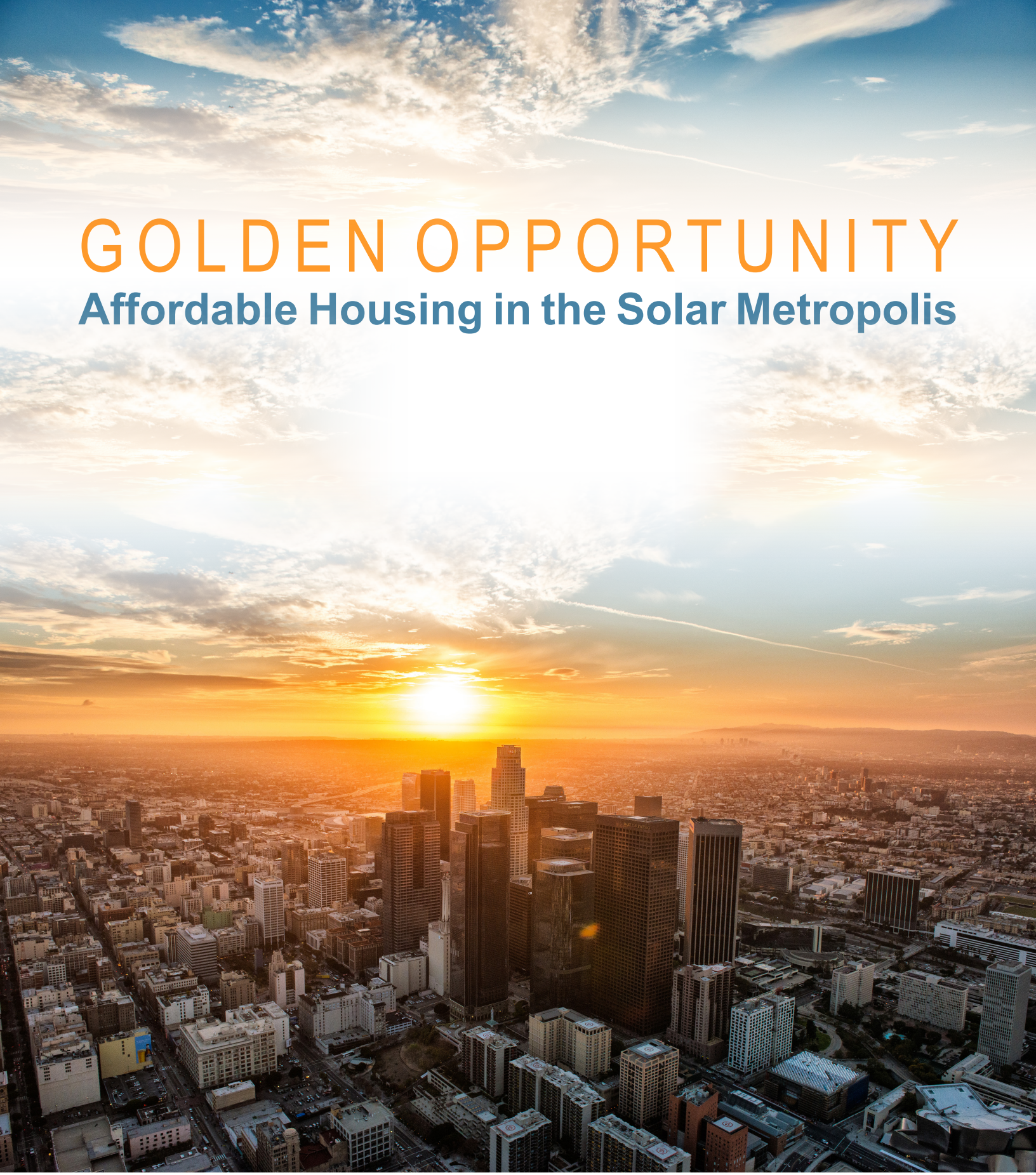

GOLDEN OPPORTUNITY

Affordable Housing in the Solar Metropolis

GRID ALTERNATIVES
Greater Los Angeles

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UCLA Luskin School *of* Public Affairs
Luskin Center
FOR INNOVATION

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Disclaimer

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1 Introduction

Los Angeles County is a national leader in the adoption of residential solar, and for good reason: The region benefits from an abundance of sunshine, a vast sprawl of single-family rooftops, and more than a decade of California clean energy policy that has catalyzed an industry. Today, more than 88,000 Los Angeles County homes produce clean solar energy from their rooftops, saving these collective households tens of millions of dollars from utility bills while contributing to California's ambitious greenhouse gas reduction goals.[i]

Most of solar's early adopters are higher-income households who can afford the up-front investment cost — a common technology adoption trend that has resulted in an inequitable distribution of solar and its benefits. Low-income households, or those earning annual incomes less than 80% of area median income, account for less than 1% of Los Angeles County's residential solar capacity.[ii] Yet it is low-income households who typically spend a higher percentage of their income on energy costs and thus stand to benefit most from utility bill savings.[iii]

Low-income households encounter a series of barriers when attempting to access the benefits of solar. Most immediate are financial barriers such as insufficient access to capital or financing alternatives. California's progressive rebate programs are critical for addressing these challenges, but other issues such as poor roof quality may persist in preventing solar installation. Low-income renters face the same barriers and more. These include an uncertain length of tenancy and diminished investment motivation for equipment they may relocate from in the near term; a shared rooftop that makes it difficult for any one resident to install large equipment; and a complex electrical and structural configuration that can result in a more challenging and expensive installation when compared to a single-family home.

As Los Angeles enters the next stage of solar adoption, policymakers and advocates for clean energy and environmental justice are considering the barriers to solar adoption for low-income residents and crafting deliberate policies that promote wider access to solar and its benefits. **This report showcases one key policy opportunity available in Los Angeles County to extend solar access to low-income renters through the development of solar on affordable multifamily housing.**

Affordable housing property owners and solar developers can substantially reduce the cost of solar by leveraging state solar rebates. Solar for affordable housing rebate programs have been available in California since the state's landmark environmental policy year of 2006, when the California Solar Incentive program launched and created the New Solar Homes Partnership and Multifamily Affordable Solar Homes program soon thereafter. To date, solar for affordable housing rebate programs have generated more than 44 megawatts (MW) of solar capacity throughout California.[iv]

In 2018, California expects to start the next chapter of solar investment for affordable housing, with a rebate program that stands orders of magnitude larger than any of its predecessors — the Solar on Multifamily Affordable Housing program (Assembly Bill 693, Eggman). With a budget of up to $100 million annually for 10 years, this rebate incentive program has the potential to transform California's affordable housing portfolio into a critical component of its clean energy economy.

Solar for affordable housing rebate programs, like the Solar on Multifamily Affordable Housing program and the Low-Income Weatherization Program - Large Multifamily, provide greater rebate incentives to affordable housing developers and property owners who construct solar systems large enough to directly benefit low-income residents. By shifting the investment motivation to the property owner, the affordable housing resident's financial barrier to solar access is effectively removed. The remaining adoption barriers unique to renters are circumvented through utility-offered virtual net metering, a common billing mechanism that allows multiple parties to share the financial benefits of a single solar system. Most areas of Los Angeles County already have access to virtual net metering, but the City of Los Angeles and other local municipalities that administer public utilities are an exception. Therefore, the City of Los Angeles and others such as Burbank and Glendale have a policy opportunity to address this barrier to equity and expand solar access to their historically underserved customers.

Solar for affordable housing rebate programs have the potential to transform the more than 1,100 qualifying affordable housing properties in Los Angeles County.[v] The installation of solar on affordable housing encourages a variety of benefits indicative of an equitable clean energy economy, including:

- **Solar access for low-income renters,** who face the greatest solar adoption barriers and shoulder some of the largest energy costs as a percentage of their income (i.e., greater energy burden).
- **Operating cost savings for affordable housing property owners,** who can reinvest savings back into their core mission(s) such as resident services and additional housing;
- **Geographically distributed commercial-scale rooftop solar,** including in zip codes with low solar penetration; and
- **Regional economic activity,** by bringing in external state solar investment, encouraging job growth in solar and complementary industries, and developing solar workforce through job training opportunities.

Audience and Structure of This Report

This report is intended to be a resource for policymakers, affordable housing developers, economic development planners, solar photovoltaic installers, utility planners, environmental justice advocates and anyone interested in the equitable development of solar power in Los Angeles County. **Section 2** of the report reviews past, current and future solar for affordable housing rebate programs in California. **Section 3** previews the capacity and benefit potential of solar for affordable housing in Los Angeles County, including the total rooftop solar potential, the utility bill savings potential for property owners and residents, the external investment potential from state solar rebate programs, and the job growth and job training potential. **Section 4** showcases solar workforce development as a primary co-benefit of solar for affordable housing rebate programs and offers strategies to maximize its impact. Finally, **Section 5** identifies policy barriers limiting certain jurisdictions' ability to maximize the benefits of solar for affordable housing, namely the unavailability of virtual net metering in the Los Angeles Department of Water and Power territory and other municipally owned utilities.

A 44-kW solar system at LINC Housing's Village at Beechwood property in Lancaster, California.
Credit: GRID Alternatives

2 Background:

California's Commitment to Investing in Solar for Affordable Housing

California has targeted solar investment for affordable housing since the state's landmark environmental policy year of 2006, when Senate Bill (SB) 1 (Murray, 2006) codified a suite of statewide solar incentive programs with the goal of installing 3,000 megawatts (MW) of new solar over 10 years. Two solar for affordable housing rebate programs eventually emerged from SB 1: the New Solar Homes Partnership to incentivize solar installations on newly constructed affordable multifamily housing, and the Multifamily Affordable Solar Housing (MASH) program to provide rebate incentives for property owners who install solar on existing affordable multifamily housing.

In 2014, California launched a new solar for affordable housing rebate program using auction proceeds from the state's Cap-and-Trade Program. The Low-Income Weatherization Program - Large Multifamily extended solar and energy-efficiency rebates to affordable housing properties located within predefined environmentally "disadvantaged communities." Importantly, these program rebates expanded beyond investor-owned utility (IOU) territory to the many affordable housing properties located within municipally owned utility territories.

The next chapter of state solar investment for affordable housing will begin in 2018 with the start of the Solar on Multifamily Affordable Housing (SOMAH) program. Created by Assembly Bill 693 (Eggman, 2015), this program will accelerate solar investment for affordable housing drastically, committing to a goal of installing at least 300 MW of new solar capacity and allocating up to $1 billion over 10 years to do so.

The following section provides additional details about these rebate incentive programs. Los Angeles County has been a primary benefactor of the state's commitment to solar investment with more than 19 MW of affordable housing solar capacity.[vi] And now, with the start of the Solar on Multifamily Afordable Housing program and continuation of the New Solar Homes Partnership and Low-Income Weatherization Program - Large Multifamily, the county's more than 1,100 rebate-eligible affordable housing properties emerge as a critical and equitable component in the region's clean energy economy.

The Multifamily Affordable Solar Housing Program

The Multifamily Affordable Solar Housing (MASH) Program targets state solar investment at affordable housing properties within territories served by an investor-owned utility; i.e., Pacific Gas & Electric (PG&E), Southern California Edison (SCE), and San Diego Gas & Electric (SDG&E). Since its start in 2008, the MASH program has provided fixed, capacity-based rebates to affordable housing property owners who install solar on existing properties.[1] A fundamental design feature of the MASH program is a tiered rebate structure that incentivizes prop-

1 For the MASH program, affordable housing is defined as any multifamily residential complex financed with either low-income housing tax credits; tax-exempt mortgage revenue bonds; general obligation bonds; or local, state, or federal loans or grants; and where either the rents of the occupants who are lower-income households do not exceed those prescribed by deed restrictions or regulatory agreements pursuant to the terms of the financing or financial assistance; or the affordable units have been or will be initially sold at an affordable housing cost to a lower-income household, and those units are subject to a resale restriction or equity-sharing agreement pursuant to the terms of the financing or financial assistance. (MASH Program Handbook)

erty owners to construct a solar system large enough to benefit their residents. Providing higher rebates for the "resident's" portion of the system effectively shifts all investment motivation to the property owner and removes the financial barrier impeding many low-income households' solar access.

