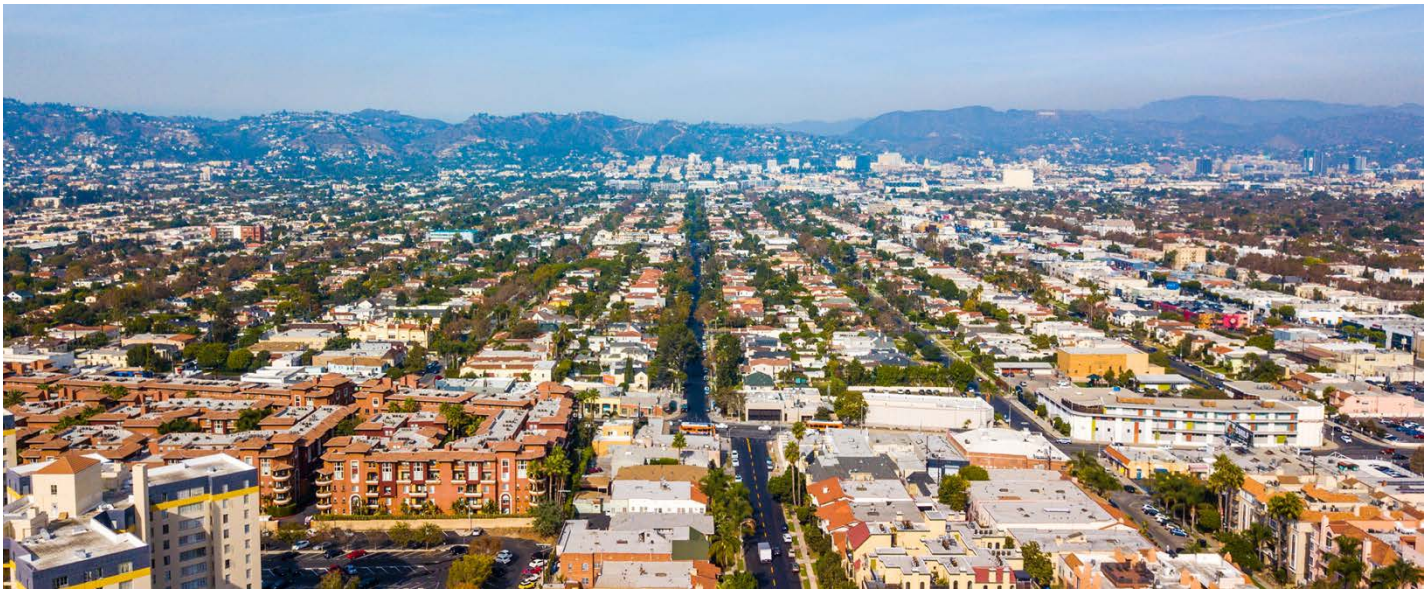
LA100 EQUITY STRATEGIES



Chapter 9: Equitable Community Solar Access and Benefits

FINAL REPORT: LA100 Equity Strategies

Ashreeta Prasanna, Jane Lockshin, Megan Day, and Kate Anderson

LA DWP

NREL Transforming ENERGY

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Authors
Ashreeta Prasanna, Jane Lockshin, Megan Day, and Kate Anderson

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LA100 EQUITY STRATEGIES

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Preface

The Los Angeles 100% Renewable Energy Study, or LA100, revealed that although all communities in Los Angeles will share in the air quality and public health benefits of the clean energy transition, increasing equity in participation and outcomes will require intentionally designed policies and programs. The LA100 Equity Strategies project was specifically designed to help Los Angeles identify pathways to such policies and programs in the form of equity strategies. The project aimed to do this by incorporating research and analysis to chart a course toward specific, community-prioritized, and equitable outcomes from the clean energy transition outlined in the LA100 study.

The Project Partners

The Los Angeles Department of Water and Power (LADWP), the National Renewable Energy Laboratory (NREL), and the University of California Los Angeles (UCLA) partnered on the LA100 Equity Strategies project to develop strategies for engaging communities, funding equitable technology and infrastructure investments, expanding existing programs, and designing new programs and policies to improve equity by incorporating what community members themselves know is needed to achieve a more equitable energy future.

The Project Approach

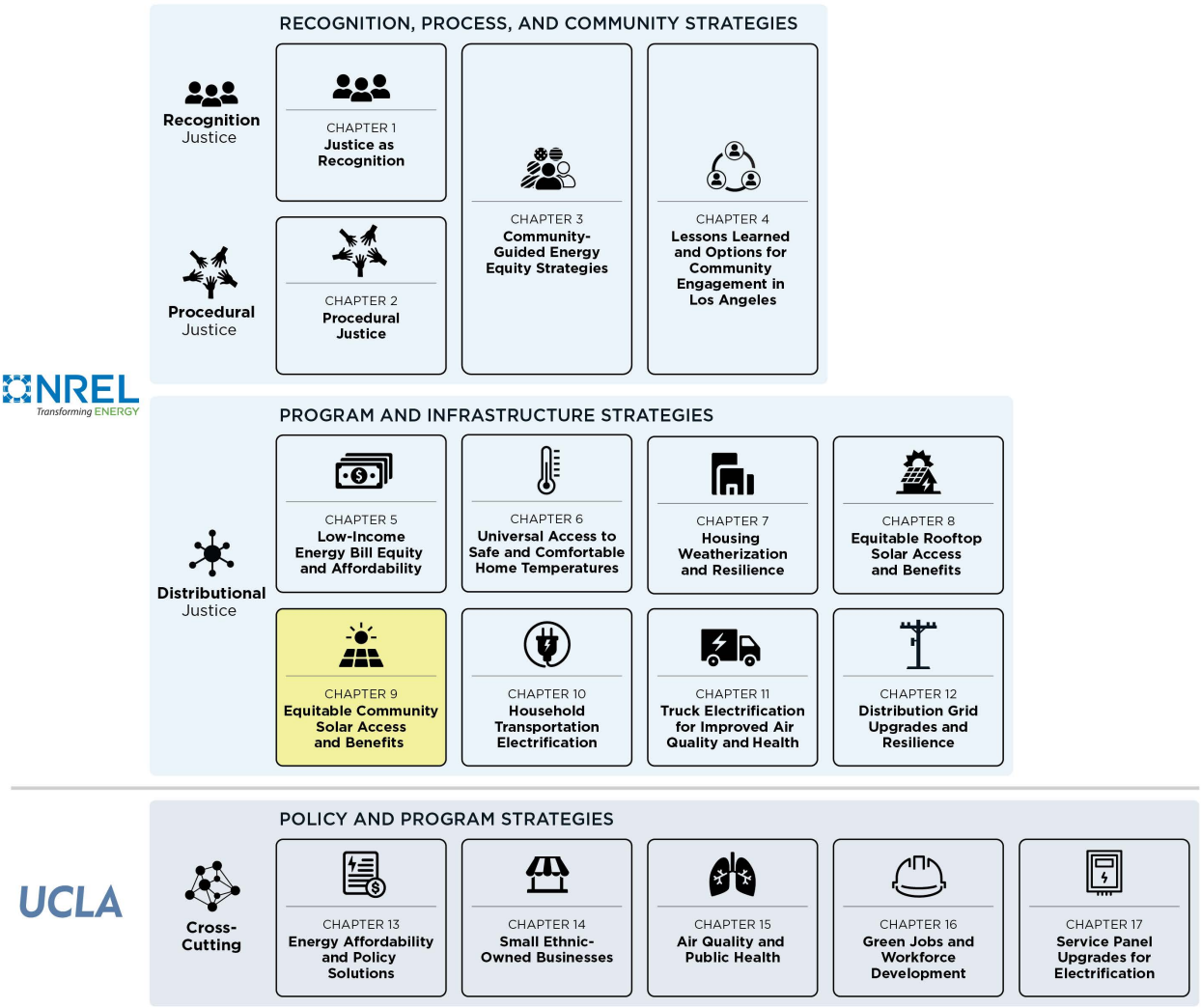
LA100 Equity Strategies employs a unique mixed-methodological approach utilizing three distinct—but connected—research efforts. Through these efforts, NREL and UCLA developed a range of strategy options for increasing equity in LA's transition to 100% clean energy.

