Justice

Procedural justice prioritizes fair, equitable, and inclusive participation in the decision-making process. Its application focuses on who is invited and able to participate, whose voices are considered as decisions are made, the co-development of procedures to inform this deliberative process, and who has access to formal measures of regulation and accountability. As community engagement is a principal method for applying procedural justice measures, the LA100 Equity Strategies project included 15 neighborhood-specific listening sessions (in English and Spanish), 19 Steering Committee meetings, and 9 Advisory Committee meetings.

The Challenges

- Underserved Angelenos have historically not been invited and able to participate, and their knowledge and expertise have not been considered as decisions are made.
- Attempts to develop more equitable energy outcomes can be constrained by a misunderstanding of what equity means to the people most negatively affected by LA's current energy system.

Key Findings

- Residents referred to the unaffordability of current electricity bills, particularly given other monthly expenses, and noted that they did not have the ability to lower these high costs.
- Factors limiting participants' ability to determine their own EV access include a lack of accessible guidance to make informed decisions, limited financial capital to purchase a used car (let alone an EV), and insufficient local EV charging infrastructure in their communities.
- Barriers to accessing programs for low-income participants include language limitations, citizenship status, housing tenure, and information gaps. Moderate-income participants emphasized the shortcomings of current eligibility criteria that effectively exclude their participation in existing programs due to an incomplete understanding of their economic status and financial burdens.
- Residents who live in non-rent-controlled housing where property owners implement upgrades—even subsidized LADWP upgrades and benefits—will most likely experience an increase in rent to cover the cost. For those living in rent-controlled housing, homeowners will most likely refrain from investing in upgrades given their inability to utilize rent to cover costs.
- While there are existing LADWP programs designed to increase energy affordability for ratepayers, there is a "missing middle"—a subset of ratepayers who cannot afford the more efficient renewable energy technologies and yet are not included in the program design for subsidized benefits given their relatively higher incomes.

Find additional information about this topic in **Chapters 1, 2, 3, and 4** on the LA100 Equity Strategies website (**http://maps.nrel.gov/la100/equity-strategies**).

Equity Strategies

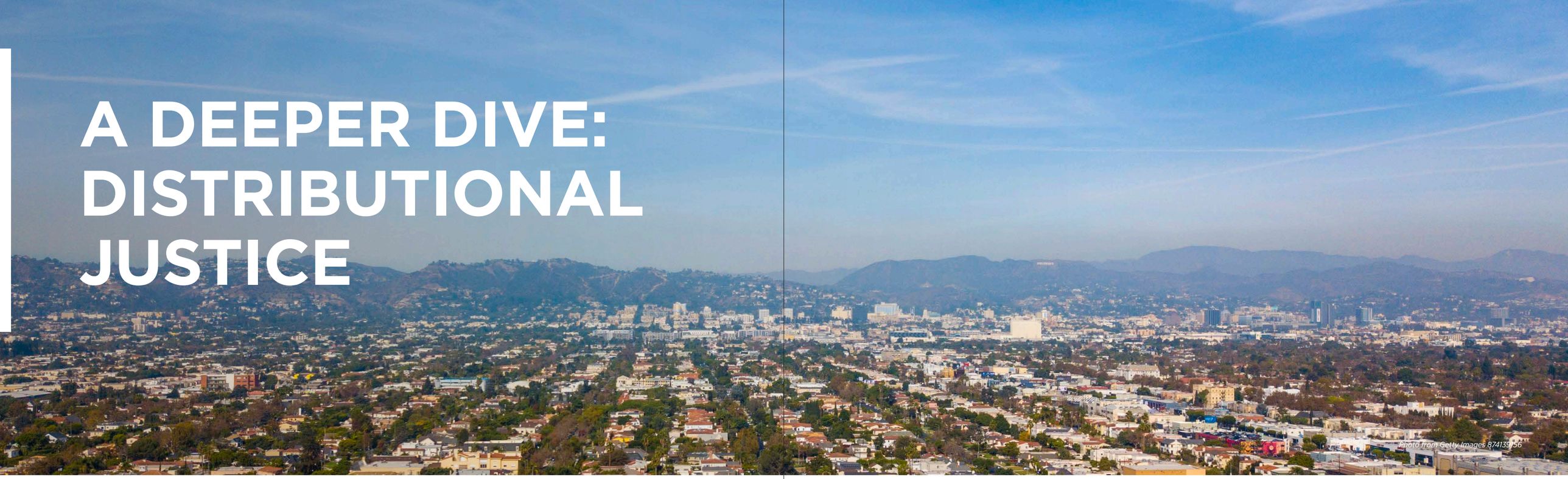
This section presents community-guided strategies seeking to improve access to affordable, safe, and resilient energy services, technologies, and programs. These improvements range from the reduction of negative impacts on health and quality of life to creating opportunities for workforce development in the green economy. These strategies focus on procedural justice: the procedures, practices, and decision makers involved in designing, implementing, and evaluating benefits such as LADWP programs. Some strategies also operationalize recognition justice by redressing the structural legacies of energy inequity.

Procedural and Recognition Justice Equity Strategies

Equity Strategy	Implementation Entity	Existing Programs	Assessment Metrics
Engage residents in developing programs and services targeting community priorities. Listening session participants suggested fostering intentional energy strategies—procedures, partnerships, and practices—that engage residents from underserved communities in developing programs and services that meet their needs and priorities.	LADWP, HACLA, Metro	LIHEIP, RETIRE, REP, ESAP, Community Grants	% of enrollment, % of households eligible, number of programs and services
Provide tailored outreach and education through local trusted messengers. Build on Community Partnership Grants and Science Bowl to (1) inform ratepayers about the options and benefits of programs, services, and technologies, and (2) incorporate energy-related resources into the community science and the community health workers (promotoras) educational methods.	LADWP	HEIP, RETIRE, REP, ESAP, Adopt a School, Community Grants	% of ratepayers aware of programs, programs using trusted messengers
Expand workforce development programs that provide equitable access to tailored training and high-road jobs (i.e., jobs that provide family-sustaining living wages, comprehensive benefits, and opportunities for career advancement). These are crucial in the cross-cutting priority area of jobs and workforce development.	LADWP, LATTC	UPCT, Lineman	% of enrollment, % of enrolled Angelenos with LADWP jobs
Tailor strategies for providing debt relief and preventing the accumulation of debt. The accumulation of debt was a primary barrier to energy affordability for many listening session participants. Mechanisms for guaranteeing energy access and use include utility bill management procedures and debt relief options. Such mechanisms could be employed via programs that incorporate community suggestions into debt relief and prevention strategies.	LADWP	EZ-SAVE Program, Level Pay, LIDP	% of enrollment, % of households eligible, shutoff protections
Invest in programs that foster community health, resilience, and well-being. Investing in programs that foster community resilience supports local capacities to identify and navigate health risks and maintain well-being among community members. For example, listening session participants mentioned supporting community science by offering home air quality monitors.	LADWP, LAUSD	LADWP Science Bowl, Neighborhood Scientists	Number of programs, quality of programs
Co-develop programs and services and improve transparency and continuity. Rely on dedicated personnel and resources and the suggested collaborative platform to engage residents in ongoing, more consistent, transparent, and community-adapted outreach and communication that builds trust, buy-in, and a continuous feedback loop for decision-making.	LADWP, HACLA, Metro	HEIP, RETIRE, REP, ESAP	% of enrollment, improvement in transparent reporting
Provide affordable programs to safely upgrade housing and infrastructure. Expand programs like the Home Energy Improvement Program and Comprehensive Affordable Multifamily Retrofits Program and collaborate with the LA Metro transit agency and Housing Authority of Los Angeles to provide affordable energy and home upgrades fostering affordable access to solar, storage, electric vehicles, and other technologies.	LADWP, HACLA, Metro	EE, EVs, LIHEIP, Weatherization Shared Solar, Cool LA	% of structural energy upgrades per type, e.g., solar panels benefiting underserved communities
Prioritize disadvantaged Angelenos in energy transition programs and investments. The ongoing need for affordable and safe upgrades in LA reveals the significance of infrastructural and systemic barriers to energy equity. For example, without upgrading home service panels, residents cannot install the infrastructure needed to support solar and storage and EV-charging in underserved neighborhoods.	LADWP, HACLA, Metro, LAUSD	EE, EVs, Solar, HEIP, RESAP, Cool LA, CAMR	% of sectoral investments and programs per type, e.g., solar panels benefiting underserved communities
Invest in programs to foster energy and housing security and safety. There is a systemic need for targeting energy and housing security, including homeowner-renter split incentives, affordability issues, and monitoring of housing safety and upgrade needs. This strategy targets homeowner and renter issues, and supports monitoring to ensure that ratepayer homes are safely up to code.	LADWP, HACLA, Metro City of Los Angeles	LADWP Customer Service, City of Los Angeles online services, Stay Housed LA	% of underserved ratepayers benefiting from: (1) Eviction protections, and (2) monitoring and enforcing programs
Build on existing networks of trusted messengers. During the listening sessions, promotoras de salud (also known as promotoras) were raised as a method to improve communications and build trust. Promotoras are community health workers who utilize their knowledge of local sociocultural norms to become trusted messengers, providing their neighbors and residents in their Latino communities access to relevant health and social resources.	LADWP, LA Care Churches	LADWP Science Bowl, Health Promoters	Number and quality of programs using trusted messengers
Improve City regulation, accountability, and enforcement for safe and efficient infrastructure. Improvements include inspection and monitoring to support housing maintenance and upgrades, and regulations and information to prevent unsafe built environments and predatory practices among service and technology providers.	City of Los Angeles, LADWP	HEIP, Solar, EVs, EE	Monitoring and enforcement of (1) upgrade and safety programs, and (2) service and technology providers
Implement a collaborative platform for continuous engagement. (1) Formalize the current LA100 Equity Strategies and other partnerships and collaborations into long-term agreements to maintain a continuous feedback loop with community partners, trusted messengers, and residents, and (2) allocate dedicated personnel and resources to co-design, implement, and evaluate the multiple energy equity projects, technologies, and programs involved in LA's just energy transition.	LADWP	All programs	Number and quality of collaborative programs

CAMR = Comprehensive Affordable Multifamily Retrofits
ESAP = Energy Savings Assistance Program
EZ-SAVE Program = Low-Income Discount Program
HACLA = Housing Authority of the City of Los Angeles
HEIP = Home Energy Improvement Program
LATTC = Los Angeles Trade-Technical College
LDP = Lifeline Discount Program
LAUSD = Los Angeles Unified School District
REP = Refrigerator Exchange Program
RETIRE = Refrigerator Turn-In and Recycle
UPCT = Utility Pre-Craft Trainee Program

A DEEPER DIVE: DISTRIBUTIONAL JUSTICE



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Distributional justice equity strategies address inequities in infrastructure investments, technology access, and negative impacts from energy systems. Strategy development began with identifying current energy equity metrics and establishing a baseline for where LA is today. Community guidance on barriers and solutions informed modeling and analysis of key scenarios and helped to ground truth findings. The baseline, community guidance, and key findings were synthesized in community-informed equity strategies for six focus areas:

1. Low-income energy bill affordability
2. Housing weatherization, resilience, and access to safe home temperatures
3. Community and rooftop solar and storage
4. Household transportation electrification
5. Truck electrification for improved air quality and health outcomes
6. Distribution grid upgrades and resilience.

Important Caveats

- Strategies are based on scenarios modeled through 2035 using data inputs and assumptions. Scenarios are not projections or predictions; they are merely modeled changes that may or may not occur. Scenarios help test different actions to identify which strategies lead to more equitable and affordable outcomes.
- LA100 Equity Strategies did not model clean energy transition costs. NREL used costs from LADWP developed through the 2022 SLTRP process. Strategies provide options and pathways to allocate costs more equitably and make the transition more affordable for low-income customers. Future costs are highly uncertain and the SLTRP process will revise cost projections annually. Rate modeling indicates the directionality of changes under various scenarios, not specific future rates.
- To analyze access to safe and comfortable home temperatures, NREL modeled home temperatures under whole-home system cooling approaches and costs for whole-home cooling and one-room cooling. Scope and modeling limitations prevent NREL from determining if one-room cooling options maintain the cooling set point for the room in which they are located.

Distributional Justice Analysis Framework

Low-Income Energy Bill Affordability

Steering Committee members identified energy affordability as their highest priority. Continuing LADWP's existing rates and low-income assistance approach will decrease affordability for low-income customers on all metrics examined. Rate and program reforms can improve affordability and equity for LADWP's low-income households in the clean energy transition.

The Challenges

Continuing LADWP's existing rate structure and bill assistance program approach would result in the lowest-income households experiencing disproportionately higher bill increases.

- Los Angeles County has a higher concentration of low-income population (30%) than any other California county, underscoring the need for effective low-income assistance.
- LADWP has low enrollment (7% of residential class in 2019) and low bill discounts ($8/month in 2019) compared to enrollment and discounts in low-income assistance programs offered by investor-owned utilities in California.
- LADWP's ability to revise rate design is inhibited by California Propositions 218 and 26, which treat municipal utility rates as taxes,[4] limit rate increases, and prohibit supporting low-income assistance programs through funds recovered from non-low-income customers (League of California Cities 2021).

4 Investor-Owned Utilities (IOUs) and non-municipal cooperatives are not subject to CA Propositions 218 and 26.

Electricity bill affordability metrics modeled for 2035 include:

- Electricity and energy burdens, or the percentage of income spent on energy bills
- Monthly electricity bills by income level
- Hours worked at minimum wage required to pay for electricity bills.

Find additional information on this topic on the LA100 website (**http://maps.nrel.gov/la100/equity-strategies**) and in **Chapter 5** (**https://www.nrel.gov/docs/fy24osti/85952.pdf**) of the full report.

Listening session participant from Boyle Heights:

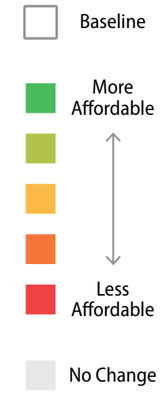
"I worked for [an organization] where we help low-income families with their utility bills. I don't earn that much, but yet I'm not qualified to get help with my electricity or gas. I helped a lot of people who make more than I do, but they get the help and that was a little concerning to me, that people like me who work have to pay bills, but that they are not qualified for assistance. It's always the low income. And I just don't know what to do. I live check by check … and it's really hard to get help from someone to raise up the low-income guidelines a little to help people like me who doesn't earn that much; you know, they think we do, but we actually don't."

Key Findings

- Converting from LADWP's current complex, multi-period rate structure to a California Public Utility Commission (CPUC)-recommended simplified tiered or time-of-use (TOU) rate design, and replacing solar net metering with net billing reduces low-income average monthly bills by $15/month even in the absence of the EZ SAVE or Lifeline low-income assistance programs. Switching to net billing reduces the cost shift from solar adopter (typically higher income) to non-adopter (typically lower income) customers that occurs with net metering.
- Continuing LADWP's rate design and solar compensation practices, but replacing the existing EZ-SAVE and Lifeline low income assistance programs with more robust assistance programs modeled after the CPUC's California Alternate Rates for Energy (CARE) and Family Electric Rate Assistance (FERA) programs yields a 22% ($42/month) reduction in average monthly electricity bills for lowest-income customers in 2035. If robust low-income assistance is combined with improved rate design (i.e., simplified tiers or TOU) and net billing for solar compensation, average monthly bills are decreased by 28% ($55/per month) and the solar adopter to non-adopter cost spread is further reduced to $29-39/month.
- Income-based fixed charges (IBFC), where certain utility costs are assigned to customers scaled to their income, achieve the greatest affordability for low-income customers and reduce energy burdens below the 6% affordable threshold for all customers.[5] IBFC design tends to increase solar adopter average monthly bills because solar adopters tend to have higher incomes (thus higher fixed charges, driving up the average). Solar adopters in all income bins continue to see lower bills than non-adopters under IBFC. IBFC are currently being investigated for implementation in California by the CPUC.
- Leveraging federal funding through the IRA, an on-bill tariff program (e.g., Pay-As-You-Save) for heat pump water heaters or enhanced insulation has the technical potential to provide energy bill (gas and electricity) savings to 154,000 or 72,000 low-income customers, respectively.