The MASH program, which is funded by IOU ratepayers, was allocated $108 million in funding through 2016. It and its sister program, the Single-Family Affordable Solar Housing (SASH) Program, designed to benefit low-income single-family homeowners, reserved their funding in advance of the programs' scheduled sunsets in 2016. The California Legislature recognized the need for continued investment in these groundbreaking low-income solar programs and, via Assembly Bill (AB) 217 (Bradford, 2013), continued the MASH and SASH programs with an additional $108 million through 2021. AB 217 also included new requirements for MASH to increase community co-benefits, such as a mandate to include job training and workforce development opportunities in every installation.

The current rebate structure under the extended MASH program includes:

1. $1.10 per watt for the portion of the solar system that offsets common-area load, nonvirtual net-metered tenant load (often master-metered settings), or virtual net-metered tenant load with less than 50% tenant benefit; and
2. $1.80 per watt for the portion of the solar system that offsets tenant load through virtual net metering with greater than 50% tenant benefit.

In total, the MASH program has funded 370 projects and 25.7 MW of affordable housing solar capacity, with more than 6,880 low-income renters now accessing the financial benefits of solar through virtual net metering.[vii] An additional 165 projects and more than 29 MW are on the wait list, and the program is closed to accepting new applications.

The New Solar Homes Partnership

The New Solar Homes Partnership (NSHP) targets state investment in newly constructed market-rate housing and affordable housing within IOU territories. The NSHP's mandate is to create a "self-sustaining market for solar homes where builders incorporate high-performing solar energy systems into highly energy-efficient new homes."[viii] Accordingly, the program requires new home construction to achieve certain energy-efficiency standards to become eligible for solar rebates.

NSHP rebates are reserved for newly constructed affordable housing properties that adhere to two separate criteria:

- The property must meet the code-compliant requirements of the 2016 Energy Standards.
- At least 20% of the property's residential units must be reserved for households earning no more than 80% of the area median income.

Rebates are again tiered to incentivize property owners to expand solar access to their residents. Solar capacity that offsets common-area load is eligible for $1.50 per watt, and capacity that offsets resident consumption through virtual net metering qualifies for $1.85 per watt. Addition-

al financial incentives extend to affordable housing properties located within predefined environmentally disadvantaged communities. The additional incentive, which endeavors to achieve environmental justice co-benefits, is calculated for each individual project and capped at $500 per affordable housing residential unit served by the solar system.

At its start, the New Solar Homes Partnership was allocated a $400 million budget, relying on monies from the Renewable Resource Trust Fund. Program funding soon fell behind the initial level, and in 2016, received an additional $111.78 million to bridge the gap.

The NSHP remains open to applicants. Since 2007, more than 15 MW of NSHP-financed solar has been incorporated into new affordable multifamily housing construction.[ix]

The Low-Income Weatherization Program - Large Multifamily

The Low-Income Weatherization Program - Large Multifamily (LIWP-LMF) directs state investments to support solar systems and energy-efficiency improvements for existing affordable housing properties located within disadvantaged communities. (See below for a definition and map of disadvantaged communities.) Unlike the other previously described programs available only in investor-owned utility territory, this program is available to affordable housing proprieties located in disadvantaged communities across all California utilities, including municipally owned utilities such as the Los Angeles Department of Water and Power.

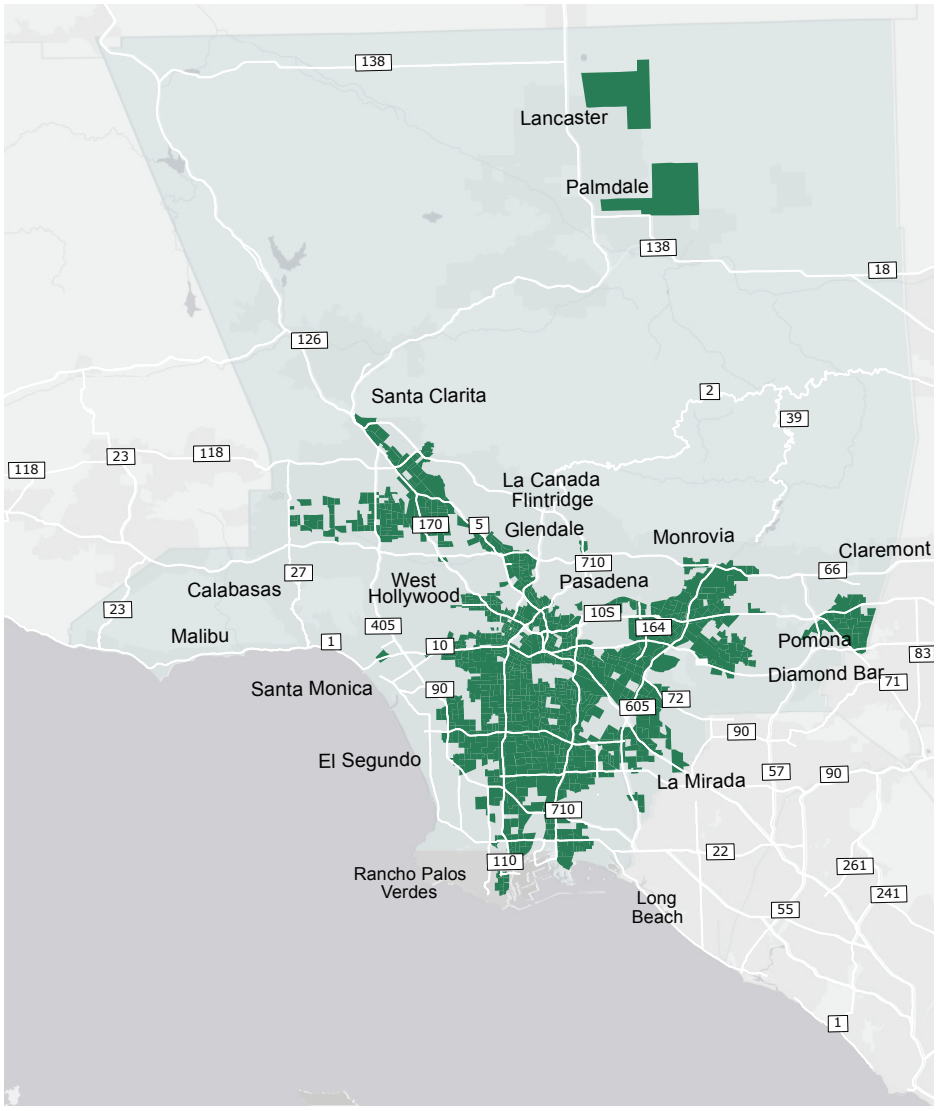
Specifically, rebates are available to affordable housing properties with 20 or more rental units and with at least two-thirds of units reserved for household incomes at or below 80% of area median income.[2] Property owner applicants must participate in co-investment for energy-efficiency upgrades and achieve 15% energy-efficiency gains to become eligible for solar rebates. In addition to solar rebates, LIWP-LMF offers energy-efficiency rebates, as well as free energy-efficiency and solar technical assistance at the onset of the application process.

Applicants to LIWP-LMF may leverage additional funding such as the previously described MASH program as well as the solar Investment Tax Credit (ITC) and the Low Income Housing Tax Credit. Once again, LIWP-LMF rebates are tiered based on whether the solar system will financially benefit the tenant through virtual net metering. For solar capacity that offsets common-area consumption, rebates range from $0.50 to $1.50 per watt, and for resident offset, rebates range from $0.90 to $3.50 per watt.

In 2014, the California Department of Community Services and Development, which administers LIWP-LMF, received $75 million from the auction revenues from the state's Cap-and-Trade Program, followed by an additional $24 million in fiscal year 2015–'16. LIWP-LMF does not have a continuous appropriation from the state's Cap-and-Trade Program. Instead, state legislators determine each year how much money the program will receive. The LIWP is wait-listing projects as of March 2017 and is set to expire in summer 2018 unless further action is taken.

2 A waiver may be obtained for smaller buildings.

Figure 1 Disadvantaged Communities in Los Angeles



LA County Disadvantaged Communities

Communities in the top quartile of CalEPA CalEnviroScreen 3.0 scores

What is a Disadvantaged Community?

Many solar for affordable housing rebate programs target investment in disadvantaged communities. The state defines disadvantaged communities as the census tracts in California most burdened by pollution from multiples sources and most vulnerable to its effects, considering socioeconomic characteristics and underlying health status. Disadvantaged communities are identified using the Office of Environmental Health Hazard Assessment's "CalEnviroScreen Tool," which is used to reinvest proceeds from the state's Cap-and-Trade Program, including for the Low-Income Weatherization Program - Large Multifamily.

Los Angeles is home to by far the most disadvantaged communities of any county in the state. More than 9.7 million Los Angeles County residents live within 2,297 disadvantaged census tracts, where they are exposed to higher concentrations of hazardous pollutants such as ozone and particulate matter. Further, these residents experience socioeconomic factors such as low high school graduation rates and high unemployment.

The Solar on Multifamily Affordable Housing Program

In 2015, the California Legislature passed Assembly Bill 693 (Eggman, 2015) establishing the goal of expanding solar access to low-income residents through the installation of at least 300 MW of new solar capacity for affordable multifamily housing. To achieve this goal, the legislation calls for an annual allocation of up to $100 million over 10 years ($1 billion total) – by far the largest solar investment commitment for affordable housing to date.

In October 2017, the California Public Utilities Commission released its Proposed Decision to implement Assembly Bill 693 and create the Solar on Multifamily Affordable Housing (SOMAH) Program. SOMAH program rebates will be reserved for affordable housing properties located in disadvantaged communities within investor-owned utility territories. Rebates will also be available to affordable housing properties not within disadvantaged communities but which reserve at least 80% of units for household incomes at or below 60% of the area median income. Properties located within territories served by municipally owned utilities, like the Los Angeles Department of Water and Power or Burbank Water and Power, will not qualify for the SOMAH program.

The Proposed Decision outlines a rebate structure similar to the Low-Income Weatherization Program - Large Multifamily. Program rebates vary depending on whether affordable housing residents receive direct benefits and whether tax credits such as the Investment Tax Credit (ITC) or the Low-Income Housing Tax Credit (LIHTC) are leveraged to finance the solar system. For the portion of the solar system that offsets the affordable housing resident electricity consumption, program rebates are proposed to range from $1.60 per watt to $3.20 per watt. For the portion of the solar system that offsets common-area load, program rebates are proposed to range from $0.60 per watt to $1.10 per watt.[x]

Like its predecessors, the SOMAH program hopes to capture additional co-benefits. The legislation contains a workforce development mandate for local hiring and community economic benefits, as well as directives on achieving geographic diversity for installations, setting appropriate incentive levels, and ensuring participating tenants receive a direct economic benefit.

See Table 1 below for a summary of the solar for affordable housing rebate programs.

Table 1 Solar for Affordable Housing Rebate Program Details

Program	Status	Eligible Customers	Eligible Properties	Most Recent Rebate Level	Total Program Budget	Energy Efficiency Requirements
Multifamily Affordable Solar Housing	Inactive	IOU customers	Rent-restricted	$1.80 per watt for tenant benefit; $1.10 per watt for common area	$216 million over 10 years	Must complete basic audit or participate in energy-efficiency program
New Solar Homes Partnership	Active	IOU customers	≥20% units ≤80% AMI[3]	$1.85 per watt for tenant benefit; $1.50 per watt for common area	$400 million for market rate and affordable housing until exhausted	Must meet code-compliant requirements of 2016 Energy Standards
Low-Income Weatherization Program - Large Multifamily	Waitlist; Future Uncertain	Customer of any utility in California	In DAC[4] and ≥66% units ≤80% AMI	Maximum of $3.50 per watt for tenant benefit; maximum of $1.50 per watt for common area	$24 million for one year (annual appropriation)	Must achieve 15% energy-efficiency gains; EE incentives available
Solar on Multifamily Affordable Housing	Proposed Decision	IOU customers	In DAC or ≥80% units ≤60% AMI	Maximum of $3.20 per watt for tenant benefit; maximum of $1.10 per watt for common area	$100 billion over 10 years	Must complete basic audit or participate in energy-efficiency program

3 The area median income (AMI) is set by the U.S. Department of Housing and Urban Development (HUD) for counties such as Los Angeles County. In 2017, the Los Angeles County median income is $64,300.