A Project Summary

To get a high-level overview of the project, you can dive into the executive summary, interactive data visualizations, and more on the LA100 Equity Strategies website at maps.nrel.gov/la100/equity-strategies.

The Full Report

NREL's final full report for the LA100 Equity Strategies project encompasses seventeen chapters. The first twelve chapters, authored by NREL, are organized around the three tenets of justice. Chapters 1–4 address recognition and procedural justice, while Chapters 5–12 address distributional justice. The final five chapters, authored by UCLA, provide crosscutting policy and program strategies. Each chapter provides data, methods, insights, and strategies to help LADWP make data-driven, community-informed decisions for equitable investments and program development.



NREL Chapters

Chapter 1: Justice as Recognition

Chapter 2: Procedural Justice

Chapter 3: Community-Guided Energy Equity Strategies

Chapter 4: Lessons Learned and Options for Community Engagement in Los Angeles

Chapter 5: Low-Income Energy Bill Equity and Affordability

Chapter 6: Universal Access to Safe and Comfortable Home Temperatures

Chapter 7: Housing Weatherization and Resilience

Chapter 8: Equitable Rooftop Solar Access and Benefits

Chapter 9: Equitable Community Solar Access and Benefits

Chapter 10: Household Transportation Electrification

Chapter 11: Truck Electrification for Improved Air Quality and Health

Chapter 12: Distribution Grid Upgrades for Equitable Resilience and Solar, Storage, and Electric Vehicle Access

UCLA Chapters

Chapter 13: Energy Affordability and Policy Solutions Analysis

Chapter 14: Small Ethnic-Owned Businesses Study

Chapter 15: Air Quality and Public Health

Chapter 16: Green Jobs Workforce Development

Chapter 17: Service Panel Upgrade Needs for Future Residential Electrification

LA DWP NREL Transforming ENERGY

List of Abbreviations and Acronyms

CPUC	California Public Utilities Commission
DAC	disadvantaged community
FiT	feed-in tariff
FRAP	Fire and Resource Assessment Program
IRA	Inflation Reduction Act of 2022
ITC	investment tax credit
kW	kilowatts
kWh	kilowatt-hours
LADWP	Los Angeles Department of Water and Power
LMI	low-to-moderate-income
MW	megawatts
NPV	net present value
NREL	National Renewable Energy Laboratory
OEHHA	Office of Environmental Health Hazard Assessment
PPA	power purchase agreement
PV	photovoltaics
SAIFI	System Average Interruption Frequency Index
SAM	System Advisor Model
SB	California Senate Bill
SGIP	Self-Generation Incentive Program
yr	year

Executive Summary

The LA100 Equity Strategies project integrates community guidance with robust research, modeling, and analysis to identify strategy options that can increase equitable outcomes in Los Angeles' clean energy transition. This chapter focuses on community solar as a means to provide equitable access to local solar and storage benefits in Los Angeles.

Specifically, NREL identified potential community solar sites that could host 30 kilowatts (kW)[1] of solar or more (Figure ES-1, page x) and evaluated economic and equity metrics under various program design options. Analysis included a Baseline scenario (business-as-usual) and an Equity scenario, which modeled program enhancements to increase access and benefits to low-income customers. Both scenarios modeled the economics of solar and storage under the LADWP Feed-in Tariff (FiT) program (LADWP 2023b) and the LADWP Feed-in-Tariff Plus Pilot program (LADWP 2023d) compared to a community solar financial model (Figure ES-2, page xi).

This research was guided by input from the community engagement process, and associated equity strategies are presented in alignment with that guidance.

Community Guidance

Our analysis was tailored to incorporate guidance from the LA100 Equity Strategies Steering Committee, listening sessions with community-based organizations and community members, and community meetings. The following community priorities related to community solar and resilience were included:

Steering Committee Member:

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

- Use community-informed methods to identify and address barriers to affordability and access—e.g., predatory practices, community mistrust, and lack of time.
- Provide community solar access and benefits through:
  - Incentives to overcome community solar price premium barriers
  - Programs tailored to both homeowners and renters
  - Revised eligibility criteria to include moderate-income customers
  - Accountability for solar developers and service providers
  - Educational, locally sensitive programs to prevent disinformation and mistrust

[1] The 30-kW lower threshold is based on the minimum capacity required to participate in the LADWP FiT program (LADWP 2023b).

- Addressing intersectional barriers to access and actual use of LADWP programs—e.g., financial capital and homeownership.

- Pair community solar with batteries in community spaces for reliable power and cooling.
- Consider community solar on LADWP properties to create health and educational co-benefits, through a community-based program design.
- Ensure ground-mounted community solar does not prevent land uses such as affordable housing or parks.

Steering Committee Member:

"Siting solar farms in disadvantaged and low-income areas might be loading environmentally challenged neighborhoods with more industrialization. Is community solar being considered in higher-income neighborhoods as well?"

Distributional Equity Baseline

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 homeowner and mostly renter communities.

The LADWP FiT program enables property owners and developers to install 30-kW systems or greater and sell all the energy to LADWP through a power purchase agreement (PPA). The total installed FiT program capacity as of December 31, 2021, was 90 megawatts (MW). In 2021, LADWP launched the Feed-in Tariff Plus (FiT+) Pilot program, which expands the existing FiT program and promotes the development of paired solar-plus-energy-storage projects in Preferred Zones of Development specified by LADWP. Five projects, totaling 1.8 MW, were proposed as of December 31, 2021, under the FiT+ Pilot program (LADWP 2022, LADWP 2023b). An analysis of FiT projects found no statistically significant socioeconomic differences in communities with project sites. As FiT projects are generally developed at commercial or industrial sites with revenues going to businesses, the FiT program does not provide direct savings to residential customers, low-income or otherwise.

Key Findings

NREL identified more than 1,800 ≥30-kW potential sites totaling over 1,000 MW of potential capacity that could be economically viable as community solar projects on government-owned land, recreation centers, educational institutions, hospitals, and multifamily parcels. Additional market factors and other challenges in deployment, such as roof age, ownership structures, and zoning restrictions, reduce this economic potential further, which makes 1,000 MW a high upper bound of feasibility. Of these, more than 400 MW of capacity on over 1,400 sites are located in low-income tracts.

- Economically viable capacity is highest on commercial and industrial land parcels under both PPA and community solar financial models, followed by restaurants and retail land parcels, educational institutions, offices, multifamily buildings, and hospitals. Because these land parcels are commonly privately owned, solar developed under a net metering agreement is more likely than development for community solar or under a PPA contract.

- Projects financed under a community solar model are more profitable—with a 41% higher net present value (NPV) on average, compared to projects financed under a PPA financial model under the Baseline scenario—and have 22% higher NPV on average under the Equity scenario.
- This analysis identified more than 600 economically viable potential community solar sites on multifamily properties in low-income census tracts with a combined potential capacity of more than 250 MW.
- The maximum savings available to customers who subscribe to the LADWP Shared Solar program under our model assumptions are approximately $68/year (yr) over 10 years. Increasing the maximum subscription amount and establishing a 20% lower subscription rate for low-income customers can provide average savings of $480/yr for low-income customers.
- The above modifications to the current Shared Solar program would decrease the number of economically viable potential sites by 9% when compared to the current program structure.
- Sites in low-income census tracts that serve low-income subscribers through the modeled discounted rate are found on average to be more economically attractive (higher NPV) because of the Inflation Reduction Act of 2022 (IRA) additional 20% investment tax credit (ITC) for projects in which at least 50% of the financial benefits are provided to low-income households.
- Approximately 160 MW of storage (4-hour duration) colocated with 260 MW of solar on 430 sites would be economically viable under the LADWP Feed-in-Tariff Plus Pilot program.

