ASPEN TECH POLICY HUB

# Virtual Net Energy Metering Plus

## A New Pilot Program for the Los Angeles Department of Water and Power

**Dillon Cruz**

ASPEN TECH POLICY HUB

# Virtual Net Energy Metering Plus

## A New Pilot Program for the Los Angeles Department of Water and Power

**Dillon Cruz**

*Cover image by Anete Lusina on Pexels*

# Contents



*Photo by Tom Arran on Unsplash*

*Image by Sungrow EMEA on Unsplash*

# Introduction

The Virtual Net Energy Metering Plus program is a pilot expansion of the City of Los Angeles's Virtual Net Energy Metering Program that would bring local energy storage to low-income renters. This program would incentivize landlords to install solar-and-storage systems with direct financial returns for renters. This operational plan provides more information for how the City of Los Angeles Department of Water and Power (LADWP) would be able to implement this pilot program.

# I. Goals

The primary goals of the Virtual Net Energy Metering Plus program described in this Operational Plan are to:

- Extend the benefits of energy storage to renters in multifamily buildings served by the LADWP.
- Discover the willingness of Los Angeles multifamily building owners to invest in energy storage.

# II. Background

In January 2021, the Los Angeles Board of Water and Power Commissioners ("Board") passed a series of resolutions that enabled LADWP to run two new pilot programs:

- The Virtual Net Energy Metering (VNEM) Pilot Program, which allows owners of **multifamily buildings** to install solar energy systems on their properties and sell all of the generated energy directly to the LADWP, with the requirement that 40 percent of the revenue is apportioned among tenants; and
- The Feed-In Tariff Plus (FiT+) Pilot Program, which allows owners of **commercial properties** to install solar energy systems paired with energy storage on their properties and sell all of the generated energy directly to the LADWP, with a revenue multiplier if the energy is sold during hours of greater system-wide need ("peak demand hours").

LADWP has not yet proposed or implemented any customer-facing pilot program that explicitly incentivizes adoption of energy storage in residential properties.



# III. Program Overview

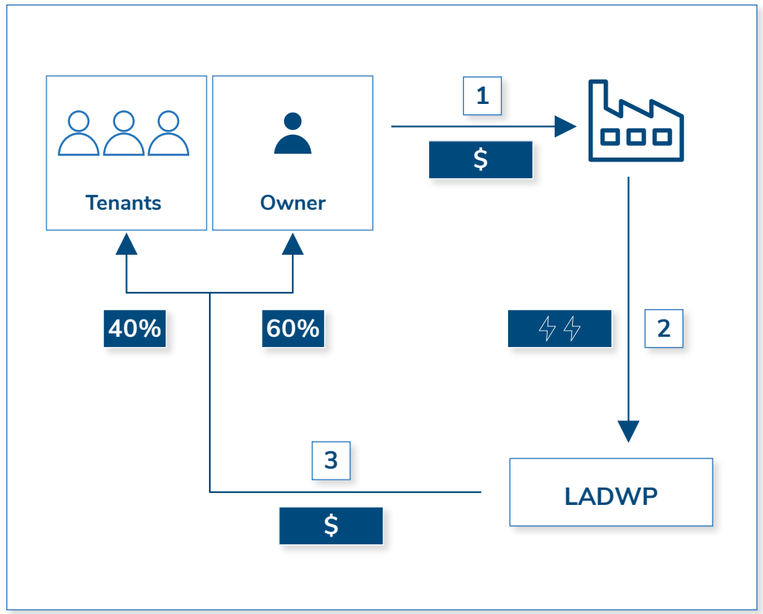



***Figure 1**. An overview of how the Virtual Net Energy Metering Plus (VNEM+) Pilot Program works. First, the owner of a multifamily apartment building secures and pays the upfront capital needed to install a solar+storage energy system on their property (Step 1). Over time, the LADWP purchases electricity from this building (Step 2). At least 40 percent of the building's sales revenue goes straight to the tenants; the other 60 percent is paid to the owner (Step 3).*

Our proposed Virtual Net Energy Metering Plus (VNEM+) Pilot Program is a new program that builds upon the structure of VNEM using mechanisms from FiT+.

VNEM+ would allow owners of multifamily buildings to attach an energy storage system to a VNEM-qualifying solar panel system. The owners would then sell all of the generated energy directly to LADWP at a predetermined price. In a mechanism borrowed from FiT+, owners could also sell this energy at a much higher predetermined price if they dispatch and sell the energy during peak demand hours, presumably using energy storage. In keeping with VNEM's original requirements on owner revenue, at least 40 percent of the revenue would be required to be apportioned among tenants, with the rest of the revenue flowing to building owners.