4 DAC stands for disadvantaged community. See previous call-out box for definition and usage of this term.

3 Seizing the Golden Opportunity:

The Benefit Potential of Solar on Affordable Housing in Los Angeles County

As California prepares to launch its largest solar rebate for affordable housing program to date, Los Angeles County — home to the most rebate-eligible affordable housing properties of any county in the state — is expected to emerge as a primary benefactor. The Solar on Multifamily Affordable Housing program and other solar for affordable housing rebate programs represent an opportunity for Los Angeles County to promote solar access for low-income households and encourage more equity in the region's clean energy economy.

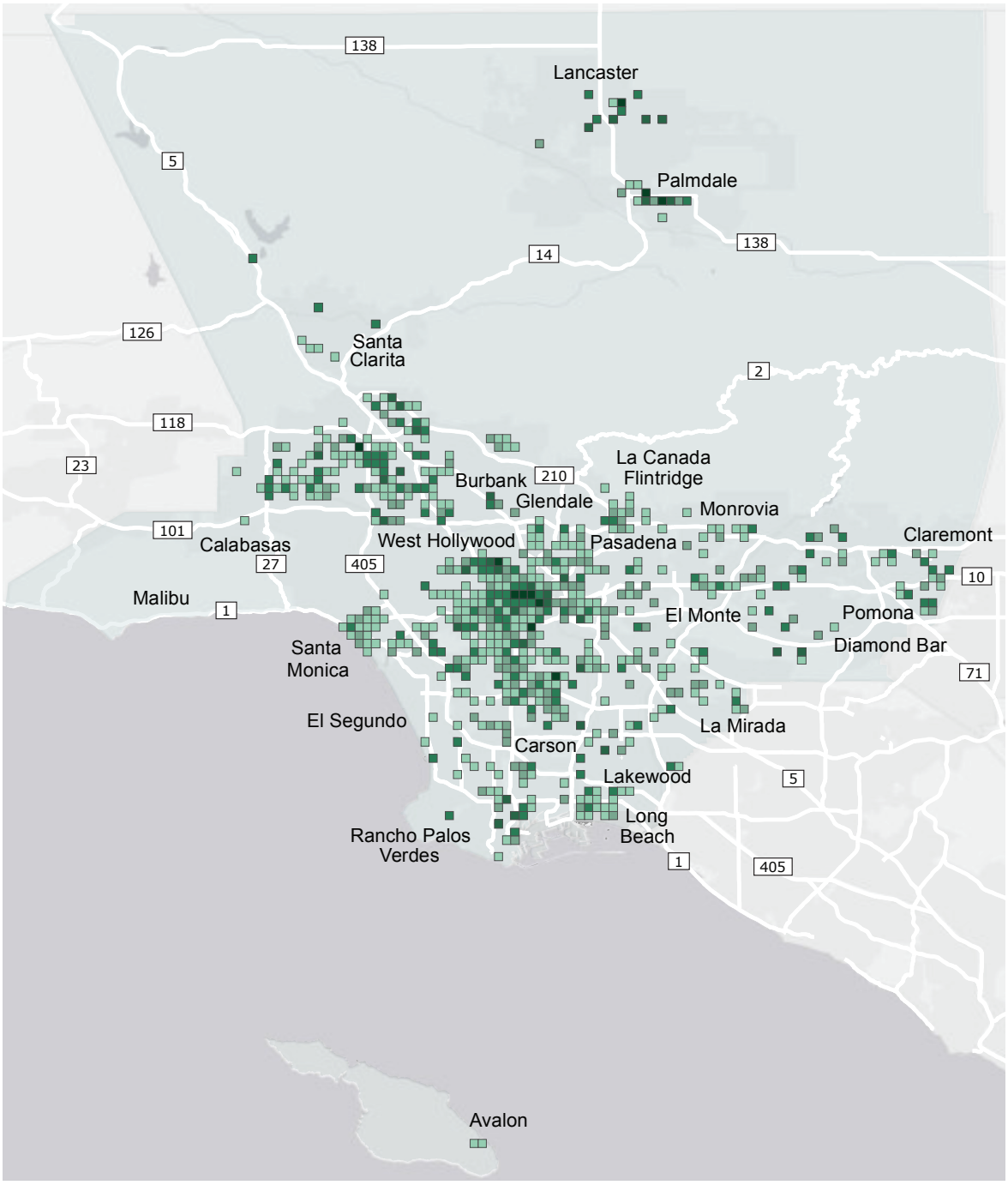
The scale of the opportunity is impressive, with an estimated 115 MW of rooftop solar potential across Los Angeles County's affordable housing portfolio, including at least 68 MW that is or will be eligible for an affordable housing solar rebate. This section showcases the opportunity at hand and estimates the potential benefits, including physical rooftop solar capacity, utility bill savings for residents and property owners, investment from state solar rebate programs, and job growth and job training opportunities. See Appendix D for a description of the methods employed in the following analyses.

Rooftop Solar Potential

Solar for affordable housing encourages commercial-scale rooftop solar that is geographically distributed throughout Los Angeles County. Figure 2 shows this distribution using a fishnet map, which aggregates the affordable housing rooftop solar capacity for each square kilometer of Los Angeles County. Table 2 then highlights how **Los Angeles County possesses over 115 MW of affordable housing rooftop solar potential** across its seven utilities. Importantly, more than 68 MW of this rooftop solar potential is within predefined disadvantaged communities — one criterion for solar for affordable housing rebate eligibility.

A 24-kW solar system that will provide utility bill savings for property owner and 36 low-income residents. Credit:GRID Alternatives

Figure 2 Affordable Housing Solar Capacity per Kilometer in Los Angeles County



[a] *Estimated rooftop solar nameplate capacity*

Table 2 Affordable Housing Solar Capacity by Utility in Los Angeles County

Utility	Total Capacity (kW)	Total Rebate-Eligible Capacity (kW)
Los Angeles Department of Water & Power	62,273	42,993
Southern California Edison	49,280	22,509
Burbank Water & Power	1,103	1,103
Glendale Water & Power	991	634
Pasadena Water & Power	1,306	494
Azusa Light & Water	331	331
Vernon Light & Power	79	79
Los Angeles County Total	**115,363**	**68,142**

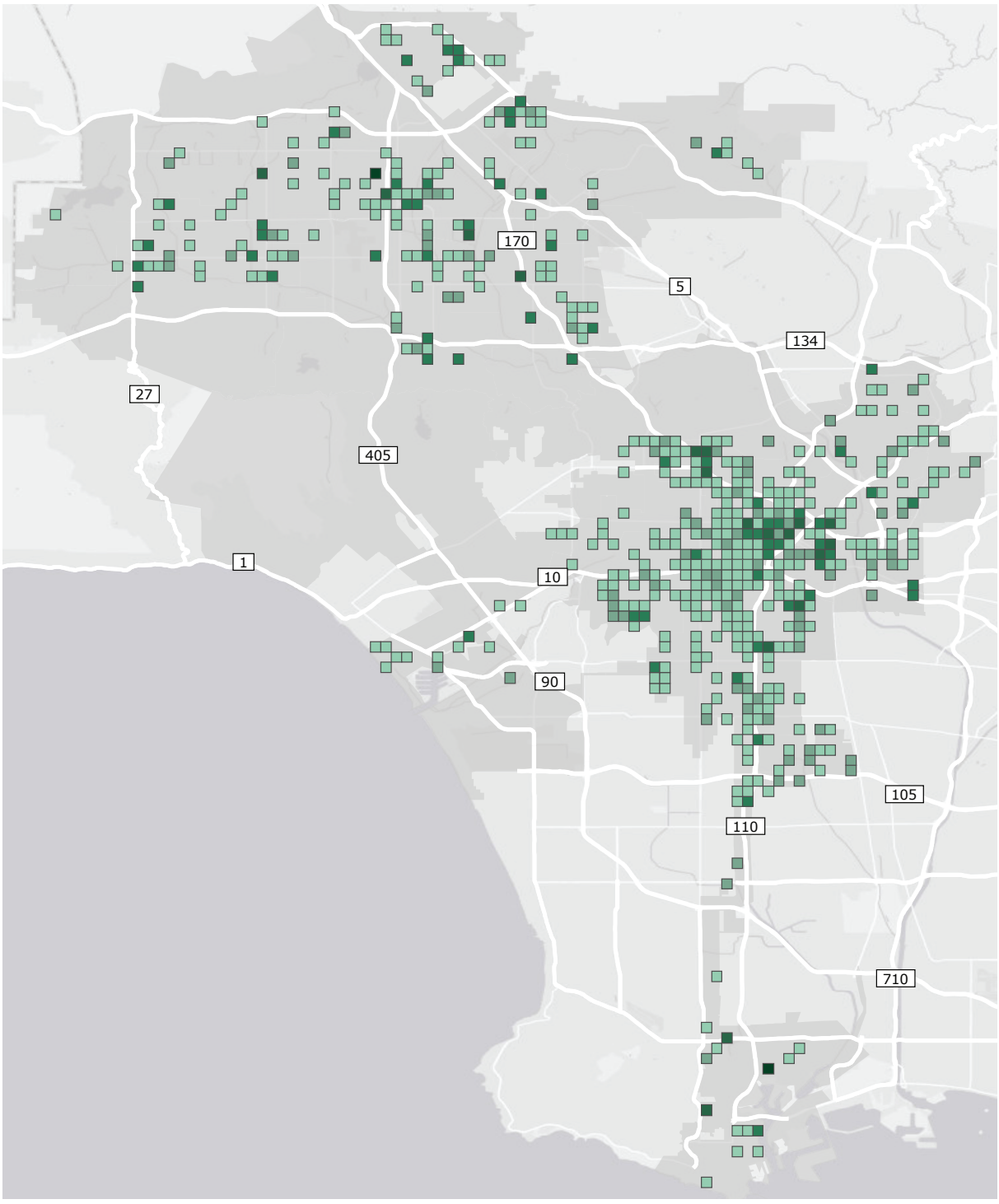
The City of Los Angeles and its municipal utility, the Los Angeles Department of Water and Power (LADWP), are home to the largest share of rooftop solar potential (62 MW) and rebate-eligible rooftop solar potential (43 MW). Affordable housing rooftop solar potential is distributed throughout the city, with 13 of 15 city council districts possessing at least 1.9 MW and nine out of 15 city council districts having more than 4 MW of affordable housing rooftop solar potential.[5] Figure 3 shows the distribution of solar in the City of Los Angeles, particularly in neighborhoods in and around downtown Los Angeles and throughout the San Fernando Valley.

Solar for affordable housing represents an opportunity for a more equitable geographic distribution of solar by increasing adoption in historically underserved neighborhoods. LADWP identifies 53 zip codes across the city with "low solar penetration" and attempts to drive adoption in these neighborhoods with energy equity programs like the Solar Rooftops Program.[6] In total, LADWP's "low solar penetration" zip codes possess 26 MW of affordable housing rooftop solar potential, including 24 MW in environmentally disadvantaged communities that are eligible for rebate programs. If harnessed, this large amount of solar potential could significantly shift the solar adoption pattern for the City of Los Angeles and contribute to achieving for all Angelenos the city's ambitious clean energy goals, per its Sustainable City pLAn.[xi]

5 See Appendix A for additional solar data on the City of Los Angeles' 15 city council districts.

6 The Solar Rooftops Program is intended to target communities with low solar penetration and offers homeowners $30 per month to install and then lease a residential solar system, with low solar penetration zip codes getting exclusive access to enrollment period 1.

