



AN ANALYSIS OF LADWP'S FEED-IN TARIFF PROGRAM:  
Lessons Learned From FiT150  
and Recommendations  
for Program Expansion

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# CONTENTS

<b>Chapter 1 Introduction</b> .....	<b>1</b>
<b>Chapter 2 The Realized Benefits of FiT150</b> .....	<b>4</b>
2.1 Environmental and Equity Goals.....	4
2.2 Economic Benefits.....	6
<b>Chapter 3 Lessons Learned from Participants</b> .....	<b>9</b>
3.1 Program Strengths.....	9
3.2 Program Challenges.....	10
3.2.1 Rooftop Constraints.....	10
3.2.2 Project Length and Timeline.....	13
3.2.3 Interconnection Challenges.....	14
<b>Chapter 4 Recommendations to Address Challenges of Current FiT Program Design</b> .....	<b>17</b>
4.1 Supporting and Facilitating Solar Installations on Public Properties.....	17
4.2 Unlocking Non-Rooftop Solar Potential.....	19
4.2.1 Carports.....	19
4.2.2 Ground Mounts.....	20
4.2.3 Floating Solar.....	23
4.3 Increasing Installations in Disadvantaged Communities and Their Social Benefits.....	23
<b>Chapter 5 Price Mechanism Recommendations for FiT Program Expansion</b> .....	<b>25</b>
5.1 Discussion Around a Necessary Base Rate Update.....	25
5.1.1 Different Methodologies to Set a FiT Base Rate.....	25
5.1.2 Uncertainty Created by National and International Policies.....	26
5.1.3 LADWP: A Necessary Base Rate Update?.....	27
5.2 Time of Delivery: Reflecting the Temporal Value of Electricity.....	28
5.3 Adders: Tailoring Rate to Project’s Specificities.....	31
5.3.1 Adders to Reflect Economies of Scale and Complexity.....	31
5.3.2 Adders to Incentivize Dispatchability.....	33
5.3.3 Locational Adder to Maximize Grid Benefits.....	34

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# CHAPTER 1

## INTRODUCTION

The City of Los Angeles has ambitious climate and renewable energy goals. In April 2019, Los Angeles Mayor Eric Garcetti released the L.A. Green New Deal, which reaffirms a local solar goal of 900 to 1,500 megawatts (MW) and set a renewable energy target of 55%, both by 2025. These local solar goals became even more relevant after the recent decision made by the mayor to not repower 53% of the generators used by three coastal natural gas plants in Los Angeles. According to the city’s news release, this represents 38% of LADWP’s total natural gas power, or approximately 11% of the total utility power. The city’s decision emphasizes the importance of further developing local sources of electricity generation to replace those generators by 2029. The Los Angeles Department of Water and Power (LADWP), which is the largest municipal utility in the United States with 4 million residents and 1.5 million electric customer accounts, is supporting local solar goals through several solar programs: the Solar Incentive Program<sup>1</sup>, the Community Solar program, the Net Energy Metering (NEM) program, and the Feed-in Tariff program (FiT).

LADWP’s local solar programs are designed to complement each other, reach different customer classes, and meet different goals. While NEM has been the largest contributor to local solar development in Los Angeles with 250 MW installed to date,<sup>2</sup> it is designed to offset on-site consumption and attracts mainly small and residential rooftop projects. A well-designed expansion of the FiT program could allow for a more cost-effective deployment of large and local solar installations in strategic locations.<sup>3</sup>

The implementation of the FiT program in particular was mainly driven by a series of state legislation, such as Senate Bill (SB) 32 (2009) and its successor SB 1332 (2012), which required LADWP to offer at least a 75 MW FiT program.<sup>4</sup> The program was further supported by the existing federal incentive tax credit (ITC) for solar installations. LADWP launched its FiT program in 2013, which allowed the construction of solar installations on commercial, industrial, multifamily, warehouse, government, and nonprofit rooftops, carports, and unbuilt land within the City of Los Angeles. Building owners, solar developers, and anyone else interested in investing in solar can sell the electricity generated from their solar installation back to LADWP at a fixed price for a 20-year period. This program is currently the largest city-offered FiT program in the United States<sup>5</sup>, and a large contributor to the city’s local solar goals with 63.6 MW in-service rooftop installations, 84.2 MW under development, and dozens of applications queued for a new program expansion.

Beyond meeting policy objectives, the FiT supports a number of other energy procurement goals, particularly when it comes to diversifying clean resources and generating them where they are needed. According to LADWP FiT program guidelines, the goals are to “[1] create an additional solar power funding mechanism to complement the Solar Incentive Program, [2] encourage distributed electrical generation from renewable resources close to load centers, [and 3] balance renewable portfolio for reliability via geographic and technology diversity.” FiT programs often fill the gap between small residential and commercial projects incentivized by NEM programs, and large out-of-basin utility scale projects.

The currently oversubscribed FiT150 program is the result of LADWP’s continuous efforts to adapt this

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<sup>1</sup> Phased out since Dec. 31, 2018. \$317 million in incentives was distributed.

<sup>2</sup> LADWP (2017). 2017 Power Strategic Long Term Resource Plan

<sup>3</sup> LADWP (2017). 2017 Retail Electric Sales and Demand Forecast

<sup>4</sup> LADWP (2016). Power System Rate Action Report, Appendix A: Alignment of Mayor’s Priority Outcomes

<sup>5</sup> LADWP 2017 IRP.

program to a fast-changing and complex environment. This report first quantifies the realized benefits of the FiT150 program. Then, the report describes the strengths and challenges identified through a series of interviews with program participants, LADWP staff, other utilities, and FiT experts. Finally, program design recommendations are suggested to address some of the challenges identified, increase capacity and cost-effectiveness, and better incentivize projects with higher added value to the grid, the utility, and the ratepayers.

This report is the final installment in a series of seven reports completed by the UCLA Luskin Center for Innovation in partnership with the Los Angeles Business Council Institute (LABCi) to inform the development and implementation of LADWP's FiT150 program.<sup>6</sup>

### **LADWP FiT Program History**

Since the first FiT launched in Germany in 2004, multiple program designs have emerged in other countries and across multiple states within the U.S. In California alone, a variety of FiT programs have been developed and administered by different types of load serving entities: from publicly owned utilities like LADWP, the Sacramento Municipal Utilities District (SMUD), City of Palo Alto Utilities (CPAU), and the Anaheim Public Utilities, to new community choice aggregators (CCAs) like MCE and Sonoma Clean Power, to the three main investor-owned utilities with their Renewable Market Adjusting Tariff (ReMAT). However, the statewide ReMAT has been suspended and is currently not accepting new applications.

LADWP first launched a 10-MW FiT demonstration in 2012. As part of this demonstration, three projects successfully came online with a combined capacity of 1.6 MW. These projects were compensated at rates of 21 to 21.7¢/kWh with a time of delivery multiplier. The FiT program officially launched in 2013 when the Board of Water and Power Commissioners approved the two programs: FiT 100 and FiT 50. FiT 100 provided solar developers with five capacity allocations of 20 MW each, and six tranches with a fixed price going from 17¢/kWh to 13¢/kWh. The first two tranches received more applications than capacity available.<sup>7</sup> The bundled FiT 50 allowed solar developers to enter a competitive bid process to bundle both out-of-basin large utility scale projects and in-basin local rooftop solar installations. The economies of scale enabled two developer teams to reach an average price of 12.4¢/kWh for the 50 MW of distributed solar. FiT 100 resulted in 25.3 MW of in-service and 1.9 MW of active projects, and the FiT 50 resulted in 29.3-MW in-service and 6.3-MW active projects.

In 2017, the 65 MW of unclaimed capacity was reoffered with several improvements in order to ensure greater interest from solar developers, as a result of input from multiple stakeholders facilitated by LADWP and the Los Angeles Business Council (LABC). The new FiT program was divided in two subprograms: the 35 MW SetFiT at a fixed rate of 14.5¢/kWh for 20 years, and the 30 MW BlockFiT, which allowed competitive bids. The SetFiT allows solar developers to identify available rooftops similar to the previous FiT 100. The BlockFiT is divided into six bundles of five MW each and provides a hunting license to assist in negotiating and securing site control. Not only was the price of the FiT program raised to a more accessible level, but LADWP also improved and streamlined the technical review, integration study, and interconnection study so they would be conducted in parallel to accelerate project development and limit the risk of project failure due to a lengthy application process. These first rounds of FiT projects are often referred to as the FiT150, and are illustrated in Figure 1 below.

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<sup>6</sup> Reports include: [1] "Sharing Solar's Promise: Harnessing LA's FIT to Create Jobs and Build Social Equity" (2014) by J.R. DeShazo and Alex Turek (LCI) and Manuel Pastor, Mirabai Auer, and Chad Horsford (USC); [2] "FIT 100 in Los Angeles: An Evaluation of Early Progress" (2014) by J.R. DeShazo and Alex Turek; [3] "Empowering LA's Solar Workforce: New Policies that Deliver Investments and Jobs" (2011) by J.R. DeShazo, Manuel Pastor, and Mirabai Auer; [4] "Making a Market: Multifamily Rooftop Solar and Social Equity in Los Angeles" (2011); by J.R. DeShazo, Manuel Pastor, Mirabai Auer, Vanessa Carter, and Nicholas Vartanian; [5] "Implementing Feed-in Tariff Programs: Comparative Analyses and Lessons Learned" (2011) by J.R. DeShazo and Ryan Matulka; and [6] "Bringing Solar Energy to Los Angeles: An Assessment of the Feasibility and Impacts on an In-Basin Solar Feed-in-Tariff Program" (2010) by J.R. DeShazo and Ryan Matulka.

<sup>7</sup> UCLA Luskin Center for Innovation (2015). Sharing Solar's Promise: Harnessing LA's FIT to Create Jobs and Build Social Equity

**FIGURE 1: Timeline of LADWP’s FiT Program**

<b>FIT DEMO</b> 10 MW Demonstration	<b>FIT 100</b> First 100 MW Offered	<b>FIT 50</b> Additional 50 MW Offered	<b>FIT 65 Reoffer</b> Remaining MW Reoffered
April 2012	January 2013	June 2014	June 2017
<b>Pilot</b> 3 projects 21 to 21.7 ¢/kWh Time of Delivery multiplier	<b>5 allocations</b> 20 MW every 6 months  <b>Price Tranches</b> First 20 MW at 17 ¢/kWh Next 20 MW at 16 ¢/kWh Next 20 MW at 15 ¢/kWh Next 15 MW at 14 ¢/kWh Final 25 MW at 13 ¢/kWh	<b>Competitive Bid</b> 28 MW at 11.7 ¢/kWh 22 MW at 13.5 ¢/kWh	<b>Set FIT (35 MW)</b> 14.5 ¢/kWh  <b>Block FIT (30 MW)</b> 6 blocks of 5 MW Competitively bid Unbid 25 MW rolled into Set FIT
<b>Capacity Status</b> 1.6 MW in-service	<b>Capacity Status</b> 25.3 MW in-service 1.9 MW active	<b>Capacity Status</b> 29.3 MW in-service 6.3 MW active	<b>Capacity Status</b> 7.5 MW in-service 75.6 MW active

Source: FiT program information from LADWP. Figure created by UCLA Luskin Center for Innovation.

# CHAPTER 2

## THE REALIZED BENEFITS OF FIT150

### 2.1 Environmental and Equity Goals

As of April 2019, 93 projects are in-service (63.6 MW), which means they are delivering electricity to the grid. There are 126 active projects (84.2 MW); they have executed contracts but are not yet fully installed and/or interconnected, and there are dozens more queued applications. This means that a year and a half after the reoffer of 65 MW available capacity, LADWP has successfully achieved its distributed energy goals set by the FiT program. Table 1 summarizes how the in-service and active solar projects are distributed across city council district (by number of projects, capacity, and estimated total capacity available).

**TABLE 1: In-service and Active FiT Projects and Capacity, by Los Angeles City Council District**

Council District	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
In-service Projects	5	5	0	0	0	21	14	2	9	1	2	9	2	4	16
In-service Capacity	2.3	1.3	0	0	0	6.9	7.5	0.4	11.2	0.1	1.0	3.3	0.3	1.1	24.2
Active Projects	5	7	9	5	2	18	11	3	3	2	7	26	1	8	19
Active Capacity	0.9	1.3	2.1	1.5	0.3	16.1	9.1	1.2	1.5	0.7	1.7	18.6	0.1	8.9	20.2
<b>Total Projects</b>	<b>10</b>	<b>12</b>	<b>9</b>	<b>5</b>	<b>2</b>	<b>39</b>	<b>25</b>	<b>5</b>	<b>12</b>	<b>3</b>	<b>9</b>	<b>35</b>	<b>3</b>	<b>12</b>	<b>35</b>
<b>Total Capacity</b>	<b>3.2</b>	<b>2.6</b>	<b>2.1</b>	<b>1.5</b>	<b>0.3</b>	<b>23</b>	<b>16.6</b>	<b>1.6</b>	<b>12.7</b>	<b>0.8</b>	<b>2.7</b>	<b>21.9</b>	<b>0.4</b>	<b>10</b>	<b>44.4</b>
Estimated Capacity Potential	439	686	651	572	443	955	537	227	504	320	434	930	380	677	479

Source: In-service data from LADWP. Estimated capacity data from Los Angeles County GIS Data Portal Solar Map  
 Table note: Active projects include only those with contracts signed. Capacity is shown in MW.

Once all active projects begin operation, the 150 MW of LADWP’s FiT projects will generate on average 289 GWh per year.<sup>8</sup> According to the emission factor calculated for distributed solar installations by the California Air Resources Board (CARB), once fully constructed, the electricity generated by this program will avoid the emission of 68,500 metric tons of carbon dioxide every year. Additionally, these projects will help to avoid the emission of criteria air pollutants associated with fossil-fuel electricity generation. This includes avoided emissions of 37,900 pounds of nitrogen oxides and 9,500 pounds of PM 2.5, which have negative impacts on human health.<sup>9</sup> It is important to note that CARB’s emissions factors are based on averages across the state.