Local solar equity metrics include:

- Annual electricity bill savings
- By income, housing type, and low-income community status

Equity Strategies

Based on the above findings, the following strategies can increase community solar equity:

- Modify the Shared Solar program to increase the maximum subscription to 500 kilowatt-hours (kWh)/month and lower the subscription rate 20% to $0.18 per kWh for low-income customers. The modeled impacts of these modifications have a relatively modest impact on profitability and number of viable projects.
- Develop Shared Solar on affordable housing multifamily sites, making them eligible for a combined 50% ITC, and deliver solar bill savings to LMI multifamily building renters.
- Expand Shared Solar program capacity on identified ≥30-kW economically viable sites to deliver bill savings to low- and moderate-income customers, renters, and multifamily building residents.
- Consider innovative use of solar in the urban environment, for example, solar on sidewalk canopies near public transit stations or parking canopies. Results indicate potential for 600 MW of economically viable parking canopy solar throughout Los Angeles. Establish a higher FiT PPA rate of $0.16/kWh for parking canopy systems in DACs
- Prioritize development for public benefit on identified NPV positive 30-kW+ potential solar+storage sites at government, hospital, and educational sites.

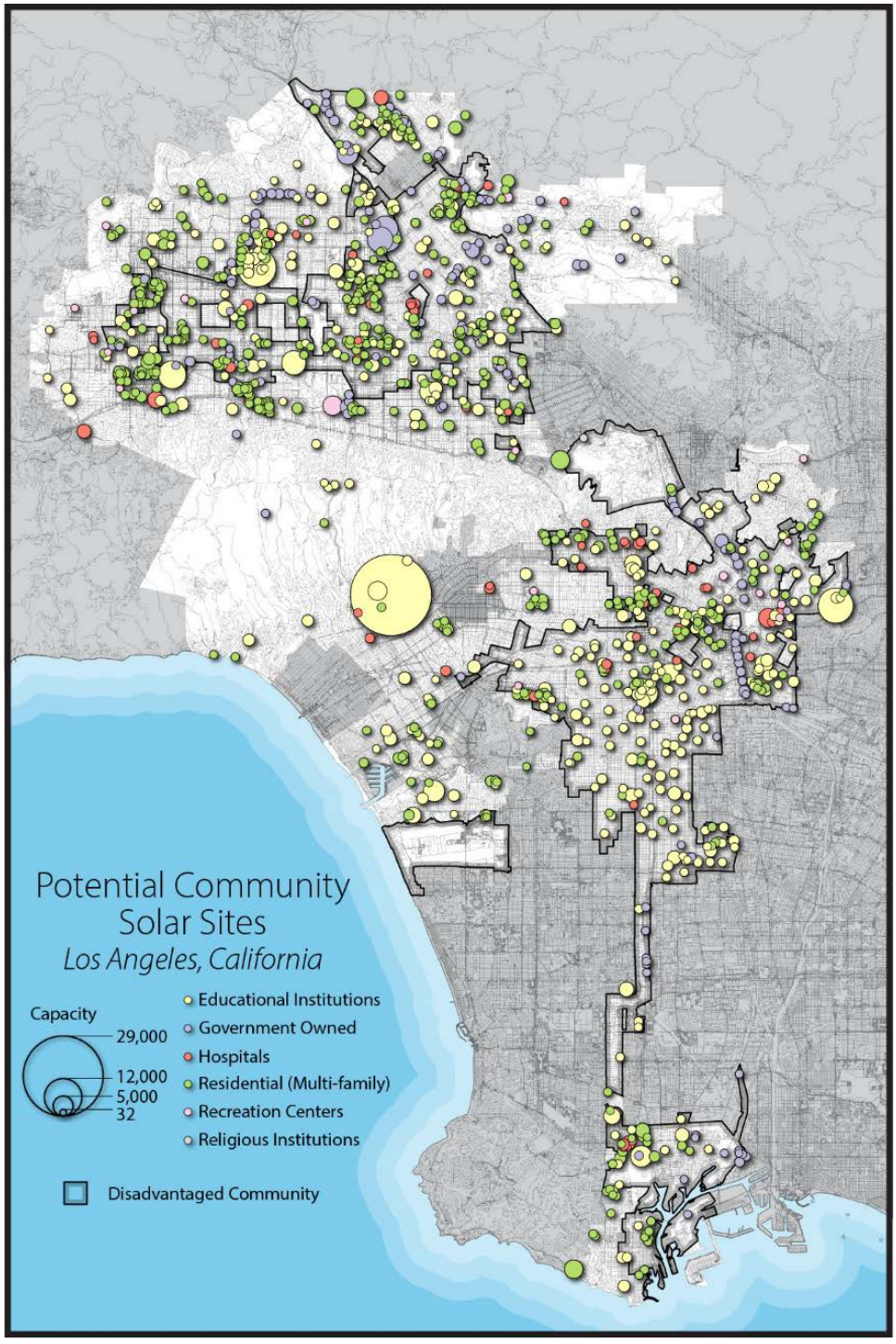


Figure ES-1. Potential community solar sites ≥30 kW on government-owned land, recreation centers, educational institutions, hospitals, and multifamily parcels with positive NPV under the Equity scenario and community solar financial mode