Figure 3 Affordable Housing Solar Capacity per Half-Kilometer in the City of Los Angeles



[a] *Estimated rooftop solar nameplate capacity*

Financial Savings and Economic Benefits Potential

At least 68 MW of affordable housing solar capacity in Los Angeles County is or will be eligible for a California solar rebate program, including the soon-to-launch Solar on Multifamily Affordable Housing program. Affordable housing property owners can leverage these rebates to reduce their operating costs and their residents' energy costs, all while bringing external investment into Los Angeles County and spreading financial and economic benefits across the region. In all, solar for affordable housing in Los Angeles County can:

- save affordable housing residents more than **$11.6 million** annually on utility electric bills;
- reduce affordable housing property costs by more than **$4.9 million** annually;
- leverage up to **$220.6 million** in external state solar investment;
- create more than **1,800 solar job years;**
- generate more than **3,800 job training opportunities** and nearly 31,000 job training hours that can be strategically targeted to encourage an equitable clean energy workforce.

Utility Bill Savings

Solar for affordable housing generates utility bill savings for both affordable housing property owners and residents. With reduced operating costs, affordable housing property owners can reinvest utility bill savings back into their core mission(s), including resident services and additional housing. Solar for affordable housing rebate programs also financially incentivize property owners to build a solar system large enough to expand its financial benefits to their residents.

According to our analysis, solar for affordable housing has the potential to save affordable housing residents in Los Angeles County more than $11.6 million annually on utility electric bills. With the monthly utility bill savings, affordable housing residents can secure other life necessities such as food, health care or transportation. **For the affordable housing property owners, solar for affordable housing has the potential to reduce operating costs by more than $4.9 million annually.** Table 3 highlights the potential utility bill savings in cities and neighborhoods throughout Los Angeles County. See Appendix B for the full list of estimated potential utility bill savings for tenants and property owners in each city or neighborhood in Los Angeles County.

Table 3 Top 10 Cities/Neighborhoods in Los Angeles County for Annual Tenant Savings Potential From Solar on Affordable Housing

City/Neighborhood	Annual Resident Savings Potential ($)	Annual Common-Area Savings Potential($)
Los Angeles	6,104,329	2,836,996
Long Beach	478,800	214,380
Pomona	307,877	99,780
Van Nuys	262,123	71,332
Compton	236,808	97,103
Wilmington	218,965	45,221
Panorama City	203,932	60,596
West Covina	198,803	68,624
Pacoima	192,954	84,973
North Hollywood	176,245	83,349
Total	**11,551,766**	**4,933,261**

State Investment

Los Angeles County affordable housing properties located within disadvantaged communities in Southern California Edison territory are eligible for all current and future California solar for affordable housing rebate programs (the New Solar Homes Partnership (NSHP), the Low-Income Weatherization Program - Large Multifamily (LIWP-LMF), and the Solar on Multifamily Affordable Housing program). Affordable housing properties within the City of Los Angeles, as well as the county's five other cities with a municipal utility,[7] qualify only for the LIWP-LMF.[8] In total, more than 1,100 properties qualify for a current and/or future solar for affordable housing rebate program.

Affordable housing property owners who leverage state solar rebate programs generate regional economic benefits across Los Angeles County. Introducing more external investment to the region would create jobs and stimulate the solar industry and other industries affected by it (such as construction) and the broader economy due to increased spending from additional income earned and utility bill savings. **In total, Los Angeles County affordable housing properties could leverage up to $220.6 million in investment from the state's solar programs.**

7 Azusa Light & Power; Burbank Water & Power; Vernon Light & Power; Glendale Water & Power; Pasadena Water & Power.

8 There is 45.6 MW of municipal utility affordable housing solar capacity that must rely on rebates only from the Low-Income Weatherization Program - Large Multifamily (LIWP-LMF). The LIWP-LMF is wait-listing projects and requires additional funding. With such a significant amount of solar capacity and related benefits in limbo, local policymakers and advocates of affordable housing and clean energy are pushing to extend programs like the LIWP-LMF.

Job Years and Job Training Opportunities Created

Designing, permitting, and installing this solar capacity will generate new solar job opportunities in the regional clean energy economy. As reviewed in Section 4, solar jobs offer competitive wages and career pathways for advancement in a growing industry and related trades such as construction and electricity. **We estimate that in Los Angeles County, solar for affordable housing rebate programs have the potential to generate more than 1,800 job years.**[9]

Solar for affordable housing rebate programs also provide opportunities for solar workforce development. For example, the Multifamily Affordable Solar Housing (MASH) program requires up to 40 hours of paid job training for each solar installation. **In total, Los Angeles County could produce more than 3,800 job training opportunities and nearly 31,000 job training hours through solar for affordable housing rebate programs.**

Job training opportunities resulting from solar on affordable housing rebate programs can be strategically deployed with a goal of developing an equitable solar workforce. Affordable housing residents and other groups who face greater barriers to employment may benefit from these job training opportunities. These workforce development opportunities are discussed at more length in Section 4.

Table 4 identifies the cities and neighborhoods in Los Angeles County that have the most potential to stimulate their economy using solar for affordable housing rebate programs. Appendix B expands on this analysis, illustrating the total physical capacity and rebate-eligible capacity as well as potential utility bill savings and economic benefits for all cities across the region.

9 One job year equals one full-time job for one year.

Table 4 Top 10 Cities/Neighborhoods in Los Angeles County With Maximum Solar Investment Potential From the State's Solar for Affordable Housing Rebate Programs

City/ Neighborhood	Maximum State Solar Investment ($)	Solar Job Training Opportunities	Solar Job Training Hours	Solar Job Years Created
Los Angeles	116,877,993	2,418	19,716	440
Long Beach	9,047,074	107	864	31
Pomona	5,835,954	64	512	22
Van Nuys	4,973,599	48	384	17
Compton	4,474,103	80	644	15
Wilmington	4,217,986	29	236	15
Panorama City	3,852,970	43	344	13
West Covina	3,787,863	30	240	13
Pacoima	3,661,749	34	276	13
North Hollywood	3,492,495	57	456	13
Total	**220,649,327**	**3,815**	**30,948**	**818**

4 Maximizing the Workforce Development Benefit

Solar for affordable housing has the potential to generate a range of benefits in Los Angeles County, including more job growth in the solar industry and related industries such as construction. With the solar industry's sustained annual job growth already outpacing the pool of qualified workers, solar job training and workforce development grows in importance. Solar for affordable housing offers a platform to train the next generation of clean energy workers and respond to employer demand for qualified labor. Los Angeles County alone has the potential to yield more than 3,800 solar job training opportunities and nearly 31,000 paid job training hours from solar for affordable housing rebate programs — opportunities that offer career pathways in a growing industry. This section showcases the workforce development co-benefit of solar for affordable housing and offers some strategies for maximizing impact.

California policymakers recognized the importance of developing a qualified solar workforce from the onset of state solar rebate design. One of the first solar for affordable housing rebate programs – the Multifamily Affordable Solar Housing (MASH) program – required up to five paid job training opportunities and 40 job training hours for each subsidized installation. The justification was clear: If public funding was to catalyze the growth of a new industry, then there had to be workers ready to take advantage of hiring when that industry started to grow.

Now, 11 years after the start of the MASH program, the solar industry has experienced tremendous growth. In California, rooftop solar installations have increased nearly thirtyfold since 2006, with more than 640,000 solar installations at residential and commercial customer sites through 2016.[xii] In step with rooftop solar adoption has been a solar workforce that has encountered sustained job growth, with an increase of at least 20% annually.[xiii] In 2016, one in every 50 new jobs added to the entire U.S. workforce was in the solar industry.[xiv]

Snapshot of Solar Jobs

- Wide range of career opportunities, including installation, design, sales, project development, and manufacturing.
- Often, these jobs unlock career pathways in a rapidly growing industry and beyond, including union tracks to the electric and construction trades.
- Installers account for 53% of solar jobs.
- Wages paid by solar firms are competitive. The average solar installer earns $21 per hour.
- Low barriers to employment: 67% of solar jobs do not require a bachelor's degree.
- Solar is increasingly diverse:
  - » 28% women
  - » 17% Latino/Hispanic
  - » 7% African American

Adapted from the 2016 US Solar Jobs Census (The Solar Foundation)

California's solar industry has grown at such a rapid pace that employers are finding it increasingly difficult to match job openings with qualified workers.[xv] Locally, utilities like the LADWP acknowledge that their "current workforce is rapidly aging."[xvi] Accordingly, LADWP programs like the Utility Pre-Craft Trainees are "striving to train the next generation of highly skilled employees."[xvii] The rapid growth of a new industry and the soon-to-be retirement of an entire age

Diana Adams, Installation Supervisor at GRID Alternatives, instructs trainees and residents of LINC Housing's City Gardens property on how to properly set and secure solar panels. Credit: GRID Alternatives

cohort at local utilities highlight the imperative for preparing workers for employment in the energy industry.

The workforce development opportunities provided by solar on affordable housing rebate programs can be utilized to prepare the next generation of energy workers. Further, these opportunities can be strategically targeted to individuals or groups who face barriers to employment or to those who have been left behind by a new service and technology economy, such as the affordable housing residents themselves.

Affordable housing residents are more likely to live in communities with higher unemployment rates, greater linguistic isolation, and lower high school graduation rates than the county at large.[xviii] This can often result in a cycle of unemployment, low-paying wages, and the need for subsidized rent. Solar developers and affordable housing resident services staff can partner to extend the job training opportunities made available by the solar rebate programs directly to the residents of the property where the solar installation is taking place. Residents can then learn transferable construction and electric skills while installing a solar system that their community will benefit from, which may ultimately spark the desire to pursue a career in a growing industry.

Solar for affordable housing job training opportunities can also be extended to individuals who face additional barriers to employment, including the reentry (formerly incarcerated) population.

After serving their term, returning citizens encounter a series of challenges, such as reestablishing their livelihood and finding steady employment. It is estimated that 60% to 75% of the reentry population remains unemployed for more than a year after release.[xix] Without steady employment, there is a risk individuals may return to the lifestyles that led to their original offense. In California, the recidivism rate remains alarmingly high, with over 44% of individuals returning to prison within three years of release.[xx]

Equipping individuals who have served their time with solar employment skills can help to provide a livelihood and a healthy reintegration back into the citizenry. Even more, job training at affordable multifamily housing sites provides the reentry population specific training in commercial solar installation — a sector that may be more inclined to hire formerly incarcerated individuals because of the relatively public nature of the installation sites when compared to the residential sector. Government agencies should recognize this opportunity and continue to support sensible laws and actions that remove employment barriers for the reentry population. The City of Los Angeles took a critical step with the Fair Chance Initiative for Hiring ordinance, which eliminates the commonly used criminal history checkbox found on many applications. Additional work must be done to connect the reentry population to quality jobs and job training opportunities such as those provided by solar for affordable housing rebate programs.

5 Policy Recommendations

Solar for affordable housing represents an opportunity for Los Angeles County to expand solar access to the region's most underserved and environmentally burdened households. For local cities with municipally owned utilities — including Azusa, Burbank, Glendale, Los Angeles, Pasadena and Vernon — the opportunity is particularly significant. Together, affordable housing properties within these cities show the potential to host more than 45.6 MW of rebate-eligible rooftop solar capacity, or two-thirds of the county's total.

While there is a significant opportunity for cities like Los Angeles to leverage state investment and promote energy equity, certain barriers stand in the way of achieving their full potential. Foremost is the unavailability of virtual net metering (VNEM), a common utility policy that allows for multiple customers to share a single solar system. In multifamily settings where multiple residents often share a single roof, VNEM is the only feasible mechanism by which customers can access solar. In the City of Los Angeles, the need for VNEM is particularly glaring, as nearly 1.6 million Los Angeles Department of Water and Power (LADWP) customers reside in multifamily settings.[xxi] By following the lead of several utilities throughout the country including in California, Los Angeles and other cities with municipally owned utilities can help affordable housing property owners maximize solar rebates and expand solar access to low-income renters.