Figure 2 shows where these projects are located across the 15 city council districts. As seen in the figure, the FiT projects are geographically distributed around the city, with a concentration at the Port of Los Angeles. Each project is represented by a blue dot, with the size varying depending on the installation capacity. The orange areas on the map show “solar equity hot spots.” These are census tracts that are defined as areas with both high solar potential and a high need for economic investment and employment opportunities.<sup>10</sup> Thirty-

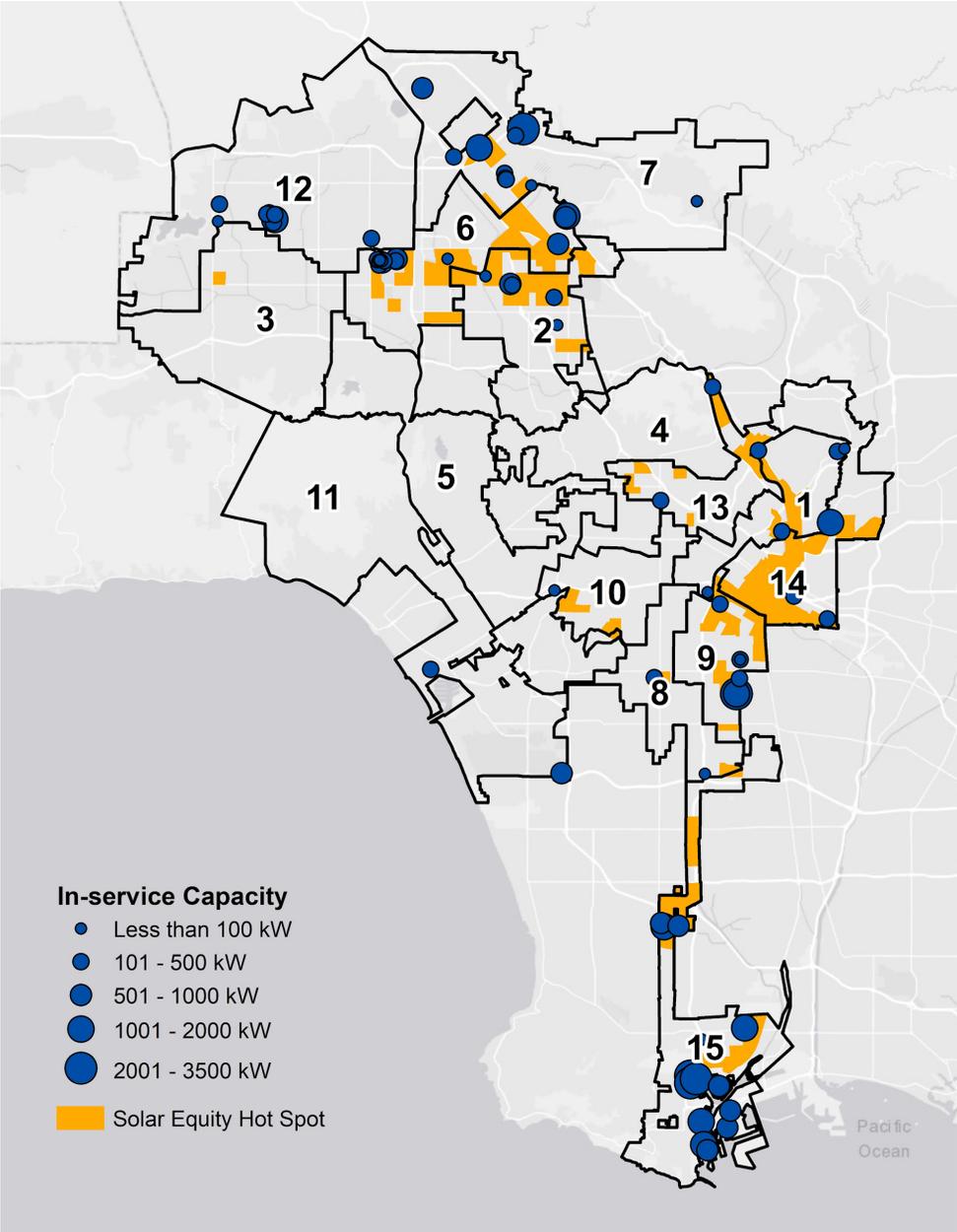
<sup>8</sup> Based on the System Advisor Model (SAM) developed by National Renewable Energy Laboratory

<sup>9</sup> Calculated using the California Air Resources Board “Criteria Pollutant Electricity Emissions for In-State Generation (2012).”

<sup>10</sup> Solar Equity Hot Spots, identified by a methodology developed by the UCLA Luskin Center for Innovation and USC, are census tracts with both high solar potential and high economic need. High solar potential is defined as the top third of rooftop solar capacity potential. High economic need is defined as census tracts in the bottom third for household income, unemployment rate, and high school graduation rate and/or are in the top 10% of CalEnviroScreen score census tracts statewide. This report includes an updated hot spots analysis completed at the census tract level. Previous reports conducted this analysis at the ZIP code level.

seven percent of installed projects are located within these solar equity hot spots. These investments can support these communities in need of jobs and new economic opportunities when developers hire and train local labor: “A variety of local programs hosted by community colleges, union apprenticeships and nonprofits offer specialized training often to less advantaged workers. One such local program is a partnership between Homeboy Industries and the East Los Angeles Skills Center that trains ex-offenders and former gang members to join the ‘green collar’ workforce.”<sup>11</sup>

**FIGURE 2: Map of In-service FiT Capacity, by Los Angeles City Council District**



Source: Solar project data from LADWP. Hot Spot data from CalEnviroScreen (2019), Los Angeles County GIS Data Portal Solar Map Database (2006, 2010), and American Community Survey 5 Year Estimates (2017). Figure created by UCLA Luskin Center for Innovation (2019).

<sup>11</sup> Los Angeles Business Council (2016). FiT Pays: Rooftop Solar Program Delivers Dividends for Business Owners.

Table 2 shows the number and capacity of in-service projects located in solar equity hot spots by council district and the estimated total solar capacity potential in those areas.

**TABLE 2: Hotspot Capacity (in MW), by Los Angeles City Council District**

Council District	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
In-service Hot Spot Projects	3	5	0	1	0	4	2	1	6	0	0	0	2	5	5
In-service Hot Spot Capacity	0.7	2.2	0	0.1	0	1.3	2.1	0.3	10.9	0	0	0	0.3	1.5	6.2
Estimated Hot Spot Capacity Potential	177	364	6	81	0	455	79	38	352	32	0	66	127	496	194

Source: Project data from LADWP. Capacity potential data from Los Angeles County GIS Data Portal Solar Map Database (2006, 2010).

Note: Capacity potential includes all solar capacity potential.

## 2.2 Economic Benefits

### Local Economy and Job Creation

One particularity of this program is that the vast majority of in-basin panels have been installed on rooftops<sup>12</sup>, which utilizes existing infrastructure and reduces land use for energy generation. Only three projects were ground mounted, one in-basin and two out of basin for a total of 4.89 MW. In exchange for use of their roof, building owners receive a lease payment from solar developers. Interviews with solar developers mentioned that these leases represent approximately 15% to 25% of the revenues generated by the solar installation. With approximately 289 GWh produced at 14.5¢/kWh, this could total \$6.3 million to \$10.5 million in revenues benefiting building owners annually in the City of Los Angeles. While a more uncommon practice, building owners may own a solar installation directly, allowing them to receive all revenues generated by the installation.

LADWP's FiT program has also supported local construction and operations and maintenance jobs. The UCLA Luskin Center for Innovation (LCI) used the Jobs and Economic Development Impact (JEDI) model developed by the National Renewable Energy Laboratory to estimate the economic impacts of constructing and operating rooftop solar installations in Los Angeles.<sup>13</sup> The model estimates that once all active projects are fully operational, the FiT program will have supported over 900 local construction and installation jobs as well as over 25 annual local operations and maintenance jobs, as summarized in Table 3.<sup>14</sup> These projects will also support over 800 additional non-local jobs in wholesale and retail solar trade jobs, professional services, and other industry related jobs.<sup>15</sup> Some solar developers target underemployed populations to train and employ to increase the benefits of the project. For example, PermaCity partnered with Empower America, which assists veterans in gaining green job training and employment. Fifty veterans worked on their 16.4 MW solar project in Westmont, whose training was funded by the City of Los Angeles.<sup>16</sup>

<sup>12</sup> As of May 2019, 0.89 out of 59.6 MW of in-basin installed projects were ground mounted. 4 MW ground mounted was installed out of basin.

<sup>13</sup> Researchers used the most recent model, which was updated in 2016.

<sup>14</sup> National Renewable Energy Laboratory JEDI model (2016 version). Used \$2/W installed cost assumption.

<sup>15</sup> No induced jobs are included in this estimation.

<sup>16</sup> MacDonald, Paul (2017). EnerG. "Getting Vets Involved in LA Solar Power."

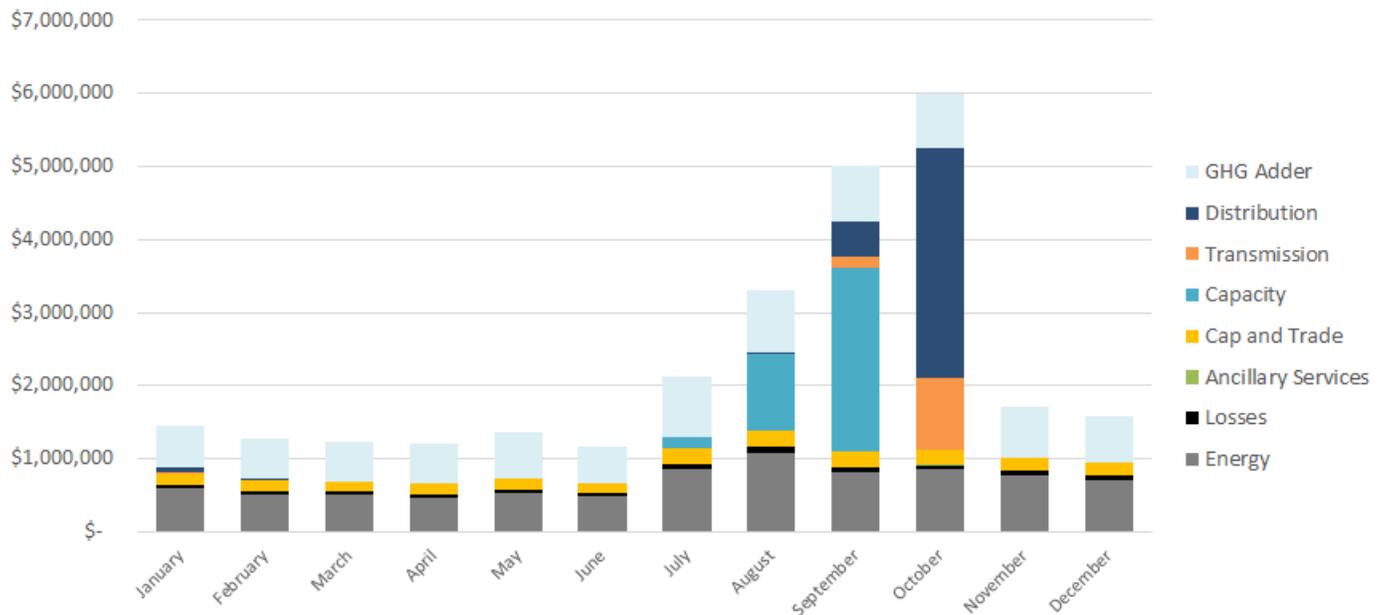
**TABLE 3: JEDI (NREL) Estimated Jobs Impact**

During Construction and Installation Period	
Direct construction and installation jobs	929
During Operating Years	
Operations and maintenance jobs	26

**Ratepayer Benefits**

The benefits resulting from distributed solar development can be monetized with a tool developed by E3 for the California Public Utilities Commission: the Avoided Costs Calculator. This model breaks down these benefits across eight cost categories illustrated in Figure 3 below.

**FIGURE 3: Avoided Costs Realized by Total Active and In-Service Distributed Solar per Month**



Source: California Public Utilities Commission “Avoided Cost Calculator” prepared and developed by E3.

Solar generation supports the utility’s efforts to reduce emissions, comply with the Renewables Portfolio Standard, and decrease the use of coal and natural gas for electricity generation.<sup>17</sup> For example, if the electricity generated by the program decreases the electricity generated by the local natural gas power plants, 150 MW of solar installations would decrease LADWP’s natural gas procurement cost by \$7 million per year. This scenario is based on the 2018 average Henry Hub natural gas prices of \$3.15 per MMBtu<sup>18</sup> and an average operating heat rate of 7,812 Btu/kWh<sup>19</sup> for a typical natural gas power plant. The 68,500 metric tons of carbon dioxide equivalent avoided emissions also translate into \$1 million in savings from the Cap and Trade market, based on an estimation of the number of carbon allowances that LADWP would have had to purchase.<sup>20</sup>

<sup>17</sup> LADWP (2017). Power Content Label: 18% coal and 31% natural gas.

<sup>18</sup> United States. Henry Hub Natural Gas Spot Price. [https://ycharts.com/indicators/natural\\_gas\\_spot\\_price](https://ycharts.com/indicators/natural_gas_spot_price)

<sup>19</sup> Energy Information Agency (2019). 2017 Average Operating Heat Rate for Natural Gas

<sup>20</sup> The February 2019 auction settlement price was \$15.73. California Air Resources Board (2018). California Cap-and-Trade Program Summary of California-Quebec Joint Auction Settlement Prices and Results.

Distributed generation also reduces the losses incurred when using long distance transmission lines and defers important investment and upgrade costs necessary to maintain, improve, or expand the grid. For example, energy efficiency and distributed solar generation have influenced the state demand load in ways that significantly avoided transmission investment, as illustrated by a recent California Independent System Operator's report: "[CAISO] recommends the cancellation of 18 transmission projects and revisions of 21 other projects in PG&E area and two in SDG&E area, avoiding an estimated \$2.6 billion in future costs."<sup>21</sup>

LCI used the E3 tool to estimate the avoided cost benefits of having 150 MW of distributed solar in Los Angeles. Because this model was designed for the three major investor-owned utilities, researchers and the LADWP transmission and distribution planning team discussed how to best use and adapt the tool. It was decided to run the model using Southern California Edison's grid parameters, but only for the climate zones relevant to LADWP's grid and urban density. LCI estimated the generation of 150 MW of local solar for each month and each climate zone using the System Advisor Model developed by the National Renewable Energy Laboratory.

With the help of those tools, LCI estimates that once all 150 MW are interconnected, the total avoided costs will be approximately \$27 million per year, or 9.1¢ per kWh generated.

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<sup>21</sup> California Independent System Operator (2018). News Release. Board Approves 2017-18 Transmission Plan, CRR Rule Changes Plan Calls for Canceling, Modifying Projects to Avoid \$2.6 Billion in Costs.

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## CHAPTER 3

# LESSONS LEARNED FROM PARTICIPANTS

During the six years of the program, LADWP continuously adapted the design, rate, and its approach to the market and participants' feedback, resulting in important lessons learned. This chapter summarizes the feedback received during a series of 20 detailed interviews that researchers conducted with awarded participants, LADWP staff, solar developers, financial institutions, advocates, other publicly owned utilities, and community choice aggregators. This feedback is organized around program strengths and challenges, and how stakeholders adapted and applied innovative solutions to overcome the identified obstacles.

### 3.1 Program Strengths

Overall, interviewees had very positive feedback on LADWP's FiT program. Interviewees identified several specific strengths, highlighting the rate, the deposit requirement, the stability and predictability of the program as the four key elements of success.

#### **Rate**

Finding the right rate is essential, as it ensures that all capacity is taken at the lowest cost for the utility's ratepayers. Interviewees identified LADWP's rate as a major strength of the program. The current 14.5¢ fixed rate was sufficient to attract enough investment and fill the entire program capacity. This rate allows for all costs to be covered, including the rooftop renting costs, and costs associated with the technical complexities of building a solar installation on a roof in Los Angeles. These comments can be confirmed by looking at the previous FiT program, which only received five bids for the 13¢ and 14¢ tranches for a total of 2.6 MW in 2014, leaving substantial available capacity. In fact, one interviewee noted that the rate supports a stable program, as a slower uptake contributes to favorable stability.

When asked about market price mechanisms, interviewees identified the fixed rate as a strength of LADWP's FiT program as it provides certainty while applicants are tying up financing, contracting, rooftop rent, labor, and more. Conversely, the investor-owned utilities' FiT Program, also known as the Renewable Market Adjusting Tariff (ReMAT), used a mechanism that allowed the rate to adjust in real-time based on specific criteria for market depth and subscription rate in the investor-owned utility queues. Multiple interviewees noted that the prices offered by ReMAT were too low, and its pricing mechanism created too much uncertainty.<sup>22</sup>

#### **Deposit**

The security deposit was identified as a good component of the program. LADWP requires a Development Security Deposit (DSD) for each FiT project application. For the SetFiT, the DSD is \$50 per kW and for the BlockFiT it was \$200 per kW.<sup>23</sup> The Clean Coalition also recommends the use of a (refundable) deposit, reasoning that this will deter "nonviable bids from clogging the lottery and project queue."<sup>24</sup> A previous report from LCI recommended the use of a deposit as "a reasonable, nonrefundable fee does not present a significant barrier to participation for single applications or for viable projects. Instead, it creates a justifiable disincentive to submitting a high volume of applications, or for submitting insufficiently planned projects." Only serious and financially strong bidders would then process an application for this program.