5 Six percent is a common affordability threshold for total energy burden. Here we use the 6% affordability threshold with the electricity burden, which slightly overstates affordability for these warm-weather climate households.

Rate Equity Metric	2019 LADWP Baseline w. EZ-SAVE	2035 LADWP BAU w. EZ-SAVE	2035 LADWP BAU w. CARE & FERA	2035 Simplified Tiers w. CARE & FERA	2035 Simplified Tiers w. IBFC
Avg. Monthly Bill (All Households)	$105	$188	$188	$188	$188
Avg. Monthly Bill (Low-Income, 0%-50% AMI)	$83	$193	$151	$138	$81
Average Annual Electricity Burden for:					
All Households	3.7%	7.3%	6.4%	6.0%	3.8%
Low-Income, 0%-50% AMI	7.8%	16%	13%	12%	5.9%
Moderate-Income, 50%-80% AMI	2.1%	4.0%	4.3%	4.1%	3.4%



Equity Outcomes Under Various LADWP Rate Structure and Bill Assistance Program Options. Based on LADWP 2022 SLTRP Case 1 projected revenue requirements

Equity Strategies for Low-Income Energy Bill Affordability*

EQUITY STRATEGY: Implement a simplified tiered or time-of-use rate structure, switch solar compensation from net metering to net billing, and moderately boost low-income solar adoption. Even without a low-income assistance program (i.e., EZ-SAVE and Lifeline), this strategy improves affordability and equity outcomes. This strategy requires legal changes.

Benefit/Impact	Cost**	Metric
• Low-income electricity bills would decrease by $14 to $15/month. • Reduced average monthly bill disparity between solar adopter (typically high-income) and non-solar adopter (typically lower-income) from $169 to $55-$65. • 3,500–3,300 fewer customers with >100% energy burdens compared to business-as-usual.	• All strategies are modeled to cover LADWP projected 2035 revenue requirements. • Improved price signals could promote cost savings if customers respond by avoiding consumption in higher-priced periods.	• Average monthly electricity bill savings. • Reduced intra-class cross-subsidization for solar compensation. • Reduced number of customers over 100% energy burden. • Customer satisfaction and customer understanding surveys before and after rate design changes.

EQUITY STRATEGY: Implement robust low-income assistance programs modeled after the CPUC CARE and FERA programs to increase electricity bill affordability for the lowest-income customers. This strategy requires ballot action or legal changes as Propositions 26 and 218 currently prohibit supporting low-income assistance programs through funds recovered from non-low-income customers.

Benefit/Impact	Cost**	Metric
• 22% ($42/month) lower electricity bills for low-income customers. • 2035 monthly assistance increases from $5.78/month under EZ-SAVE to $54/month under CARE and about $37/month under FERA. Increase in assistance recipients from 150,000 under EZ-SAVE to 436,000 under CARE and FERA.	• Larger cross-subsidy from non-participating to participating customers. • $307-$335 million per year (in 2035) of reallocated funds from non-participating to participating customers.	• 30%–35% discount on electric bills for CARE enrollees. • 89% and 15% eligible enrollment rate for CARE and FERA, respectively.

EQUITY STRATEGY: Explore income-based fixed charges (IBFC).

Benefit/Impact	Cost**	Metric
• 58% ($112/month) lower average monthly electricity bills compared to current rate structures business-as-usual for low-income customers. • IBFC reduces average electricity burdens below the 6% affordability threshold.	• No direct low-income program budget required. • Costs for income verification. • Higher fixed costs and bills for higher-income customers. • Potential for weaker price signals that reduce incentive to conserve; may incentivize electrification.	• Change in electricity burden by different income bins.

EQUITY STRATEGY: Implement an on-bill tariff program leveraging IRA funds, to support heat pump water heater or enhanced insulation installation for low-income customers.

Benefit/Impact	Cost**	Metric
• Technical potential for nearly 154,000 and 74,000 LMI customers to save on energy bills through on-bill financed heat pump water heaters and enhanced insulation, respectively.	• Leverages Inflation Reduction Act funds. • Only participating customers are assessed monthly bill riders.	• Income-eligible customers who qualify for the program will see energy (gas and electricity) bill savings 25% higher than the program bill rider. • Number of participating households.

* All dollar values in this chart are in 2021 dollars. **Strategies that change LADWP's current rate structure require ballot action and will also likely result in cessation of the approximately $220 million annual transfer from LADWP to the City of Los Angeles. Eliminating this transfer would reduce customer rates.

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Housing Weatherization, Resilience, and Access to Safe Home Temperatures

An estimated 230,000 low-income households in LA lack access to cooling and are projected to experience the equivalent of more than two months of exposure to dangerous indoor temperatures by 2035. Multifamily building residents are at much higher risk of dangerous heat exposure. This analysis identified strategies to increase access to safe and comfortable home temperatures through housing weatherization and cooling technologies. NREL identified building envelope upgrades and cooling strategies that could save lives and maintain safe home temperatures for low-income households during heat waves.

The Challenges

- Fewer than half of low-income households use cooling, even if they have access to cooling. More than 30% of extremely low-income households, and more than 26% of renters and households in disadvantaged communities, lack access to cooling.
- More than half of low-income households will experience dangerous indoor air temperatures of 95°F at least once a year by 2035. In the event of a power outage during a heat wave, 85% of LA housing stock reaches the dangerous temperature threshold (86°F) in the first 24 hours of an outage. Thirty-seven percent of low-income households will start a power outage during a heat wave at unsafe indoor temperatures.
- Although roughly half the population lives in disadvantaged communities, less than half of LADWP spending on residential energy efficiency programs between 2013 and 2021 benefited households in these communities.
- Communities are seeking affordable options with fewer upfront costs, programs that reach moderate-income households and renters, and upgrades that will not raise rents and cause displacement.

Housing energy equity metrics include:

- Level and duration of exposure to unsafe (>86°F) home temperatures by income, housing type, and renter or owner occupancy
- Upgrade costs and utility bill impacts by income, housing type, and renter or owner occupancy
- Access to cooling by income, housing type, and renter or owner occupancy.

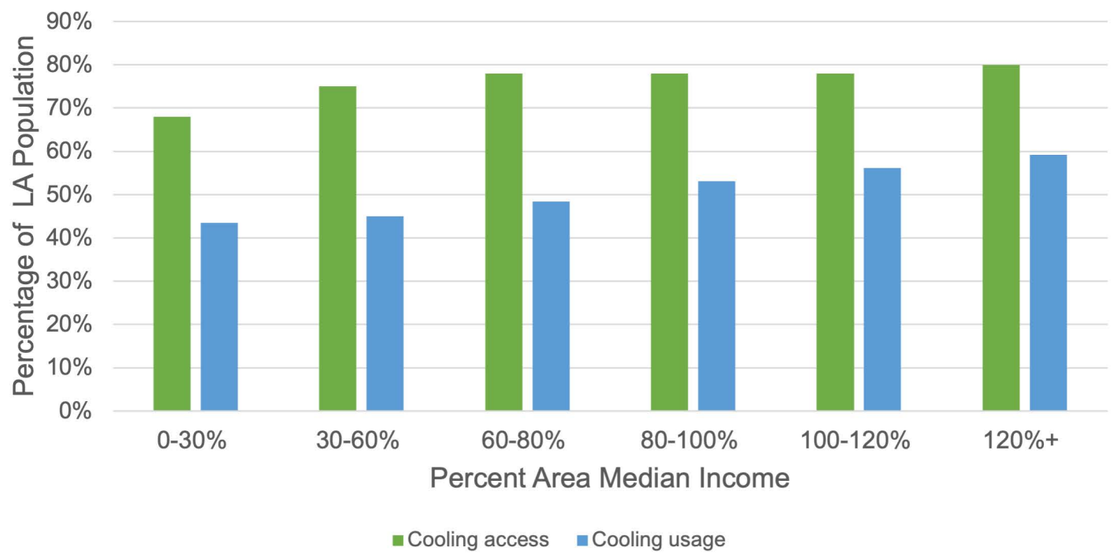
Find additional information on this topic on the LA100 website (http://maps.nrel.gov/la100/equity-strategies) and in **Chapters 6** (https://www.nrel.gov/docs/fy24osti/85953.pdf) **and 7** (https://www.nrel.gov/docs/fy24osti/85954.pdf) of the full report.

Equity Strategies Steering Committee member on how they handled a recent heat wave:

"I have a window [AC] unit and it's in a different room than what I spend most of my time in. It was quite difficult. I would just go sit in my car for relief."

Key Findings

- Multifamily building residents, who comprise 56% of the Los Angeles population and 95% of low-income renters, have the highest exposure to dangerous indoor temperatures. Exposure increases as the number of units increase due to the increased thermal mass of the buildings, limited natural ventilation, and insulated, shared walls.
- Dangerous heat exposure can be reduced at lower cost in multifamily buildings than single-family buildings. Installation costs are lower in multifamily dwellings than single-family dwellings because these dwellings are generally smaller and better insulated, resulting in smaller cooling system sizes and costs.
- Providing cooling through heat pumps dramatically improves access to safe and comfortable whole-home temperatures. Heat pumps nearly eliminate dangerous temperature exposures (above 86°F) for low-income, multifamily households.
- Installing and using cooling systems in households with no prior access to cooling would increase utility bills between $140 and $180 annually for cooling one room, and between $120 and $270 for whole-home cooling.
- IRA rebates, when available, reduce or eliminate the cost of upgrades for LMI households. With IRA Section 50122 rebates, LADWP could install cooling with mini-split heat pumps in low-income (0%–80% AMI) households without households incurring any debt or subscribing to payment plans by using a direct install program. However, IRA program budgets are limited, and current funds would likely cover upgrades in less than 1% of 0%–150% AMI households in LA.
- Whole-home heat pumps provide the most energy efficient cooling but have high initial costs of $5,700–$9,000 for minimum efficiency systems in low-income households. In some cases, the costs can be mitigated by IRA funds. Adding minimum efficiency cooling for a single room has costs of $530 to $800 for low-income homes.



Cooling access and usage based on area median income

Equity Strategies for Safe Home Temperatures

EQUITY STRATEGY: Expand direct installation of cooling in extremely low-income households without cooling, prioritizing multifamily buildings.

Benefit/Impact	Cost	Metric
• An estimated 230,000 low-income households in Los Angeles lack access to cooling and are projected to experience nearly two months of exposure to dangerous indoor temperatures by 2035.	• Whole home cooling system upgrade costs range from $5,700-$9,000 for minimum efficiency systems in low-income households. One-room minimum efficiency upgrades for low-income households are $530-$800 per home. Providing one-room minimum efficiency cooling for all extremely low-income households lacking cooling would cost approximately $79 million.	• Number of systems deployed in LMI households. • Percentage of LMI households with cooling.

EQUITY STRATEGY: Provide heat pump incentives in the Cool LA Program and auto-enroll low-income incentive recipients in bill assistance programs to mitigate energy burdens.

Benefit/Impact	Cost	Metric
• Heat pumps provide up to 29% more energy-efficient cooling for equivalent total lifecycle costs to window-unit air conditioning (ACs). • Adding one-room cooling increases annual average utility costs between $140 and $180.	• Cool LA provides up to $225 on new cooling units and a $25 rebate to dispose of an old AC system. • If the City of LA provided the maximum Cool LA incentive for the purchase of a heat pump and the removal of an old system ($250) for every extremely low-income household without cooling, it would cost $58 million.	• Number of households with heat pump incentives. • Percentage of eligible households enrolled in program. • Average bill assistance enrollment time of less than 10 minutes on a smart phone.

EQUITY STRATEGY: Combine IRA or Weatherization Assistance Program funding with LADWP incentives to augment LADWP's HEIP, Cool LA, and other programs to lower heat pump and envelope efficiency upgrade costs for low-income households. Expand LADWP's HEIP to include funding for electrical upgrades needed to install heat pumps.

Benefit/Impact	Cost	Metric
• The Weatherization Assistance Program covered an average of $8,250 per dwelling in low-income households for energy efficiency upgrades. • IRA Section 50122 covers up to $8,000 for heat pumps in low-income households. • IRA Section 50122 provides rebates up to $2,500 for electrical wiring and $4,000 for electrical panel upgrades.	• A total of 1,500 low-income (0%–80% AMI) households could be covered by federal funding available through IRA Section 50122. • Providing the $250/dwelling incentive would reduce upfront cost for low-income households by 3.7%. • Electric panel upgrades required to install heat pumps are estimated to cost $1,300 to $5,000 (NV5 2022).	• Number of households with upgrades as a result of incentives.

EQUITY STRATEGY: Partner with the Housing Authority to provide cooling and weatherization in public housing and implement mechanisms to mitigate rent increases associated with LADWP-supported upgrades elsewhere. Renter protections, "right to return" provisions if renovations temporarily displace renters, and mechanisms to prevent short-term rent increases for multifamily rental properties receiving utility-supported upgrades could avert rent increases and displacement for non-public housing that receives low-income-qualified cooling and weatherization interventions.

Benefit/Impact	Cost	Metric
• More than 95% of low-income LA households living in multifamily buildings are renters. • Improve health and resilience without increased rent.	• Potentially limited to administrative costs or implementing rent increase restrictions post-upgrade.	• Number of public housing units with LADWP-supported upgrades. • Number of LADWP-supported upgrades with rent increase mitigation measures.

Community and Rooftop Solar and Storage

Rooftop solar has had limited reach in disadvantaged communities because of barriers such as homeownership, financing challenges, costs to upgrade electrical panels or replace roofs, and split incentives (where a building owner would pay for solar, but renters would save on electricity bills).

Wilmington, LA Harbor resident:

"I'm a homeowner. And I have a duplex, so I rent out … And we're trying to get solar from the Department of Water and Power, it's difficult. Yes, you have subsidies and stuff. But you gotta put up almost twenty grand just to get the solar power. Who's going to take on all that with my tenants?"

Community solar can broaden access to solar energy benefits such as bill savings for low-income and disadvantaged community customers.

Steering Committee Member:

"Find ways to financially incentivize community solar participation. We hear folks want to participate, but there is not enough incentive."

Challenges:

- Analysis of LADWP residential net energy metering programs indicates that 62% of incentives went to households in non-disadvantaged communities. The $340 million in LADWP solar net energy metering incentives analyzed (1999-2021) disproportionately benefited predominantly White, non-Hispanic, home-owning, and wealthier communities. Disadvantaged communities, particularly in South LA and the Harbor Region, did not receive solar incentives proportional to their populations.
- Analysis of the 2,116 LADWP Shared Solar Program participants (as of December 31, 2021) indicates higher participation and subscribed capacity among non-disadvantaged, non-Hispanic, and above-median-income communities. While only multifamily building residents are eligible to participate, there was no statistically significant difference in program participation between mostly owner and mostly renter communities.

Local solar equity metrics include:

- Annual electricity bill savings by income, housing type, and low-income community status
- Change in electricity burden by income, housing type, and low-income community status.

Find additional information on this topic on the LA100 website (**http://maps.nrel.gov/la100/equity-strategies**) and in **Chapters 8** (**https://www.nrel.gov/docs/fy24osti/85955.pdf**) **and 9** (**https://www.nrel.gov/docs/fy24osti/85956.pdf**) of the full report.