# IV. Program Design

## 1. AUTHORITY OF LADWP TO IMPLEMENT VNEM+

The Board may, by resolution, delegate authority to the General Manager of LADWP to implement and execute renewable energy purchasing contracts under the Los Angeles Administrative Code (LAAC) §10.5.2, which also explicitly allows for sellers to combine renewable energy generation with energy storage. Thus, we do not believe LADWP would need City Council approval to implement VNEM+.

Further, the LADWP does not need to request the Board for an expansion of LADWP's renewable energy purchasing contract authority to implement a new program like VNEM+. Instead, the Board may, by resolution, reallocate toward VNEM+ any amount of unused contracting capacity, which currently totals 19.6 MW, from the 150 MW authorized by the Board under Resolution 020 059.

Note that LADWP must also own all Renewable Energy Credits produced by VNEM+ projects, per LAAC §10.5.2.

## 2. PROGRAM ADMINISTRATION

VNEM+ is a new program that would be managed by the LADWP Power System Department and its internal Distributed Energy Resources Program. This new pilot program may also be jointly managed by LADWP FiT+ Group and LADWP VNEM Group, due its similarity to those customer-facing programs.

## 3. PROGRAM CAPACITY

LADWP should restrict VNEM+ program capacity to 3 MW, with support for two to ten projects, in order to keep the scope of this pilot program small.

**Definition of "program capacity"**

The upper limit on the total amount of energy that all projects participating in the program can collectively discharge at any single moment into LADWP's power grid.

## 4. PROJECT CAPACITY

Projects participating in VNEM+ should have a maximum project capacity of 3 MW (in keeping with other LADWP programs) and a minimum project capacity of 10 kW.

The 10 kW minimum project capacity purposefully departs from practices set in other LADWP programs in order to expand access to more renters. Most other LADWP programs have a minimum project capacity of 30 kW. This minimum project capacity excludes the 76 percent of multifamily buildings that have <30 kW output potential, representing 36 percent of multifamily renters.[1]

**Definition of "project capacity"**

The amount of energy that a single energy system is authorized to dispatch to the grid, according to the guidelines of the LADWP program in which the energy system is participating. In most LADWP customer-facing programs, participating projects may have a maximum project capacity of 3 MW and a minimum project capacity of 30 kW.

"Project capacity" may also be called "interconnection capacity."

## 5. SELECTION PROCESS

To quickly gain signal about the energy storage market, VNEM+ applications should be evaluated and selected through a competitive bidding process, as is done with FiT+. After collecting submissions for a period of time (e.g., 120 days), LADWP should award contracts that:

- Minimize costs (e.g., projected total power purchase costs and interconnection costs);
- Optimize grid benefits (e.g., project location and energy production profile);
- Maximize financial benefits for tenants (e.g., tenant apportionment percentage); and,
- Satisfy all technical and eligibility requirements.

### 5.1. Future Consideration: Local Workforce Priority

In the future, to further its local development and environmental justice goals, LADWP may choose to favor applications that prioritize partnerships or sub-contracting with Los Angeles–based organizations and contractors, especially those that are based in or hire from disadvantaged communities across Los Angeles.

*Image by Cristiano Firmani on Unsplash*

## 6. ECONOMIC COMPENSATION

### 6.1. Energy Purchasing with Multipliers and Revenue-Sharing

LADWP should use data from electrical meters installed on site at the project building to determine how much energy is sold by property owners who are participating in VNEM+ and when. Then LADWP should pay those owners in a manner that combines FiT+ and VNEM economic compensation mechanisms, outlined below.

#### 6.1.a. Base Price of Energy, Adapted From FiT+

When applying to participate in VNEM+, property owners should propose a base price of energy (BPE) as part of their competitive bidding strategy. Adapted from FiT+, the BPE is the minimum price at which LADWP would purchase energy from the owners. Allowing owners to competitively set their BPE allows the LADWP to gain a better understanding of the expectations that property owners have regarding the financial returns of solar+storage systems.

#### 6.1.b. Price Multipliers, Adapted From FiT+

LADWP should adopt the "price multiplier" mechanism from FiT+. Each kilowatt-hour of renewable energy sold to LADWP under VNEM+ should be purchased at the BPE multiplied by a price multiplier that is determined at the time of energy dispatch.

Ideally, the price multiplier would give owners the financial incentive to dispatch energy when LADWP's grid needs it most. Thus, the price multiplier should be higher at times when LADWP electricity supply is limited and costly (i.e., during peak demand hours), and should be lower when LADWP electricity supply is abundant and cheap (e.g., during daylight hours). Because peak demand hours usually overlap with the late evening, owners would likely need energy storage to take full advantage of this financial incentive.