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<sup>22</sup> Despite these critiques, ReMAT resulted in the installation of 74 MW of renewable energy generators, including 43 MW of ground mounted solar. The other 31 MW came from a combination of other renewable energy sources including small hydro, biogas, landfill gas, and wind.

<sup>23</sup> LADWP. "Feed-in-Tariff Program-SetFiT" and "Feed-in-Tariff Program-BlockFiT."

<sup>24</sup> Clean Coalition (2017). "East Bay Community Energy: Feed-in Tariff Design Recommendations."

However, this financial requirement could prevent smaller competitors from submitting an application (as a deposit favors those with capital). As of April 2019, the average installation size is 683 kW, resulting in an average deposit of \$34,150 for SetFiT and \$136,600 for BlockFiT. The deposit requirement constrains solar developers to put down a certain amount of cash to be part of the bidding process, automatically increasing the amount of time between their first cash out and first cash in. LCI found that it takes an average of 2.5 years from the day the application is submitted to the commercial operation date when the solar developer first starts generating electricity for revenue from LADWP (see further discussion regarding time constraints in the following section 3.2 Challenges).

### **Stability and Predictability of the Program: Credit Rating, Market Deregulation, and Foreseeable Capacity**

Financial stability and credit rating are crucial for long-term investors. Interviewees identified LADWP's position as the largest municipal utility in the U.S. and its strong credit rating as favorable elements for financial institutions. The three most important credit rating agencies have given a "AA/Aa2" and a "stable outlook" to LADWP, while all three main investor-owned utilities have lower credit ratings and "negative outlook".<sup>25</sup> The confidence that the utility will be around for the foreseeable future is even more appreciable after PG&E's decision to file for bankruptcy due to fire liabilities, and during this important energy transition that is happening in California with the proliferation of community choice aggregators. The three main investor-owned utilities estimate that they could lose 85% of their customers to community choice aggregators, direct access providers, energy efficiency programs, or behind the meter programs in the coming years. However, this fast-paced market transition and fragmentation should not impact publicly owned utilities as they are not affected by community choice aggregators or direct access competition.

Additionally, interviewees noted the importance of stability in available capacity. Due to the time investment required to develop a project, solar developers and financiers are more likely to participate in programs where they can more assuredly access capacity. One interviewee noted, "Generally, more capacity is better." Another interviewee noted, "the more transparency and predictability, the stronger the program from a development perspective." One interviewee expressed appreciation for LADWP's frequent communication and updates about program capacity, which helps to assuage developers' concerns.

## **3.2 Program Challenges**

This section discusses challenges interviewees faced when developing solar through LADWP. While these are not necessarily unique to this FiT program, LADWP could take steps to help address these challenges. The most commonly identified challenge among interviewees was finding and maintaining site control, specifically regarding the physical constraints of the roof and rooftop owner concerns. Additional challenges included project timeline length, interconnection time and costs, and the vista switch.

### **3.2.1 Rooftop Constraints**

#### **Physical Challenges and Limitations**

Interviewees identified finding viable roofs in the region as the biggest operational challenge, as there are multiple issues to consider when finding sufficient space to develop a solar installation on the built environment. There are limited number of roofs in the city of Los Angeles that are large enough to be financially interesting for solar developers. An interviewee mentioned that the most financially attractive projects are built on rooftops of at least 100,000 square feet, and cannot include office buildings as they already have part of their building infrastructure installed on the roof. Some interviewees expect a further decrease in

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<sup>25</sup> Ratings retrieved from Moody's Investors Service, Standard & Poor's, and Fitch Ratings

installation costs in the coming years, which would increase their financial ability to secure deals with building owners. While this makes sense as labor becomes more experienced and trained, it is also important to prevent any pressure on the local labor market to the profit of building owners.

Furthermore, not all building owners want to have solar installations on their roof because of the potential damage due to the weight of the solar infrastructure, or potential water leakage issues due to solar installations being bolted to their roof. In order to palliate this problem, PermaCity has developed patented technology that does not require the system to penetrate the roof. It has made this technology available to its competitors.

Roofs need to be able to support a solar system, both in terms of weight and length of the solar system's life. Building and roof age can cause barriers to developing solar projects, even when the building owner is interested. Some interviewees noted that the age of buildings in Los Angeles is higher than the average building in California, making it more complex and requiring deeper assessment. In fact, according to census data, Los Angeles County has the second-oldest median building age in the state (1962) after San Francisco County. Also, roofs need to be replaced around every 20 years. If a roof needs to be replaced mid-contract, it disrupts the ability of the solar system to generate power and it consequently increases the cost of rooftop replacement. This is especially a challenge in low-income areas. PCS and PermaCity use an innovative approach to overcome this barrier and create an opportunity to make the FiT program more attractive to these specific rooftop owners: They offer to replace the old rooftop before they install solar panels. This can reduce roof replacement costs for the building owner, help to create additional jobs, renovate aging real estate, and increase the intrinsic value of buildings in Los Angeles.

### **Dealing With Building Owners and Renters**

Finding building owners willing to lease their roof is a large barrier. Rooftop owners directly benefit from the FiT program as they receive lease payments from the solar project owner in exchange for using their rooftop. However, the lease payment building owners get from a solar FiT project is often significantly less than what they make renting the building to tenants. The first challenge with building owners is offering a sufficiently high lease payment. Under a certain amount, it is not worth the time and effort to a building owner to participate. Not all lease negotiations succeed because it needs to make economic sense both for the lessee and the lessor. Interviewees noted that some building owners ask for lease payment that can make up a substantial part of the revenues: on average 15% to 25%. Due to data paucity, researchers have not analyzed these cost implications, but interviewees mentioned that this is an important variable and a potential deal breaker in some cases. Furthermore, one interviewee noted that the lease payments expected by building owners can be inflated as a result of offers from unviable projects. Unviable projects may overestimate the potential lease payments to building owners and could raise their expectations. These types of projects can also discourage building owners from participating if they spend time on projects that fall through. Unviable projects also have the negative side effect of adding to the queue of projects and requiring LADWP staff time.

Also, a lot of potential buildings are rented, which can provide barriers to participation for building owners who either are looking to participate in the FiT program directly by owning an installation or by leasing their roof to a solar developer. First, they need to ensure that their lease with their tenant considers the roof as separate to lease from the interior of the building. Second, building owners may be concerned that a future tenant may want to utilize the roof space for other purposes, such as air conditioning or refrigeration, and may not want to restrict that ability. Some interviewees also mentioned that rooftop owners may also be afraid that these installations could affect their ability to sell the building in the future. This all contributes to building owners' hesitancy to commit to 20-year terms.

Through our interviews, some solar developers suggested that LADWP could assist in promotion of the program in order to reassure building owners, increase participation and rooftop potential. This solution would make sense especially for buildings in disadvantaged communities. LADWP could help to reassure disadvantaged community members of the legitimacy of the program, as these communities may often be targeted by predatory sales tactics and may be more hesitant to participate in such a program. However, such a campaign will require more LADWP staff time toward marketing and outreach. Alternatively, solar developers can partner with real estate brokers to assist in marketing the program to tenants. For example, CBRE offers this as a tenant benefit.

**Building Owners With High Load Demand**

If a building has high on-site energy consumption, the NEM program is likely to make more financial sense for the building owner, as it offsets electricity consumption with the production of the rooftop solar installation. The NEM program also provides a financial hedge against future electricity price increases as it guarantees that the owner of the building can buy and sell the electricity at roughly the same price throughout the length of the contract. This further reduces the attractiveness of the FiT program to such building owners.

From a generation perspective however, the NEM program does not incentivize the maximum utilization of the roof space, but rather pushes the building owner to size the installation to its consumption needs only. On the other hand, the FiT program strongly supports the maximization of rooftop space utilization.

Combining both programs can help convince more building owners, as they benefit from the NEM incentives while also maximizing rooftop space for FiT solar generation. There are already examples in LADWP territory of these types of hybrid installations. For example, PermaCity developed a project on the Forever 21 Headquarters in Lincoln Heights that utilizes both FiT and NEM. 3 MW are NEM, which allows Forever 21 to offset its on-site energy consumption, and 2 MW are FiT, fully maximizing the remaining available rooftop space.<sup>26</sup> Hecate Energy also developed a hybrid FiT and NEM project on the United States Postal Service mail processing center in Los Angeles. On this rooftop, 1 MW is NEM and 10 MW are FiT. Supporting the development of these hybrid programs would allow all parties to maximize the various benefits of LADWP’s different solar programs and encourage more participation.

**FIGURE 4: Forever 21 Headquarters (left) and U.S. Postal Service (right) FiT and NEM Projects**



Source: PermaCity (2019) and United States Postal Service (2019). “Expansion of Solar Power Generation.”

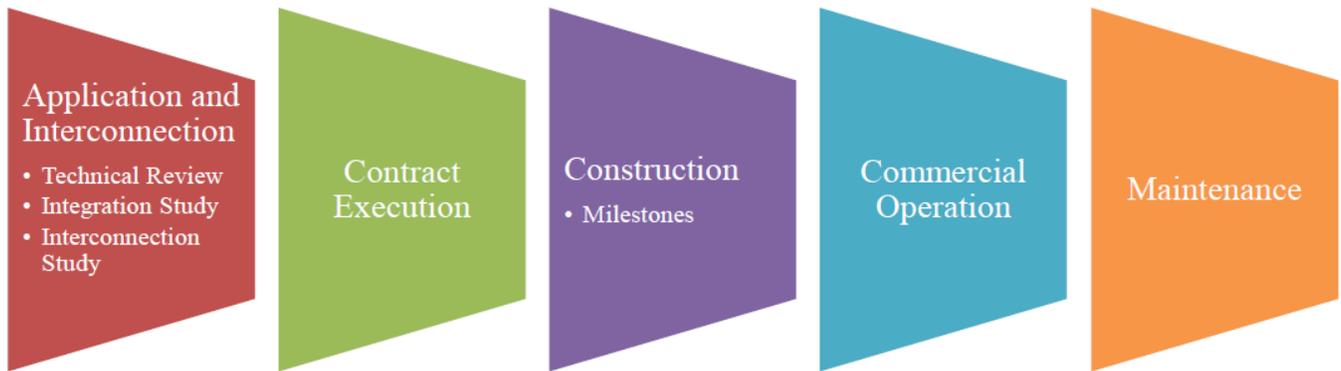
<sup>26</sup> LABC (2015). FiT Pays: Rooftop Solar Program Delivers Dividends for Business Owners.

### 3.2.2 Project Length and Timeline

Another challenge identified was the length of time necessary to complete a solar project from start to finish. One interviewee actually identified time as the biggest contributor to project failure. Not adhering to timelines can exacerbate challenges with maintaining site control and issues with building owners, as well as put financing at risk for smaller developers.

The entire process of finding a roof, filing an application, conducting the technical review, and completing integration study and interconnection study can vary a lot and was identified by interviewees to take one to two years. In particular, one interviewee identified engineering challenges as a source for delays and suggested that DWP allocate additional resources to its engineering department. LADWP has already streamlined the process as much as possible, in part by conducting all the studies in parallel with other processes, as illustrated in the figure below. However, LADWP notes that each project is unique, tailored to a specific rooftop, and includes specificities related to technical installation and/or interconnection. These elements naturally limit how fast LADWP’s team can review each application. The figure below summarizes the steps needed to support a solar project.

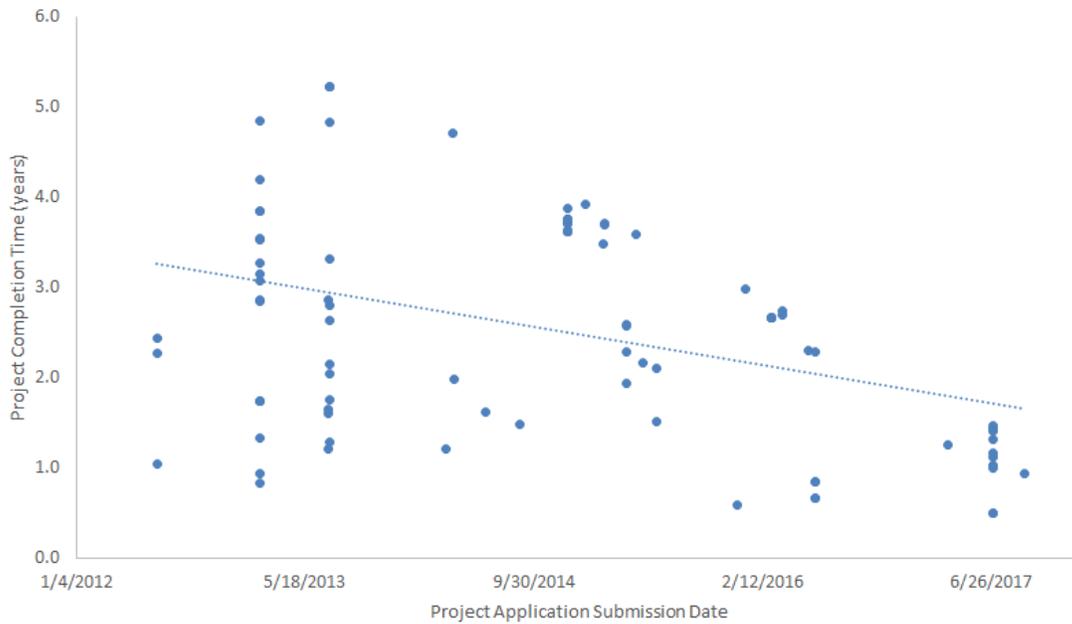
**FIGURE 5: FiT Project Process Improvement**



Source: LADWP

Figure 6 shows how LADWP’s effort to streamline the FiT projects’ processes have impacted project length over time. This figure shows how the time between application submission and commercial operation has evolved since the start of the program. The average number of years has decreased over time, meaning that projects are completed more quickly. A project that submitted an application in 2013 had an average completion time of 2.8 years, while a project submitted in 2017 had an average completion time of 1.1 years.

**FIGURE 6: Project Completion Length Over Time**

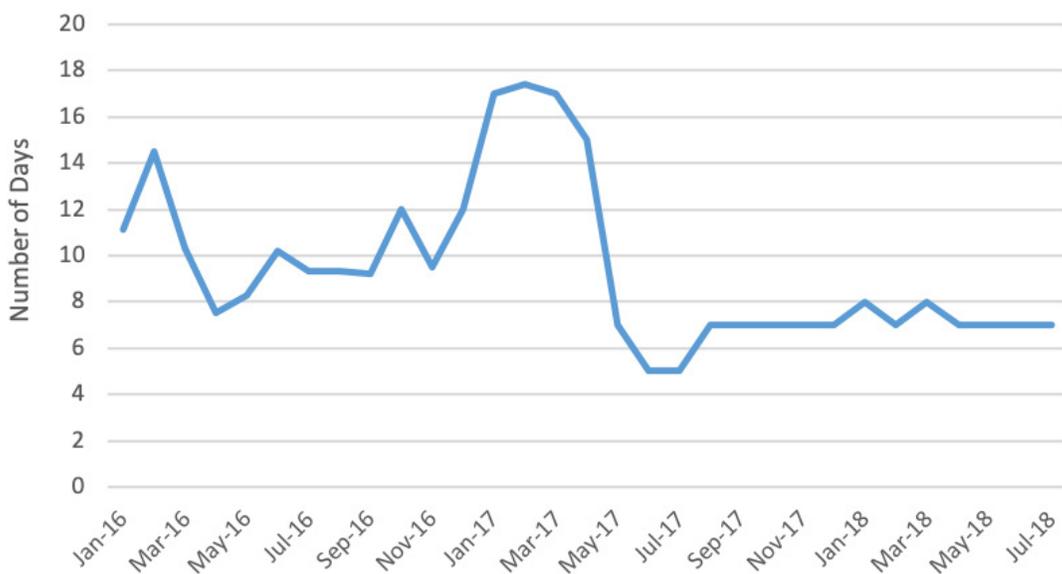


Source: LADWP data. Figure created by the UCLA Luskin Center for Innovation.