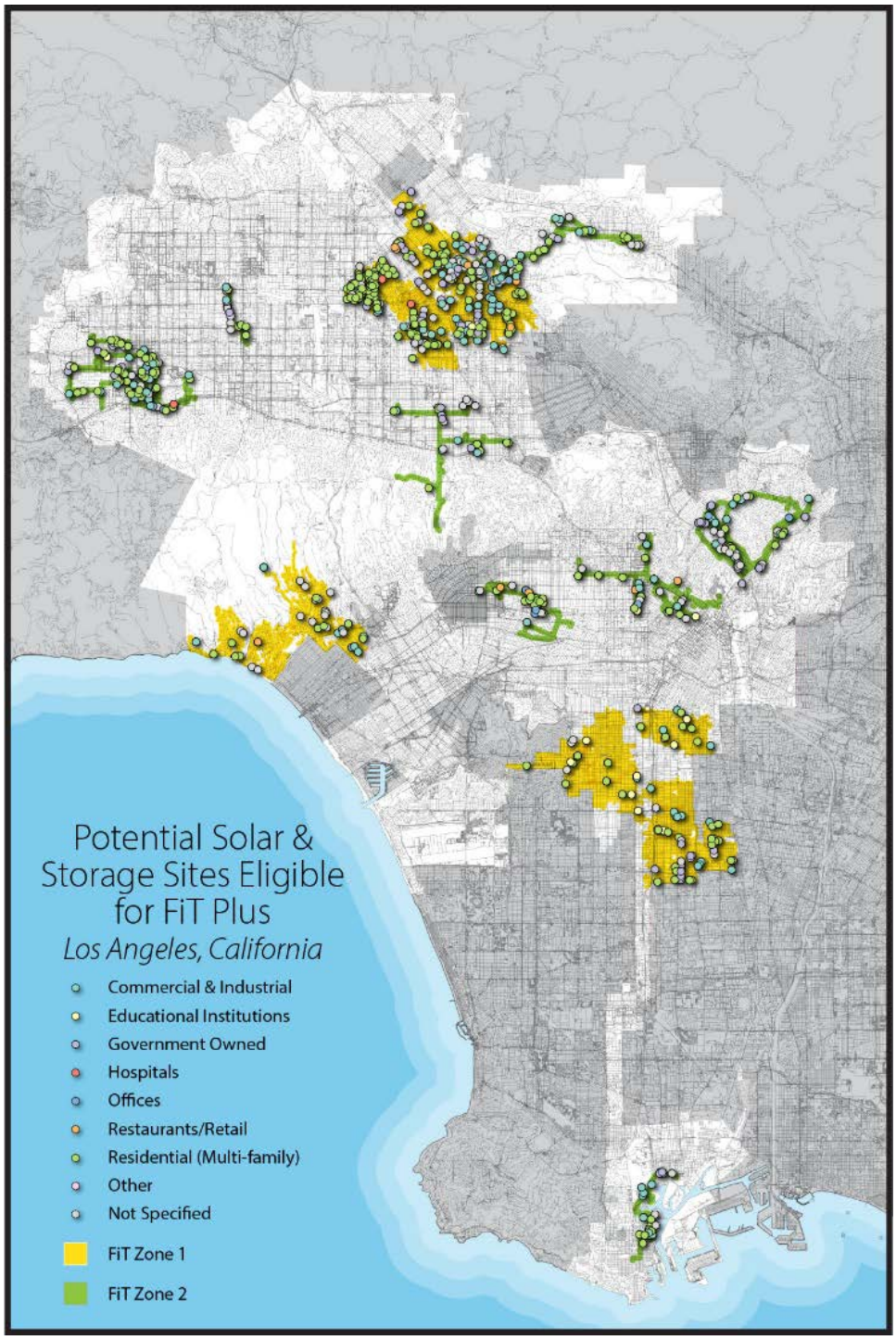


Figure ES-2. Potential solar and storage sites with positive NPV under the LADWP Feed-in-Tariff Plus Pilot program

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1 Introduction

The LA100 Equity Strategies project integrates community guidance with robust research, modeling, and analysis to identify strategy options that can increase equitable outcomes in Los Angeles' clean energy transition. This chapter focuses on identifying potential community solar sites as well as evaluating their economic attractiveness and ability to provide equitable access to bill savings from solar and storage in the city of Los Angeles.

Community solar programs allow energy consumers to purchase a share of electricity generated in an off-site solar facility. These customers can benefit from their subscription by having a portion of their electricity costs remain fixed over the duration of their contract, protecting against retail electricity price increases in the long term. Literature indicates community solar provides benefits to the utility—through development of ideal project locations—as well as the utility's customers, through the ability to achieve cost reductions via economies of scale, collaborative emissions goals, provision of resiliency, and enhanced community cohesion, among other positive attributes (Michaud 2020).

Launched in May 2019, the Los Angeles Department of Water and Power (LADWP) Shared Solar program allows residential customers in multifamily buildings to subscribe to either 50 kilowatt-hours (kWh) or 100 kWh of solar power monthly. (The monthly consumption of the average customer in Los Angeles is 500 kWh). Shared Solar participants are charged a fixed rate for this portion of their electric bill for up to 10 years, starting at a premium[2] but potentially leading to savings as utility rates increase. The blocks of clean electricity come from new solar energy facilities constructed in or near the LA Basin.

Our analysis in this chapter focuses on the following priorities:

- Identifying and ranking potential community-scale solar sites within Los Angeles according to their economic metrics, and further categorizing sites by brownfield (eligible for the 40% ITC), low-income community (eligible for the 50% ITC), land use type, and installation type.
- Identifying which sites are suitable to host storage (in addition to solar) based on available land area and an optimal colocated storage capacity for each site.

[2] Based on a Standard Residential Rate (R-1A) January–March 2023 of $0.19/kWh and the 2023 Shared Solar program rate of $0.22/kWh (LADWP 2023c).

2 Modeling and Analysis Approach

Figure 1 provides an overview of the community solar analysis methodology. First, potential community solar site locations are identified based on suitable in-basin local solar ground-mount and parking canopy sites from the LA100 Study, Chapter 5 (Mooney et al. 2021), as well as potential rooftop solar sites (e.g., schools or hospitals) identified in the LA100 Study, Chapter 4 (Sigrin et al. 2021). Site types evaluated for community solar and storage include locations that can host fixed-tilt ground-mount solar installations; parking lots suitable for solar parking canopy installations; and rooftop solar on larger buildings that can serve as anchor tenants. Only sites with the potential to host 30 kW or more—the minimum capacity eligible for the LADWP Feed-in Tariff (FiT) program (LADWP 2023b)—are considered suitable for community solar.

These locations are then overlaid with census tract sociodemographic information that includes the percentage of low-income households, renter-occupied households, and households living in multifamily dwelling units, as well as other equity metrics and disadvantaged community (DAC) status (based on California Senate Bill [SB] 535 DAC designation). Each potential community solar site is simulated under the System Advisor Model (SAM)[3] community solar financial model to obtain financial output metrics. Simulations for thousands of potential sites in SAM are run using the Python wrapper for SAM or PySAM.[4] This information informs the ranking of potential community solar sites that indicate promising opportunities to provide bill savings.

Since potential solar sites can also be developed under the LADWP FiT program and solar-plus-storage under the LADWP Feed-in Tariff Plus Pilot program, the power purchase agreement (PPA) financial model available as part of SAM is used to obtain financial output metrics for these programs. Under the FiT program, property owners and developers can install 30-kW systems or greater and sell all the energy to LADWP through a PPA. A PPA financial model has no subscribers; therefore, no bill savings are available to low-income customers under this program.

[3] System Advisor Model Version 2022.11.21 (SAM 2022.11.21) (sam.nrel.gov).

[4] PySAM Version 4.0.0 (github.com/nrel/pysam).

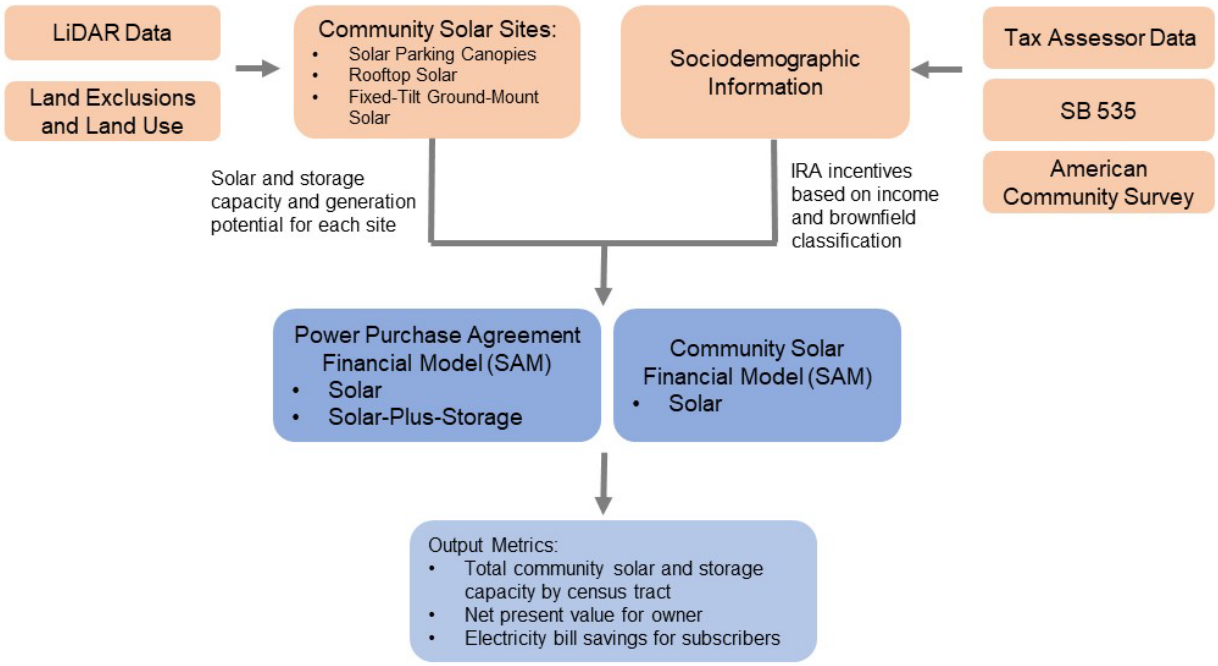

Figure 1. Overview of methodology for community solar and storage analysis

SAM is the System Advisor Model.