Key Findings

Community Solar

- The maximum savings available to customers who subscribe to the LADWP Shared Solar Program under our model assumptions are approximately $68/year over 10 years. Increasing the maximum subscription amount to 500 kWh, establishing a 20% lower subscription rate for low-income customers, and allocating 50% of new capacity to these customers can provide average savings of $480/year for low-income subscribers.
- More than 800 MW on approximately 1,300 sites could be economically viable as 30 kW or larger projects under this modified Shared Solar approach on government-owned land, recreation centers, educational institutions, hospitals, and multifamily parcels. There are 610 economically viable potential community solar sites on multifamily properties in low-income census tracts.
- Sites in low-income census tracts that serve low-income subscribers are more economically attractive because the IRA provides incentives for projects in which at least 50% of the financial benefits are provided to low-income households via an additional 20% ITC.

Rooftop Solar

- 1.4 gigawatts (GW) of cumulative rooftop solar adoption are projected by 2035 in LA. Approximately 70% of that adoption is projected to come from single-family, owner-occupied, non-LMI households under current trends and compensation structures.
- Rooftop PV adoption among LMI customers could increase by 85% (up to 530 MW of solar and 520 MW of storage) under a direct install program for LMI customers funded by LADWP, if combined with strategies to convey solar savings to renters and resolve the split incentive challenge. A direct install approach would provide LMI households with average annual electricity bill savings of $420, or 16%–18%. Program costs of $2.2 billion over 16 years for 160,000 additional LMI household PV installations mean full implementation of this approach is cost-prohibitive and risks increasing rates for non-solar adopters.
- LMI rooftop PV adoption could increase by 40% (up to 280 MW of solar with no added storage) under a net metering program, where LMI customers are paid for any excess solar energy generated at retail rate, combined with strategies to convey solar savings to renters. Net metering would provide LMI households with average annual electricity bill savings of $460 or 30%–34%. Program costs of $2.7 billion over 16 years for 52,000 LMI households mean full implementation of a net metering approach has the highest costs of modeled scenarios and risks increasing rates for non-solar adopters.

Equity Strategies for Rooftop and Community Solar

EQUITY STRATEGY: Establish an LMI Shared Solar subscription rate. Deliver solar bill savings to LMI, renter, and multifamily building resident customers by lowering the subscription rate by 20% for low-income customers and increasing the maximum subscription to 500 kWh per month.

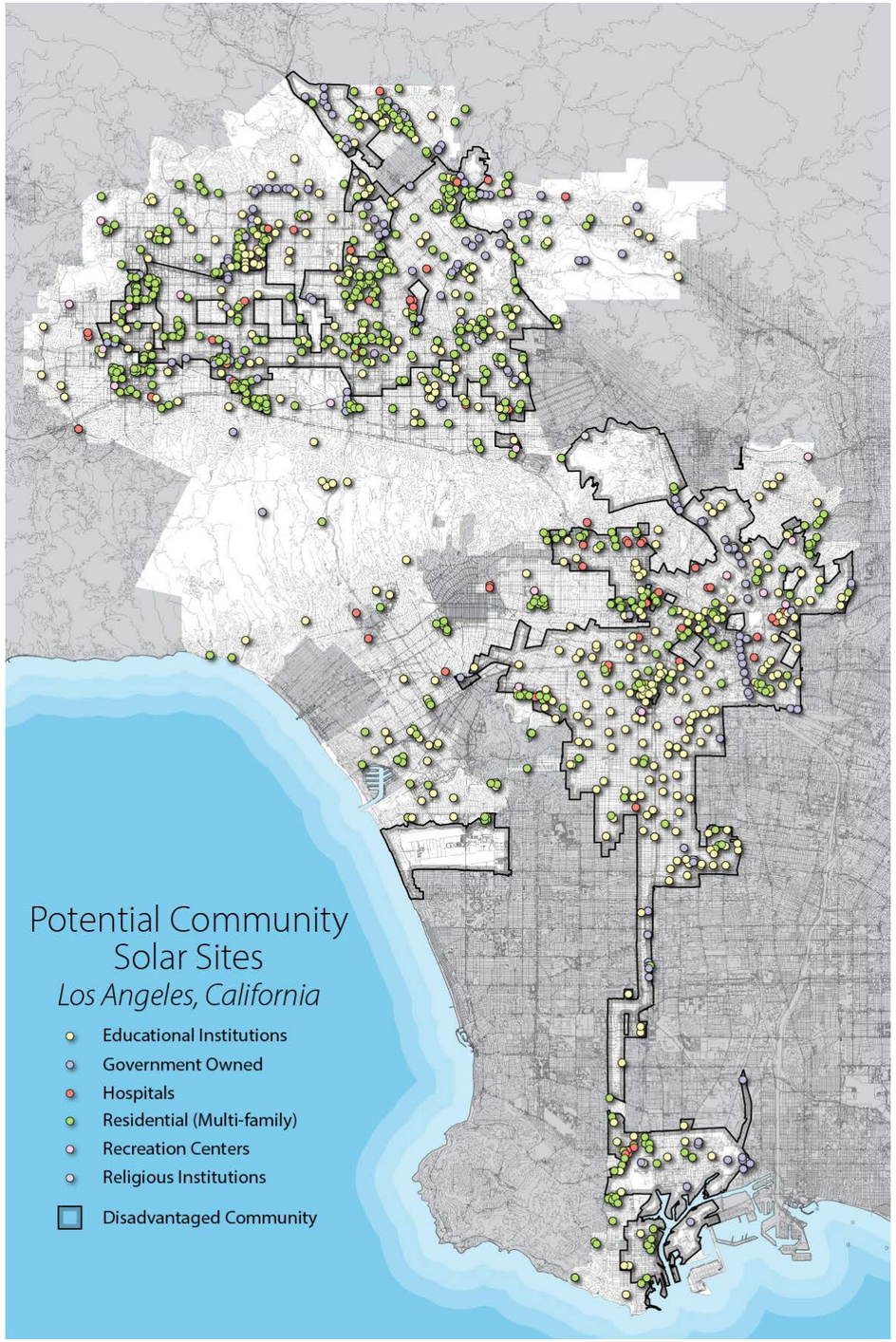
Benefit/Impact	Cost	Metric
• Maximum subscriber savings increase from a $68/year average over 10 years to $480/year for LMI customers. • Potential sites have a 41% higher net present value (NPV) under community solar compared to a feed-in-tariff power purchase agreement financial model.	• Decreases average NPV by 20%, but positive NPV still modeled at more than 4,000 potential sites with ≥30 kW capacity totaling more than 3.2 GW.	• 50% of all new Shared Solar subscribers and capacity delivered to LMI subscribers under discount rate makes projects eligible for 50% ITC.

EQUITY STRATEGY: Develop Shared Solar on economically viable ≥30 kW multifamily potential sites in low-income tracts eligible for 50% ITC to deliver solar bill savings to LMI, multifamily building renters.

Benefit/Impact	Cost	Metric
• Prioritize affordable public housing to mitigate rent increases from improvements. • Integrate Shared Solar deployment with CAMR. Six hundred economically viable, ≥30 kW suitable multifamily shared solar sites identified in low-income census tracts totaling 250 MW.	• All identified sites have a positive NPV. • LADWP costs would be primarily administrative.	• Number of the potential multifamily sites developed for Shared Solar by 2030 and 2035, e.g., 15% economically viable multifamily sites in low-income tracts developed by 2030 (38 MW), 40% by 2035 (100 MW). • Number of LMI renters enrolled by 2030 and 2035.

EQUITY STRATEGY: Substantially expand Shared Solar capacity at economically viable ≥30 kW sites and allocate 50% of new capacity to LMI subscribers. Partner with developers, contractors, and property owners to dramatically expand Shared Solar capacity on the 1,900 economically viable ≥30 kW potential community solar sites on government-owned land, recreation centers, educational institutions, hospitals, and multifamily buildings.

Benefit/Impact	Cost	Metric
• Economically viable, ≥30 kW potential sites identified at 150 government, 21 recreation center, 75 hospital, and 370 educational institution sites.	• All identified sites have positive NPV.	• Meet in-basin solar goals more affordably and equitably through Shared Solar development on economically viable public-benefit sites, e.g., 15% economic capacity developed by 2030 (125 MW), 40% by 2035 (334 MW), 80% by 2050 (668 MW).



Potential community solar sites on government-owned land, recreation centers, educational institutions, hospitals, and multifamily parcels that have a positive NPV under the Equity scenario for a community solar-based financial model

Household Transportation Electrification

The most significant inequities in the distribution of LADWP residential incentives were identified in residential EV and EV charging infrastructure investments. NREL modeled scenarios that increase equity in household light-duty EV adoption and EV charging infrastructure distribution and extend access to electric transportation to households who do not own vehicles.

Challenges:

- Between 2013 and 2021, 67% of LADWP incentives for used light-duty EVs and 82% of incentives for residential charging infrastructure went to households in non-disadvantaged communities. The $5.4 million in LADWP incentives analyzed disproportionately benefited predominantly White, non-Hispanic, home-owning, and wealthier neighborhoods.
- Communities are seeking affordable and accessible transportation options to enhance mobility and reduce pollution.
- More than 11% of LA households do not currently own a vehicle (American Community Survey [ACS] 2015–2019), including 16% of households in disadvantaged communities.

Household transportation electrification equity metrics include:

- Used EV affordability as a percentage of household expenses
- Access to home and public charging
- Household vehicle ownership rates, public transit access, time and cost of shared EV, e-bike, and transit options
- Proximity to bike lanes
- Income and disadvantaged community status.

Find additional information on this topic on the LA100 website (**http://maps.nrel.gov/la100/equity-strategies**) and in **Chapter 10** (**https://www.nrel.gov/docs/fy24osti/85957.pdf**) of the full report.

East LA resident:

"I'm envisioning...a future of carbon free...and I was thinking about like, will it be cheap to buy solar panels for charging my car? Or like, as of right now, gas prices are so expensive, so...I'm choosing to not...go to certain places, like sometimes even skip work because I work so far away like a cost-benefit is [not going to work], it's really impacting my financial decisions. Right? Will it be affordable for everybody?"

Key Findings

- Increasing LADWP's used light-duty EV rebates for low-income households from the current $2,500 to $4,000 could result in an increase in used EV adoption among low-income households in LA of approximately 50,000 vehicles by 2035.
- Households in LA that make $75,000 or less annually and adopt used EVs would reduce their average total household expenditures by 3%, scaled by income, compared to the case adopting new EVs.
- Around 20% of EV owners in LA in 2035 are estimated to lack at-home charging access, of which about 80% are those living in multifamily homes. The lack of home charging access would cost an additional approximately $300/year for LMI households, compared to households with home charging access. Neighborhood chargers can compensate for the lack of home charging access and enable increased low-income EV access and affordability. Neighborhoods including Little Tokyo, Crenshaw, Leimert Park, Central City, and Hollywood are projected to have high EV adoption potential with low home charging access.
- Providing shared EV programs, shared e-bike programs, and improved transit service could reduce trip travel time up to 12%, save up to 18% in transportation costs, and increase access to destinations by up to 3% in neighborhoods with very low car ownership.
- Fewer than 50% of LA households eligible for California Air Resources Board e-bike incentives (i.e., household incomes up to 300% of the Federal Poverty Level) are within 1,000 feet of existing bike infrastructure.
- Widespread access to e-bikes could reduce vehicle miles traveled in LA by an estimated 4.7%, saving 316,000 tons of carbon dioxide equivalent annually relative to gasoline-powered cars and avoiding 187 gigawatt-hours (GWh) of electricity demand, relative to those miles being traveled in light-duty EVs.

Shared e-bike access | Shared EV access | Improved transit

Transportation Analysis Zone ID & Neighborhood	Most affordable	Most time efficient	Access to most opportunities	Transportation Analysis Zone ID & Neighborhood	Most affordable	Most time efficient	Access to most opportunities
3718 – Panorama City	e-bike	e-bike	transit	4111 – Boyle Heights	e-bike	e-bike	EV
3731 – Panorama City	e-bike	e-bike	transit	4114 – Boyle Heights	e-bike	EV	EV
3734 – North Hills	e-bike	e-bike	transit	4115 – Boyle Heights	EV	EV	EV
3737 – Panorama City	e-bike	e-bike	transit	4150 – Boyle Heights	e-bike	EV	EV
3864 – Reseda	e-bike	e-bike	transit	4335 – East Hollywood	EV	e-bike	EV
3866 – Canoga Park	EV	e-bike	EV	4611 – Wilmington	EV	e-bike	EV
3872 – Winnetka	e-bike	e-bike	transit	4612 – Wilmington	EV	e-bike	EV
3877 – Van Nuys	EV	e-bike	EV	4614 – San Pedro	EV	e-bike	EV
4067 – Boyle Heights	EV	EV	EV	4630 – Wilmington	EV	e-bike	EV
4105 – Boyle Heights	e-bike	EV	EV	*Calculated for low-vehicle ownership, low transit access, disadvantaged communities*			

Optimized, neighborhood-specific multimodal strategies for affordability, time efficiency, and access to opportunities (by transportation analysis zone and associated neighborhoods)

Equity Strategies for Household Transportation Electrification

EQUITY STRATEGY: Increase the low-income used EV incentive from $2,500 to $4,000 and establish a purchase price cap of $25,000 for incentive eligibility.

Benefit/Impact	Cost	Metric
• Increasing low-income used EV rebates could result in 50,000 more vehicles adopted among low-income households by 2035.	• $6.2 million/year. May be offset by $25,000 purchase price cap.	• Incentive uptake of 4,200 low-income households per year for 12 years.

EQUITY STRATEGY: Shift from delayed rebates to a point-of-sale discount.

Benefit/Impact	Cost	Metric
• A point-of-sale price discount will shift some administrative burden off the customer and lower credit and loan qualification barriers.	• Neutral	• Number of participating dealerships in the city. • Incentive uptake of 4,200 low-income households per year for 12 years.

EQUITY STRATEGY: Expand at- and near-home EV charging access for low-income multifamily building residents to enable more equitable access to and use of EVs, targeting neighborhoods identified with high EV adoption potential and low charging access.

Benefit/Impact	Cost	Metric
• Apply the $5,000 maximum rebate for Level 2 chargers in disadvantaged communities and other incentives to achieve 50,000 chargers by 2035.	• $22 million/year from 2024 to 2035. • $260 million total potentially offset by state and federal funding.	• 50,000 chargers by 2035, 4,200 chargers/year in predicted low-income EV adopter areas with low charging access. • 70% Level 2 in disadvantaged communities; 20% Level 2 non-disadvantaged communities; 10% Direct current fast charging.

EQUITY STRATEGY: Provide vouchers or charging subscriptions for public EV charging for low-income households without home charging access, in partnership with charging network providers.

Benefit/Impact	Cost	Metric
• Public charging costs approximately $300/year more than home charging for LMI households in Los Angeles.	• $1.7 million/year through 2035.	• Provide each low-income used EV incentive recipient with $300/year electric vehicle supply equipment (EVSE) voucher.

EQUITY STRATEGY: Establish community-guided EV car-share, e-bike, and e-scooter programs in transportation disadvantaged communities, including Boyle Heights, Wilmington, and Panorama City.

Benefit/Impact	Cost	Metric
• Grants for program establishment and e-bike, e-scooter, and potentially low-speed EV purchase. Support with existing EVSE rebates of $5,000 for Level 2 chargers in disadvantaged communities.	• See universal basic mobility pilot in South LA (Los Angeles Department of Transportation) costs .	• Apply the existing disadvantaged community EVSE rebate for each installed charger for the program.

EQUITY STRATEGY: Collaborate to pair e-bike incentives and programs with the expansion of safe and accessible bike infrastructure and charging options.