### 3.2.3 Interconnection Challenges

Interconnection time and costs have been identified by solar developers as one of the main issues in developing distributed electricity generation. Interconnection issues can delay a project and create important uncertainties surrounding cost, time, and feasibility. In response to feedback from solar developers, LADWP provides data on average interconnection time and costs for different regions and project sizes to help with planning. According to these data, in 2016 and 2017 the average interconnection time varied between five and 17.4 days. The figure below also shows a downward trend over time and from August 2017 to August 2018, the average hovered between seven and eight days.

**FIGURE 7: LADWP Average Interconnection Time (Days)**



Source: Los Angeles Open Data (2019).“LADWP Solar Interconnection Time.”

Interviewees found interconnection costs to be very variable. These costs vary from \$16,080 to \$296,036 depending on the area, the size of the installation, and the type of interconnection.

**TABLE 4: Weighted Average Interconnection Costs**

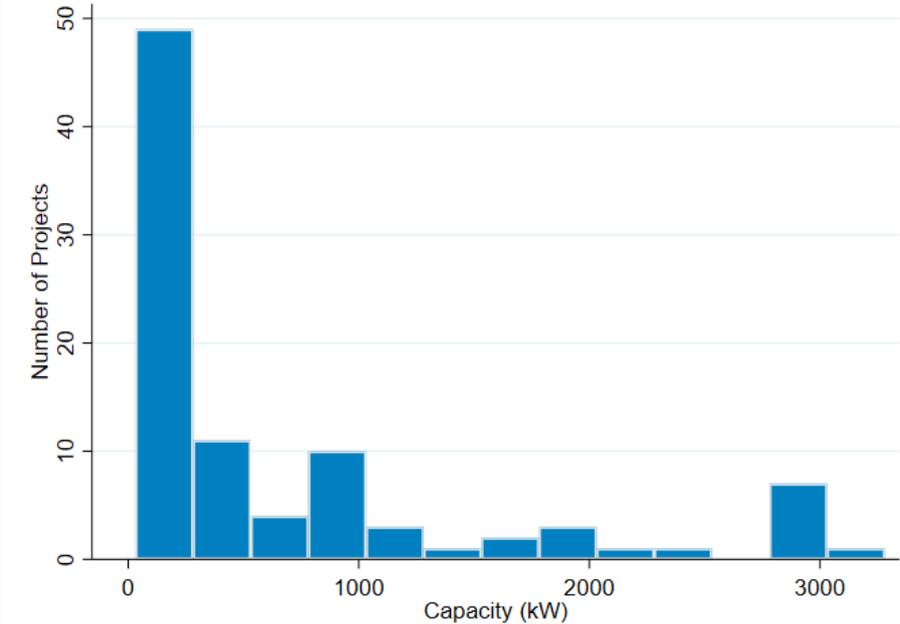
		Small <200kW	Medium 200-999kW	Large >999 kW
Valley	4.8 KV	\$17,456	\$60,170	N/A
	34.5 KV	\$45,162	\$96,176	\$283,972
Metro-West	4.8 KV	\$19,434	N/A	N/A
	34.5 KV	N/A	\$20,949	N/A
Metro-East	4.8 KV	\$16,080	\$38,742	N/A
	34.5 KV	N/A	\$73,903	\$296,036

Source: LADWP (20 18). “FiT Weighted Average Interconnection Costs.”

**Vista Switch**

Another challenge raised by interviewees is the Vista Switch, which is required by LADWP for installations larger than 1 MWac. This requirement can add \$330,000 to \$400,000 to project costs.<sup>27</sup> One interviewee estimated that the Vista Switch can increase interconnection costs by 50%, and can cost up to an additional \$1 million. Additionally, one interviewee noted that the price of the Vista Switch has recently increased 30%. Solar developers noted that they therefore try to target projects that are just under 1 MWac to avoid the costs associated with the Vista Switch requirement, as illustrated in Figure 7 below. Figure 7 shows the frequency distribution of project sizes, with each bar showing the number of projects within that 250 kW range; in total 78% of the projects are less than 1 MW. The added costs resulting from the Vista Switch seem to become a less of a financial problem around 3 MW.

**FIGURE 8: Distribution of In-Service Project Sizes (in kWAC)**



Source: LADWP data. Figure created by UCLA Luskin Center for Innovation.

<sup>27</sup> UCLA Luskin Center for Innovation (2014). FIT 100: An Evaluation of Early Progress.

This requirement also provides an additional challenge as it further restricts the number of available rooftops and may result in underutilization of rooftops that could host installations larger than 1 MW, but not large enough to absorb the additional interconnection costs resulting from the Vista Switch requirement.

Some interviewees recommended that LADWP reassess the Vista Switch requirement. One interviewee suggested changing the requirement to apply to projects larger than 3 MW, when the Vista Switch becomes financially viable. Alternatively, cheaper interconnection technology could be utilized in place of the Vista Switch. LADWP staff mentioned that the Vista Switch is not an immutable requirement, and they remain opened to other solutions. They are, in fact, currently lab testing other technologies.

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## CHAPTER 4

# RECOMMENDATIONS TO ADDRESS CHALLENGES OF CURRENT FIT PROGRAM DESIGN

In its integrated resource plan, LADWP established a FiT program expansion of an additional 300 MW by 2025. Based on the same methodology used in Chapter 2, LCI estimates that 300 MW would generate 578 GWh of clean electricity annually and avoid the emission of 137,000 metric tons of carbon dioxide equivalent per year.<sup>28</sup> This would also multiply the economic benefits estimated in Chapter 2, including the support of an additional 1,900 local jobs and other ratepayer benefits.<sup>29</sup>

However, Chapter 3 identifies that finding and maintaining site control is the number one challenge faced by solar developers. This crucial first step can be costly and time consuming for both participants and building owners, and the lease required by some building owners can be a deal breaker. In light of the new FiT expansion, this chapter recommends a focus on public buildings and non-rooftop installations in order to overcome this obstacle and achieve a rapid program expansion while improving cost-effectiveness for ratepayers' benefit.

### 4.1 Supporting and Facilitating Solar Installations on Public Properties

As noted before, the City of Los Angeles has ambitious goals when it comes to local clean energy, which makes LADWP its most important supporter and partner. While the vast majority of FiT solar installations were made on private building rooftops, LADWP has installed 25.4 MW on city-owned and LADWP properties since 2000. These utility-built solar projects are all small scale and in-basin, and were not constructed as part of the FiT program. LADWP has identified at least 52 MW of potential solar capacity on public buildings, such as fire departments, police stations, libraries, and recreation centers. The 2010 LCI "Bringing Solar to Los Angeles" report estimates that government and nonprofit buildings represent a total of 156 MW of physical rooftop solar potential in the City of Los Angeles.

While interviewees identified public buildings as a large source of underutilized potential, they also highlighted the difficulties in making deals with public agencies, including some of their labor and contracting requirements. One solution to palliate some of the challenges of contracting with public agencies is if the city bundles its public properties and offers them through a competitive bid process to FiT program participants. Bundled sites would reduce the time and costs for participants associated with finding and securing rooftops, increase their economies of scale, and streamline project interconnection studies and permitting, all while resulting in a lower overall program cost. This approach was successfully tested and implemented by several public agencies in the San Francisco Bay Area.

#### **The Case Study of the San Francisco Bay Area**

In 2013, the San Francisco Bay Area launched the nation's largest multiagency collaborative solar procurement to date. The Regional Renewable Energy Procurement Project, or R-REP, had 19 participating governmental

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<sup>28</sup> Calculated using California Air Resources Board emission factor.

<sup>29</sup> The jobs estimate is completed using the same assumptions described in section 2.2 and should be considered illustrative.

agencies across four counties, led by Alameda County, and solicited 31 MW capacity of renewable energy. R-REP offered 10 distinct projects, each bundling up to 70 rooftop sites, ranging from 500 kW to 8 MW. This “collaborative procurement” helped mitigate some of the challenges that individual agencies may have faced in developing renewable energy further independently.

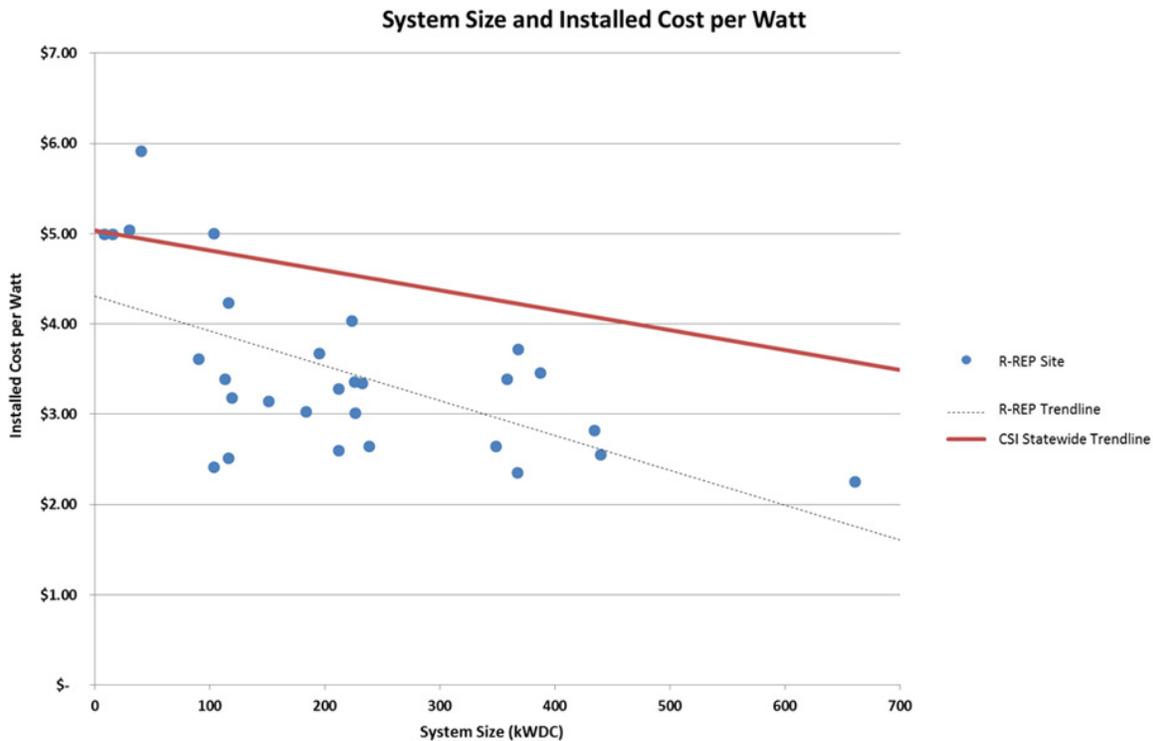
First, by aggregating together many small sites and bundling them into larger projects, the R-REP was able to attract bigger solar companies, creating greater competition, and leading to more aggressive bids. R-REP bundled sites strategically based on “technology, system size, existing rate structures, geography, and unique contracting requirements” to maximize savings. Bundles could be made up of sites across multiple agencies due to the collaborative nature of the project.

Bundling small rooftop solar capacities into larger projects offers important economies of scale for solar developers and the governmental agencies. R-REP’s streamlined process, standardized documents, financing and process, and strategic bundling of sites reduced the cost of installation through lower soft costs. This strategy strongly reduces the time and money usually required for each site for customer acquisition, transaction costs, administrative time, legal and contract terms, financing, permitting, commissioning, interconnection, installation labor and deployment. According to Alameda County, “the bundle pricing is intended to reflect a discounted price given the economies of scale and reduced transaction costs associated with the collaborative procurement.” These agencies were successfully able to keep costs lower through the bundling of their solar projects, which resulted in rooftop solar installations at 46 sites. Bundling sites could be a potential way for other public agencies to further lower the costs of rooftop solar installations.

According to the SunShot Initiative, the median cost of installation for commercial rooftop was between \$4.36 per watt (10-100 kW) and \$3.99 per watt (>100 kW) in 2013. According to data obtained from the California Distributed Generation Statistics, the median cost of installation for commercial NEM rooftop between 10 kW and 1 MW was \$4.35 per watt, in 2013. Consequently, the R-REP’s median cost of installation per watt was \$3.28 per watt, or roughly 25% cheaper than the state median. The majority of R-REP’s bundled bids were below the 2013 median price of rooftop solar installation.

The graph below shows the cost of installation per watt of each of the winning bids, for this specific R-REP. In this analysis, we only consider all non-PPA sites constructed as a result of the R-REP effort from 10kW to 1MW in size in order to more accurately compare to the cost of installation for other directly owned sites, such as NEM, as reported by the California Distributed Generation Statistics. The red line in the graph illustrates the median cost of installation depending on the system size in California in 2013. The dashed line illustrates the relationship between the installed price per watt and the system size of the R-REP sites.

**FIGURE 9: Bundled Rooftop Solar Sites Installed Cost per Watt**



Source: Data from Alameda County and the California Solar Initiative. Figure created by UCLA Luskin Center for Innovation. Figure note: Four sites were larger than 1 MW and were not included in this graph for visibility.

### Lessons Learned From This Case Study

While the R-REP provided solar developers with attractive and cheaper rooftop sites, only 46 sites received formal bids out of 186 sites proposed. This illustrates one of the main challenges of bundling strategies, where only the most economically interesting sites get the attention of bidders. LCI believes that these proposals should bundle less attractive sites with the most attractive ones, and constrain bidders to take them as one lot, like LADWP’s BlockFiT. This would maximize the utilization of rooftop space across the region, by incentivizing solar developers to include sites that are less interesting.

## 4.2 Unlocking Non-Rooftop Solar Potential

LADWP’s FiT is unique in that its projects are mainly developed on building rooftops. Other FiT programs have developed projects on diverse location types. For example, MCE’s FiT program has supported the development of solar systems on a variety of sites including commercial building rooftops, carports, and airports as well as ground mounts at an industrial park and quarry. This section examines three unique non-rooftop project opportunities that come with additional associated benefits.

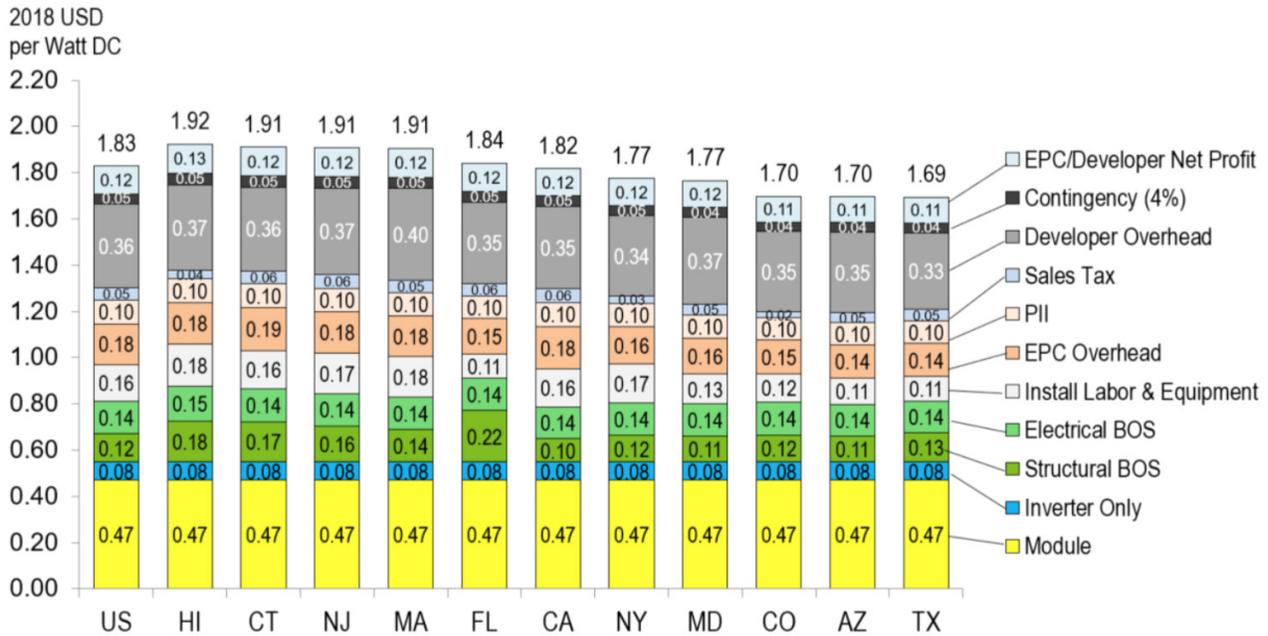
### 4.2.1 Carports

Installing solar on carports reduces building owners’ concerns about weight on the roof and potential leaks, keeps parked cars cooler, and reduces asphalt heat.<sup>30</sup> Adding solar installations on top of existing carport infrastructure would be ideal, but those opportunities are rare in Los Angeles. Interviewees also identified that the main barrier to building solar carports from scratch is the associated 30% to 50% increase in cost of construction. Even if the construction costs represent only a portion of the overall project costs, as illustrated

<sup>30</sup> Haley Gilbert, a researcher in the Heat Island Group of Lawrence Berkeley National Laboratory: “Because dark pavements absorb almost all of the sun’s energy, the pavement surface heats up, which in turn also warms the local air and aggravates urban heat islands.”

in Figure 10 below, interviewees estimated that 14.5¢/kWh was not enough to make carports financially feasible. One interviewee estimated that a 2¢ to 3¢ higher rate is necessary to make the construction of carports with solar panels feasible.