The following section reviews design criteria for implementing VNEM and offers recommendations to maximize solar access and state solar investment. First, the section highlights the Low-Income Weatherization Program - Large Multifamily as a vital source of funding for solar on affordable housing located within a municipally owned utility territory.

Extend the Low-Income Weatherization Program - Large Multifamily

More than two-thirds of Los Angeles County's rebate-eligible affordable housing rooftop solar capacity (45.6 MW) is located within cities with municipally owned utilities (MOUs). Unlike their counterparts within investor-owned utility (IOU) territory, affordable housing property owners located within MOU territories qualify for only one of the state's active solar for affordable housing rebate programs: the Low-Income Weatherization Program - Large Multifamily (LIWP-LMF). The program is a vital funding source for solar on affordable housing located in Los Angeles, Burbank and other cities that administer a MOU.

The LIWP-LMF is a unique solar for affordable housing rebate program in that it does not have a continuous allocation of funding. Instead, legislators must determine funding annually. With the program set to expire in summer 2018, legislators are now evaluating program extension.

Considering the importance of this single rebate program in Los Angeles County, it would behoove relevant stakeholders and beneficiaries — including cities, municipal utilities, affordable housing property owners, and advocates for clean energy and environmental justice — to actively support the extension of the LIWP-LMF and urge legislators to set funding that creates more financial certainty for affordable housing property owners. Without the extension of the LIWP-LMF, the more than 800 affordable housing properties and over 70,000 low-income residents living within MOU territory will be excluded from the large pool of state funding available for solar for affordable housing.

Virtual Net Metering and the Consequences of Inaction

Municipally owned utilities in Los Angeles County do not currently offer virtual net metering (VNEM). As such, residents of apartments and other multifamily dwellings, including affordable housing, cannot access the financial benefits of solar. Consequently, the absence of a VNEM in the City of Los Angeles and other municipally owned utility territories creates two adverse policy outcomes:

1. **Energy inequity.** Homeowners, who on average earn higher incomes when compared to renters, can utilize rebates to install solar on their property with relative ease, while renters cannot and thereby miss out on the financial benefits of solar power for their home.
2. **Potential external investment loss** and the disqualification from higher rebates due to the inability to deliver direct financial benefits to affordable housing residents. For example, the Low-Income Weatherization Program - Large Multifamily offers a maximum rebate of $3.50 per watt for the portion of a solar system that delivers financial benefits to affordable housing residents. Without a mechanism to deliver these benefits, applicants can qualify for only $1.50. **The City of Los Angeles alone is forgoing up to $116.7 million in potential state solar investment** that could be channeled into undeserved communities to the benefit of underserved residents.

To correct these issues, we recommend LADWP and the other municipally owned utilities of Los Angeles County implement a VNEM tariff. If the utility decides to introduce a pilot program, we recommend affordable multifamily housing residents as the pilot participants. Affordable housing property owners will then be eligible to qualify for the maximum solar rebate offered by the state, and the potential external investment loss will be remedied.

The following recommendations provide design features for a robust and equitable VNEM tariff, using lessons from active VNEM tariffs across the country. The recommendations are targeted to LADWP, where more than 42 MW of affordable housing solar potential exists, although other municipally owned utilities could utilize these recommendations as well.

VNEM Design Recommendation #1:
Maximize Solar Access With a Broadly Defined Qualifying Customer

The implementation of virtual net metering is relatively straightforward, involving an investment in billing software and additional administrative capacity. The design of a VNEM tariff, however, requires policymakers to consider several tradeoffs while attempting to balance solar access, the burden placed on both utility and customer, program cost, and other concerns.

Utilities across the country offer a range of VNEM tariff designs: the investor-owned utilities of California allow participants at a single property to share an on-site solar system's production, while utilities in Colorado and Minnesota allow participants to share the solar production regardless of where they might reside in relation to the system. At times referred to as "shared

GRID Alternatives, in partnership with Grand Valley Power, constructs a community solar array in Colorado dedicated exclusively to low-income subscribers.

solar," this treatment of qualifying customer has set the stage for the country's most robust and inclusive community solar programs.

While a broad definition of qualifying customer maximizes solar access and energy equity, utilities must consider retail wheeling and cross-subsidization implications. In the context of solar, retail wheeling is the use of a utility's grid infrastructure to transport solar energy from system to off-site participant. The use of the utility transmission and distribution lines by participating solar customers may necessitate grid upgrades or maintenance, which is to be paid for by all utility ratepayers. The result is cross-subsidization, or the disproportionate cost sharing for solar-related grid upgrades or maintenance between participating solar customers and nonparticipating ratepayers.

Because of these concerns, some utilities limit their treatment of qualifying customers to include only those customers within certain proximity to the shared solar system. In Minnesota's Community Solar Gardens program, only customers located within the same county or contiguous county as the solar system can qualify. In California's IOU territories, qualifying customer is limited to those who share a utility service delivery point with the solar system; i.e., the qualifying customer is located at the same site as the solar system. While this narrowed definition of a qualifying customer may resolve retail wheeling and cross-subsidization concerns, it continues to preclude customers who cannot install solar on-site or who share too small a rooftop with too many people.

LADWP could take this blank-slate opportunity to emerge as a leader in solar equity and broadly define qualifying customer to include any customer within the service territory, regardless of the shared solar system's location. Any concerns for retail wheeling and cross-subsidization within the utility's relatively small service territory are limited and can be reconciled through a distance-based customer fee.

A broad definition of qualifying customer will not only allow full participation in solar for affordable housing rebate programs, but it also will encourage the development of community solar and

other shared solar programs pertinent to the City of Los Angeles and its more than 1.4 million multifamily housing residents. Across the country, progressive VNEM policy has catalyzed a community solar market that is expected to consistently drive 20% to 25% of the country's annual nonresidential solar and become a half-gigawatt annual market by 2019.[xxii] Community solar has largely surpassed California, where the policy environment is uncharacteristically disadvantageous for shared solar programs. The City of Los Angeles can lead the state and begin to cultivate this new market through a progressive VNEM design that broadly defines the qualifying customer.

VNEM Design Recommendation #2:
Set a Tariff Rate That Encourages Participation

The VNEM tariff rate determines the economic feasibility of shared solar investments for customers and will ultimately influence participation in the program. For most electric service providers who offer VNEM, the tariff rate will mirror that of the traditional net energy metering (NEM) rate — a one-for-one kilowatt-hour offset between solar production and customer electricity consumption, with any remaining consumption billed at that customer's applicable rate. Other utilities may adjust their retail rate with additional charges, or even design an entirely new rate for VNEM customers, often diminishing the value proposition for the participating customer.

IOUs in California offer a NEM-V (their version of VNEM) tariff that nets a participating customer's consumption with their solar share's production on a one-for-one kilowatt-hour basis. Any remaining consumption is billed at the customer's applicable rate, while any monthly excess production is carried over to the following billing period until year-end. If there is surplus solar production remaining at year-end, it is eligible for a net surplus compensation, valued at the utility wholesale rate. Additionally, participating customers of the NEM-V can opt to receive a demand credit for a charge.

We recommend that the VNEM tariff rate be equivalent to the LADWP's current net energy metering (NEM) tariff rate. The solar electricity produced should offset the on-site electricity consumed, with any remaining electricity consumed to be billed using the customer's current applicable rate. Any excess electricity remaining at the end of the billing period should be calculated as a credit and rolled over to each subsequent bill until no further adjustment is due. We also recommend offering some form of demand credits, particularly for affordable housing property owners and potentially in a way that encourages energy storage adoption.

VNEM Design Recommendation #3:
Balance Program Cost Recovery and Customer Cost Burden

As the administering utility, LADWP assumes two primary costs when implementing a VNEM tariff: the fixed technological cost for the billing software upgrade and the additional annual overhead costs for administering a new tariff. Administrative costs generally include application intake and review, technical review of commercial systems, and other administrative costs such as a potentially complex allocation of system benefits and treatment of customer transferability and exit options. These annual overhead costs can vary depending on the complexity of the program. For example, if the qualifying customer is limited to a single service delivery point (SDP), then a greater administrative burden will be placed on both the utility and customer to determine who is

indeed qualified, either through an initial site visit or some other early verification process. Alternatively, if the definition for qualifying customer is broad and a distance-based fee is implemented, there may be additional administrative costs in calculating and verifying the fee.

Some program costs can be recovered through program fees, including an initial setup fee. NEM-V projects in California investor-owned utility IOU territories incur a setup fee of $25 per participating customer, not to exceed $500 per arrangement. A fee may also be applied when modifying how the solar system's production will be split among qualifying customers. The IOUs provide one free reallocation per year, with fees for additional changes set at $7.50 per modified account.[xxiii]

We recommend that the LADWP consider cost-recovery mechanisms that allow some program costs to be recovered without placing an unreasonable cost burden on the participating customer. For affordable housing property owners, we recommend fee waivers.

VNEM Design Recommendation #4:
Communicate Early and Often During the Application Process

The application process for a virtual net-metered solar project includes several interactions between applicant and utility. While the installation of the solar system is often the most straightforward step in this process, pre- and post-installation tasks can be quite time-consuming, as the utility and applicant must determine a cost-effective method for interconnection, the allocation of benefits across multiple and potentially hundreds of customers, and safe and accurate solar production prior to system operation. Additionally, a third party — the local building and safety department or authority having jurisdiction (AHJ) — needs to ensure that the solar system abides by fire and safety codes to issue the final building and electrical permits. Miscommunication and errors at any step between the utility, AHJ, and applicant can trigger a cascade of delays and result in unforeseen administrative requirements and costs.

The application process starts when the applicant submits system specifications to the utility for technical review. The utility can reject the application for a number of reasons, such as errors on the customer allocation form (e.g., allocating too much production to one participating customer) or inaccuracies on the single-line diagram or site plan (e.g., incorrect interconnection method). Most issues can be corrected by the applying customer and resubmitted for a second review. Once the applicant receives application approval from the utility, and the necessary permits from the AHJ, solar system construction can commence.

After the system is installed, the utility and the AHJ will visit the site at least once to inspect the system, set a specialized VNEM meter and temporarily turn the system on to test performance and safety. Each site visit can result in the issuance of corrections, which must be resolved and approved before continuing to the next step. Delays in the review of corrections can significantly delay operation of the system.

We recommend that the LADWP work with applicants early in the application process to review methods of interconnection and other site-specific details such as meter placement. Additionally, we encourage the LADWP to maintain transparency during the customer benefit allocation stage, and work with the applicant to determine the maximum-allowable benefit allocation for common-area and tenant customer accounts. Frequent communication from the onset of the project can

save significant time and money and is particularly important for applicants of solar for affordable housing rebate programs, who may have a fast-approaching rebate deadline that, if missed, can result in forfeiture of rebate.

To ensure an expeditious application process, LADWP should take advantage of its shared departmental mandate with the Los Angeles Department of Building and Safety and optimize review while ensuring one's requirements do not contradict the others. The utility's feed-in tariff (FiT) program, which reviews medium and large commercial-scale rooftop solar projects, can serve as a model for this cross-departmental coordination. At the beginning of the FiT application process, an area service planner and electric service representative from LADWP, as well as an electrical inspector from the Los Angeles Department of Building and Safety, will meet the solar developer on-site to review methods of interconnection and ultimately agree on a safe and cost-effective method. From here, the applicant can move through the permitting process with an important sense of certainty.

The combined impact of streamlining LADWP communications, which is highlighted by early approval of interconnection and transparency during benefit allocation stage, should allow an operator to complete the process from VNEM application to permission-to-operate (PTO) in six to nine months, depending on the size of the system and complexity of the interconnection.