Benefit/Impact	Cost	Metric
• LADWP e-bike incentives can be stackable with state and potential future federal incentives. • Collaborate on charging and bike lane infrastructure planning; provide financial support for program development. • Fewer than 50% of LA households eligible for California Air Resources Board e-bike incentives are within 1,000 feet of existing bike lanes.	• California Air Resources Board $13 million 2023 budget will fund 4,000–7,000 state rebates.	• Number of e-bike incentive recipients; vehicle miles traveled and emission reduction. • E-bike incentive recipients within 1,000 feet of bike lanes.

Photo from Getty images 1164647702

Truck Electrification for Improved Air Quality and Health Outcomes

Air pollution from heavy-duty trucks disproportionately impacts residents living in disadvantaged communities, which are more likely to be located near freeways and experience poorer air quality. Although heavy-duty trucks account for only 5% of registered vehicles in LA, they account for 51% of emissions of nitrogen oxides (NO_x) from on-road transportation. Electrification of heavy-duty trucks could yield significant health benefits, including reduction in premature deaths and reduction in asthma incidences in children. Pursuing electrification of heavy-duty trucks (>8,500 lbs.), and within that, heavy-heavy-duty trucks (>33,000 lbs.) like fire trucks, dump trucks, fuel trucks, and long haul tractors could achieve the highest and most equitable air quality and health improvements.

Truck electrification equity metrics include:

- Exposure to poor air quality from traffic by disadvantaged community status
- Premature deaths and asthma-related health impacts from exposure to heavy-duty truck emissions, by disadvantaged community status.

Find additional information on this topic on the LA100 website (**http://maps.nrel.gov/la100/equity-strategies**) and in **Chapter 11** (**https://www.nrel.gov/docs/fy24osti/85958.pdf**) of the full report.

Challenges:

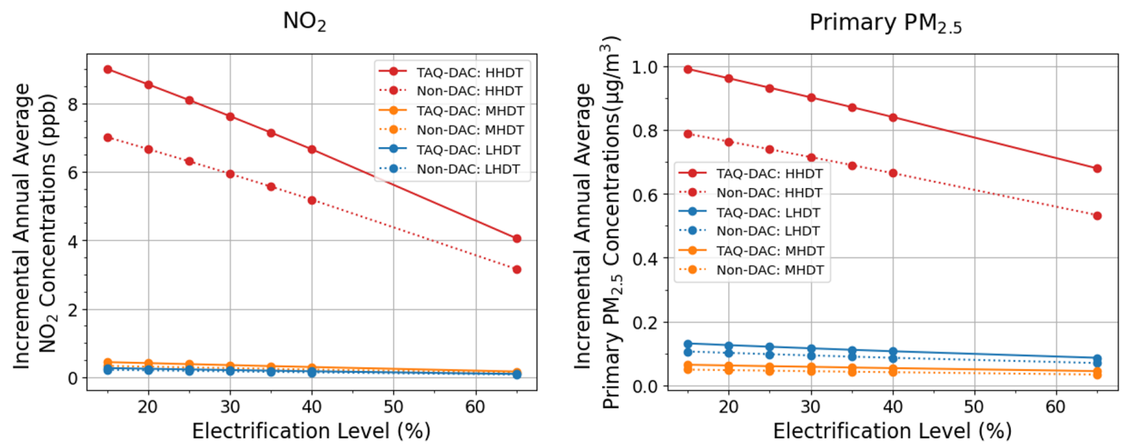
- Disadvantaged communities are disproportionately affected by traffic; 58% of disadvantaged communities have percentile scores >75 for either traffic impacts, measured by the number of vehicles on roads in the area, or diesel particulate matter exposure, and 32% of disadvantaged communities have both. NREL identified traffic air quality disadvantaged communities where neighborhoods face both high traffic impacts and diesel particulate matter exposure.
- LADWP's Charge Up LA! electric vehicle charging incentive program has had minimal participation in medium- and heavy-duty charger rebates. Communities are seeking reduced pollution from truck traffic, starting with investments in areas that have had the most pollution burden.

Wilmington, LA Harbor resident:

"Since I have been here, three generations, half of my family has died from cancer. As young as 34 years old. From breast cancer, lung cancer, liver cancer, kidney cancer. With people that don't even drink or smoke…I know that the refineries have an issue. The contaminants from the trucks and the containers, from the brakes. They have a black soot in our community. And in that black soot, who knows what that's giving us? …And you wake up in the morning, your car is full of that stuff. You wipe your car down and your rag is black. Or it's inside your house."

Key Findings

- Heavy-duty trucks currently contribute 51% of emissions of NO_x and 32% of particulate matter ($PM_{2.5}$) emissions from on-road transportation sources.
- By 2035, heavy-heavy-duty trucks (such as fire trucks, dump trucks, fuel trucks and long haul tractors) are expected to generate more than 90% of truck-related NO_2 and 80% of $PM_{2.5}$ incremental near-road pollutant concentrations (five times the other heavy-duty truck categories).
- The air quality benefits that can be achieved by electrifying heavy-duty trucks vary by where such trucks are more prevalent on LA roadways. The largest pollutant concentration reductions from heavy-duty truck electrification occur in census tracts located closest to freeways, including Interstate Highways 5, 10, 110, and 405, and U.S. Highway 101.
- Truck electrification can benefit traffic-impacted disadvantaged communities approximately 25% more than comparable non-disadvantaged communities. This is because disadvantaged communities, and especially traffic air quality disadvantaged communities, are more likely to be near major roadways in Los Angeles than non-disadvantaged communities and thus would see greater benefit from emission reductions on these roadways.
- Electrifying heavy-duty trucks could provide major health benefits, especially for disadvantaged communities near high traffic areas. These include avoided premature deaths, avoided hospital visits for cardiovascular and respiratory illnesses, and fewer asthma cases and heart attacks. Disadvantaged communities see more benefits than non-disadvantaged ones for each increase in truck electrification. For example, disadvantaged areas accrue about 55% of the benefits in avoided deaths and 60%-65% of the benefits in avoided childhood asthma incidences associated with higher electrification levels.



Incremental annual-average truck-related NO_2 concentrations (ppb, left panel) and primary $PM_{2.5}$ (µg/m³, right panel) at tested electrification levels for the three categories of heavy-duty trucks registered in LA. Evident from these results is the outsized role heavy-heavy-duty trucks play in air pollution near roadways and the greater benefits from electrification of this heavy-duty truck category. *(TAQ-DAC = traffic air quality disadvantaged community; LHDT = light-heavy-duty truck; MHDT = medium-heavy-duty truck; HHDT = heavy-heavy-duty truck).*

Equity Strategies for Truck Electrification for Improved Air Quality

EQUITY STRATEGY: Establish goals, a timeline, and a budget for electrification of LADWP's heavy-duty truck fleet (Class 2b-8), with a heavy-heavy-duty truck carve-out. Consider adding a contractual provision requiring electrification of heavy-duty vehicle fleets over time by companies contracting with LADWP.

Benefit/Impact	Cost	Metric
• Health and air quality benefits increase proportional to the fraction of LADWP fleet electrified. • Electrification of heavy-heavy-duty trucks reduces air pollution emissions five times more than electrification of other truck types, which leads to proportionally greater improvements in health outcomes.	• Dependent on fleet goal, purchase price, and operation and maintenance cost differentials.	• 6% of LADWP heavy-duty truck fleet electrified by 2025 is 240 Class 2b–8 trucks. • 18% of LADWP heavy-duty truck fleet electrified by 2030 is 710 Class 2b–8 trucks. • 40% of LADWP heavy-duty truck fleet electrified by 2035 is 1,580 Class 2b–8 trucks and aligns with Advanced Clean Fleets target.

EQUITY STRATEGY: Establish a citywide 2035 Charge Up LA! heavy-duty truck electrification target, with a heavy-heavy-duty truck carve-out; Collaborate with city agencies to establish a city-owned fleet truck electrification target; Establish heavy-duty electric truck purchase incentives.

Benefit/Impact	Cost	Metric
• 38% and 23% reduction in incremental near-road NO_2 and primary $PM_{2.5}$ concentrations respectively from heavy-duty trucks in traffic-impacted disadvantaged communities.	• Cost as low as $0 by leveraging federal and state funds or augmented by LADWP funding.	• 28,000 electric heavy-duty trucks in LA in 2035 (40% of heavy-duty trucks) aligns with Advanced Clean Fleets target.

EQUITY STRATEGY: Locate incentivized charging infrastructure by working with city and regional agencies (e.g., Los Angeles Department of Transportation and Southern California Area Governments) to understand where heavy-duty trucks would ideally be charged.

Benefit/Impact	Cost	Metric
• 400–1,700 GWh demand increase/year.	• $10,000– $125,000 per Class 3–8 truck charger rebate. • $12 to $250 million/year.	• 1,900–3,300 truck chargers by 2025. • 5,400–9,600 truck chargers by 2030. • 14,000–24,000 truck chargers by 2035.

Photo from Getty images 678817331

Distribution Grid Upgrades for Resilience and Access

The transition toward a clean energy future can put additional stress on the distribution system from DERs and electrification—especially EVs and increased use of electricity for heating, cooling, cooking, and hot water. As LA transitions toward clean energy, existing and aging distribution grid infrastructure will need to be updated and expanded to support routine operations, enable interconnection of DERs and electrified loads, and provide access to energy-related services during disaster events. Ensuring a resilient and reliable distribution grid for all communities within LA in a changing climate will require distribution system upgrades that enable equitable access to, and adoption of, clean energy technologies and equitable, resilient access to electricity-related services during disaster events.

South LA resident:

> **"I need to find someone with an upgrade of electric because…we have blockage [outages] all the time when somebody hits a [utility] post and the electricity go off and it cause problem in my home now that I cannot wash [clothes] and watch a TV at the same time. My electric goes off… they have these accidents, these people hit these posts [utility poles], then your electric's out for two hours or so, and it messes up your appliance…your appliance be off and…it's a mess."**

Find additional information on this topic on the LA100 website (**http://maps.nrel.gov/la100/equity-strategies**) and in **Chapter 12** (**https://www.nrel.gov/docs/fy24osti/85959.pdf**) of the full report.

Challenges:

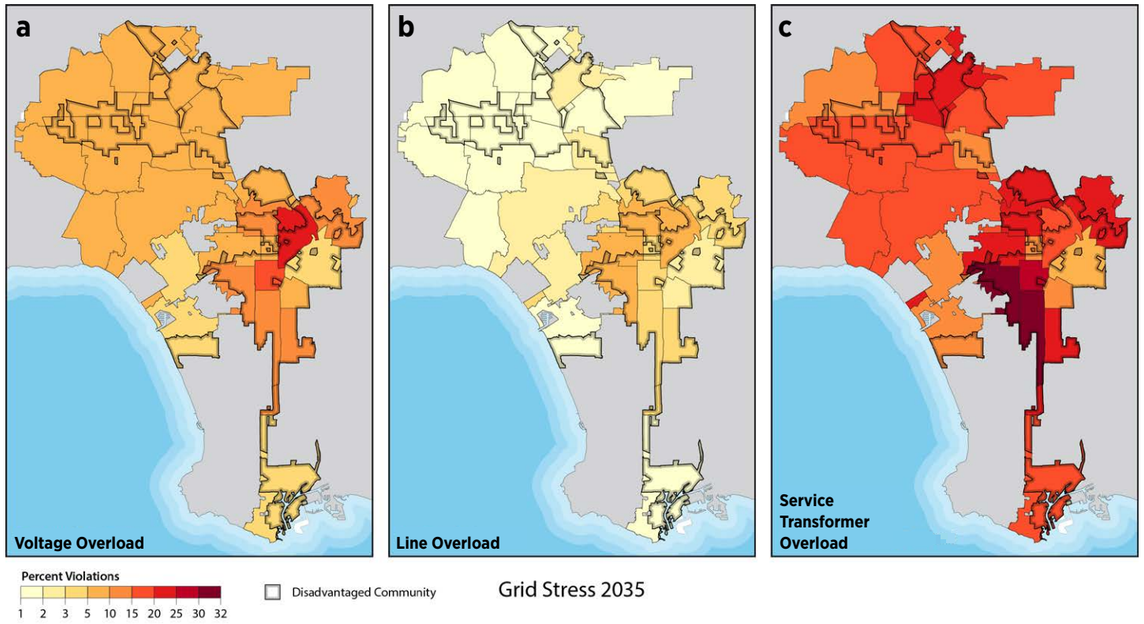
- A significant quantity of deferred maintenance has resulted in grid stress throughout LA, creating reliability challenges. These effects already cause inequitable impacts, with disadvantaged communities and mostly Hispanic communities experiencing more frequent power interruptions than non-disadvantaged, mostly non-Hispanic communities. Without intervention, these trends are likely to become worse with future load growth, particularly in areas with historically small electric usage that could see substantially higher loads with electrification.
- Underground lines offer reliability, aesthetic, and other benefits, yet disadvantaged communities are less than one-half as likely to have underground distribution lines compared to non-disadvantaged community areas (13% versus 27% of lines undergrounded).
- During disasters, the distribution system can be damaged, knocking out power to both customers and critical services. With weather-related disasters likely to become more common with climate change and the potential for significantly higher impacts of electricity outages as more services become electrified—notably transportation—distribution grid resilience becomes critical.

Distribution grid equity metrics include:

- Risk of power outages and grid stress by disadvantaged community status and neighborhood
- Ability for LMI customers to install electrified appliances, EVs, solar, storage, and other technologies without grid or service transformer limitations
- Access to critical services during disasters by disadvantaged community status and neighborhood.

Key Findings

- Grid reliability challenges are unequally distributed and disproportionally impact disadvantaged communities. Modeled levels of grid stress—overloads and voltage challenges that provide a forward-looking proxy for lower reliability—are an average of 14% higher in regions of the city with significant disadvantaged community fractions. This is expected to worsen to 25% by 2035.
- Grid stress represents a key challenge to supporting significantly higher loads from electrification and widespread integration of distributed solar and storage. By 2035, to overcome these challenges, significant increases in distribution capacity are needed.
- Grid limitations may hinder clean energy equity programs. Upgrade costs borne by customers can deter adoption, especially for lower-income customers. Required grid upgrades, if delayed, could also delay programs promoting electrification, solar, and storage.
- Access to critical services—grocery stores, hospitals, emergency shelters, convenience stores, and banking—and residential electricity varies considerably across neighborhoods, even without disaster events. Although disadvantaged communities have generally lower access to services such as groceries, hospital, and convenience stores, they generally have higher access to emergency shelters and banking. These trends continue during disasters bringing some neighborhoods into very low service access particularly for residential electricity.
- Implementing resilience strategies such as microgrids and adding backup power such as solar plus storage to 50% of critical infrastructure can improve service access during disasters. If targeted for communities with initially lower resilience, such approaches could help provide more equitable service access during disaster events.



Grid stress level estimates for 2035-Equity case showing (a) over/under voltages, (b) line overloads, and (c) service transformer overloads

Equity Strategies for Distribution Grid Upgrades for Resilience and Access

EQUITY STRATEGY: Incorporate equity as a metric in prioritizing grid infrastructure investments. Load growth and technology uptake has historically been more prevalent in wealthier neighborhoods, resulting in inequitable grid investments. Incorporating equity metrics into upgrade prioritization—such as grid stress, level of anticipated DER adoption, and demographic data—is crucial to overcoming the inequities seen in access to clean energy technologies, current and future grid stress, and reliability.

Benefit/Impact	Cost	Metric
• Reduce grid stress, increase reliability, and prevent the grid from presenting a barrier to clean energy adoption in disadvantaged communities.	• Neutral.	• Grid stress (undervoltages, overvoltages, service transformer overloads and line overload) and reliability (e.g., system average interruption duration index and system average interruption frequency index) in disadvantaged communities versus non-disadvantaged communities.