**FIGURE 10: NREL Q1 2018 Benchmark by Location: 200-kW Commercial PV System Cost (2018 USD/Wdc)**



Source: National Renewable Energy Laboratory (2018). *U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018*

Bundling solar carports with battery energy storage and electric vehicle (EV) charging stations would allow for cost share among three participants. For example, solar, battery and EV charging station companies could all share the costs of trenching, interconnection, and any potential network upgrades required by their business applications. Splitting these costs and the rent could offset the additional costs associated with the construction of carports. Moreover, these three technologies are each eligible for different additional incentives, and when combined, can be eligible for more subsidies. For example, under the Low Carbon Fuel Standard program, renewable electricity supplied directly to an EV charging station would qualify for lower carbon intensity value than if the electricity was supplied by the grid. This results in additional credits generated and a higher incentive.

#### 4.2.2 Ground Mounts

Ground mounted is the most cost-efficient manner of developing distributed local solar. Other FiT programs in California largely owe their success to this type of installation. SMUD received nearly enough bids to fill its entire 100 MW FiT within one day of program launch entirely with ground mounted systems, and at a rate lower than LADWP’s FiT rate.<sup>31</sup> Similarly, a lot of Sonoma Clean Power’s FiT projects are ground mounts.<sup>32</sup> This is primarily due to the fact that there are local rules restricting the development of solar on existing buildings.

The LCI’s 2010 report *Bringing Solar to Los Angeles* recommends that ground mounted represent a third of the local solar installations, suggesting up to 200 MW of capacity. However, these project types can be hard

<sup>31</sup> SMUD (2019). Email.

<sup>32</sup> Sonoma Clean Power (2018). Interviewee.

to implement in Los Angeles because the city suffers from a housing shortage and a dense, sprawling urban landscape. Moreover, some communities complained about this type of installation in places where they can be too visible, which can seem ironic in a city with thousands of visible oil wells. In 2014, a city council ordinance required all solar installations to receive a conditional use permit (CUP). LADWP and the LABC Institute worked with the Los Angeles City Council and Department of City Planning to negotiate a master CUP for rooftop and carport solar, but did not include ground mounted solar.<sup>33</sup> This poses an important barrier to ground mounted installations as they each require their own CUP, which can be an expensive and lengthy process.

Researchers recommend that ground mounted installations be better supported when LADWP expands its FiT program. One interviewee suggested an interim solution in which LADWP allows developers to secure the capacity allocation for ground mounted projects before beginning the CUP process, providing some stability and predictability to solar developers.

### **Brownfields and Oil Fields: Siting Opportunities for Ground Mounted in Los Angeles**

In light of the limited opportunities for ground mounted projects in Los Angeles, one interviewee suggested brownfields as a good place for such installations, as they have more limited uses due to the presence or potential presence of hazardous substances, pollutants, or contaminants.<sup>34</sup>

The City of Los Angeles Department of Sanitation administers the Citywide Brownfields Program, which provides assistance to “assess, clean up and revitalize Brownfield sites.”<sup>35</sup> Some brownfields projects can also qualify for both federal and state remediation incentives. No sites have been used for solar projects yet through the city’s program, however there are many examples of this nationwide. For example, MCE developed a 10.5 MW solar project on 60 acres of a remediated brownfield site.<sup>36</sup> While not all brownfield sites may be suitable for a solar development project, there are over 1,500 brownfield sites in the City of Los Angeles, as illustrated in Figure 11. Further research should be conducted to assess the potential for solar development on brownfields in Los Angeles depending on their classification, location, orientation, shading, and other constraints.

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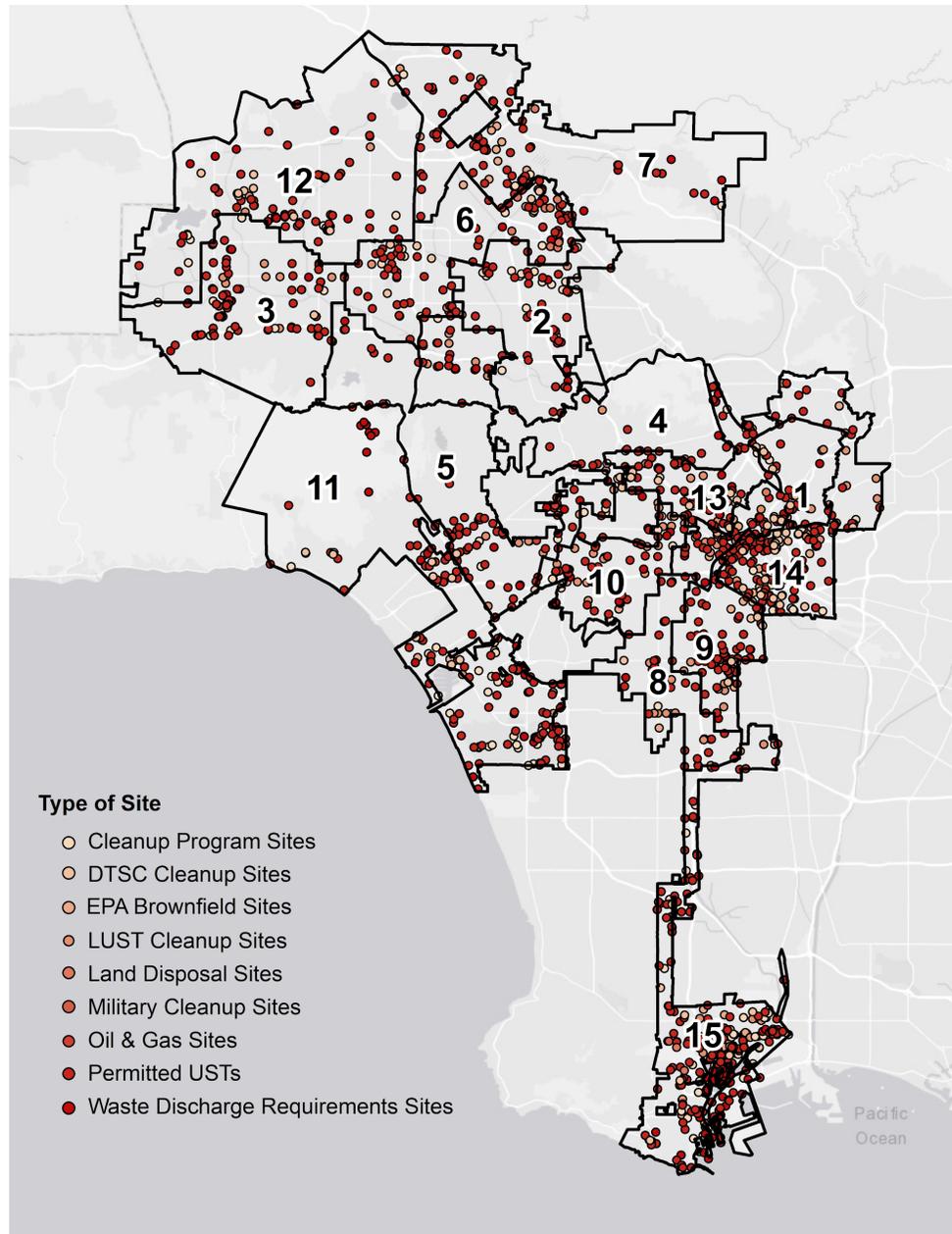
<sup>33</sup> [http://planning.lacity.org/PressRelease/HN\\_Q%26A\\_Infographic\\_SolarFiTCUP\\_Packet.pdf](http://planning.lacity.org/PressRelease/HN_Q%26A_Infographic_SolarFiTCUP_Packet.pdf)  
<http://file.lacounty.gov/SDSInter/bos/supdocs/95458.pdf>  
<http://cityplanning.lacity.org/staffrpt/initialrpts/CPC-2014-4595.pdf>

<sup>34</sup> Los Angeles Environment Sanitation (2019). “Citywide Brownfield Program.”

<sup>35</sup> City of Los Angeles (2019). LA Sanitation and Environment. “Citywide Brownfields Program.”

<sup>36</sup> MCE (2019). “Local Renewables.”

**FIGURE 11: Map of Brownfield Sites in the City of Los Angeles<sup>37</sup>**



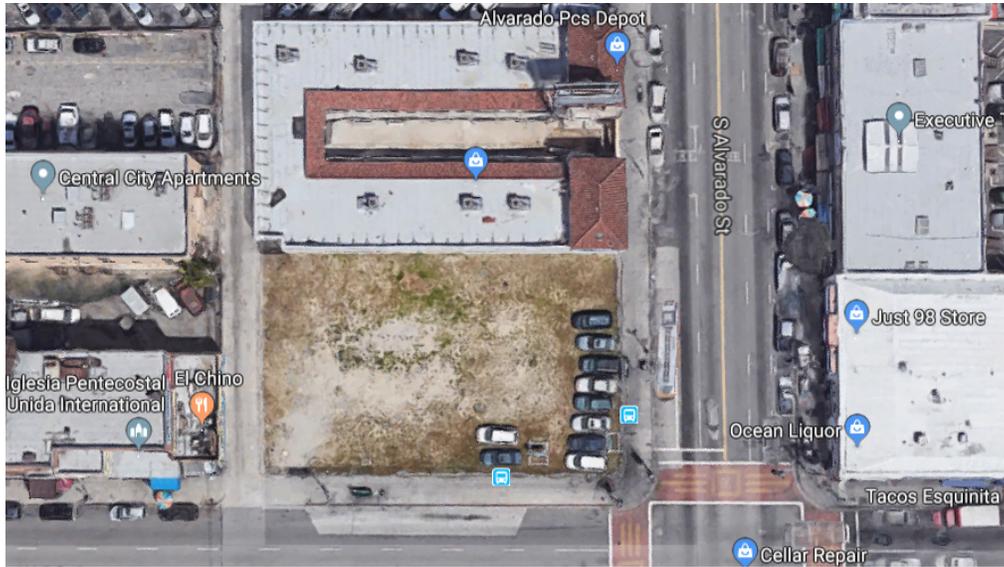
Source: Data from L.A. Dept. of Sanitation. Figure created by UCLA Luskin Center for Innovation.

Figure 12 below shows an example of brownfield located in CalEnviroScreen disadvantaged communities. This former gas station in the Westlake neighborhood of Los Angeles is classified as a LUST cleanup site (leaking underground storage tank). This 17,000-square-foot patch of land could accommodate a 285 kWdc solar system that could generate up to 457,900 kWh per year given no shading issue.<sup>38</sup>

<sup>37</sup> Map created by UCLA Luskin Center for Innovation. Brownfield site data from federal and state databases and compiled by L.A. Department of Sanitation and includes: Cleanup program sites identified by the State Water Resources Control Board; California Department of Toxic Substances and Control (DTSC) Cleanup Sites; EPA Brownfield Sites; leaking underground storage tanks (LUST) Cleanup Sites; Oil & Gas Sites; Permitted underground storage tanks (USTs); Waste Discharge Requirements Sites. Map excludes sites with a status of 'case closed.'

<sup>38</sup> L.A. County methodology: "Area in square feet is converted to area in square meters (divide area 10.76391), and multiplied by 0.181 (18.1% efficiency)."

**FIGURE 12: Brownfield Site Example**



Source: Google Maps (2019).

### 4.2.3 Floating Solar

Reservoirs provide another opportunity for future solar sites, especially in Los Angeles. LADWP estimated the capacity potential of local floating solar to be up to 53 MW.<sup>39</sup> The water temperature helps to cool the panels, which increases the power generation efficiency, while the panels prevent excessive water evaporation from the water reservoir and reduce the land burden in dense urban areas.<sup>40</sup>

The community choice aggregator Sonoma Clean Power had a similar project to cover a pond with a 12.5 MW floating installation. However, as noted in an interview, this project was canceled due to a combination of the interconnection costs required by PG&E for this installation, other requirements from the State Division of Safety of Dams, and the new government tariff on imported solar panels.<sup>41</sup>

In April 2018, former City Councilman Mitchell Englander introduced a motion to develop floating solar in Los Angeles. In July 2018, a 11.6 MW floating solar proposal on the Van Norman water reservoir was approved by the City Council.

## 4.3 Increasing Installations in Disadvantaged Communities and Their Social Benefits

Thirty-seven percent of active and in-service FiT projects are located in disadvantaged communities. These projects brought investments into disadvantaged communities and provide additional income to building owners. In some cases, those investments benefit the local communities by providing the local workforce with jobs and trainings.

These investments can be further leveraged to provide additional benefits to the local community. One example is the installation of a 35 kW solar system on the Esperanza Community Housing Corporation building by GRID Alternatives of Greater Los Angeles in collaboration with the 11th Hour Project and

<sup>39</sup> Council District 12 (2018). "Initiating the LADWP 'Floating Solar' Pilot Program."

<sup>40</sup> Divya Mittal, B K Saxena, and K V S Rao (2017). Floating solar photovoltaic systems: An overview and their feasibility at Kota in Rajasthan <https://ieeexplore.ieee.org/document/8074182/>  
[https://www.researchgate.net/publication/307540858\\_Floating\\_photo\\_voltaic\\_power\\_plantA\\_review](https://www.researchgate.net/publication/307540858_Floating_photo_voltaic_power_plantA_review)

<sup>41</sup> According to a discussion with Deb Emerson, Director of Power Services at Sonoma Clean Power

Enphase Energy. This building is located a few hundred feet away from active oil drilling in a neighborhood with poor air quality. The construction was realized with staff, volunteers, and youth from the Conservation Corps of Long Beach. The entirety of the revenues generated by this project is reinvested in the community. Part goes to the construction of a media lab, and the rest will support Esperanza's goal to develop and preserve affordable housing in the neighborhood.<sup>42</sup>

This project illustrates how the FiT program can improve its social benefits beyond installing rooftop solar on disadvantaged communities' rooftops. However, these types of projects are confronted with financial challenges, as they would not be feasible without the help of grants and other partnerships. Furthermore, the recent phaseout of the Solar Incentive Program (\$0.95/W installed for government, nonprofit and affordable housing customers) will hinder project development within and for disadvantaged communities.<sup>43</sup>

To increase the number of projects with social benefits, nonprofits like GRID Alternatives could use the revenues generated by the installation to first pay off project installation costs. Then, once the project becomes financially profitable, the benefits can be allocated to local electricity ratepayers in the form of credit on their electricity bills. A barrier to this, mentioned by an interviewee, is that the current billing software does not allow for the allocation of revenues or credits generated by a single solar system to multiple utility customers. A tool similar to "virtual net metering" could better facilitate the distribution of benefits to disadvantaged communities, increase the social impact of the FiT program, and palliate the inability for low-income ratepayers to invest in solar.