Community solar feasibility is analyzed for each potential site from both utility and subscriber perspectives. Two main scenarios are modeled in this analysis: a Baseline scenario and an Equity scenario. The Baseline scenario considers the current LADWP Shared Solar program, the FiT program, and the FiT+ program. The Equity scenario considers enhancements to the LADWP Shared Solar program to increase access by, and benefits for, low-income customers, while maintaining the same offering to other customers. The modeled enhancements to the LADWP Shared Solar program include:

1. The maximum subscription amount increases from 100 kWh/month to 500 kWh/month for low-income subscribers.
2. An offering for low-income customers is added where the current program subscription rate of $0.21665 per kWh is reduced to $0.18 per kWh (below the Standard Residential Rate [R-1A] January–March 2023 of $0.19/kWh [LADWP 2023c]).
3. Half of the capacity of new community solar projects is allocated to low-income customers with the above provisions.

The increase in maximum subscription amount for low-income subscribers allows a majority of annual consumption to be met through the community solar subscription, while the decrease in the current program subscription rate below the R-1A rate ensures the program provides immediate savings for low-income customers rather than requiring a premium payment for access to solar. The Equity scenario also considers a slightly higher FiT PPA rate ($0.16 per kWh) provided by LADWP for sites that are developed as parking canopies in DAC tracts. For the FiT+ program, the Equity scenario considers additional incentives offered for solar-plus-storage systems under the California Public Utilities Commission (CPUC) Self-Generation Incentive Program (SGIP) with equity and resiliency adders and incentive levels (CPUC 2021).

In both scenarios, potential sites are evaluated under the community solar financial model (which models economics for the LADWP Shared Solar program) as well as the PPA financial model (which models economics for the LADWP FiT and FiT+ programs).

This analysis also applies incentives available through the Inflation Reduction Act (U.S. Department of the Treasury 2023, Wood Mackenzie 2023, McGuireWoods 2023) to both scenarios, including a 20% bonus for sites located at a low-income residential building project and/or where at least 50% of the financial benefits of the electricity produced are provided to households with incomes of less than 200% of the poverty line or less than 80% of the area median gross income and a 10% bonus credit to all sites on parcels classified as brownfield by the U.S. Environmental Protection Agency (EPA 2019). Appendix A provides additional information on these incentives and other model input data and assumptions.

3 Modeling and Analysis Results

From the LA100 Study (Cochran and Denholm 2021), both DACs and non-DACs were found to have significant solar technical potential; therefore, identifying approaches that prioritize DACs and lower barriers to realizing the economic benefits from solar in these communities is key for equitable outcomes in Los Angeles. The LA100 Study did not assess community solar as a solar deployment strategy that could benefit low-income households or DACs. To address this limitation, this analysis focuses on financial analysis of sites suitable for community solar development that can provide bill savings for low-income customers and resilience benefits for DACs.

After further analyzing data generated as part of the LA100 Study, over 57,000 potential community solar sites or land parcels with potential to install 30 kW or more were identified within the LADWP service territory, totaling more than 13 GW. After accounting for historical solar adoption and removing potential sites where solar has already been installed, the total technical potential for community solar is 12.7 GW on over 56,000 potential community solar sites. Of this capacity, 3.5 GW can be cited on land parcels classified as government-owned, recreation centers, educational institutions, hospitals, religious institutions, and multifamily residential. Based on our model assumptions, 30% of this capacity, or approximately 1,050 MW on more than 1,800 sites, would be economic or have a positive net present value (NPV) if developed.

The following aspects are investigated to identify promising sites by land use type, installation type, and other characteristics:

- Optimal sites for community solar development, considering:
  - Land use type classifications (e.g., multifamily, government, educational institution)
  - Installation type (rooftop, ground-mount, parking canopy)
  - Sites located in tracts with low-to-median income, sites classified as brownfield, sites in DAC communities
- Project economic viability under the community solar financial model compared to the PPA financial model
- The impact of modifying the current LADWP Shared Solar program to increase benefits and access to low-income customers
- The impact of additional ITC incentives on project profitability
- The number of sites that have sufficient area to host storage in addition to solar and have storage technical potential.

Table 1 presents economic potential solar sites by land use type under the Baseline and Equity scenarios. Economic capacity is the capacity with positive NPV. The economic capacity under both financial models is largest on commercial and industrial land parcels, followed by multifamily buildings, restaurants or retail land parcels, educational institutions, offices, and hospitals. As these land parcels are commonly privately owned, development of solar under a net

metering agreement is more likely than under a community solar or PPA contract. While net metering contributes to in-basin clean electricity generation, other benefits, such as lower or more stable electricity bills, are only available to the on-site consumer; thus, low-income customers and customers without access to solar would only benefit with virtual net metering.

Table 1. Economically Viable Solar Sites ≥30 kW by Land Use Type

Land Use	Baseline Scenario				Equity Scenario			
	Economic Capacity and Number of Sites: Community Solar		Economic Capacity and Number of Sites: PPA		Economic Capacity and Number of Sites: Community Solar		Economic Capacity and Number of Sites: PPA	
	MW	Sites	MW	Sites	MW	Sites	MW	Sites
Commercial, Industrial	2,200	2,800	830	190	1,900	2,100	870	210
Educational Institutions	380	470	86	20	330	370	86	20
LADWP-Owned	108	180	43	13	103	160	43	13
Hospitals	68	110	17	11	53	75	17	11
Offices	170	340	25	15	120	240	30	18
Other	440	410	240	60	7	13	2	2
Recreation Centers	12	28	5	1	9	21	5	1
Religious Institutions	1	2	0	0	1	2	0	0
Restaurants/Retail	450	660	76	37	350	440	89	44
Residential (Multifamily)	470	1,100	26	16	340	740	26	16
Total	4,299	6,100	1,348	363	3,213	4,161	1,168	335

Table 2 presents the economic attractiveness of potential solar sites categorized by installation type under the Baseline and Equity scenarios. Multiple installation types above 30 kW each could possibly be included on a single site or land parcel however the most economic installation type is selected. Results show most potential capacity is on rooftops. Only 9% of parking canopy installation sites are found to be economic. Therefore, a higher FiT rate of $0.16/kWh under consideration by LADWP[5] to encourage development of parking canopy solar in DAC tracts is also modeled under the Equity scenario. An increased FiT rate of $0.16/kWh results in additional sites (11% of parking canopy sites) and capacity becoming economic under the PPA financial model. Under the Equity scenario community solar financial model, fewer rooftop installations are economic (a decrease of 503 rooftop installations) due to the lower subscriber rate for low-income customers.

[5] LADWP SME Meeting Discussions with NREL, November 10, 2022, and January 20, 2023.