EQUITY STRATEGY: Upsize transformer capacity by a factor of 2–3+ when replacing service transformers to cover load increases and high-capacity services needed with electrification and technology adoption. This is especially important for customers with existing 60-100A service projected to need to grow to 150-200A.

Benefit/Impact	Cost	Metric
• Reduce grid barriers to clean energy adoption and avoid a need for further upgrades if new transformers have to be upgraded within a few years to accommodate higher growth.	• Medium now; cost reduction in long run.	• Number of transformers upsized systemwide, in disadvantaged community versus non-disadvantaged community, and for clusters of LMI customers outside disadvantaged communities.

EQUITY STRATEGY: Coordinate grid upgrade programs with other programs—such as those aimed at increasing equity in cooling, EVs, home electrification, and electric panel upgrades—so that the grid does not create a barrier for electrification and upgrade deployment. For example, this could include programs that cover any service transformer upgrade costs for LMI customers.

Benefit/Impact	Cost	Metric
• Prevent grid limitations from being a barrier to electrification, efficiency, and other programs.	• Neutral: potential moderate increase in program cost offset by increased ability for programs to achieve goals.	• Percent of equity-oriented programs that impact customer loads that have a correlated equity-oriented grid upgrade program.

EQUITY STRATEGY: Consider increased investment in underground distribution lines in non-flood-prone portions of disadvantaged communities.

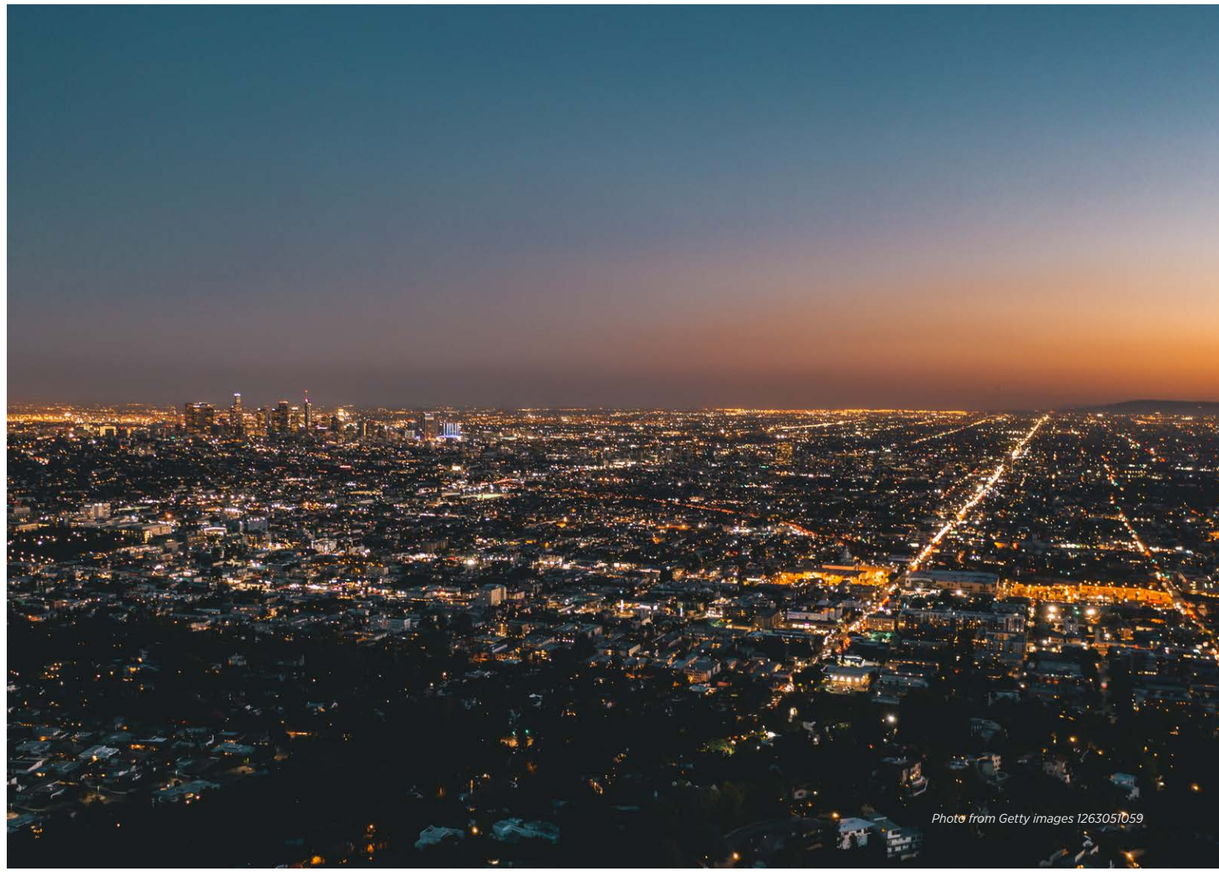
Benefit/Impact	Cost	Metric
• Increased reliability, improved aesthetics, and higher resilience to most disaster events.	• High.	• Non-disadvantaged communities have 27% of distribution lines underground. Achieving disadvantaged community parity (27%) would require 980 underground miles of the total 3,700 miles of distribution lines in disadvantaged communities, an increase of 520 miles or 43 miles/year through 2035.

EQUITY STRATEGY: Implement community-specific resilience strategies for equitable service access during disasters. This includes targeted programs to prioritize resilient electricity upgrades for critical emergency services in neighborhoods with low non-disaster service access.

Benefit/Impact	Cost	Metric
• Increased equity in access to critical services.	• Medium to high.	• Number of critical services that can be accessed during disaster events in disadvantaged communities versus non-disadvantaged communities.

EQUITY STRATEGY: Collaborate with community-based organizations for preparedness education and support programs.

Benefit/Impact	Cost	Metric
• Increased preparedness in disadvantaged communities.	• Low.	• Number of promotoras trained. • Number of community members reached.



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COMMUNITY-INFORMED AND DATA-DRIVEN POLICY AND PROGRAM STRATEGIES

UCLA

Photo from Getty images 166041568

Introduction, Framework, and Approach

The University of California Los Angeles (UCLA) recognizes the landmark opportunities and challenges that the Los Angeles Department of Water and Power (LADWP) faces as a result of the Los Angeles City Council's commitment to achieving 100% carbon-free energy by 2035, and from the call for community-driven pathways stemming from the scenarios developed through the LA100 project. As a customer, partner and stakeholder, UCLA has committed to applying its research, relationships and expertise to support a vision of what our public utility and the communities it serves will need to thrive, both financially and otherwise, during this time of immense transition. UCLA's contribution demonstrates the variety of methods and disciplinary perspectives that we integrate to support LADWP and the broader city community in preparing for the challenges that lie ahead.

The UCLA portfolio of work described here reflects UCLA's capacity, commitment and contributions to ground-truth LA100 Equity Strategies rooted in the local context by providing community-informed and data-driven strategies reflecting the policy landscape to provide direct recommendations to LADWP that will help the utility deliver renewable energy at affordable prices, in a manner that is equitable and responsive to the ways in which the unfolding climate crisis is already harming our communities. UCLA's approach is justice centered, promoting mixed methods of community engagement to ensure that priorities are co-developed and responsive to the needs of residents and stakeholders within the region.

The contributing UCLA researchers believe that the LA100 Equity Strategies analyses should go beyond a technology and economics focus, and incorporate broader local context, behavioral, social and political insights to ensure a more just transition. Overlooking these influences, both past and present, fails to represent the co-evolving nature of society and technology, which are critical factors of influence in a large-scale socio-technical transition like what LADWP is faced with. UCLA is especially poised for this work, and to speak to the landscape of related societal and institutional elements, both on individual and organizational levels.

Below, are the main equity dimensions of the transition that UCLA either led or co-led within the LA100 Equity Strategies effort.

Affordability and Policy Solutions Analysis. LADWP must continue to explore and increasingly implement at scale novel and innovative metrics and policies to support customer affordability. This entails adapting its core business model, while also acknowledging current regulatory limitations in terms of revenue collection. UCLA's work considers the paradigm shift inherent with the increased adoption of Distributed Energy Resources (DERs), while also providing a menu and specific recommendations for actionable strategies to improve energy and broader customer affordability across LADWP's service territory beyond the status quo. Additionally, UCLA has considered the affordability impacts on ethnic-owned businesses and assessed financial and other barriers to energy access.

Air Quality and Public Health. While LADWP is not the lead agency for the implementation of ZEV and alternative electrified modes, it plays a crucial role in ensuring that there is sufficient electricity to power these ZEVs and other modes. Therefore, it is essential for LADWP to develop the necessary infrastructure, especially in disadvantaged communities, to support the transition to ZEVs. UCLA's research examines the potential benefits of transitioning from conventional vehicles to ZEVs in LA, emphasizing equity strategies for a just transition. The study provides valuable insights for LADWP to achieve this goal and underscores the agency's unique position to contribute to the improvement of the region's air quality and public health.

Jobs and Workforce Development. A major transformational impact of LA100 will be on jobs, workforce, technology and business development within the energy, infrastructure and broader green jobs sectors in the city. This is a multi-faceted concern, and UCLA developed a multiscale data analysis and modeling platform to project changing occupational and industry needs for green jobs employment throughout the city, including all race/gender demographics groups and disadvantaged communities.

In parallel to this multiscale data platform, the research team conducted an in-depth community case study in Wilmington, CA which has drawn on local knowledge and established relationships in the region with community members, unions and decision-makers to inform the development of workforce development pathways and technology solutions for communities that will be impacted most severely. This work can guide LADWP's strategy at multiple scales and locations, in multiple dimensions, using mixed methods that together could yield a comprehensive perspective to inform this transition strategy.

Housing and Buildings. As the transportation fleet and domestic appliances transition from being powered by fossil fuels to renewable, electrical energy, buildings will become a central conduit of energy flows. These declines in fossil fuel consumption will result in corresponding, but not necessarily proportional, increases in building electricity demand. Due to the criticality of these end-uses for health, safety, and economic activity, the reliability of the power system must improve in a commensurate manner. Via the Energy Atlas, UCLA has enriched historical account level energy usage, expenditures, and arrears data with additional relevant context. This is done by aggregating account level usage to the parcel level and linking these records to building attributes from County Assessors' office, building construction permits data from the city, and sociodemographic information from the Census. Additionally, we are also able to aggregate and visualize these data at the community level, relative to measures environmental pollution burden and community disadvantage from CalEnviroScreen, among others. This work provides a technical foundation from which LADWP can build on in the future to better assess other related equity issues within the energy system such as (1) if there is inequitable exposure to grid disruptions, (2) estimate the economic impact of power outage incidents, (3) support evidence-based prioritization of grid upgrades and if the 100% renewable future will mitigate this situation.

Energy Affordability and Policy Solutions Analysis

Gregory Pierce, Rachel Sheinberg, Daniel Coffee, et al.

UCLA Luskin Center for Innovation, Institute of the Environment and Sustainability and School of Law

I. Introduction

Background and Motivation

Affordability refers to utility customers' ability to pay their bill. The considerable but necessary costs of the transition to 100% renewable electricity by 2035, coupled with the folding in of current heating and transport expenditures into future electric bills, are a key equity concern to LADWP, LA residents and small businesses as they directly influence energy burden, and, indirectly, affect broader affordability considerations for LADWP customers.

Generally, costs incurred by public utilities such as LADWP, including those to transition to renewable energy, must be recovered directly by the utility through revenue increases. This first means increased 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% renewable energy without further increasing the financial burdens of already disadvantaged Angelenos, while also making sure that the broader benefits of the transition are equitably distributed. There also remains considerable uncertainty on the exact level and timing of costs associated with the utility's 100% renewable investments.

To that end, the UCLA Luskin Center for Innovation (LCI) and School of Law were commissioned to conduct an Energy Affordability and Policy Solutions analysis as part of the broader LA100 Equity Strategies (ES) effort. This work builds on LCI's past and present engagement on utility affordability and broader equity issues in both LA and California. Our work on affordability in LA100 Equity Strategies was undertaken in complement to and in partnership with NREL's affordability focused-rate structure and on-bill

financing modeling. Consequently, our research goes beyond rate (re)design to focus on the landscape of and specific options for, implementable, robust, and long-term structural solutions. Specifically, this entails data, analyses, and strategy architecture that will comprehensively address affordability, building on ongoing efforts. This work is also complementary to the UCLA Center for Neighborhood Knowledge's analysis of ethnic small business energy equity issues, including affordability.

II. Approach

Data and Methods

To undertake this work, we synthesized 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:

- Existing primary quantitative, representative, or census-type household and customer data, including LADWP customer-level data shared through the UCLA California Center for Sustainable Communities' Energy Atlas, as well as 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.
- Published reports by LADWP and LA city offices including the Office of Public Accountability and City Controller.
- Stakeholder input, including from LA100 ES Steering and Advisory Committees.
- Academic and peer utility literature review.
- LADWP administrative staff interviews.

Using these data sources, we produced four distinct, but interrelated analyses detailed in brief with key highlights below:

- Describing current and historical legal constraints to addressing affordability.
- Creating a profile of the baseline energy affordability status quo in LA.
- Producing a landscape analysis as well as detailed consideration of and recommendations on implementation for long-term energy affordability metrics.
- Producing a landscape analysis as well as detailed consideration of and recommendations on implementation for long-term energy affordability policy solutions.

III. Findings

Legal Constraints on Affordability Support

We include an analysis of 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. This work included a review of the various agencies and governing documents that determine how LADWP sets electricity rates, which exist at the municipal, state, and, to a lesser extent, federal levels. Regulations reviewed include but are not limited to: California's Constitution and Propositions 13, 218, and 26; California's Public Utilities Code and California Energy Commission regulations; and the Los Angeles City Charter, Municipal and Administrative Codes, City Council Ordinances, and Executive Directives.

First among these constraints, especially in the context of ratemaking for affordability, is Proposition 26's restriction on municipal imposition of new special taxes, fees, and cross-subsidies unless approved by two-thirds in a city-wide vote. Therefore, discussion of structural changes to LADWP's electricity rate structure or discount programs will have to consider working within the bounds of Proposition 26 or pushing for a ballot initiative for approval of more fundamental changes.

Baseline Affordability Profile

In order to map a path forward it is critical to understand the energy affordability status quo facing LADWP ratepayers, especially vulnerable populations. Our Baseline Affordability Analysis provides a wide-ranging overview of electricity affordability considerations for households in LA. This analysis addresses the effects of bureaucratic processes and structures, effects of rates and costs, utility policy actions, and consumption trends as they relate to the planned renewables and electrification transitions. With respect to each of these areas, the prevailing focus is on the experience of in-need households.

We characterize, broadly, the status quo facing in-need LA households with respect to energy affordability and energy burden to answer key questions, including:

- How will the LA100 transition impact affordability for in-need households?
- How do rates and billing affect affordability?
- 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?
- What are other potential barriers that might influence the transition to renewables?

A few high-level takeaways from this work are that:

- The whole LADWP bill – that includes four 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 LA city, despite pandemic-era and post-pandemic shut-off moratoria and crisis relief policies. Debt is concentrated in communities of color and stratified by income and housing status.
- Bills from customers on discounted rates represent a small portion of LADWP's residential and total power system revenue, and discount program offerings are under-enrolled and have smaller, less flexible benefits than similar programs in other service areas. Expansion of enrollment and benefits is needed and will have muted negative revenue impacts.
- Electricity affordability burdens constrain energy use among in-need households, and this constraint manifests in potentially health-harming under-consumption of air conditioning, and thus insufficient thermal comfort in extreme heat events.
- Affordability and broader just transition support programs continue to grow at LADWP, but as is true across many utilities, survey data suggests program offerings are hard to navigate for many households, leaving major programs under-enrolled and not benefitting all households in need.