Summary of VNEM Policy Design Recommendations

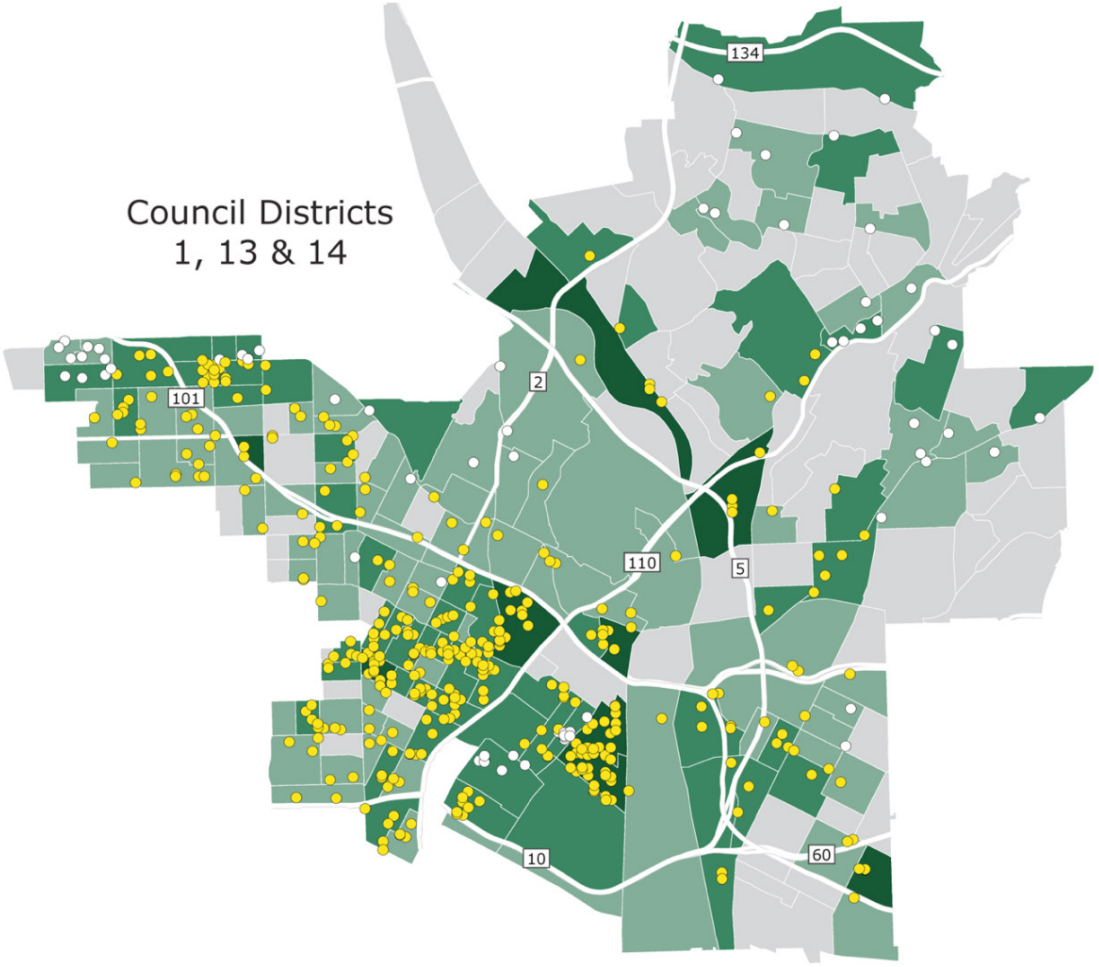
The following list summarizes the VNEM design recommendations for LADWP and other cities in Los Angeles County with a municipally owned utility:

1. **Qualifying Customer:** Broadly define qualifying customer to include any customer within the service territory.
2. **Customer Billing:** Model the VNEM tariff rate after the current net energy metering (NEM) tariff rate, with solar production offsetting customer electricity consumption. Any remaining electricity consumed should be billed using the customer's current applicable rate. Any excess electricity produced at the end of the billing period should be calculated as a credit and rolled over to each subsequent bill until no further adjustment is due. There should also be some form of demand credit, particularly for affordable housing property owners and potentially in a way that encourages energy storage adoption.
3. **Program Costs:** Consider cost-recovery mechanisms, such as setup fee or reallocation fees, which allow some program costs to be recovered without placing an unreasonable cost burden on the participating customer.
4. **Communication:** Communicate early and often in the application process, including an early approval of a reasonable interconnection method and transparency in determining benefit allocation for common-area and tenant accounts.

Appendixes

Appendix A

City of Los Angeles Solar Potential Maps and Tables

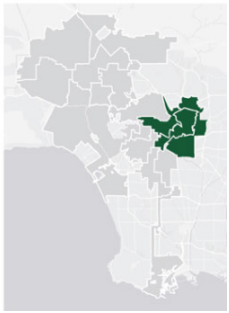


Affordable Housing Aggregate Solar Capacity[a]
(by census tract)

< 100 kW | > 100 kW | > 500 kW

Affordable Housing Property Locations[b]

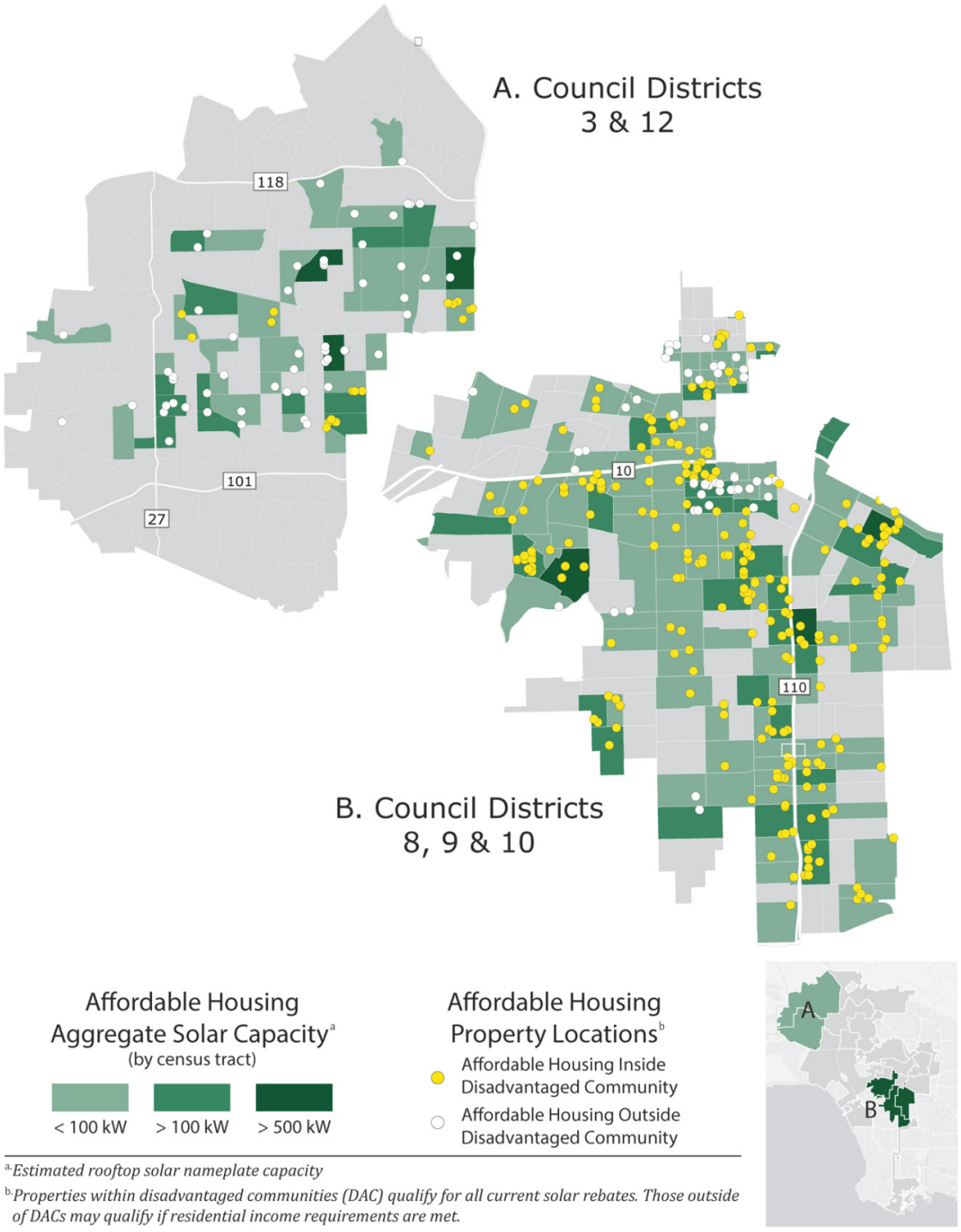
- Affordable Housing Inside Disadvantaged Community
- Affordable Housing Outside Disadvantaged Community



[a] *Estimated rooftop solar nameplate capacity*

[b] *Properties within disadvantaged communities (DAC) qualify for all current solar rebates. Those outside of DACs may qualify if residential income requirements are met.*

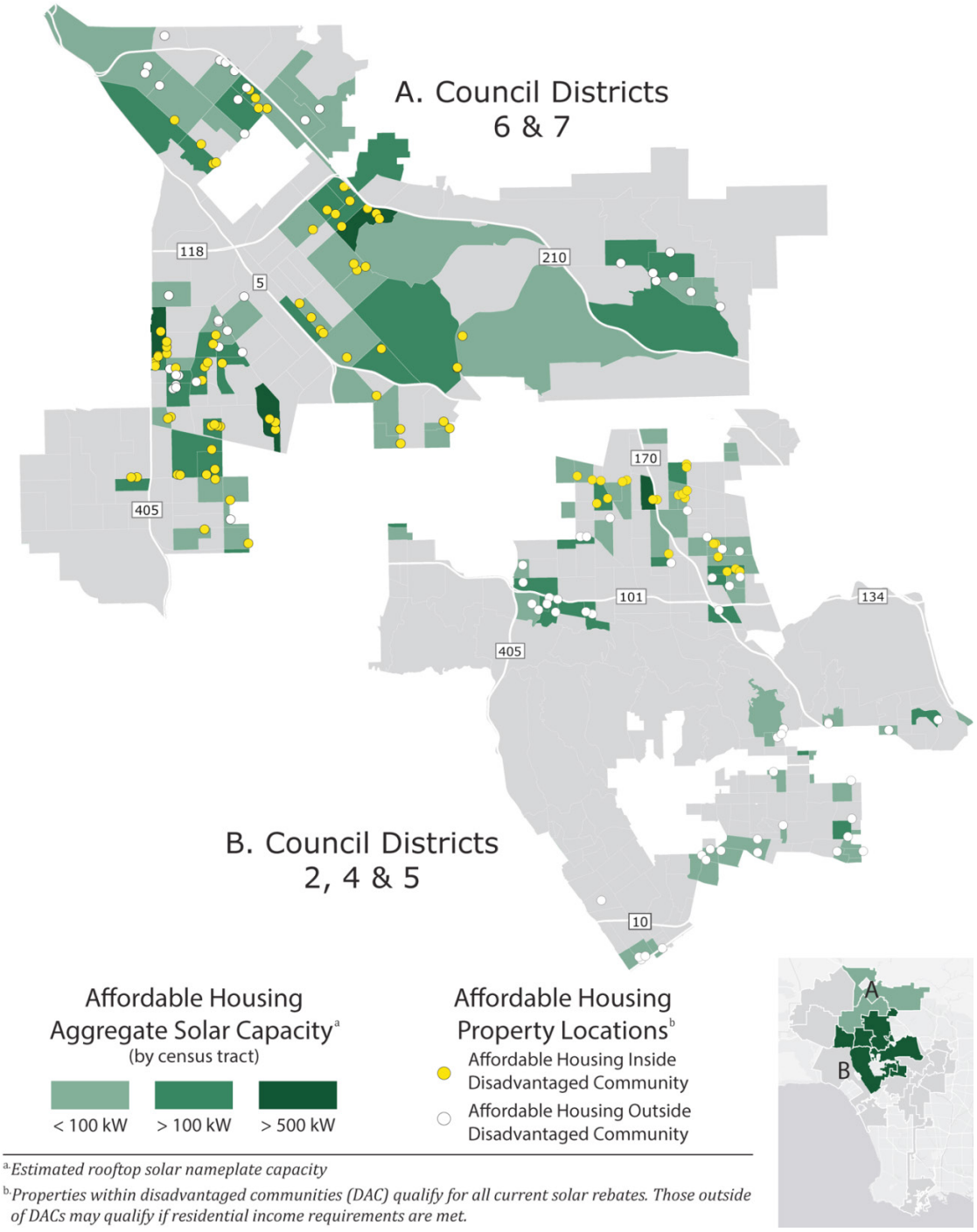
City Council District	Total Capacity (kW)	Total Rebate-Eligible Capacity (kW)	Maximum State Solar Investment ($)	Maximum Annual Resident Savings ($)	Maximum Annual Common-Area Savings ($)
1	9,728	9,478	28,734,278	1,490,699	694,605
13	5,673	4,553	14,386,410	747,701	414,806
14	6,013	4,562	14,867,456	772,915	485,973