Table 2. Economically Viable Solar Sites ≥30 kW by Installation Type

Installation Type	Baseline Scenario				Equity Scenario			
	Economic Capacity and Number of Sites: Community Solar		Economic Capacity and Number of Sites: PPA		Economic Capacity and Number of Sites: Community Solar		Economic Capacity and Number of Sites: PPA	
	MW	Sites	MW	Sites	MW	Sites	MW	Sites
Rooftop	2,900	4,400	650	220	2,400	3,200	650	220
Parking Canopy	601	480	260	34	480	250	340	74
Ground-Mount	890	1,400	450	120	840	1,200	450	120

Table 3 presents the economic attractiveness of potential solar sites classified as brownfield or located in a low-income census tract under the Baseline and Equity scenarios. Brownfield sites and sites in low-income tracts are shown because these sites are eligible for either a combined 40% ITC (for brownfield sites) or a 50% ITC (for sites in low-income tracts), while all other sites are assumed to be eligible for the 30% ITC. The bonus ITC results in a higher percentage of sites in low-income tracts with a positive NPV (11%), compared to sites not classified as brownfields or within low-income communities (where 5% of sites have a positive NPV). Under the Equity scenario, 260 MW of solar are found to be economically viable on more than 600 multifamily buildings in low-income tracts. Brownfield sites also benefit from the ITC, and 15% of sites have a positive NPV; however, this percentage could increase if these sites are also in low-income tracts and can additionally claim the 20% bonus ITC.

Table 1, Table 2, and Table 3 show the total economic capacity (capacity with a positive NPV) under a community solar financial model and a PPA financial model. Under the community solar financial model, project costs are financed through fixed customer subscriptions over a specified time period, while under the PPA financial model, project costs are financed through the sale of electricity from the project owner to LADWP at a fixed rate over the contract term. Details of the input parameters for both these financial models are provided in Appendix A. As shown in Table 1, economic capacity under PPA financing is lower compared to community solar. Sites with a positive NPV under both financial models have on average a 41% higher NPV under the community solar financial model compared to the PPA financial model under the Equity scenario, and 22% higher NPV under the Baseline scenario. The increase in economic capacity is primarily a result of the difference in the compensation for electricity produced; electricity sold for community solar subscriptions is valued at a subscription rate comparable to retail tariffs, while electricity sold under a PPA agreement (in this case, the LADWP FiT program) is valued at a PPA price comparable to average wholesale market prices.

Table 3. Economic Potential of ≥30-kW Solar Sites by Special Site Classifications

Site Classification	Baseline Scenario				Equity Scenario			
	Economic Capacity and Number of Sites: Community Solar		Economic Capacity and Number of Sites: PPA		Economic Capacity and Number of Sites: Community Solar		Economic Capacity and Number of Sites: PPA	
	MW	Sites	MW	Sites	MW	Sites	MW	Sites
All other parcels	1,100	1,400	340	160	800	950	350	170
Parcels in low-income tracts	3,300	4,800	1,010	210	2,900	3,600	1,080	250
Parcels classified as brownfield	4	9	2	1	3	6	2	1

To identify the impact of modifying the current LADWP Shared Solar program to increase benefits to and access by low-income customers, our analysis considers an Equity scenario. Results indicate the maximum savings potential for LADWP Shared Solar subscribers under the Baseline scenario is approximately $68/yr. If the program were modified to increase the maximum subscription to 500 kWh per month and lower the subscription rate to $0.18 per kWh for low-income customers, as modeled in the Equity scenario, the average savings could increase to approximately $480/yr for low-income customers and remain $68/yr for all other customers. These modifications to the current Shared Solar program would have a relatively moderate impact on project profitability. Based on model assumptions, we found the number of economically viable sites (with positive NPV) decreases by 9% compared to the current program structure.

The Equity scenario also ensures that community solar projects developed by LADWP would be eligible for the IRA low-income benefit ITC bonus, which requires at least 50% of subscribers to be low-income and benefit economically from the solar electricity produced.

Battery Storage

Approximately 820 MW (4-hour duration), or 3,300 MWh, of storage could be colocated with photovoltaics (PV) on 4,000 land parcels in Los Angeles based on land area requirements for storage (where the storage-to-PV capacity ratio is 0.71 for 4-hour storage and 1.0 for 8-hour storage),[6] but only 100 MW of storage colocated with 230 MW of solar is economically viable under the FiT+ Pilot program.

Sites with storage colocated with solar PV that are located in LADWP Preferred Zones of Development were simulated under the PPA financial model with assumptions reflecting the

[6] Storage land-area requirements and sizing assumptions are provided in Table 3 of the LA100 Study, Chapter 5 (Mooney et al. 2021).

FiT+ Pilot program. Storage colocated with PV was not simulated under the community solar financial model because the current LADWP Shared Solar program does not specify addition of storage, nor does the program provide resiliency services to subscribers. In addition, the lack of time-varying compensation for storage or compensation for resiliency results in storage capacity not being economically viable.

Table 4 presents the economic attractiveness of potential solar sites with added storage capacity categorized by land use type under the Baseline and Equity scenarios. The PPA economic capacity represents the amount of colocated solar and storage that is feasible to install in the FiT+ Pilot program Preferred Zones of Development that have a positive NPV under the PPA financial model. If projects can qualify for additional incentives like the SGIP, modeled under the Equity scenario, the economic storage capacity increases to 160 MW colocated with 290 MW of solar capacity. Therefore, the FiT+ Pilot program provides sufficient incentives for solar and storage deployment if the PPA price is at least $0.25/kWh. Under the Equity scenario, 42 MW of storage colocated with 75 MW of solar is found to be economically viable on multifamily buildings in low-income tracts; note that this is a subset of all multifamily buildings where 72 MW of storage paired with 140 MW of solar is found to be economically viable.

Table 4. Positive NPV Solar-Plus-Storage Potential with FiT+ Pilot PPA in Preferred Zones of Development by Land Use Type

Land Use	Baseline Scenario			Equity Scenario		
	PPA Economic Solar Capacity	PPA Economic Storage Capacity	Number of Sites	PPA Economic Solar Capacity	PPA Economic Storage Capacity	Number of Sites
	MW	MW (4 hr)	Sites	MW	MW (4 hr)	Sites
Commercial and Industrial	86	45	100	97	66	190
Educational Institutions	9	4	18	10	4	24
Government-Owned	18	13	42	22	16	90
Hospitals	1	0.2	2	2	0.5	6
Offices	7	1	12	8	2	25
Other	0	0	0	0.1	0.1	1
Recreation Centers	0	0	0	0	0	0
Religious Institutions	0	0	0	0	0	0
Restaurants/Retail	10	2	8	11	3	18
Residential (Multifamily)	98	44	220	140	72	580

4 Equity Strategies Discussion

Substantially expanding development of community solar and establishing a low-to-moderate-income (LMI) subscription rate could result in annual bill savings of $480 for LMI customers and economically viable potential capacity of 340 MW on 740 multifamily sites, and 3 MW on 6 brownfield sites. Multifamily community solar sites with economic capacity can be examined to identify sites on qualified low-income residential building projects, making them eligible for a combined 50% ITC. Prioritizing community solar on affordable and rent-controlled multifamily sites can both deliver economic benefits to low-income building residents and ensure improvements do not cause rent increases and displacement.

Community guidance indicated concern that solar development could displace other, prioritized land uses, such as affordable housing development or parkland. One approach to mitigate this concern is targeting community solar development on brownfield sites that may not be suitable for other land uses and where solar development can also deliver mitigation benefits, such as toxic soil stabilization and revegetation.

Development of community solar economic capacity on privately owned sites under an anchor tenant model could expand access to community solar benefits, especially for sites where electricity generation would be greater than the on-site consumption. An anchor tenant is a large entity that can take a substantial sum (e.g., 40%) of the community solar production or shares and provide the developer a credit-worthy customer who "anchors" the project. An anchor tenant allows the developer to seek out and offer participation to other customers, i.e., homeowners and small business owners, who will take a smaller share from the project. The anchor tenant(s) could be a local school, government entity, or an established business that is likely to be in existence for a long period (Weissman and Brockway 2018). Because of regulations that only allow customers to purchase electricity from LADWP, projects would have to be developed and financed by LADWP with the land parcel owner serving as an anchor tenant for the project.