Energy Affordability Metrics

As the LA100 transition moves forward, LADWP will need to commit to tracking and transparently reporting on specific, quantitative affordability outcomes for the city's in-need households to assess whether equity and affordability goals are being realized. Capturing data that accurately reflects real-world outcomes calls for a multifaceted approach that is in keeping 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, which requires reliable data collection options.

We conducted a first-stage analysis consisting of background review of pros and cons for each of eight core metric categories to reduce energy burden. Based on the results of this background analysis and input from the LA100 Steering Committee and other stakeholders, our second-stage, detailed analysis focused on four potential metric areas: Discount Programs, Crisis Relief, Thermal Comfort and Energy Insecurity. Two of these metrics, discount programs and crisis relief, relate to specific policies, whereas thermal comfort and energy insecurity can be supported by a wider range of policy strategies. See Figure 1 for our core recommendations for adoption and tracking in these metric areas.

Energy Affordability Policy Strategies

The adoption of robust affordability metrics alone will do little to actually ensure affordability for customers. LADWP will need to take further, short- and long-term policy action to lower energy bills for low-income households and equitably distribute other LA100 benefits. We conducted a first-stage background review of eight core policy strategy categories to reduce energy burden. Based on the results of this background analysis and input from the LA100 Steering Committee, our second-stage, detailed analysis focuses on four potential policy areas: Discount Programs, Crisis Relief, Structural Energy Efficiency, and Community Solar. This analysis serves to complement NREL's focus on Rate Structure and On-Bill Financing.

Two of these policies, discount programs and crisis relief, are affordability specific, whereas structural efficiency and community solar relate to broader energy equity and supply goals.

In each of these areas, LADWP also undertook action during the course of our study. Accordingly, our analysis addresses both how best to evaluate the benefits of these actions and potential pathways to evolve programs further in the long-term.

IV. Recommendations and Next Steps

See the figure below for our core recommendations for adoption of and tracking in these policy areas. Generally, we recommend focusing on data collection and evaluation of novel programs in the near-term, while scaling up and expanding program activities and benefits in the long-term.

METRICS

DISCOUNT PROGRAMS
- 80% or higher enrollment

CRISIS RELIEF
- <1% uncovered residential shutoffs
- Aggressive numerical target for uncovered small business shutoffs

THERMAL COMFORT
- <5% self-reported discomfort
- <5% thermostat > 78 degrees

ENERGY INSECURITY
- No current recommendation

POLICIES

DISCOUNT PROGRAMS
- Enhance enrollment in two major programs
- Next: expand benefits & eligibility pool closer to CARE/FERA

CRISIS RELIEF
- Boost discount enrollment and evaluate motion impact
- Next: protections for other residential & small biz customers

STRUCTURAL EFFICIENCY
- Support city-wide efforts to route IRA & LIHEAP+ funds
- Rapidly scale & adapt "in field" impacts of CAMR

COMMUNITY SOLAR
- Evaluate "in field" VNEM pilot for potential expansion

Small Ethnic-Owned Businesses Study

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I. Introduction

Small Ethnic Owned Businesses (EOBs) are a vibrant part of the economy, our culture, and a critical pathway for wealth building in ethnic economies. In the City of Los Angeles alone, there are over 400,000 entrepreneurs, 3 in 5 are people of color, and 1 in 3 are ethnic-owned enterprises. Despite EOBs making up a majority of the business sector in the City of Los Angeles, little research has been conducted to understand the structural barriers EOBs' will face in adapting to climate change and transitioning to renewable energy as well as the opportunities for EOBs to contribute to the transition to cleaner energy. Developing evidence-based policies, programs, and practices to assist EOBs is critical because they employ a significant number of workers and are crucial to the economic growth of disadvantaged communities.

II. Approach

The UCLA Center for Neighborhood Knowledge (CNK) and the UCLA Latino Policy and Politics Institute (LPPI) embarked on a one-year community informed research project to identify and assess financial and other barriers to energy access and affordability for small EOBs and entrepreneurs in the Los Angeles region as LADWP commits to 100% renewable energy.

In the Ethnic Small Business Technical Chapter, we present findings from a survey of small ethnic-owned businesses (EOB) in the Los Angeles area and pilot workshops to better understand their attitudes towards sustainability, energy burden, anticipated climate change impacts, and needs to transition to 100% renewable energy. We conducted this study using a community partnership model where the following organizations informed and provided feedback for the research: Asian Business Association - Los Angeles, Asian Pacific Islander Small Business Program, Dine Black Los Angeles, the Greater Los Angeles African American Chamber of Commerce, Inclusive Action for the City, Los Angeles Legal Assistant, and New Economics for Women. We employed an online survey to draw quantitative findings to inform the Los Angeles Department of Water and Power's transition to 100% renewable energy. The community/business partners, LADWP staff, and prototype workshops provided qualitative insights.

III. Findings

Our analysis of the survey yielded six key takeaways:

- Nearly three-fourths of small ethnic-owned businesses (EOBs) experienced negative COVID impacts and faced numerous barriers to accessing government programs and assistance.
- Almost a third of small EOBs are energy burdened and struggle to pay their utility bills.
- Over half of EOBs reported that they have already been hurt by climate change, and nearly half expect negative impacts for their future.
- Only a tenth of EOBs businesses in the City of Los Angeles are aware of and understand the consequences of LADWP's transition to 100% renewable energy.
- Less than a quarter of EOBs in the Los Angeles region have a sustainability plan in place.
- The priority needs for small EOBs to transition to 100% renewable energy are payment programs to fund upgrades to existing equipment, educational materials, available in multiple languages, to understand how their business can transition and new energy efficiency equipment.

The analysis also finds significant differences in small EOBs by race/ethnicity, industrial clusters, and type of business (home-based vs. storefront).

- African American/Black and home-based businesses face more challenges in paying their utility bills than other racial/ethnic groups and storefront businesses.
- Businesses in low-wage industries feel that climate change will have a negative impact on their businesses and storefront businesses are more likely to anticipate both positive and negative impacts due to climate change.
- Storefront businesses were more likely to select educational materials to understand how their business can transition, and training for existing staff as their top needs to adapt to 100% renewable energy.

In addition to the survey findings, the prototype workshops and qualitative input from stakeholders yielded three additional findings:

- LADWP does not currently have a unified strategy to analyze business data to better understand their small business customers in terms of energy consumption and program participation.
- Direct outreach to small ethnic-owned businesses, small ethnic business serving organizations, and in-language accessibility is necessary to reach entrepreneurs who are typically excluded from traditional business studies.
- Outreach events should include opportunities for two-way interaction -- LADWP providing critical information on small-business programs to EOBs, and EOBs providing recommendations to LADWP on EOB priorities and needs.

IV. Recommendations and Next Steps

Based on the empirical findings from the survey, the prototype workshops and qualitative input from stakeholders, we offer five main recommendations for LADWP:

- Evaluate recent and current small-business energy efficiency programs to identify which have been effective in engaging small EOBs to effectively reduce energy consumption and costs.
- Develop more targeted policies, programs, and practices to assist small businesses and eliminate the participation barriers that EOBs face.
- Partner with business-serving community-based organizations and other trusted agencies to provide technical assistance and better engage their small business customers, particularly EOBs.
- Collect and generate more robust and precise data on energy usage, energy burden and location of their small business customers to prioritize LADWP's outreach to the most disadvantaged businesses and neighborhoods.

Examine the legal mechanism that would enable LADWP to provide monetary assistance to small businesses and EOBs to reduce participation barriers to energy efficiency equipment upgrades which are typically cost prohibitive.

LADWP has taken some important initial steps to achieve equity for small businesses and EOBs, but much more is required. Implementation of new equity policies, programs and practices will not be easy. It will also require joint efforts with governmental energy agencies and utilities. As daunting as this may sound, these entities share a common goal of a just transition to 100% renewable energy. While the study focuses on LADWP, many of the findings and recommendations are applicable to the other entities. Many of the potential solutions are also relevant beyond LADWP.

Air Quality and Public Health

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I. Introduction

We explore the potential environmental and public health benefits of replacing conventional vehicles with zero-emission vehicles (ZEVs) in LA, especially in disadvantaged communities as the city transitions to 100% renewable electricity by 2035.

Los Angeles faces persistent challenges related to air pollution, which disproportionately affects disadvantaged communities. These communities often experience higher levels of traffic-related air pollution due to their proximity to roadways, leading to increased health risks. By examining the potential benefits of ZEV adoption, this study addresses existing knowledge gaps regarding the equitable distribution of air quality and health benefits during the clean vehicle transition.

The findings from this research have practical applications for policymakers, stakeholders, and communities working together to develop a more sustainable and equitable future for LA. By assessing the environmental, health, and economic impacts of increased ZEV adoption, this study can help inform decision-making and ensure that the benefits of cleaner transportation are shared by all residents, including those in historically underserved areas.

II. Approach

We developed three future scenarios in 2035 to assess how ZEV adoption affects various communities, particularly disadvantaged ones. These scenarios are Disparity (varying light-duty ZEV ownership rates), Equity (uniform 50% light-duty ZEV ownership rate), and Equity_MSS (focus on medium- and heavy-duty vehicles and off-road equipment with emission reductions aligned with CARB's Mobile Source Strategy).

We estimated ZEV ownership in each census tract within Los Angeles County for 2035. We also developed an integrated transportation system model to predict traffic volume distribution. Furthermore, we collected emission data for different sources and adjusted them based on ZEV adoption scenarios. Finally, we used a meteorology-chemistry model, to simulate air quality and a health benefits analysis tool, to estimate the health impacts of changes in air pollution levels.

Our approach provides a comprehensive understanding of the potential consequences of different ZEV adoption scenarios on air quality and public health in disadvantaged communities. By comparing these scenarios, we can inform decision-making processes and recommend strategies for cleaner air and healthier communities.

III. Findings

Air Quality:

- Light-duty ZEV adoption leads to relatively even improvements in regional air quality across LA, as the benefits are spread out due to travel between communities.
- Hotspots with high fine particulate matter ($PM_{2.5}$) concentrations are found in city center areas and the southern part of the city.

- As reported in the original LA100 study, the reduction of NO_x emissions led to an increase in ozone (O_3) levels.
- Implementing the Equity_MSS scenario, which involves a higher adoption of zero-emission medium- and heavy-duty vehicles and off-road equipment, leads to the most significant reduction in $PM_{2.5}$ concentrations.

Impact on disadvantaged communities:

- Disadvantaged communities have higher $PM_{2.5}$ concentrations and lower O_3 concentrations compared to non-disadvantaged communities.
- The Equity_MSS scenario provides the most substantial health benefits, particularly for the Hispanic population, highlighting the importance of considering racial and ethnic-specific factors in health impact assessments.

Health benefits and economic gains:

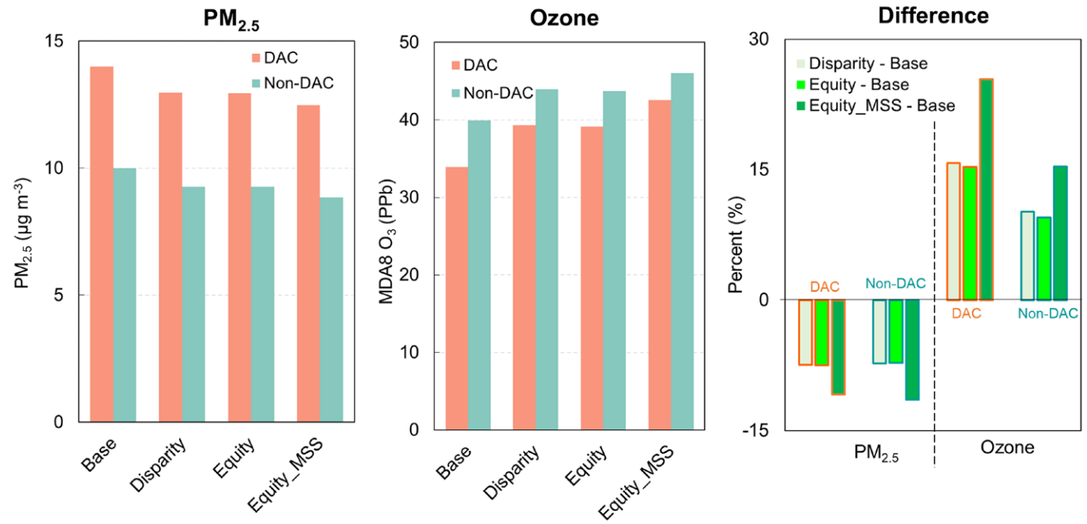
- Transitioning to zero-emission light-duty vehicles could result in $2 billion in health benefits, with $1.3 billion directed toward disadvantaged communities.
- By implementing the Equity_MSS scenario, an additional $900 million in health benefits can be achieved, with $500 million specifically benefiting disadvantaged communities.

IV. Recommendations and Next Steps

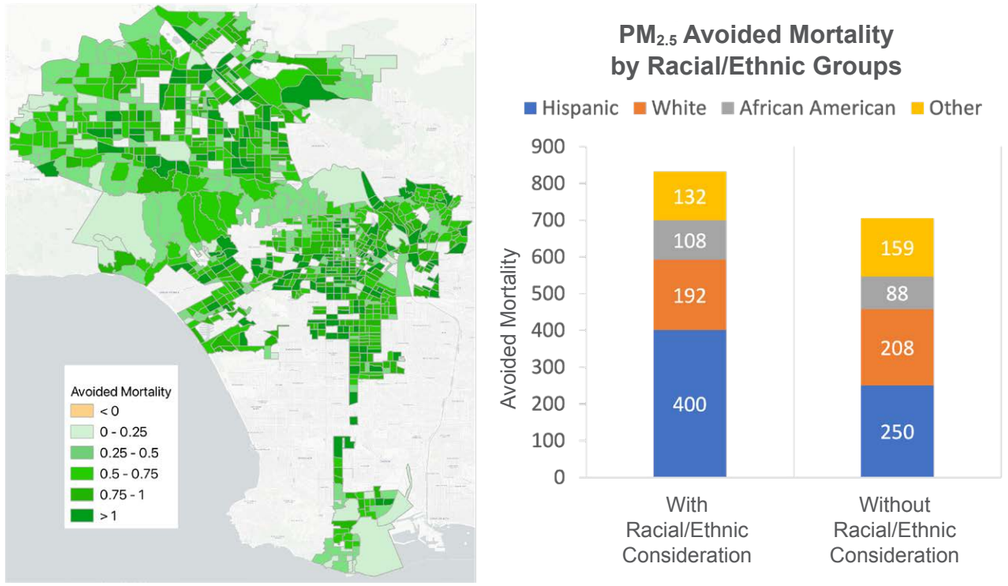
Based on our results, we recommend that LADWP collaborate with other responsible parties, focusing on the following next steps:

- Encourage vehicle electrification to reduce $PM_{2.5}$ levels to provide significant public health and economic benefits.
- Focus on electrifying medium- and heavy-duty trucks, as this will bring extra health benefits, especially for disadvantaged communities.
- Employ ethnic- and race-specific dose-response parameters in health benefits analysis to enable more equitable evaluations of the health benefits from air quality improvement strategies.
- Continue reducing both NO_x and VOC to lower O_3 levels and create a more complete strategy for managing air quality in LA.

In conclusion, our study highlights the need for comprehensive air quality control strategies that consider the complex relationships between pollutants and focus on fair treatment for all communities. By understanding these complexities and targeting the right strategies, decision-makers can improve public health and ensure a just transition toward a cleaner future.



$PM_{2.5}$ (left) and ozone (middle) concentrations averaged over disadvantaged community and non-disadvantaged communities in Los Angeles City for 2017 Base, and 2035 Disparity, Equity and Equity_MSS scenarios, as well as the relative differences between the Disparity, Equity, and Equity_MSS scenarios compared to the base scenario (right).