Importantly, virtual net metering would also enable the City of Los Angeles to leverage state funds. A recent report published by LCI estimates that "the City of Los Angeles is home to 43 MW of rebate-eligible affordable housing solar capacity, with the potential to save low-income residents over \$7 million in energy costs."<sup>44</sup> The report also identifies the absence of mechanism like virtual net metering as the most important barrier to allow the distribution of benefits produced by one solar system to several customers: "For example, the Low-Income Weatherization Program for Large Multifamily offers a rebate of up to \$3.50 per watt for the portion of a system that delivers direct financial benefits to affordable housing residents and \$1.50 per watt for the capacity that offsets the non-resident common area load. In the absence of a virtual net metering tariff, the City of Los Angeles and its public utility could be forgoing up to \$116.7 million in external state solar investment."

Another approach has been taken by MCE, a community choice aggregator. It offers an innovative solution for customers to benefit from local solar. Customers enrolled in its "Local Sol" electricity product directly support the FiT program through their electricity rate. Since customers' rate is based on the FiT price (plus a small administrative fee), customers pay a flat, fixed rate that will not increase during the 20-year FiT contract.<sup>45</sup> This provides an opportunity to customers who cannot install rooftop solar on their houses to benefit from local solar installations without any upfront investments required.

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<sup>42</sup> Grid Alternatives (2018). Flipping the Switch: Esperanza Community Housing welcomes a new era of energy justice at Alegria.

<sup>43</sup> According to an article written by PickMySolar: page 4 of the LADWP's 2017 Solar Incentive Program guidelines planned that funds stop being allocated on Dec. 31, 2018.

<sup>44</sup> DeShazo, J.R., Michael Kadish, Alex Turek (2018). Golden Opportunity: Affordable Housing in the Solar Metropolis

<sup>45</sup> MCE (2019). "Local Sol 100% Locally-Produced Solar Energy."

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## CHAPTER 5

# PRICE MECHANISM RECOMMENDATIONS FOR FIT PROGRAM EXPANSION

The recent decision to not repower 10 of the 26 natural gas generators within Los Angeles further justifies an expansion and a more tailored FiT program that better meets the future needs of the utility. According to an interviewee, LADWP's existing electrical grid has been designed to work with a specific configuration that includes these three power plants at full capacity. Consequently, distributed generation, dispatchability, and frequency regulation are important factors to consider when deciding how to replace these 1,662 MW of capacity that will be phased out. It is important to design a price mechanism that supports the development of local sources of energy with the most thoughtful, progressive, and innovative approach possible.

Setting up a FiT program rate is a particularly complex and difficult task to undertake. This chapter identifies a variety of important factors that need to be taken into consideration for a future program expansion. Researchers believe that a combination of a lower base rate with potential time of delivery rate multipliers and adders would better value when and where distributed electricity is generated. These price mechanism recommendations would ensure program cost-effectiveness while supporting projects that meet LADWP's distribution grid and capacity needs.

## 5.1 Discussion Around a Necessary Base Rate Update

### 5.1.1 Different Methodologies to Set a FiT Base Rate

There are multiple approaches to setting a program rate. Some rates are designed to reflect the cost components, while others reflect the monetized benefits of the program. The first methodology is often conducted with software like the System Advisor Model (SAM).<sup>46</sup> This tool provides an estimation of the necessary rate based on a breakdown of the cost components of a rooftop solar project, the incentives, the taxes, the financing and other parameters. Researchers did not use the SAM model to estimate a rate based on current cost components, because this would involve many assumptions that are often kept confidential by solar developers.

The second methodology, which has been used by SMUD, incorporates marginal cost (market price, ancillary services, generation capacity, transmission and subtransmission capacity); and for eligible renewable resources, the costs of avoided greenhouse gas emissions and risk avoidance of future natural gas prices.<sup>47</sup> This method estimates the value of distributed generation per amount of electricity produced, without taking into account the actual cost of construction of those solar projects. For example, for a 20-year contract in 2018, the annual average rate paid by SMUD is estimated to be 8.45¢/kWh.<sup>48</sup> This approach more accurately values the benefits of this program to ratepayers, the grid, and the utility. Through the E3 avoided cost calculator used in Chapter 2, researchers found that distributed solar saved approximately 9¢/kWh to ratepayers in the greater region of Los Angeles. However, this number is illustrative and needs to be tailored to the actual costs parameters specific to the LADWP's grid.

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<sup>46</sup> National Renewable Energy Laboratory (2018). System Advisor Model

<sup>47</sup> Sacramento Municipal Utility District (SMUD) (2018). Q&A Feed-In Tariff for Sale of Customer Sited Generation to SMUD.

<sup>48</sup> SMUD (2018). Rates. SMUD Feed-in Tariff for Distributed Generation (FiT)

Another method can be used to palliate cost uncertainties: market-based responsive pricing. This was implemented by the three investor-owned utilities for their 480 MW FiT program, also known as the Renewable Market Adjusting Tariff (ReMAT). The ReMAT rate was set by the “market price referent” (MPR), a mechanism that allows the rate to increase or decrease depending on market conditions and participants’ uptake. Such a mechanism provides greater flexibility, adaptability, and very likely, cost efficiency. The language, the capacity and the price mechanism were set by a CPUC decision in 2012,<sup>49</sup> and 59.6 MW of solar capacity were installed through this program before it was suspended in 2017.<sup>50</sup> While the MPR let the market condition set the right price for the FiT program and permitted a cost-effective approach, this mechanism was criticized by interviewed solar developers as it creates price volatility and uncertainty, which can further complicate negotiations with rooftop building owners and financial investors.

**5.1.2 Uncertainty Created by National and International Policies**

**Phaseout of the Federal Solar Investment Tax Credit**

As part of the Consolidated Appropriations Act (H.R.2029, 2016)<sup>51</sup>, the federal solar investment tax credit (ITC) will rapidly decrease, as illustrated by Table 5. The ITC directly reduces the income taxes of a person or company that invests in solar photovoltaic systems and/or solar water heating systems. The solar ITC is currently a one-time credit of 30% of the total system cost with no upper limit. Since its implementation, the ITC and the Modified Accelerated Cost-Reduction System (MACRS) have significantly supported solar deployment in the U.S.<sup>52</sup> However, when asked, most interviewees did not express major concern over the ITC phaseout in the context of this specific FiT program.

**TABLE 5: Phaseout of ITC**

	2019	2020	2021	2022	2023	2024+
Commercial Solar ITC	30%	26%	22%	10%	10%	10%

Source: United States Energy Information Administration (2016). Annual Energy Outlook 2016 with projections to 2040. LR-8.

The impact of the ITC on the feasibility of a project may also be influenced by the financing structure of the project. Some of the most common structures include single-owner, all equity partnership flip, leverage partnership flip, and sale leaseback. A study by NREL noted that “renewable energy project developers typically do not have sufficient taxable income to take full advantage of the tax incentives directly. Accordingly, renewable energy project developers have implemented a wide array of complex financing structures with specialized ‘tax equity investors’ (typically large investment banks or insurance companies) that have sufficient taxable income from other business activities and expertise to take advantage of the tax benefits.”<sup>53</sup>

**Tariffs on Imported Panels and Steel**

Several interviewees did note that the new panel and steel tariffs on imports will likely “hurt the industry more” than the ITC phaseout. The Trump Administration’s 30% tariff on solar panel imports erodes major

<sup>49</sup> California Public Utilities Commission (2012). Decision D.12-05-035.  
<sup>50</sup> The ReMAT was suspended in 2017 and is currently not accepting new applications as a result of the U.S. District Court’s determination that the program “violate[d] the Supremacy Clause of the U.S. Constitution by placing numerical limits on utility obligations to purchase power from QFs, and establishing a purchase price different than the utility’s avoided cost. The letter instructed the IOUs to not accept or approve new ReMAT contracts pending further CPUC action.” (California Energy Commission [2018]. Renewable Market Adjusting Tariff webpage).  
<sup>51</sup> Congress.gov (2016). “H.R.2029 - Consolidated Appropriations Act, 2016.”  
<sup>52</sup> Comello, Stephen, S. Reichelstein (2015). The Federal Investment Tax Credit for Solar Energy: Assessing and Addressing the Impact of the 2017 Step-Down  
<sup>53</sup> Mendelsohn, Michael, Claire Kreycik, Lori Bird, Paul Schwabe, and Karlynn Cory. (2012). The Impact of Financial Structure on the Cost of Solar Energy, CO: National Renewable Energy Laboratory.

gains in cost reductions. Additionally, as racking systems are made of steel, the new 25% steel tariff and 10% aluminum tariff also will increase installation costs. Specifically, interviewees noted that the unpredictability surrounding the tariffs caused the most issues. This policy decision is likely to impact FiT installations, NEM customers, utilities, and solar developers in general. However, the panel tariff will decrease over time.

Finally, the foreign exchange rate between China and the U.S. is also likely to impact the price at which Chinese manufacturers sell their solar panels to American solar developers.

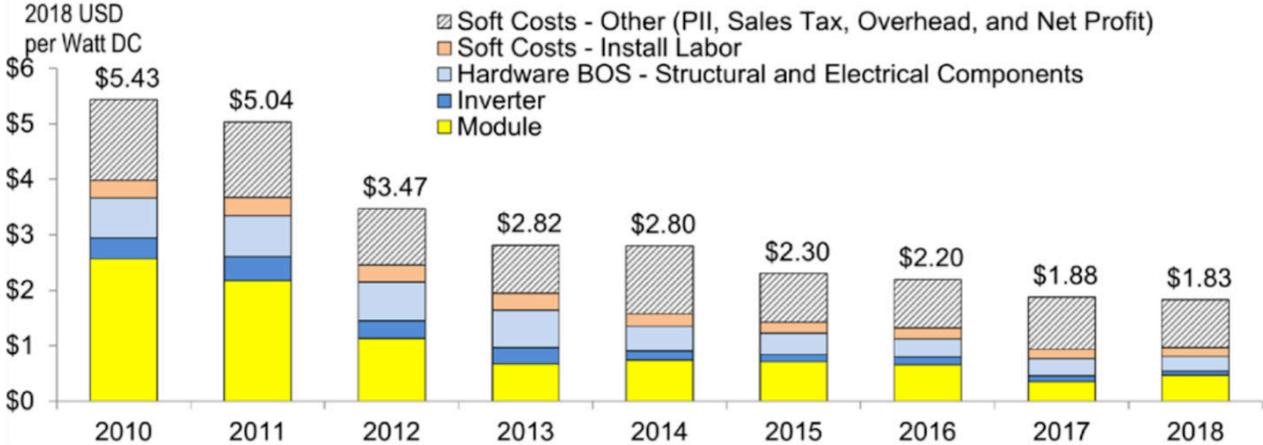
**5.1.3 LADWP: A Necessary Base Rate Update?**

**Historical Downward Cost Trend**

According to the National Renewable Energy Laboratory, commercial rooftop solar installation costs have decreased by 66% between 2010 and 2018: “79% of that reduction can be attributed to total hardware costs (module, inverter, and hardware BOS)... An additional 5% can be attributed to labor... The final 16% is attributable to other soft costs, including PII, sales tax, overhead, and net profit.”<sup>54</sup>

When LCI advised to relaunch the 65 MW remaining capacity at the flat rate of 14.5¢/kWh in 2016, the analysis was based on the 2015 average cost of commercial rooftop solar in the U.S.: \$2.30/W installed.<sup>55</sup> According to Figure 13, the commercial PV system cost benchmark has dropped 20% between 2015 and 2018. Everything else held constant, this downward cost trend should trigger a rate adjustment of the FiT program down to 12¢/kWh. This is further supported by an interviewee who commented that as a result of recent tax revisions the payback period for solar projects with LADWP has shortened to four years today, which leaves room for a rate update.

**FIGURE 13: NREL Commercial PV System Cost Benchmark Summary (Inflation Adjusted)**



Source: National Renewable Energy Laboratory (2018). U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018.

**Successful Projects Delivered at Lower Prices**

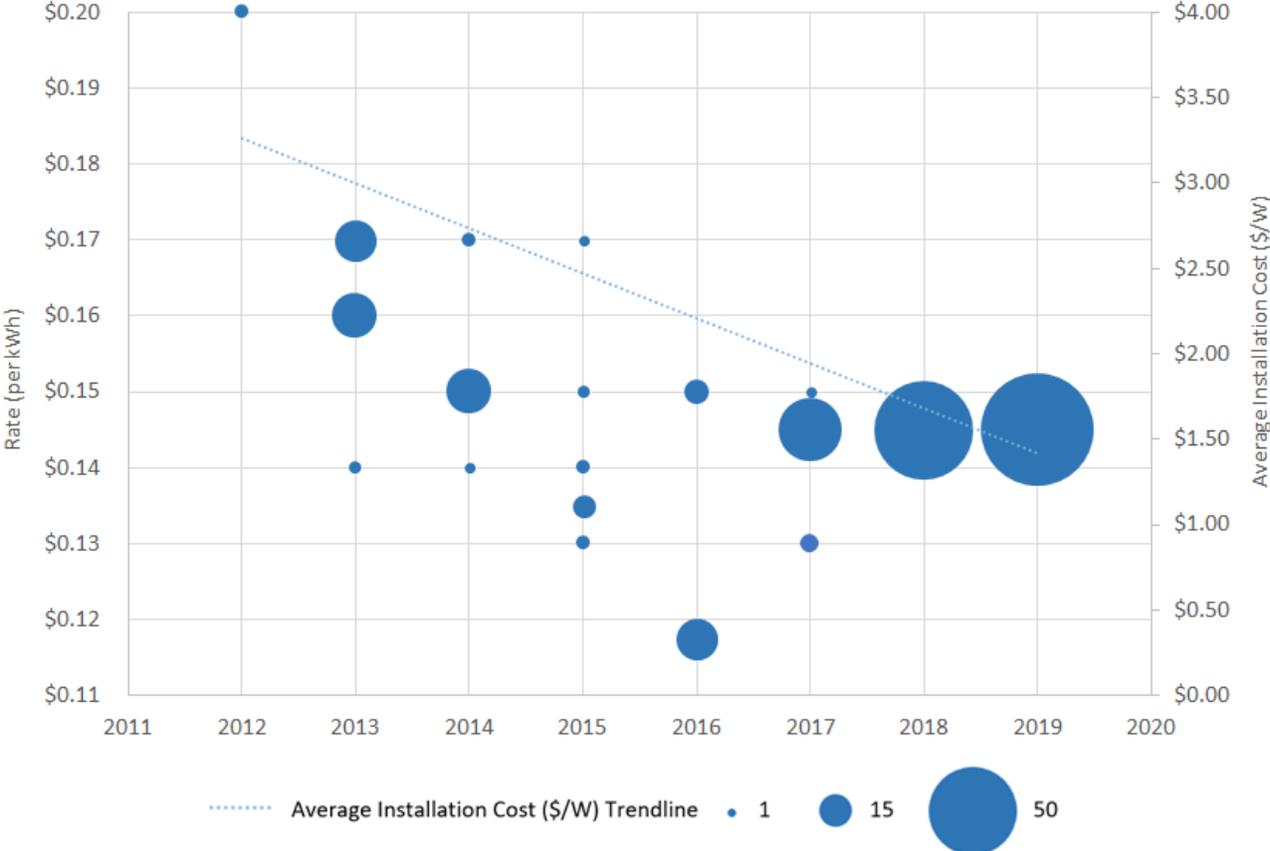
Figure 14 below displays the number of project applications submitted each year to LADWP and their awarded rate. The larger the circle, the greater the number of projects. The dashed line shows the trendline of NREL’s average annual installation cost per watt using the secondary axis on the right of the graph. This shows that 14.5¢ allowed for a large amount of capacity to be awarded after two years of slower uptake from solar developers. This graph also shows that rooftop solar installation can still happen at a lower rate. Now

<sup>54</sup> Fu, Ran, David Feldman, and Robert Margolis. 2018. U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018. Golden, CO: National Renewable Energy Laboratory.