A challenge to community solar deployment identified from stakeholder interactions[7] is a lack of access to easy-to-use tools and data to identify and prioritize potential project sites. Appendix B includes the link to an interactive map with potential community solar sites with economic capacity of 30 kW or more, which further categorizes sites by brownfield (eligible for a 40% ITC), low-income community (eligible for a 50% ITC), land use type, and installation type. This map can inform equitable community solar site development prioritization and investment as well as goal setting and community engagement discussions. The analysis and results presented in this report aim to enable easy identification of economically viable potential sites, and the results from the economic analysis can be reproduced using the National Renewable Energy Laboratory's (NREL's) SAM.

[7] LADWP SME Meeting Discussions with NREL, November 10, 2022, and January 20, 2023.

Feedback from LADWP SMEs indicated that the deployment of solar—and thus, the scaling up of the Shared Solar program—has been a challenge, with some of the main reasons being prohibitive installation and labor costs in the LA Basin and difficulty in staffing for solar deployment. Strategies to address these issues include:

- Subcontracting project development
- Collaborating with other city agencies to jointly develop solar on government-owned parcels
- Seeking technical assistance, as well as legal assistance, to ensure developed projects receive IRA incentives.

The U.S. Department of Energy Solar Energy Technologies Office provides technical assistance to nonprofit and for-profit organizations, state and local governments, and other entities working to address barriers and improve access to solar energy (DOE 2023).

Outreach and education, making programs more flexible and accessible for low-income customers (clear and streamlined eligibility requirements), as well as expansion of eligibility, are key to ensuring higher program participation and therefore increased access to benefits. NREL analysis of utility programs that target LMI customers (Heeter et al. 2018) found that several LMI customer types are particularly difficult to reach, including renters and foreign language-speaking households. For these reasons, piggybacking on existing LMI programs or partnering with groups that are regularly interacting with these LMI communities can be effective. A common method to facilitate LMI customer identification is to define program eligibility consistent with pre-existing programs. Referrals from friends and relatives can also provide a trusted source of information for LMI customers.

Storage development at solar sites can be accomplished through the FiT+ Pilot program, which was found to provide sufficient incentives to install storage with the modeled PPA price of $0.25/kWh. In programs like CPUC's SGIP (CPUC 2021), incentives modeled under the Equity scenario lower the cost of energy storage technology by providing an incentive of $850 per kWh under the "Equity" category or $1,000 per kWh under the "Equity Resilience" category. Both of these incentives would mean an energy storage system for the home or facility would be almost, to potentially completely, free of cost.

These strategies, summarized in Table 5, can facilitate scaling of community solar development and associated bill savings opportunities for LMI customers via increased Shared Solar program development, community participation, and collaboration between LADWP, community members, and community-based organizations.

Table 5. Equity Strategy Benefit, Cost, Timeline, Responsible Party, and Metric for Evaluation

Equity Strategy	Benefit/Impact	Cost	Timeline	Responsible Party	Metric
Modify the Shared Solar program to increase the maximum subscription to 500 kWh/month and lower the subscription rate 20% to $0.18 per kWh for low-income customers	Maximum subscriber savings increases from $68/year average over 10 years to $480/year for LMI customers Expands access to solar bill savings to the 55% of LA households that are renters	Positive NPV (cost neutral) potential at 160 LADWP sites, 21 recreation centers, 740 multifamily sites	2024–2035	LADWP	50% of all new Shared Solar capacity delivered to LMI subscribers under the reduced rate makes projects eligible for 50% ITC
Develop Shared Solar on affordable housing multifamily sites, making them eligible for a combined 50% ITC and deliver solar bill savings to LMI multifamily building renters	Prioritizing affordable housing projects ensures improvements do not cause rent increases and displacement 610 economically viable multifamily sites in low-income census tracts totaling 250 MW	Positive NPV sites only. $1,840/kW installed costs Admin costs not calculated	2024–2025	LADWP, LA Housing Department, project developer and engineering, procurement, and construction partners Integrate with CAMR	Projects on low-income residential building projects qualify for IRA 20% ITC bonus 42 MW of storage colocated with 75 MW of solar is economically viable on 370 multifamily sites in low-income tracts
Expand community solar capacity at identified economically viable ≥30 kW sites to increase in-basin solar generation and access to solar bill savings for LMI, renters, and multifamily customers	Economically viable sites with reduced LMI rate include: 3 MW on 6 brownfield 340 MW on 740 multifamily sites 9 MW at 21 recreation centers 103 MW at 160 LADWP sites	Positive NPV (cost neutral)	2024–2035	LADWP	Set a development target for a portion of the economically viable capacity and sites identified
Establish a higher FiT PPA rate of $0.16/kWh for parking canopy systems in DACs	Provides shading, increases economically viable sites from 260 MW on 34 sites to 340 MW on 74 sites	$0.16/kWh FiT rate $2,640/kW installed cost assumed	2024–2035	LADWP	Set a development target for a portion of the 74 viable sites, e.g.,10 of the 67 economically viable parking canopy sites in DAC tracts and 5 of the 17 economically viable parking canopy sites in FiT zones 1 or 2
Prioritize development for public benefit on identified NPV positive 30 kW+ potential solar+storage sites at government, hospital, and educational sites	~160 MW of storage (4-hour duration) colocated with 260 MW of solar on 430 sites are NPV positive under FiT+ Pilot program	Existing FiT+ solar and storage PPA rates	Starting 2023	LADWP with developer, site host, and engineering, procurement, and construction partners	Set target for solar-plus-storage development of a portion of the economically viable public-benefit sites