$PM_{2.5}$-related avoided mortality in Los Angeles City, comparing 2035 Equity_MSS and 2017 Base scenarios. Spatial distribution (left). Differences contrasting the use of a uniform beta (i.e., change function) with racial/ethnic-specific beta (right). This visualization emphasizes the disparities in health outcomes when incorporating race and ethnicity in the analysis. "Other" includes Asian American, Pacific Islander, and Native American populations.

Green Jobs and Workforce Development

Raul Hinojosa, Abel Valenzuela, Leticia Bustamante, Marcelo Pleitez, Magali Sanchez-Hall, Saul Ruddick-Schulman

I. Introduction

This research focuses on creating an equitable workforce development strategy as an integral element of a "Just Transition" to 100% renewable energy generation by LADWP in the context of the emerging green jobs economy for LA City and LA County. We developed a LA100 Public Access Data Calculator that allows for multiple community stakeholders (including ratepayers) to engage in environmental and energy justice planning. We also conducted a Community Case Study of Wilmington and created a Community Engagement Approach to identify multiple pathways for meaningful community engagement and planning for energy, ecological, and environmentally- just transition with a primary focus on jobs and workforce development connected to LADWP investments, policies, and existing programs.

II. Approach

The LA100 Public Access Data Calculator was created to allow stakeholders to explore multiple policy questions with respect to historical employment equity of LADWP and Green Jobs, as well as potential future scenarios for greater employment equity for LADWP and Green Jobs in Los Angeles (both at LADWP and outside of LADWP). The Calculator was based on well established modeling techniques such as Input-Output techniques and Social Accounting Matrices, and was customized and expanded as a unique tool designed to address a series of questions specific to the Equity Strategies project and LADWP (see Findings below).

Wilmington Case Study and Community Engagement

Wilmington, CA is known as an example of ground zero for pollution exposure locally and nationally. To complement our LA100 Public Access Data Calculator, we conducted a case study in Wilmington, CA to gather direct input from typically excluded community members that have often been excluded historically. This engagement involved monthly meetings over a period of six months, with two main goals in mind: (1) educating the community about green jobs and LADWP, and (2) understanding the obstacles in accessing such jobs. The feedback from this engagement is invaluable in informing the development of an effective LADWP and green jobs workforce development plan that includes building a green job pipeline to meet LADWP transition demands and addresses the specific needs and challenges faced by the community. Our approach was based on leading disadvantaged community indicators that revealed the environmental racism inflicted on a population that is approximately 90% Latinx and was subjected to high levels of emissions from the oil industry and Port of Los Angeles. In our community engagement meetings we developed a survey to measure before and after levels of knowledge of residents on environmental racism, green jobs, workforce development and LADWP.

III. Findings

What was the historical growth of green and non-green jobs in LA City and County between 2011 and 2019, as well as the "direct" and "indirect" employment impact of green job creation on green and non-green jobs?

- Our findings show that total green jobs grew more rapidly compared to total non-green jobs in LA City from 2011 to 2019. Green jobs grew 8.2% while non-green jobs grew 4.6%. We also found that direct green jobs are growing at a rapid pace, and are influencing the growth of non-green jobs due to green job linkages with other sectors that are not considered "green." This is creating a multiplier growth in non-green jobs.

What is the equity composition of employment by race and gender (Latinx, African American, White, Asian and other workers) for all Green Jobs in terms of Zip Codes and Disadvantaged Communities?

- Latinx represent nearly 48% of the workers holding Green Jobs, while whites hold 32% of the Green Jobs positions in the City of LA. The most underrepresented race in Green Jobs are American Indian or Alaska Native people, with 0.1% of total Green Jobs.

What is the race and gender of LADWP workers by industry and occupation, inside and outside of the LA Basin, by work location and residency as well as by Zip Codes and disadvantaged communities?

- Most LADWP workers, who are relatively well paid, do not live in disadvantaged communities. However, Latinx and African American workers make up the largest share of LADWP employees living in disadvantaged communities and earn the lowest wages of LADWP workers living in both disadvantaged communities and Non-disadvantaged communities. This is because Latinx and African American workers are more concentrated in lower wage occupations and activities, but do earn comparable wages to workers of other races in both higher and lower paid occupations.

What are the likely future scenarios for Green jobs in LA City and Country (direct, indirect and induced), taking into account future ethnic demographic projections to identify "gaps" needed to be filled in order to achieve future equity in Green employment?

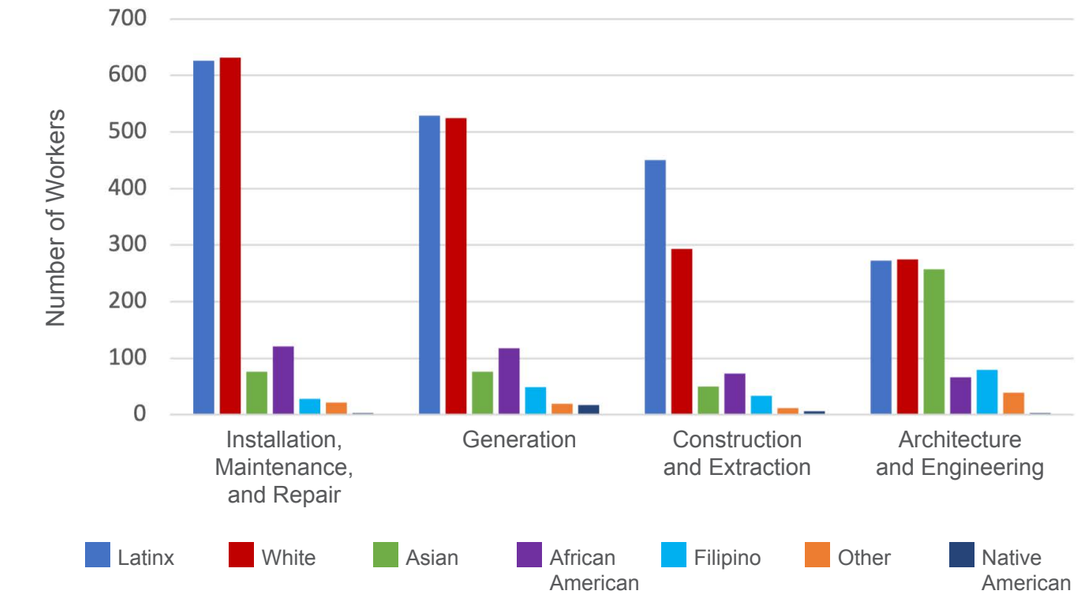
- Total green jobs in LA County are expected to grow 20% from 2019 to 2035, while non-green jobs are expected to grow 30%. The "gap" analysis shows that the number of Latinx green job workers will have to grow faster to keep up with higher demographic growth.

What are the potential future employment scenarios for LADWP by industry and occupations based on LA100 modeling of alternative technology investment options, including employment "gap" projections by race and gender category and geography?

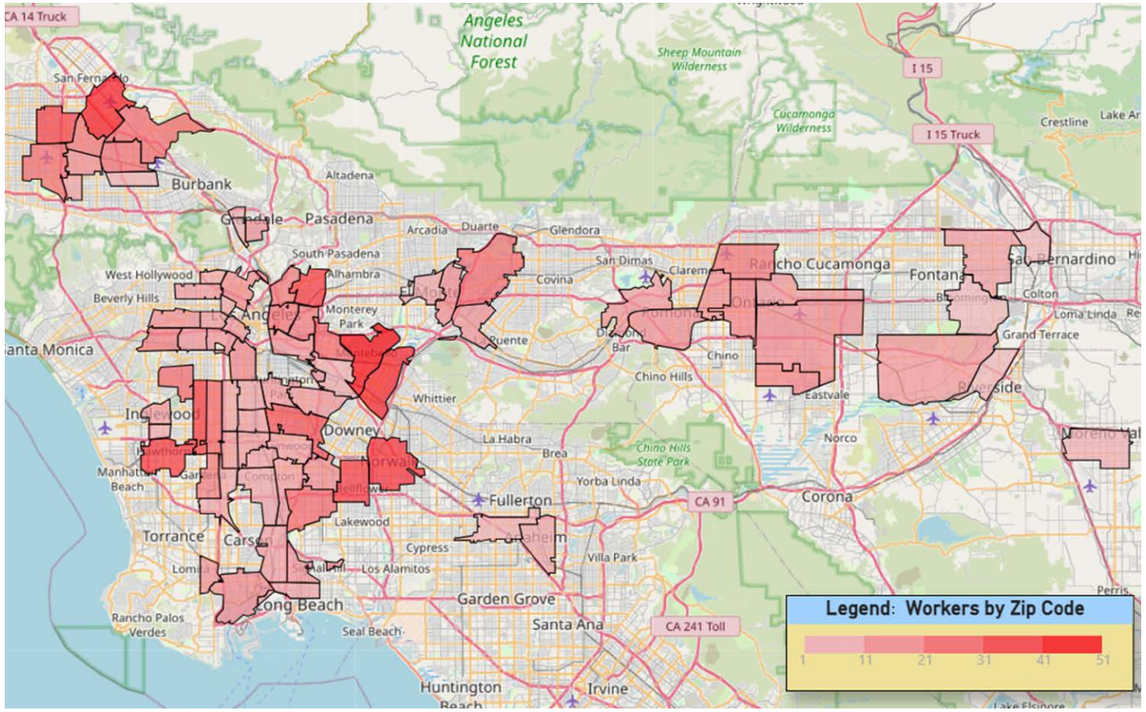
- Future LADWP employment scenarios indicate important growth in large LADWP industry sub-sectors and occupations, which will require more rapid recruitment and targeted training of Latinx and African American workers

Based on estimates for Green jobs and LADWP scenarios for workforce development training needs by industry and occupations, what are the best future equitable employment transition strategies that could be implemented?

- LADWP will need to manageably invest in and implement new Green Jobs Workforce Development pilot projects designed to expand training in particular projected occupations and to specifically recruit workers from growing race and gender groups in disadvantaged communities.



LADWP total workers in power sector by occupation and ethnicity.



LADWP workers living in zip codes with high concentration of DACs.

To assess the participants' familiarity with green jobs and workforce development for the Wilmington Case Study through the community engagement meetings, we created a survey that was administered before the community engagement sessions. The purpose of this survey was to inform the development of the curriculum. Additionally, the same survey was administered after the completion of all community sessions to track the increase in understanding and confidence in the material. The survey was completed anonymously by the same 20 participants on both occasions. Based on our analysis, the main findings are:

- The level of understanding about green jobs increased greatly, with 85% of participants indicating an above average or very high understanding compared to only 15% in the first survey.
- The level of understanding about the purpose of LADWP increased greatly, with 70% of participants indicating a higher than average or very high understanding in the second survey, compared to only 55% in the first survey.
- While participants feel better informed about job opportunities in their communities, some still feel like they could use more guidance. The number of participants who felt very empowered or extremely empowered more than doubled between the first and second survey. However, 60% of participants still felt either slightly or moderately informed.
- Participants feel more comfortable about training others, with 75% of participants indicating they feel either very empowered or extremely empowered to train other community members on green jobs and workforce development, compared to only 50% in the initial survey. Furthermore, only 1 participant indicated feeling slightly empowered, compared to 7 people in the initial survey.
- All participants maintained their interest in having a green job, with 80% indicating their desire for a green job in the second survey, compared to 75% in the initial survey.
- There was a slight increase in participation in workforce development programs, with 2 more participants indicating participation in a workforce development program in the second survey, and four others unsure if they had been part of a program. In the initial survey, 90% of participants indicated they had never been a part of a workforce development program, with only one participant stating they participated in a program.
- Interest in certification and training slightly increased, with 75% of participants indicating a very high interest in receiving certification or training from LADWP in the second survey, compared to 55% in the first survey. In both surveys, all participants had indicated an interest in receiving certification or training from LADWP.

IV. Recommendations and Next Steps

This report shows that the City of Los Angeles can achieve a just transition to renewable energy and a green jobs future, but requires community engagement and workforce development for green and LADWP jobs to close the inequality gaps in gender and race employment.

Expanding and maintaining stakeholder access to a Green Jobs Calculator can help direct investments in green jobs workforce development centers in communities that are usually marginalized, such as Wilmington, CA. A just transition for LADWP and green jobs will require a skilled and prepared workforce, and a higher paying workforce development pipeline that can cost-effectively be directed to disadvantaged communities in order to create a fair distribution of jobs in the new green economy. Our Wilmington Case Study and Community Engagement approach shows that the community is ready to participate in developing the new training pipeline for green jobs and workforce development pilot projects. More projects like this could be created by accessing Justice40 funds that require partnerships with community based organizations to invest in more disadvantaged communities Green Jobs LADWP Workforce Development.

Service Panel Upgrade Needs for Future Residential Electrification

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Figure 1. Methodology overview diagram.

I. Introduction

The goal of the electrical panel analysis was to understand the landscape of existing customer-owned electric service panels (a.k.a. load centers) within the city of LA. Utilities typically do not record information about hardware components that are installed on the customer side of the meter. Rather, they tend to only track the status of the utility-owned distribution system hardware that resides on the utility side of the meter. This analysis of customer owned service panels is explicitly focused on the equity implications associated with expected future growth in the electrification of the light-duty transportation vehicle fleet and domestic end-use appliances. Understanding the implications for customer owned infrastructure is important as all of the different transition pathways that were previously analyzed as part of the original LA100 analysis assumed significant increases in these types of electrification. The degree to which the existing capacity of customer's service panels might be a barrier to the adoption of these new technologies, particularly within disadvantaged communities, has so far been poorly understood.

The results of this work include detailed estimates of the as-built and existing service capacities of the load center hardware installed at all of the single and multi-family properties throughout LADWP's service territory. We also provide estimates of the total number of properties that will likely require panel upgrades to support full electrification going forward. Detailed analyses of these findings focus on the differences in the scope of the challenges in this area for the city's disadvantaged versus non-disadvantaged communities. Cost estimates associated with these upgrade requirements were only able to be generated for the single-family context due to high levels of uncertainty within the multi-family sector. The analyses concluded with a set of summary findings and recommendations for strategies that could better promote equitable electrification going forward. As part of this discussion, we point to new technologies and approaches to panel sizing requirements that could potentially reduce the need for service capacity upgrades, and their associated costs.

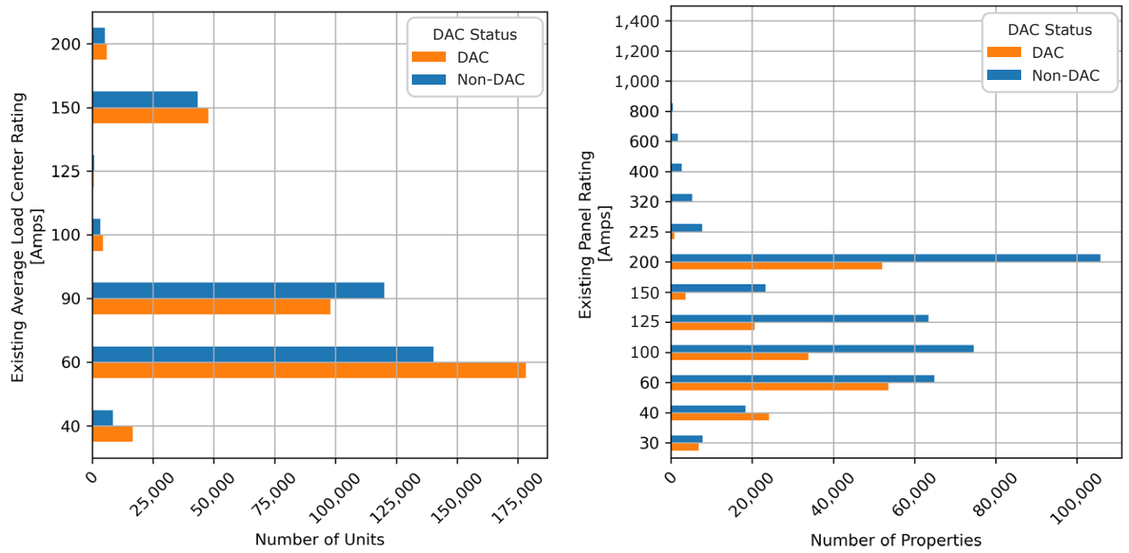
II. Approach

In order to estimate the capacity of existing customer owned load center hardware, and the potential need for hardware upgrades to support future electrification, we developed a quantitative methodology that draws upon a combination of data from historical electrical code requirements, literature analyses, local parcel level building attributes, and historical building construction permit applications throughout the city. A high-level overview of this methodology is provided in Figure 1.