<sup>55</sup> Ibid.

that LADWP has reached its first 150 MW target, the utility needs to make a choice: allowing for as much capacity installed as quickly as possible, or revise the base rate down to increase cost efficiency of the program. In any case, LADWP would benefit from updating its price mechanism to foster innovation, reflect economies of scale, and address some of the future challenges resulting from the phaseout of natural gas generation.

**FIGURE 14: Frequency of Successful Applications by Rate per Year**

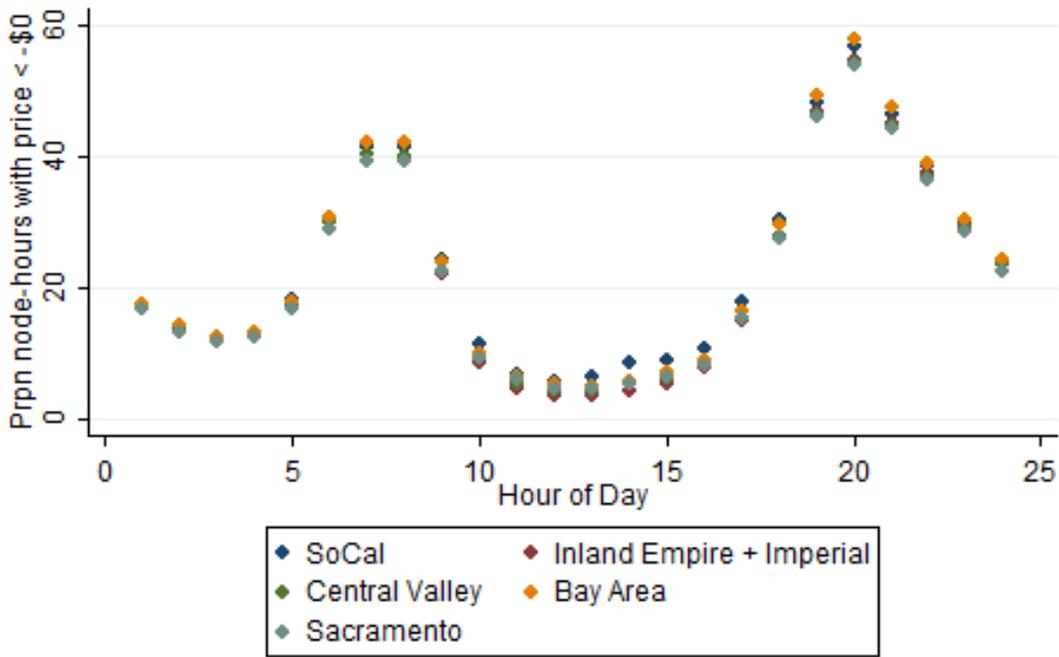


Source: Data from LADWP. Figure created by UCLA Luskin Center for Innovation.

### 5.2 Time of Delivery: Reflecting the Temporal Value of Electricity

While a flat rate benefits from simplicity and provides solar developers with certainty about future revenues, it does not take into account the important temporal variation in the market value of electricity in California. The increasing penetration of solar has shifted the net peak demand to later hours, when the sun does not shine, resulting in higher prices around 8 p.m. as illustrated in Figure 15 below. The continued growth in solar generation without battery storage will exacerbate this price differential between peak and off-peak hours, and will most likely increase technical challenges posed to the grid.

**FIGURE 15: Average Day-Ahead Price (\$/MWh) in March 2017**



Source: Data from CAISO. Figure created by Samuel Krumholz for the UCLA Luskin Center for Innovation.

A time of delivery (TOD) rate better reflects when electricity is needed, and indirectly incentivizes dispatchable renewable energy sources like renewable natural gas, biomass, or storage, which support distribution grid reliability. Prior to 2017, LADWP offered TOD multipliers as detailed in Table 6.

**TABLE 6: LADWP’s TOD Multipliers**

		High Peak	Low Peak	Off Peak
		1 p.m. to 5 p.m.	10 a.m. to 1p.m. 5 p.m. to 8 p.m.	8 p.m. to 10 a.m. All Day Weekends
High Season	June to September	2.25	1.1	0.5
Low Season	October to May	1.3	0.9	0.5

Source: LADWP Board Approval Letter (2013).

A time of delivery multiplier can also incentivize different solar panel installation orientation so electricity generation better aligns with the actual need for electricity, as the direction solar panels face affects when and how much electricity is generated. For example, the California Energy Commission previously provided incentives for specific installation orientations by offering up to \$500 for west-facing panels (azimuth between 259 to 281 degrees) through the New Solar Homes Partnership, in order to help smooth down the ramping needs during sunset.<sup>56</sup>

Researchers analyzed how different solar panel orientations and rate structures could result in more electricity generation at times that the electricity is more valuable. Using NREL’s System Advisor Model (SAM), researchers estimated electricity generation and revenues generated by a 1 MWac installation facing south (azimuth 180 degrees), southwest (azimuth 225 degrees), and west (azimuth 270 degrees) in Los Angeles. Each scenario was run with flat rate of 12¢/kWh, and with TOD multipliers using a base rate of 12¢/kWh.

<sup>56</sup> The incentive was offered from September 2014 to March 2017, as per the California Energy Commission (2017) New Solar Homes Partnership Guidebook: Tenth Edition - Revised.

Using E3’s Avoided Cost Calculator, researchers also estimated the associated benefits of distributed generation for each scenario, which include the avoided costs associated with reduced needs for transmission and distribution, capacity, losses, and more. For more information on this model, see Chapter 2.

Table 7 below summarizes this analysis. Holding the capacity constant, south-facing panels generate the greatest total electricity, but southwest-facing panels result in more avoided costs. Scenario 1 examined these benefits under flat rate. A flat rate incentivizes south-facing installations because they maximize the total generation output. However, when considering the total avoided costs, west-facing panels provide a lower net cost per kWh to the utility.<sup>57</sup> In this scenario, the benefits for program participants and the utility are not aligned.

Scenario 2 uses TOD multipliers that better align program participants’ and the utility’s interests: despite generating less electricity, southwest-facing panels would provide more revenues to solar developers while also generating more electricity when most needed. These installations consequently increase the total avoided costs resulting in lower net costs per kWh.

**TABLE 7: Comparison of South, Southwest, and West-Facing Panels**

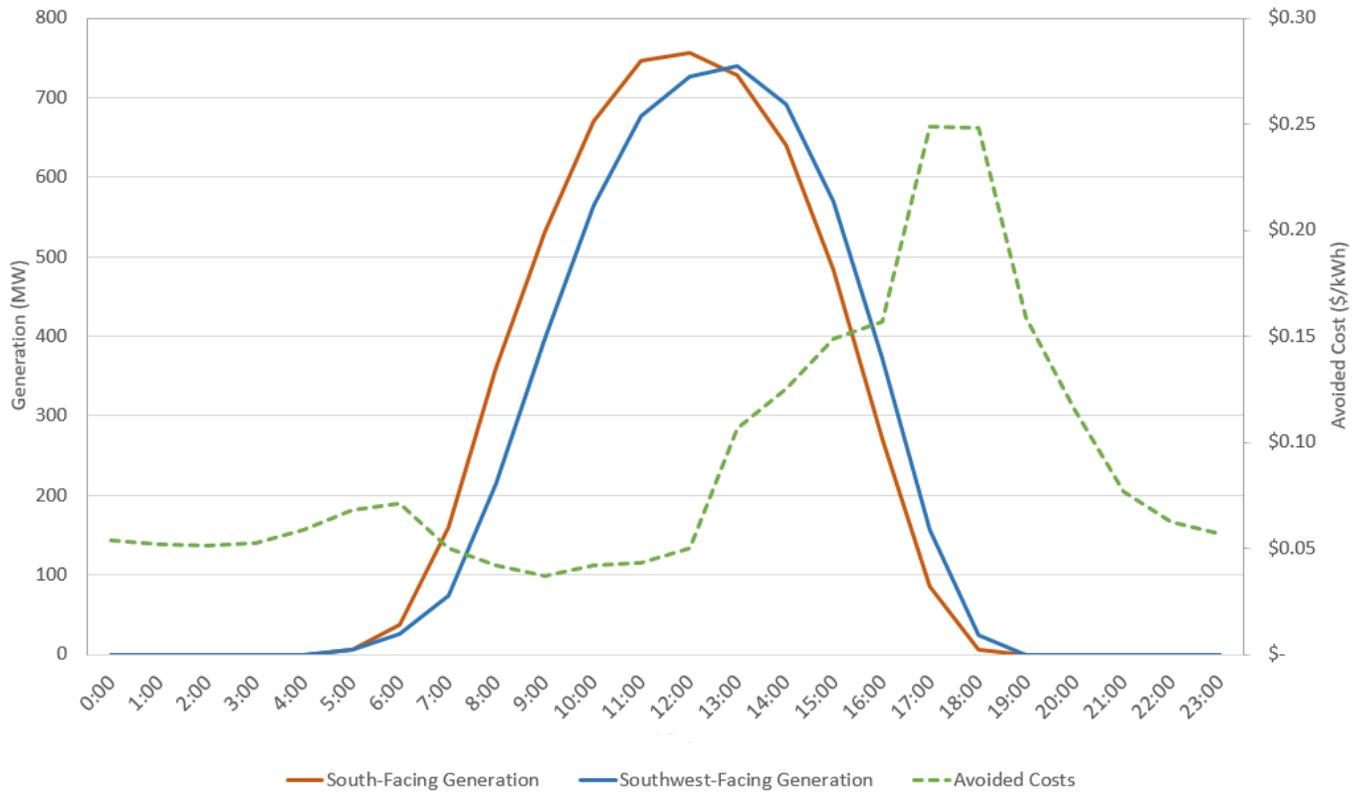
	South	Southwest	West
Annual Generation	<b>2,000,804 kWh</b>	1,912,635 kWh	1,712,006 kWh
Annual Avoided Costs	\$159,008	<b>\$172,257</b>	\$161,809
<b>Scenario 1: 12¢ per kWh Flat Rate</b>			
Annual Revenues for Participants	<b>\$240,096</b>	\$229,516	\$205,441
Net Cost per kWh	-4.1¢	-3¢	<b>-2.5¢</b>
<b>Scenario 2: TOD Multiplier using a 12 ¢ per kWh Base Rate</b>			
Annual Revenues for Participants	\$244,266	<b>\$248,361</b>	\$230,816
Net Cost per kWh	-4.26¢	<b>-3.98¢</b>	-4.03¢

Source: Analysis completed by UCLA Luskin Center for Innovation using data from NREL’s SAM and E3’s Avoided Cost Calculator.

Figure 16 illustrates how electricity generation and average avoided costs per kWh of distributed generation vary throughout the day in the Greater Los Angeles Region. Southwest-facing panels capture more of the avoided-costs benefit than south-facing panels, as they produce more electricity between 5 p.m. and 7 p.m. TOD multipliers can also be designed in such a manner that would encourage the inclusion of battery energy storage.

<sup>57</sup> Net cost per kWh is calculated by taking the cost of the installation to the utility (annual revenue to participants) minus the benefit of the program (annual avoided costs) and dividing by the annual generation.

**FIGURE 16: Avoided Costs and Generation for South-Facing versus Southwest-Facing Installations**



Source: Figure completed by UCLA Luskin Center for Innovation modeled using NREL’s SAM and E3’s Avoided Cost Calculator.

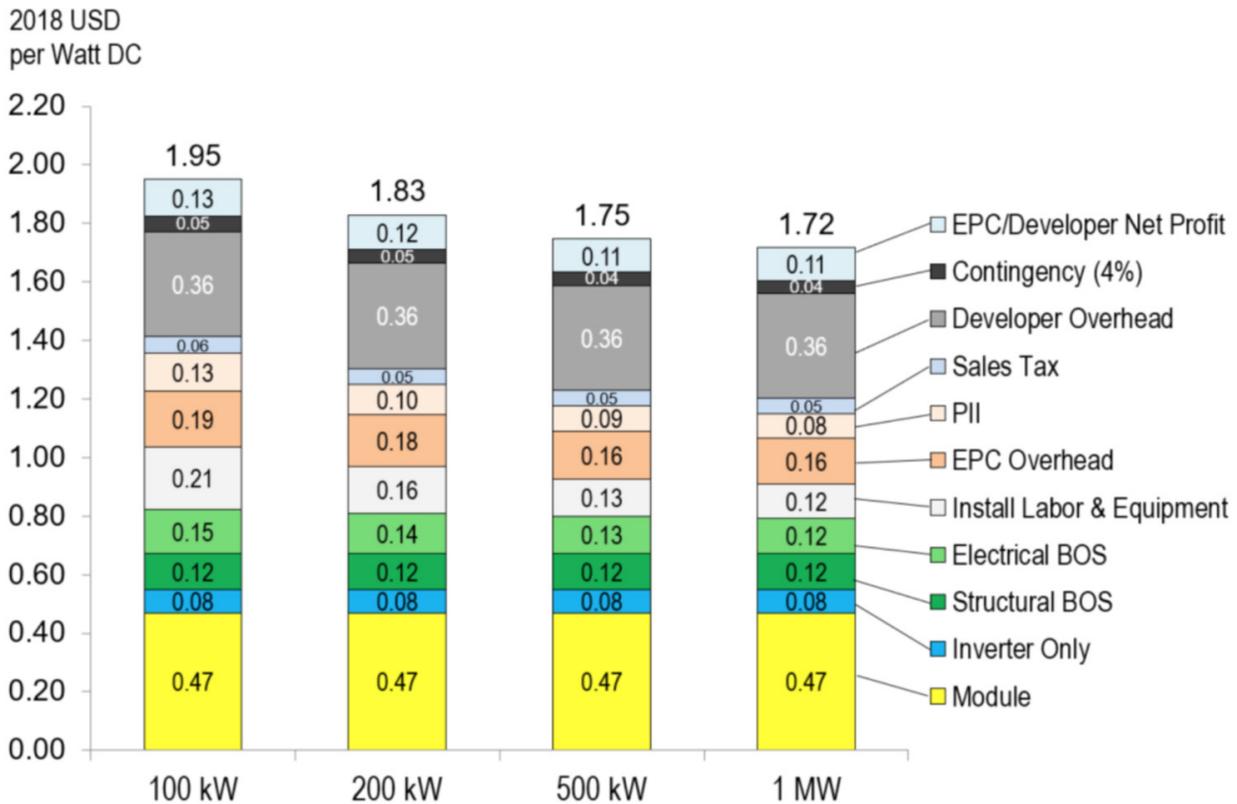
### 5.3 Adders: Tailoring Rate to Project’s Specificities

This section illustrates the benefits of adders to better reflect the economies of scale, technological innovation, and locational value of each project.

#### 5.3.1 Adders to Reflect Economies of Scale and Complexity

Offering the same flat rate for a 100 kW or a 3 MW rooftop solar installation does not guarantee the most cost-efficient approach for LADWP’s ratepayers as it ignores the barriers and opportunities provided by economies of scale. Figure 17 below shows the variation in commercial PV system installation costs per watt installed depending on their size.

**FIGURE 17: Q1 2018 U.S. Benchmark: Commercial PV System Cost (2018 USD/Wdc)**



Source: National Renewable Energy Laboratory (2018). *U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018*.