We therefore propose that LADWP use the predefined price multipliers outlined in Table 1, which vary based on peak demand hours (time of day) and season.

| Season | Exact dates | Time of day | BPE multiplier |
|---|---|---|---|
| **Winter/Spring** | November 1–May 31 | 5:00–10:00 p.m. | **2x** |
| **Summer/Fall** | June 1–October 31 | 3:00–8:00 p.m. | 3x |
| | All other times | | 1x |

*Table 1: How the base price of energy (BPE) depends on the season and time of day*

#### 6.1.c. Revenue Sharing, Adapted From VNEM

As with VNEM, when applying to participate in VNEM+, property owners should propose the percentage of revenue that will be shared with their tenants. LADWP should require a revenue-sharing percentage of at least 40 percent.

#### 6.1.d. On-Bill Payments

As with VNEM, payments for owners and tenants should be disbursed on a monthly basis. However, LADWP should apply VNEM+ payments directly to customer bills to maximize the likelihood that tenants receive financial benefits from this program. This is a departure from the VNEM program, in which tenants are paid using individually apportioned physical checks mailed to their address.

### 6.2. Future Consideration: Value-Based Compensation Model

Given that energy storage incentives are a new concept for Los Angeles (and the world at large), LADWP is presented with the opportunity to experiment with compensation models. A compensation model fairer than the aforementioned "Energy Purchasing with Multipliers" design might instead pay property owners for the holistic, system-wide value of services provided by energy storage, rather than simply paying for energy itself. Such services included avoided/deferred costs from distribution and transmission system upgrades, voltage stabilization, frequency regulation, peak demand reduction, and, in the future, load shift and demand response. Methodologies like E3's Avoided Costs Calculator could assist LADWP in quantifying this system-wide value.

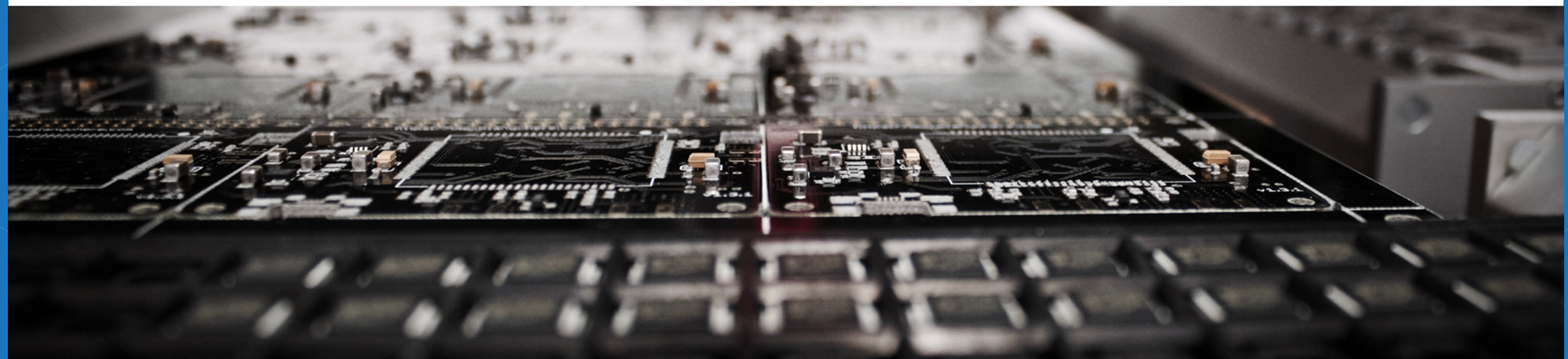
## 7. IMPACT ON LADWP EXPENDITURES

If LADWP implements VNEM+ as proposed and at its full 3 MW proposed capacity, the impact on annual expenditures could range from an increase of $412,060 to a decrease of $956,030. As explored in detail in Appendix A, the impact on annual LADWP expenditures depends on four components, listed below in Table 2.

| Component | Description | Benefits (costs) | |
|---|---|---|---|
| | | Best-case | Worst-case |
| **Annual purchasing expenses** | Cost of purchasing energy from VNEM+ participants. At least 40 percent of these expenses are directly paid to the tenants of participating multifamily buildings. | **($405,360)** | **($1,773,450)** |
| **Annual energy resale revenue** | Revenue from reselling energy purchased through VNEM+, assumed to be $0.17 per kWh (approximated from residential rates). | **$861,390** | |
| **Annual system-wide benefits** | System-wide benefits received by LADWP due to avoiding distribution grid upgrades and maintenance, about $0.095 per kWh. | **Approx. $500,000** | |
| **Other costs** | Miscellaneous capital and operating expenses, such as staffing, inspections, and equipment. | **N/A** | |
| **Total benefits (total costs)** | | **$956,030** | **($412,060)** |

*Table 2: Annual program costs by base price of energy (BPE) and dispatch profile. Each component assumes that the 3 MW of pilot program capacity is fully subscribed, and that every kW of deployed solar+storage has maximum productivity of 1689 kWh/year per kW.[2] See Appendix A for details on how these figures were calculated.*

*Image by Louis Reed on Unsplash*



## 8. PROJECT ELIGIBILITY

### 8.1. Interconnection Design

Projects should be renewable energy systems with an attached energy storage system located on a single parcel of property containing a multifamily residential building. The parcel of property should be contained within one of the geographic zones described in section 8.1.a Project Locations below. Projects may be completely new systems or preexisting VNEM-participating systems with a retrofit for added energy storage.