[a] *Estimated rooftop solar nameplate capacity*

[b] *Properties within disadvantaged communities (DAC) qualify for all current solar rebates. Those outside of DACs may qualify if residential income requirements are met.*

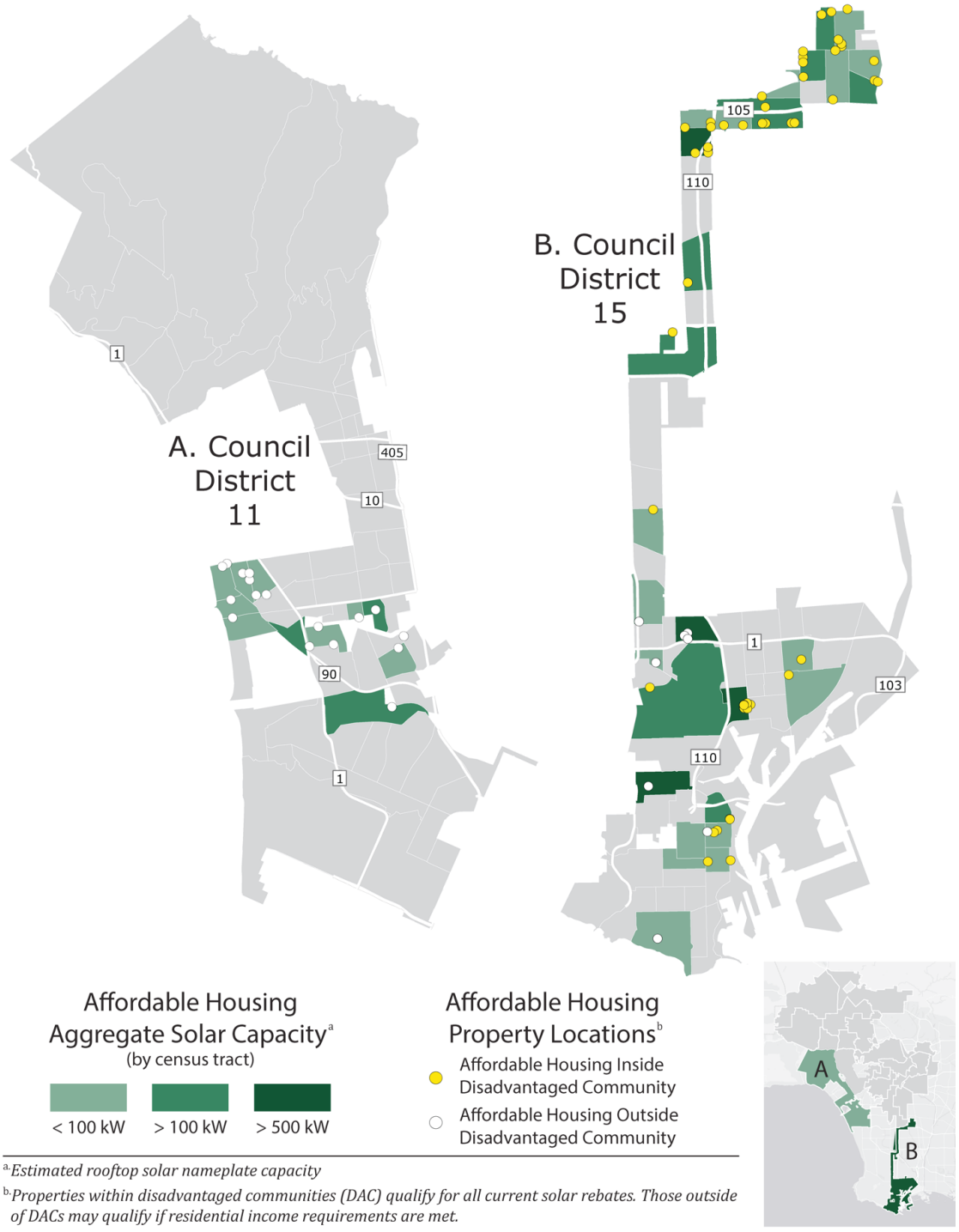
City Council District	Total Capacity (kW)	Total Rebate-Eligible Capacity (kW)	Maximum State Solar Investment ($)	Maximum Annual Resident Savings ($)	Maximum Annual Common-Area Savings ($)
3	3,410	552	1,887,101	98,643	47,846
8	4,345	3,729	12,909,628	681,853	301,470
9	4,329	4,150	12,860,343	673,280	242,231
10	3,569	2,937	10,236,648	540,763	285,932
12	4,460	45	158,093	8,368	5,435



[a] *Estimated rooftop solar nameplate capacity*

[b] *Properties within disadvantaged communities (DAC) qualify for all current solar rebates. Those outside of DACs may qualify if residential income requirements are met.*

City Council District	Total Capacity (kW)	Total Rebate-Eligible Capacity (kW)	Maximum State Solar Investment ($)	Maximum Annual Resident Savings ($)	Maximum Annual Common-Area Savings ($)
2	2,713	1,553	5,010,585	256,595	119,750
4	1,913	0	0	0	0
5	197	0	0	0	0
6	4,299	3,422	11,471,423	599,733	191,514
7	5,181	3,721	12,073,487	631,093	207,774



[a] *Estimated rooftop solar nameplate capacity*

[b] *Properties within disadvantaged communities (DAC) qualify for all current solar rebates. Those outside of DACs may qualify if residential income requirements are met.*

City Council District	Total Capacity (kW)	Total Rebate-Eligible Capacity (kW)	Maximum State Solar Investment ($)	Maximum Annual Resident Savings ($)	Maximum Annual Common-Area Savings ($)
11	785	0	0	0	0
15	5,679	4,342	14,743,158	772,617	239,240

Appendix B

Solar for Affordable Housing Benefit Potential Throughout Los Angeles County

City/ Neighborhood	Solar Potential		Utility Bill Savings Potential		Economic Benefit Potential				Project Size Analysis		
	Total (kW)	Rebate-Eligible (kW)	Maximum Annual Tenant ($)	Maximum Annual Common Area ($)	Maximum State Solar Investment ($)	Solar Job Train-ing Opportunties	Solar Job Training Hours	Solar Job Years Created	< 50 kW	50 to 100 kW	>100 kW
Los Angeles	45,475	36,698	6,104,329	2,836,996	116,877,993	2,418	19,716	440	527	127	94
Long Beach	3,429	2,585	478,800	214,380	9,047,074	107	864	31	21	4	7
Pomona	2,023	1,796	307,877	99,780	5,835,954	64	512	22	6	3	8
Van Nuys	1,512	1,437	262,123	71,332	4,973,599	48	384	17	6	2	4
Compton	1,574	1,278	236,808	97,103	4,474,103	80	644	15	12	5	4
Wilmington	1,236	1,236	218,965	45,221	4,217,986	29	236	15	2	1	3
West Covina	1,315	1,124	198,803	68,624	3,787,863	30	240	13	0	1	5
North Hollywood	1,620	1,119	176,245	83,349	3,492,495	57	456	13	9	4	3
Burbank	1,103	1,103	150,009	70,281	2,929,574	35	280	13	0	4	3
Panorama City	1,517	1,101	203,932	60,596	3,852,970	43	344	13	3	4	3
Pacoima	1,100	1,075	192,954	84,973	3,661,749	34	276	13	1	2	4
Claremont	1,017	954	175,879	36,945	3,330,164	20	160	11	0	0	4
El Monte	931	931	172,491	71,996	3,258,937	54	432	11	6	4	5
Azusa	896	896	148,519	30,902	2,858,830	20	160	11	0	1	3
Cudahy	824	824	112,761	28,744	2,179,031	30	240	10	0	4	2
La Puente	856	779	88,547	27,673	1,730,562	16	128	9	3	0	2
Monterey Park	763	756	140,107	46,199	2,647,092	32	256	9	4	0	5
Inglewood	1,079	722	99,372	48,620	1,917,524	35	284	9	4	2	2
Sylmar	1,410	705	105,373	29,757	2,008,244	18	144	8	2	0	3
Carson	695	679	124,879	57,255	2,366,042	41	328	8	6	1	4
Glendale	965	608	94,204	54,706	1,794,239	50	408	7	15	3	1
Sun Valley	589	589	80,715	47,731	1,629,383	31	252	7	5	1	2
Baldwin Park	561	561	103,973	39,634	1,964,397	34	272	7	4	1	3
Norwalk	678	512	94,832	46,243	1,791,695	24	192	6	3	1	2
Duarte	500	500	89,790	39,462	1,718,932	28	224	6	2	3	1
Whittier	558	498	92,316	31,414	1,744,162	26	208	6	3	2	2
Pasadena	1,318	494	91,429	63,953	1,727,409	41	328	6	12	3	1
San Pedro	1,222	471	83,151	22,495	1,576,996	24	192	6	2	2	2
South Gat	470	470	87,006	31,860	1,643,833	13	104	6	0	1	1

City/ Neighborhood	Solar Potential		Utility Bill Savings Potential		Economic Benefit Potential				Project Size Analysis		
	Total (kW)	Rebate-Eligible (kW)	Maximum Annual Tenant ($)	Maximum Annual Common Area ($)	Maximum State Solar Investment ($)	Solar Job Train-ing Opportunties	Solar Job Training Hours	Solar Job Years Created	< 50 kW	50 to 100 kW	>100 kW
Reseda	1,657	469	83,381	35,355	1,598,743	26	208	6	1	4	1
Montebello	455	455	84,209	48,801	1,590,998	20	160	5	0	2	2
Huntington Park	438	438	81,213	40,060	1,534,382	25	200	5	4	2	2
San Fernando	401	401	74,207	25,662	1,402,018	22	176	5	3	2	2
Bellflower	398	398	73,650	28,842	1,391,495	12	96	5	1	1	1
North Hills	691	348	58,684	17,437	1,127,340	21	168	4	3	2	1
Pico Rivera	343	343	63,490	23,911	1,199,536	14	116	4	1	0	2
Commerce	271	271	50,268	23,738	949,737	21	172	3	4	1	1
Bell Garden	250	250	46,127	6,215	873,150	5	40	3	0	0	1
Hawaiian Gardens	220	220	40,818	22,788	771,190	5	40	3	0	0	1
Santa Fe Springs	217	217	40,197	24,246	759,454	20	164	3	5	1	0
E. Rancho Dominguez	210	210	38,903	6,042	735,000	5	40	3	0	0	1
Gardena	290	203	37,557	21,253	709,575	16	128	2	2	2	0
Hollywood	265	198	36,669	16,142	692,806	20	160	2	3	2	0
Bell Gardens	148	148	27,341	12,085	516,569	9	76	2	1	0	1
Bell	144	144	26,508	13,121	502,090	14	112	2	3	1	0
South Whittier	108	108	20,098	5,693	379,727	5	40	1	0	0	1
Hawthorne	244	105	19,477	12,948	367,992	10	80	1	1	1	0
Hacienda Heights	657	103	19,167	6,474	362,124	5	40	1	0	0	1
Lakeview Terrace	95	95	17,614	5,179	332,785	5	40	1	0	1	0
La Mirada	519	86	16,017	6,474	302,608	5	40	1	0	1	0
Vernon	79	79	14,587	3,884	275,593	5	40	1	0	1	0
Lawndale	64	64	11,890	4,834	224,651	5	40	1	0	1	0
Alhambra	326	64	11,846	8,368	223,813	7	56	1	1	1	0
Arleta	73	64	11,802	4,489	222,975	5	40	1	0	1	0
Maywood	39	39	7,276	4,799	137,473	6	48	0	2	0	0
Canoga Park	1,217	39	7,143	5,845	134,958	5	40	0	2	0	0
Lennox	30	30	5,546	1,813	104,781	4	36	0	1	0	0
Sepulveda	75	24	4,481	2,778	84,663	5	40	0	5	0	0
So. San Gabriel	24	24	4,392	4,575	82,987	3	24	0	1	0	0
Torrance	1,262	2	444	517	8,382	1	8	0	1	0	0
Monrovia	241	2	311	362	5,868	1	8	0	1	0	0
Northridge	946	1	266	310	5,030	1	8	0	1	0	0
Lancaster	6,672	0	0	0	0	0	0	0	0	0	0
Palmdale	4,903	0	0	0	0	0	0	0	0	0	0
Santa Monica	1,348	0	0	0	0	0	0	0	0	0	0