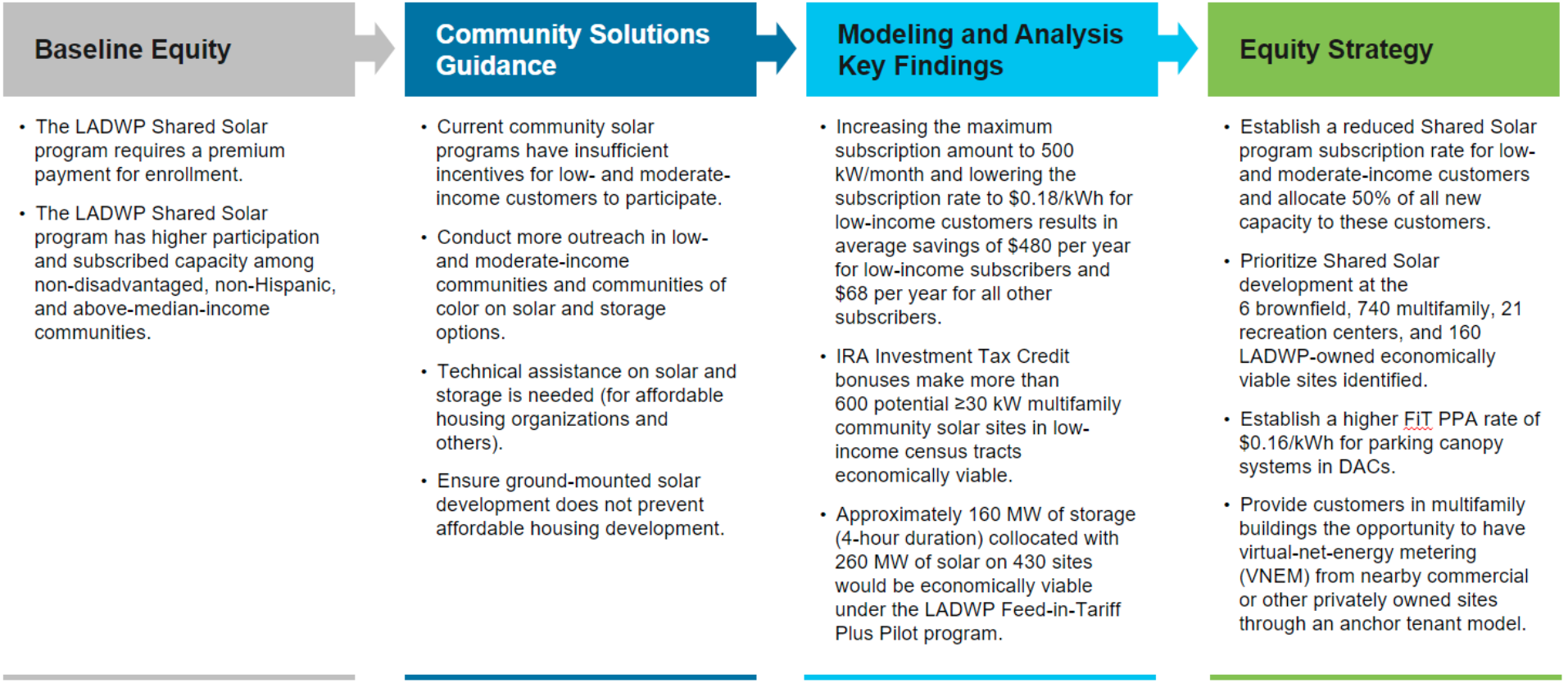

Figure 2. Strategies for equitable access to community solar bill savings

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Appendix. Data Sources and Assumptions

Table A-1 describes the data sources used for this analysis.

Table A-1. Summary of Data Sources for Local Solar and Storage Analysis

Data	Source	Description	Resolution	Vintage
Distributed Generation Market Demand (dGen) model agent database	LA100 analysis (NREL)	Agents created in LA100 1.0 will be used as inputs and outputs for dGen's agent-based modeling.	Parcel	2020–2050
Utility options for local solar and storage	LA100 analysis (NREL)	Agents ranked (by cost) for non-rooftop solar will be analyzed as potential sites for local solar and storage.	Parcel	2020–2050
Income-differentiated building loads	NREL Buildings team	Hourly building loads will be differentiated by income and tenure.	Census tract	2035
Existing LADWP programs for low-income customers	LADWP	Participation/cost information for: Low-Income, Lifeline, and Energy Savings Assistance Programs	Address/ census tract	2006–2021
Income	American Community Survey (ACS)	Detailed sociodemographic population data and housing information	Census tract	2019
Retail electric sales and demand forecast	LADWP	Residential retail electric sales and demand data	City/ service territory	2019–2022
LA100 Equity Strategies Deliverable #143 – Preliminary Results of Analysis, Factors Influencing Current Inequities	Statistical analysis (NREL); CalEnviroScreen 4.0	Distribution of programs by sociodemographic indicators inform sampling of agents and adoption criteria Disadvantaged communities are identified as tracts with the highest 25% CalEnviroScreen Scores.	Census tract	1999–2022 (LADWP program data) 2021 (CalEnviroScreen 4.0)
Shared Solar Program	LADWP	Customer enrollment/cost	Address/ census tract	1999–2022

Data	Source	Description	Resolution	Vintage
California Battery Storage Program	California Public Utilities Commission (CPUC)	Energy storage incentives customer enrollment	Address/ census tract	All program years
LADWP power infrastructure investments	LADWP	Programs for resilience analysis: power systems reliability; System Average Interruption Duration Index (SAIDI) / System Average Interruption Frequency Index (SAIFI)	Address/ census tract	All program years
Data on regions with very high fire hazard severity zones	California Department of Forestry and Fire Protection's Fire and Resource Assessment Program (FRAP) and CPUC FireMap	Regions with very high fire hazard severity zones	City	2017

Table A-2 describes the modeling assumptions used in this analysis.

Table A-2. Model Assumptions

Input Parameter	Value
Community solar analysis period	10 years
PPA analysis period	20 years
Land lease cost	$50 per kW
Total installed cost, rooftop or ground-mount solar	$1840/kW
Total installed cost, parking canopy solar	$2,640/kW
Inflation rate	2.5%
Real discount rate	6.4%
ITC	30%
ITC brownfield	40%
ITC low-income	50%
Community solar subscriber rate	$0.21665/kWh
Community solar low-income subscriber rate	$0.18/kWh
Site classification to receive low-income ITC bonus	Site is in a tract where the median income equals less than $66,750/yr

Input Parameter	Value
Bill credit rate modeled for community solar subscribers	$0.18857/kWh
Bill credit escalation	9.5%/year, applied year on year until 2035
FiT PPA rate	30 kW – 500 kW: $0.145/kWh > 500 kW – 3 MW: $0.14/kWh > 3 MW: $0.135/kWh
FiT PPA rate for parking canopy solar in DAC	$0.16/kWh
FiT+ PPA rate	$0.25/kWh
FiT+ PPA rate multipliers	South LA Multiplier Table specified in the FiT+ Pilot Program Guidelines

IRA incentives are included in both the Baseline and Equity scenarios as described below (U.S. Department of the Treasury 2023, Wood Mackenzie 2023, McGuireWoods 2023):

- Projects that are 5 MW or less qualify for a bonus tax credit if they are in a low-income area, located on Indian land, benefit an affordable housing building, or qualify as a low-income economic benefit project (for full details see Internal Revenue Service Notice 2023 17 [U.S. Department of the Treasury 2023]). Projects will be awarded either a 10% or a 20% bonus tax credit, depending on which subcategory they qualify for. Bonus adders cannot be stacked (i.e., a project cannot earn a 30% adder). If a project qualifies for both a 10% category and a 20% category, they will earn the 20% adder and the project's capacity will be assigned to the corresponding 20% category. Eligible projects will qualify under one of four subcategories:
    - The facility is located in a low-income community, which is currently defined as a census tract where the poverty rate is at least 20% or where the median family income does not exceed 80% of the statewide median family income.
    - Facility is located on Indian land defined in the Energy Policy Act of 1992 as (1) any land located within the boundaries of an Indian reservation or land not located within the boundary of an Indian reservation but held (a) in trust by the United States for the benefit of an Indian tribe, (b) by an Indian tribe or individual Indian, or (c) by a dependent Indian community.
    - The facility is part of a qualified low-income residential building project. A facility is considered part of a qualified building project if the facility is installed on a residential rental unit that participates in an affordable housing program. The financial benefits of the electricity produced must be allocated equitably among the facility's occupants.
    - The facility is part of a qualified low-income economic benefit project. A facility is considered part of a low-income benefit project if at least 50% of the financial benefits of the electricity produced are provided to households with incomes of less than 200% of the federal poverty line or less than 80% of the area median gross income.

- In this analysis, we apply the maximum bonus adder of 20% for sites located in tracts that have a median income of less than 80% of the area median gross income. We also consider 50% of the subscribers of the community solar project to qualify as low-income under the equity scenario.
- Solar generation projects placed in service after Dec. 31, 2022, and located within an "energy community" will be entitled to a 10% additional ITC (2% for base credit). An energy community is defined to include:
    - A brownfield site
    - A census tract or any adjoining tract in which a coal mine closed after Dec. 31, 1999, or a coal-fired electric power plant was retired after Dec. 31, 2009
    - An area that has (or, at any time during the period beginning after Dec. 31, 1999, had) significant employment or local tax revenue related to the extraction, processing, transport or storage of coal, oil or natural gas.
- In this analysis, we apply a 10% bonus credit to all sites on parcels classified as brownfield by the U.S. Environmental Protection Agency (EPA 2019).
- If a parcel is in a low-income tract and also classified as brownfield, we apply the 20% (higher) bonus credit and report it as a parcel in low-income tract under the Equity scenario.

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