Consequently, one option often taken by utilities is to offer a FiT program with a low flat base rate that would only attract applicants with large ground mounted projects. Then, adders can be offered for smaller installations and/or more complex projects like those built on rooftops, carports, or reservoirs. Such a rate design would allow for a more cost-effective program that reflects the unique costs of each project.

The Clean Coalition also recommends pricing that varies according to a project’s type and size in its recently designed program tailored to the City of San Diego, which suggests a lower base rate. Then, adders can be included to reflect varying installation costs. They recommend that a 100 kW system installed on a roof would receive more than a 1 MWac ground mounted installation, as exemplified in Table 8.<sup>58</sup>

**TABLE 8: Clean Coalition’s Pricing Recommendations for the City of San Diego’s FiT**

Capacity (kWac)	Project Location	Installation Cost (per Wdc)	Base Rate (per kWh)	Location Adder (per kWh)	Size Adder (per kWh)	20-year fixed PPA price (per kWh)
100 kW	Rooftop	\$2.19	8¢	+ 1.6¢	+1.6¢	11.2¢
350 kW	Rooftop	\$2.02	8¢	+1.6¢	+0.8¢	10.4¢
500 kW	Rooftop	\$1.96	8¢	+1.6¢		9.6¢
1 MW	Rooftop	\$1.81	8¢	+1.6¢		9.6¢
1 MW	Ground mount	\$1.76	8¢			8¢

Source: Clean Coalition (2019). *City of San Diego Final Draft Feed-in Tariff Design*.

### 5.3.2 Adders to Incentivize Dispatchability

Battery storage mitigates issues inherent to solar energy: It allows for generation to be stored and released.  
Note: The use of this example is not to recommend that LADWP adopt the same price, but rather to illustrate how an adder can vary to reflect differences in installation cost due to project size and installation location.

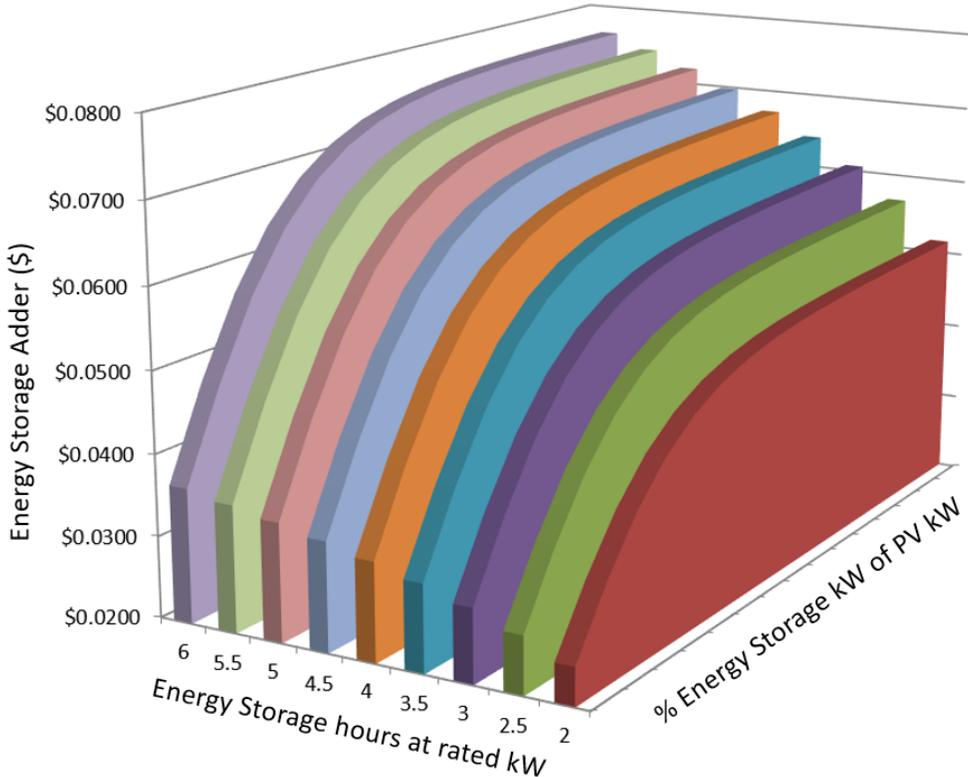
when needed, which transforms a nondispatchable and intermittent energy source into a clean and reliable power source for the distribution grid. Storage coupled with solar also helps to increase the hosting capacity of the distribution grid, as not all power would be released and withdrawn at the same time. Finally, supporting battery storage installations would help LADWP to achieve its AB 2514 energy storage targets of 155 MW by 2021, 25 MW of which are to be distribution connected.<sup>59</sup>

Interviewees identified that storage could easily be incorporated into FiT projects without sacrificing solar capacity, as it does not require significant additional space. Section 4.2.1 provides an example of how carpools can also support storage deployment in key areas, without decreasing the total solar installation size.

When considering how to incentivize storage, interviewees encouraged that LADWP consider which benefits it wants to prioritize. For example, using storage solely for resource adequacy may need a different incentive structure than using storage to deal with an excess of generation during the day and smooth down the ramp-up needs during sunset time. The Solar Massachusetts Renewable Target (SMART) program provides a great example of how to value storage.<sup>60</sup> This program provides a per kWh adder that depends on two factors: the size and the duration of energy discharge, as illustrated in the graph below.<sup>61</sup>

**FIGURE 18: Massachusetts SMART Program Energy Storage Adder**

Source: Solar Massachusetts Renewable Target (SMART) Program (2019). “Energy Storage Calculator.”



<sup>59</sup> LADWP (2017). Los Angeles Department of Water and Power Assembly Bill 2514 - Energy Storage Procurement Target Reevaluation. [http://www.energy.ca.gov/assessments/ab2514\\_re-eval\\_reports/LADWP\\_AB2514\\_Package.pdf](http://www.energy.ca.gov/assessments/ab2514_re-eval_reports/LADWP_AB2514_Package.pdf)

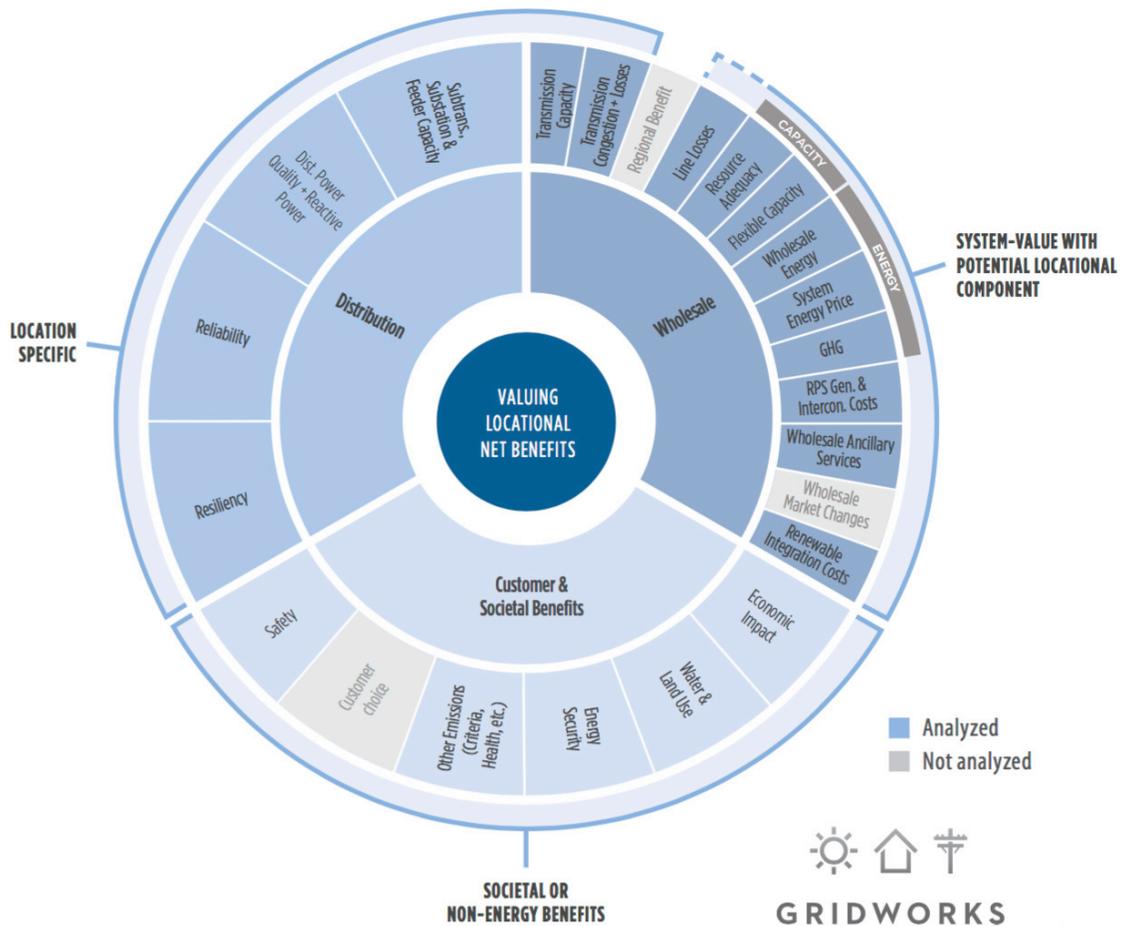
<sup>60</sup> Mass.gov (2019). “Solar Massachusetts Renewable Target (SMART).”

<sup>61</sup> Massachusetts Department of Energy Resources (2018). “Solar Massachusetts Renewable Target (SMART) Program Summary.”

### 5.3.3 Locational Adder to Maximize Grid Benefits

Projects sited in grid-constrained areas can alleviate some of the stress on the distribution grid, avoid costly grid upgrades, and avoid the construction of new lines. Because Net Energy Metering (NEM) and FiT programs share some of the same drawbacks, researchers believe that the recent discussions around NEM policy in California could inform improvements to LADWP’s future FiT program. To assist in these policy revisions, Gridworks published a recent study that analyzes alternative NEM payout structures. One focuses on estimating the locational value of the electricity exported to the grid by assessing the benefits that solar electricity generation provides to the system depending on where the installation is located. Figure 19 summarizes these location-specific benefits by sorting them into three categories: distribution benefits, wholesale benefits, and customer and societal benefits. LCI suggests that LADWP consider some of these important location-specific benefits such as reliability and resiliency, avoided line losses and more.<sup>62</sup> The FiT program could adopt a similar pricing valuation to the one under consideration for NEM to encourage project development in places that maximize grid benefits.

**FIGURE 19: Value Components Included in the Locational Net Benefits Analysis of Gridworks’ Paper**

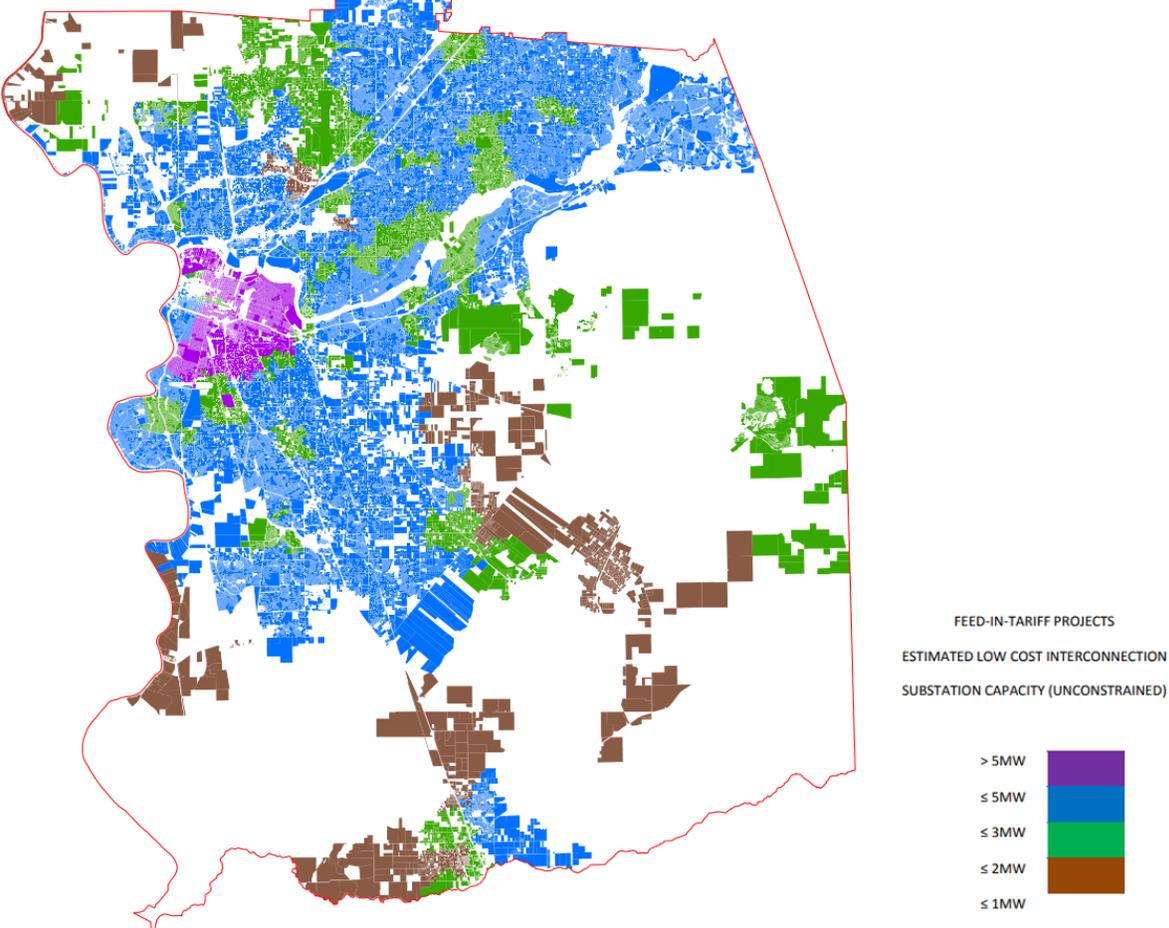


Source: Gridworks (2018). *Sustaining Solar Beyond Net Metering*.

<sup>62</sup> Gridworks (2018). "Sustaining Solar Beyond Net Metering."

Some tools already exist to help identify buildings and their potential rooftop capacity in Los Angeles: LA County’s Solar Map Application<sup>63</sup> and Google’s Project Sunroof.<sup>64</sup> The expansion of a similar tool with information related to the distribution network lines, such as existing and available capacity, estimated cost of interconnection, locational value or adders, could benefit both solar developers and LADWP with siting and grid management. Similar tools, known as integration capacity analysis, have been developed for some investor-owned utilities and cities. For example, the Clean Coalition has recently released its Solar Siting Survey for the City of San Diego, which includes important information for each distribution lines.<sup>65</sup> The map uses SDG&E’s integration capacity analysis to display available generation capacity for each three-phase segment of the distribution grid based on the information retrieved from the closest feeder. SMUD also provided a map for potential applicants illustrating the current capacity limitations on their distribution system with associated estimated interconnection costs.

**FIGURE 20: SMUD’s Interconnection Map**



Source: SMUD (2009). “Interconnection Map.”

The development of such tools could help solar developers identify locations with larger hosting capacity, and potentially, lower interconnection costs, prior to submitting an application. Furthermore, if LADWP offers the locational adder, it will help solar developers prioritize the installations that benefit the grid, as they would generate higher revenues.

<sup>63</sup> <http://egisgcx.isd.lacounty.gov/solar/m/?viewer=solarmap>  
<sup>64</sup> <https://www.google.com/get/sunroof#p=0>  
<sup>65</sup> Clean Coalition (2018). “Solar Siting Survey: San Diego.”



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