City/ Neighborhood	Solar Potential		Utility Bill Savings Potential		Economic Benefit Potential				Project Size Analysis		
	Total (kW)	Rebate-Eligible (kW)	Maximum Annual Tenant ($)	Maximum Annual Common Area ($)	Maximum State Solar Investment ($)	Solar Job Training Opportunties	Solar Job Training Hours	Solar Job Years Created	< 50 kW	50 to 100 kW	>100 kW
Sherman Oaks	1,211	0	0	0	0	0	0	0	0	0	0
West Hollywood	1,146	0	0	0	0	0	0	0	0	0	0
Culver City	1,077	0	0	0	0	0	0	0	0	0	0
Santa Clarita	842	0	0	0	0	0	0	0	0	0	0
Rowland Hills	793	0	0	0	0	0	0	0	0	0	0
La Verne	598	0	0	0	0	0	0	0	0	0	0
Harbor City	564	0	0	0	0	0	0	0	0	0	0
Woodland Hills	472	0	0	0	0	0	0	0	0	0	0
Tujunga	446	0	0	0	0	0	0	0	0	0	0
Granada Hills	386	0	0	0	0	0	0	0	0	0	0
Glendora	373	0	0	0	0	0	0	0	0	0	0
Beverly Hills	367	0	0	0	0	0	0	0	0	0	0
Valley Village	358	0	0	0	0	0	0	0	0	0	0
Southgate	347	0	0	0	0	0	0	0	0	0	0
Downey	282	0	0	0	0	0	0	0	0	0	0
Rancho Palos Verdes	273	0	0	0	0	0	0	0	0	0	0
Sierra Madre	266	0	0	0	0	0	0	0	0	0	0
Lomita	257	0	0	0	0	0	0	0	0	0	0
Covina	255	0	0	0	0	0	0	0	0	0	0
San Dimas	227	0	0	0	0	0	0	0	0	0	0
Winnetka	219	0	0	0	0	0	0	0	0	0	0
Castaic	211	0	0	0	0	0	0	0	0	0	0
Redondo Beach	207	0	0	0	0	0	0	0	0	0	0
Lakewood	203	0	0	0	0	0	0	0	0	0	0
Signal Hill	203	0	0	0	0	0	0	0	0	0	0
Arcadia	192	0	0	0	0	0	0	0	0	0	0
Eagle Rock	154	0	0	0	0	0	0	0	0	0	0
Venice	149	0	0	0	0	0	0	0	0	0	0
Sunland	145	0	0	0	0	0	0	0	0	0	0
Marina Del Rey	128	0	0	0	0	0	0	0	0	0	0
Mission Hills	88	0	0	0	0	0	0	0	0	0	0
Valencia	80	0	0	0	0	0	0	0	0	0	0
Hermosa Beach	78	0	0	0	0	0	0	0	0	0	0
Quartz Hill	56	0	0	0	0	0	0	0	0	0	0
Valley Glen	51	0	0	0	0	0	0	0	0	0	0
San Gabriel	28	0	0	0	0	0	0	0	0	0	0

City/ Neighborhood	Solar Potential		Utility Bill Savings Potential		Economic Benefit Potential				Project Size Analysis		
	Total (kW)	Rebate-Eligible (kW)	Maximum Annual Tenant ($)	Maximum Annual Common Area ($)	Maximum State Solar Investment ($)	Solar Job Train-ing Opportunties	Solar Job Training Hours	Solar Job Years Created	< 50 kW	50 to 100 kW	>100 kW
Highland Park	17	0	0	0	0	0	0	0	0	0	0
Altadena	16	0	0	0	0	0	0	0	0	0	0
Avalon	13	0	0	0	0	0	0	0	0	0	0
West Hills	12	0	0	0	0	0	0	0	0	0	0
Chatsworth	11	0	0	0	0	0	0	0	0	0	0
Newhall	3	0	0	0	0	0	0	0	0	0	0
Calabasas	2	0	0	0	0	0	0	0	0	0	0
Manhattan Beach	2	0	0	0	0	0	0	0	0	0	0

Appendix C

Virtual Net Metering Designs From Throughout the U.S.

State	Qualifying Customer	Valuation
California	Served by same service delivery point as facility	Full retail rate minus non-bypassable charges
Colorado	Located in same municipality or county as facility	"Total Aggregate Retail Rate," excluding transmission and distribution component and administrative charges, relying on the class-average rate.
Connecticut	Located in same electric service territory as facility	Full retail rate, adjusted in accordance with declining percentage of transmission and distribution component
District of Columbia	Located in the District with facility	Full retail rate
Delaware	Located in same electric service territory as facility	Full retail rate, if subscribers are located on same feeder as facility; Supply service charge, if subscribers are located on different feeder from facility.
Hawaii	Not specified	Not specified
Illinois	Located in same electric service territory as facility	Subscriber's energy supply rate
Massachusetts	Located in the same "neighborhood" as the system	With limited exceptions, all classes' credit value includes default service charge + transmission charge + transition charge
Maryland	Located in same electric service territory as facility	Full retail rate
Maine	Located in same electric service territory as facility	Full retail rate minus non-usage charges
Minnesota	Located in same electric service territory as facility	"Value of Solar" rate
New Hampshire	Not specified	For small customer-generators: Payments equal to all charges that are based on kWh usage; For large customer-generators: Payments equal to utility's default service rate.
New York	Located in in the same NYISO Load Zone	"Value of DER" rate
Oregon	Located in Oregon with facility	"Value of Solar" rate
Rhode Island	Located on same site or complex of sites	Bill credit rate equals the sum of the utility charges
Vermont	Located in same electric service territory as facility	Bill credited at "blended residential rate"

Adapted from IREC's State Shared Renewable Energy Program Catalog. For more information, visit: http://www.irecusa.org/regulatory-reform/shared-renewables/state-shared-renewable-energy-program-catalog/.

Appendix D

Methods and Assumptions

Rooftop Solar Capacity

This report's solar potential calculation uses two separate data sources. First, researchers identified affordable housing parcels in Los Angeles County using a Low-Income Housing Tax Credit project mapping resource from the California Tax Credit Allocation Committee (TCAC).[10] Housing and Urban Development (HUD), rural development locations, and California Housing Finance Agency/California Department of Housing and Community Development properties were identified using data from California Housing Partnership Corporation's PolicyMap tool.

Next, researchers joined affordable housing property parcels with parcel-level solar potential previously calculated for the UCLA Luskin Center for Innovation's "Los Angeles Solar Atlas."[11] The result is affordable housing parcel-level solar potential that could be aggregated to the census tract, city, and utility-level.

Utility Bill Savings for Affordable Housing Residents

The utility bill savings are calculated for each affordable housing parcel by multiplying a blended Southern California Edison CARE tariff rate of $0.1235[12] by the total amount of resident kWh offset by solar. Researchers assume an affordable housing resident annual electricity consumption of 5,400 kWh.[13] Researchers also assume a 1,500 kWh energy production factor[14] and thus estimate a 3.5 kW-dc solar system would be required to offset annual electricity consumption for an affordable housing unit under the CARE tariff (or 5,250 kWh [3.5 kW multiplied by 1,500] of the 5,400 kWh annual electricity consumption).

Researchers assume maximum solar capacity is allocated to the tenant; i.e., a parcel's rooftop solar capacity is first allocated to offset all tenants' electricity consumption. Only when capacity remains after tenant offset is it allocated to offset the property's common-area load.

Example:

> A 20-unit affordable housing property shows a solar hosting potential of 80 kW-dc. In total, 70 kW of the solar capacity is allocated to residents (20 units multiplied by 3.5 kW per unit system size), while the remaining 10 kW offsets the common-area load. Solar on the property is estimated to generate 120,000 kWh of energy annually (80kW multiplied by 1,500 kWh energy production factor), including 105,000 kWh for the residents of the property. Assuming a blended CARE rate of $0.1235, the annual residential utility bill savings for this example property equals $12,967.50 (105,000 kWh multiplied by $0.1235 per kWh).

10 http://www.treasurer.ca.gov/ctcac/projects.asp

11 Available at luskin.ucla.edu/publications

12 https://www.sce.com/NR/sc3/tm2/pdf/ce93-12.pdf

13 From investor-owned utility Energy Savings Assistance Program and CARE Program 2012 Annual Reports, the average electricity consumption for CARE participants is 547 kilowatt-hours per month (6,464 kWh annually). Since this value may be an overestimate for multifamily affordable housing participants, as the average includes single-family households with typically higher electricity needs.

14 Calculated using the National Renewable Energy Lab's PVWatts calculator (http://pvwatts.nrel.gov/)

Common-Area Utility Bill Savings

Affordable housing common-area savings is calculated for each affordable housing parcel by multiplying a blended Southern California Edison TOU-GS-1A tariff rate of $0.1439[15] by the total amount of common area kWh offset by solar. Researchers assume common-area electricity consumption to correspond to number of units (a proxy for property size) in a 2.5:1 unit:kW ratio (e.g., 100 units require 40 kW of solar capacity to offset all common-area electricity consumption).

Common-area savings assumes maximum solar capacity is allocated to the common area; i.e., a parcel's rooftop solar capacity is first allocated to offset the common-area electricity consumption and only if capacity remains is it allocated to offset common area load.

State Investment

State investment assumes maximum solar capacity is allocated to the tenant; i.e., a parcel's rooftop solar capacity is first allocated to offset all tenants' electricity consumption; only when capacity remains after tenant offset is it allocated to offset the property's common-area load. Therefore, state investment should be viewed as the total maximum amount of rebate potential.

Researchers assume rebate values equal to the Low-Income Weatherization Program - Large Multifamily: $3.50 for the portion of the system that goes to offset the affordable housing resident's electricity consumption and $1.50 for the portion that offsets the common-area electricity consumption.

Job Years and Job Training Opportunities Created

Job years created: Researchers used IMPLAN Pro to identify the number of jobs created by every $1 million spent on residential rooftop solar systems. In Los Angeles County in 2017, the relevant industries are estimated to create 8.31 full-time equivalent job years per $1 million invested. This number reflects direct, indirect, and induced jobs associated with investments in rooftop solar installations and the ripple effect that they have on the local economy in Los Angeles County. Researchers assumed an average installation cost of $3.25 per watt, in which total investment for solar on affordable housing rebate programs equals $221,461,500 ($3.25 per watt installed multiplied by 68,142 kW of affordable housing rooftop solar potential).

Job training opportunities created: Researchers classified each affordable housing parcel's solar system by system size and then assigned the corresponding number of Multifamily Affordable Solar Housing (MASH) required job training opportunities, as shown in the table below.

System Size	Job Training Opportunities	Job Training Hours
Under 10 kW	1	8
10 to 19 kW	2	16
20 to 29 kW	3	24
30 to 39 kW	4	36
40 kW and greater	5	40

15 See https://www.sce.com/NR/sc3/tm2/pdf/ce93-12.pdf. The blended rate was calculated using 12 affordable housing common-area utility bills in GRID Alternative's possession.

Appendix E

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