III. Findings

We first estimated as-built panel sizes for each parcel in the city based upon code recommended panel sizing guidelines at the time of each building's construction. From an equity standpoint, it is important to note that both the age and size of single-family homes are strongly correlated with the disadvantaged community status of the census tracts in which they are located. For example, the average disadvantaged community single-family home is 1,427 ft2 and was constructed in 1948 while the average non-disadvantaged community home is 2,094 ft2 and was built in 1960. This means that the non-disadvantaged community homes are 46% larger and 12 years newer, on average, than their disadvantaged community counterparts. As we shall discuss, these differences manifest important equity implications in terms of the likely need for panel upgrades to support future decarbonization of the residential sector.

In analyzing the building permit data, and specifically, permitted panel upgrades, we found that there has been a roughly ~2x faster rate of turnover of panel upgrades for single family dwellings within the non-disadvantaged community census tracts, and the rate at which the number of annual upgrades is occurring has been steadily increasing over time. The average annual total permitted panel upgrades over this period (1996-2022) were 2,189 per year for disadvantaged community census tracts and 4,234 per year for non-disadvantaged community households. However, in the multi-family sector, this panel turn-over was



Overview of the estimated existing load center rating capacities for the city's single-family (left) and multi-family (right) housing stock disaggregated by disadvantaged community status.

significantly slower with only around ~200 properties being upgraded each year, in recent years. Overall, the distribution of cumulative permitted panel upgrades shows the highest concentration of permitted upgrades in single family homes has occurred within the city's more affluent coastal, hills, and inland valley neighborhoods.

By combining these panel upgrade permit data with a novel simulation approach, we were also able to assess the likelihood of upgrades having occurred before the time period of permit data availability as well as in the case of upgrades that were otherwise unpermitted. By combining these approaches, we developed final estimates for the number of existing panels of different sizes throughout the city.

Future Upgrade Requirements

Generally, ≥200 Amps is considered sufficient panel capacity for the typical single-family home to support full electrification of all existing fossil fuel end-uses as well as the addition of a single EV fast charger. It is possible for similarly sized homes with panel sizes ranging between 100-200 Amps to fully electrify without panel upgrades. However, doing so will be more challenging, and likely require the selection of lower power appliances, the use of load splitting hardware and/or dynamic load management systems.

Homes whose existing panels have rated capacities <100 Amps, are considered very likely to require an upgrade in order to fully electrify. For tenant sub-panels within multi-family properties, these thresholds are different, mostly due to the assumption that they will not be the interconnection point for EV-charging infrastructure. In the multi-family case, the thresholds for likely, potentially, or unlikely upgrades shift to <90 Amps, ≥90-150 Amps, and ≥150 Amps, respectively. Table 1 below provides the percentage of properties that fall into these different categories for each property class based upon our estimates of their existing panel capacity ratings.

Moving beyond these simple threshold based methods, using information about the size distribution of service panels at properties where permitted upgrades have occurred, we estimate that a total of 67% of the single-family homes in the non-disadvantaged community cohort and 71% of the homes in the disadvantaged community cohort have existing panel ratings that are deficient with respect to the capacity of the hardware that would most likely be installed if an upgrade were to be performed today. These figures are based upon the individual size characteristics of each property and assume that the same recommended panel sizing calculation methods that have been historically used would remain unchanged, though this may not be the

case going forward given new technologies and standards. For the multi-family context, the proportion of properties that will very likely need to be upgraded to support full electrification is 67% in disadvantaged communities versus 56% in non-disadvantaged communities.

We estimate that the total cumulative costs of upgrading all of the single-family properties with deficient capacity service panel hardware to be between $279–$629 Million within disadvantaged community census tracts and in $502–$1,129 Million in the non-disadvantaged communities. These are non-trivial figures and represent a significant potential barrier for property owners, particularly within disadvantaged community communities with less financial resources. It is possible that many of these panel upgrades can be avoided, or at least deferred, if intelligent electrification strategies are pursued and code mandated panel sizing calculations can be updated to accommodate the capabilities of new technologies and more realistic load assumptions. We did not estimate costs for multi-family upgrades due to the heterogeneity of the load center hardware and communal/unitary load configurations involved.

IV. Recommendations and Next Steps

- Support efforts to retrofit the capacity of the load centers at existing residential buildings to 200 Amps for single-family homes and 150 Amps for multi-family units.
- Prioritize alternative approaches to enlarging capacity, as further capacity increases will likely require significant investments in upstream transmission and distribution systems.
- Leverage different sources of external funding support for panel upgrades that are currently being made available at both the state and federal levels, especially those offered through CA's TECH program and the Federal Inflation Reduction Act (IRA).
- ncentivize the installation of 120-Volt electric appliances and/or circuit splitting hardware when pursuing electrification retrofits.
- Incentivize the adoption of new smart-panel and smart breaker software-controlled load center hardware.
- Support the revision of code required methods for calculating the capacity of load center hardware to take into account more realistic assumptions about concurrent loads and the new load management capabilities of smart panel/breaker systems.
- Begin tracking both the capacity and command/control capabilities of customer installed load center hardware.
- Advocate for new City, State, and Federal programs that provide more direct funding support for multi-family property load center upgrades with detailed prescriptions for how costs/incentives will be split between tenants and property owners.

Summary overview of the proportions of single and multi-family properties that will likely require panel upgrades to support full electrification based upon commonly used panel rating classification thresholds

Property Class	Panel Rating Classification	Upgrade Required for Future Full Electrification?	Disadvantaged Community Properties	Non-Disadvantaged Community Properties
Single-Family	<100 Amps	Likely	45.8%	25.9%
	≥100 & <200 Amps	Potentially	30.6%	45.1%
	≥200 Amps	Unlikely	23.6%	29.0%
Multi-Family	<90 Amps	Likely	66.9%	56.3%
	≥90 & <150 Amps	Potentially	19.2%	30.0%
	≥150 Amps	Unlikely	13.9%	13.7%

Conclusions and UCLA's Vision for LA100 Equity Strategies Beyond this Report

UCLA is committed to working collaboratively with LADWP staff on continued knowledge transfer, advising on metrics and developing evaluation architecture that can be implemented and iterated over time. UCLA has been committed to a fulsome and productive collaboration with the National Renewable Energy Laboratory (NREL) for the life of this project, and, importantly, an ongoing partnership with LADWP to see the findings of this study implemented.

Ensuring greater equity for the residents of Los Angeles, the constituents and partners in our public utility, is a process that takes time. The legacy of redlining and the current inequalities in the city, including exposures to environmental contamination, poverty, unaffordable housing, and more, are a result of many decades of history. LADWP has an important role to play to ensure that everyone has equal access to energy sufficiency at affordable costs, while maintaining the fiscal integrity of the utility.

One of the important tasks going forward includes assessing the technical recommendations of NREL's 100 percent renewable analysis, and their implications for the region and for equity. This deep dive and unpacking needs to be done with communities across Los Angeles such that there is deep engagement and dialogue about the choices before us. UCLA can work to develop the assessments and materials that can frame these discussions and help organize them.

NREL's report has important equity implications for LADWP, both internally and externally, and its novelty requires new thinking about metrics to evaluate equity over time. UCLA can help co-develop tools with LADWP (such as using the Energy Atlas for a database that is spatially enabled) in conjunction with the Luskin Center's equity analysis to propose different strategies for measurement and tracking as the Department determines priorities with communities and its internal needs. UCLA can bring best practices that may help in this development.

Included in the endeavor of developing energy metrics is more work on energy burden. This may include both the financial burden on households and businesses in the region, particularly small businesses, but also the burden that very large scale consumers of electricity create, for example very large luxury homes. This is not analysis that has been commonly done, anywhere and is important for LADWP such that it can meet 100% renewable generation in a manner that minimizes harm. Through a deep look at rates and the inequalities in consumption alongside the power division's capacities for distributing energy across the region, through to increased need for generation to meet the increasing consumption of electricity with electrification, a better understanding of the requirements for the transition will be possible. This can include such things as materials necessary (metals and minerals), land and transmission impacts and more. Such cost factors are an important part of equity analysis and the impacts of 100% renewable. UCLA is well placed to provide this analysis for the agency to consider.

NEXT STEPS

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LA100 Equity Strategies is just the beginning of our journey to a more equitable clean energy future. The strategy options presented in this report will serve as guidance for our city's transition. We have a bold goal, and we have the knowledge and strategies needed to reach that goal. Now it is up to us, the city of Los Angeles, to make it happen.

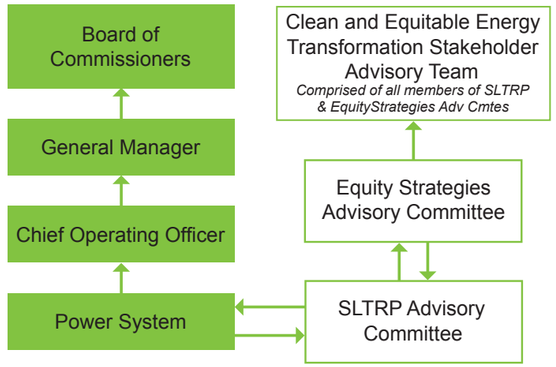
The city of Los Angeles is its people and the unique, diverse communities that they form. LADWP has a mission to serve the people of LA with reliable, resilient, affordable energy. We know that past injustices have resulted in an inequitable distribution of the costs and benefits of our energy system. We know that improving equity requires intentionally designed strategies and actions. The guidance provided by the community-based organizations represented on the Steering Committee helped us to better understand and appreciate the priorities and challenges of some of the city's most vulnerable communities. The clean energy transition requires a new way of thinking about how we share in both the benefits and costs of our energy systems: Available does not mean it is accessible to everyone. Lowest-cost energy is not affordable to many of our residents. Life-saving technology such as air conditioning may be commonplace to some, but out of reach for others. And equal is not the same as equitable.

Our commitment is to make future decisions by leading with equity. This means:

- Carefully considering and implementing a subset of the strategies developed through this work
- Engaging communities in the decision-making process and co-designing our energy future together
- Measuring our progress along the way to provide transparency and accountability.

Building on LA100 Equity Strategies, LADWP will update the SLTRP, LADWP's roadmap for decarbonization and modernization. Changes that will be part of the 2024 SLTRP include:

- **Energy Burden and Affordability.** In addition to evaluating alternatives based on reliability and decarbonization, scenarios will also include comparisons of energy burden and relative affordability.
- **Local Air Quality.** Future plans will also include relative comparisons of improvements to local air quality, driven primarily by transportation and building electrification.
- **Community Outreach.** Expanding on LADWP's industry-leading public engagement, LADWP will also include a broader campaign to increase awareness of decarbonization plans and program offerings.
- **The Equity Strategies Advisory Committee.** Continuing the model established through LA100 Equity Strategies, a newly-formed Equity Strategies Advisory Committee will have an active role throughout the SLTRP process.
- **Equity Strategies Program Development.** The Equity Strategies Advisory Committee will provide important contributions on a full range of strategic options, evaluations and design of existing and new programs, planning for equitable infrastructure investments, green jobs workforce initiatives, data analytics, and metrics development.
- **The Clean & Equitable Energy Transformation Stakeholder Advisory Team.** Collectively, the Equity Strategies Advisory Committee and the SLTRP Advisory Committee will form the Clean & Equitable Energy Transformation Stakeholder Advisory Team as illustrated in the figure.



The Clean & Equitable Energy Transformation Stakeholder Advisory Team

LADWP cannot do this alone. The partnerships that are required to move into a carbon-free future are tremendous. We have already seen the passion and determination of the communities and people who participated in this work, but more engagement is needed. City and county agencies must work closely on policies, programs, and strategic initiatives in order to create more energy efficient housing, access to cooling and EV charging, truck electrification, and to develop cleaner transportation options for Angelenos. More importantly, our community leaders, elected officials, industry leaders, and private organizations must engage to ensure no one is left behind in this transition. It will require difficult conversations about money, priorities, and a hard look at our current regulations so that the city can evolve to better serve its people. All of its people.

Together, we'll change the future of our city. We'll change the future of our nation. We'll build an equitable clean energy future for all.

Acknowledgements

LADWP, NREL, and UCLA would like to thank the following organizations for guiding our team throughout the duration of this project:

Steering Committee

Climate Emergency Mobilization Office (CEMO)
Climate Resolve
Community Build
DWP MOU Advisory Committee
Enterprise Community Partners
Esperanza Community Housing
Los Angeles Alliance for a New Economy (LAANE)
Move LA
PACE
Pacoima Beautiful
RePower
SLATE-Z
South LA Alliance of NCs
Strategic Concepts in Organizing and Policy Education (SCOPE)

Advisory Committee

Center for Energy Efficiency and Renewable Technologies (CEERT)
Chief Legislative Analyst (CLA)
Civil & Human Rights and Equity Department
Council District 01 - CM Eunisses Hernandez
Council District 02 - CM Paul Krekorian
Council District 03 - CM Bob Blumenfield
Council District 04 - CM Nithya Raman
Council District 05 - CM Katy Yaroslavsky
Council District 06 - CM Imelda Padilla
Council District 07 - CM Monica Rodriguez
Council District 08 - CM Marqueece Harris-Dawson
Council District 09 - CM Curren Price
Council District 10 - CM Heather Hutt
Council District 11 - CM Traci Park
Council District 12 - CM John Lee
Council District 13 - CM Hugo Soto-Martinez
Council District 14 - CM Kevin de Leon
Council District 15 - CM Tim McOsker
Housing Authority of the City of Los Angeles
International Brotherhood of Electrical Workers (IBEW)
LA Cleantech Incubator
Los Angeles City Planning Department (LACP)
Los Angeles Department of Transportation
Los Angeles World Airport (LAWA)
Natural Resources Defense Council
NC Sustainability Alliance
Office of Public Accountability (Rate Payer Advocate)
Office of the Mayor
Port of Los Angeles (POLA)
Sierra Club
Southern California Association of Non-Profit Housing
USC Equity Research Institute

A special thanks to the residents of the following communities who provided their expertise, insights, and ideas through participation in the community listening sessions:

South LA*	March 29, 2022 @ 6 p.m.
SF Valley*	March 29, 2022 @ Noon
East LA*	March 30, 2022 @ 6 p.m.
Harbor*	March 31, 2022@ 6 p.m.
South LA*	April 27, 2022 @ 6 p.m.
SF Valley	September 21, 2022 @ 1 p.m.
South LA 2	October 25, 2022 @ 10 a.m.
Wilmington 1	October 25, 2022 @ 6 p.m.
Wilmington 2	October 26, 2022 @ 6 p.m.
Watts	November 9, 2022 @ 6 p.m.
South LA 2	November 10, 2022 @ 5:30 p.m.
South LA 1	December 6, 2022 @ 6 p.m.
East LA	December 7, 2022 @ 5:30 p.m.
East LA	December 8, 2022 @ 6 p.m.

**Meeting held virtually.*

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LA100 EQUITY STRATEGIES

NREL is a national laboratory of the U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Operated by the Alliance for Sustainable Energy, LLC

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