#### 8.1.a. Project Locations

As with VNEM, to optimize for system-wide needs, LADWP should limit initial VNEM+ Pilot Program projects to South Los Angeles, East Valley, and West Los Angeles. These are the regions with the greatest need for traditional upgrades in their 4.8 kV distribution grids. Energy storage systems installed through VNEM+ may provide valuable non-wires alternatives (NWAs), which defer or replace those traditional upgrades.

Furthermore, projects in tracts with higher CalEnviroScreen scores (i.e., lower environmental quality and household income) should be given higher priority, which means that projects in South Los Angeles and the East Valley would be given higher priority than projects in West Los Angeles.

#### 8.1.b. Future Consideration: Shared Systems for Multiple Buildings

In the future, LADWP may allow multiple buildings to share a larger energy generation and storage system interconnected front-of-meter to allow applicants to take advantage of economies of scale and for LADWP to learn more about interconnection capabilities. An example of this is the Clean Coalition's Valencia Gardens Energy Storage project.

### 8.2. Applicant Requirements

As with other LADWP programs, applicants may be either the property owner of a multifamily residential building or a private or nonprofit third-party entity that contracts with the owner to build, own, or operate the project on the property (e.g., a private company that specializes in solar+storage systems for multifamily buildings).

### 8.3. Nature of Tenants

As with VNEM and other residential LADWP customer-facing programs, the benefits of this program are targeted at residential customers, so building tenants must already pay residential rates (i.e., rate schedules of R1A-Standard Residential, R1B-Time-of-Use, R1D-Low-Income, or R1E-Lifeline) in order to qualify for owner–tenant revenue-sharing.

*Image by Marcel Strauß on Unsplash*

#### 8.3.a. Future Consideration: Virtual Subscriptions

In the future, LADWP should allow owners to split revenue with tenants who live in a building separate from one with solar+storage that is participating in VNEM+, as with Hawaii's Community-Based Renewable Energy Program.

## 9. TECHNICAL REQUIREMENTS

As with all LADWP customer-facing programs, participating projects must meet all technical codes, standards, and conditions set by LADWP, including technological safety and performance requirements. VNEM+ projects must follow the following additional technical requirements.

### 9.1. Operating Modes

As with VNEM, the energy systems deployed in projects should be designed to support three specific modes of operation:

- **Normal operations.** No energy is consumed onsite. All energy generated or stored onsite is directly dispatched to the LADWP grid for purchase by LADWP.
- **Resiliency operations.** No energy is dispatched to the LADWP grid. During LADWP power shutoffs or blackouts, all energy generated or stored onsite is directly consumed onsite by the multifamily residential building.
- **Peak-shaving operations.** During peak demand periods, energy generated or stored onsite is consumed onsite by the multifamily residential building. The amount of energy consumed onsite should meet minimum

requirements set by the California Public Utility Commission (CPUC)'s Self-Generation Incentive Program (SGIP). Any energy that isn't consumed onsite according to minimum requirements set by the CPUC's SGIP is directly dispatched to LADWP for purchase by LADWP.

### 9.2. Future Consideration: Other Operating Modes

In the future, the Board should recommend to Los Angeles City Council an amendment to LAAC §10.5.2 that allows VNEM+ energy systems to operate under other modes not listed above, including:

- **Grid services operations**, in which batteries are responsible for voltage stabilization, frequency regulation, and reliability services;
- **Curtailment mitigation operations**, in which excess renewable energy is straining the grid and the batteries are responsible for absorbing this excess energy; and,
- **Coordinated operations**, in which multiple batteries act to achieve certain goals in a coordinated fashion, such as serving as a virtual power plant or microgrid.

## 10. OUTREACH

To maximize the equity outcomes of VNEM+, LADWP should invest as much as possible in public engagement, education, and project assistance for property owners and developers of multifamily buildings, and affordable housing with low-income tenants. The success of initiatives should be measured by their contributions to the number of successful applications that directly benefit low-income renters.

Outreach initiatives should collaborate directly with advocacy groups and community-based organizations as often as possible, and might cover the following topics:

- **Targeted outreach.** Workshops, webinars, and outbound communications targeted directly at property owners of multifamily buildings with low-income tenants.
- **Project assistance.** Consultations that cover technical design, financing options, ownership models, tax implications, long-term impact on building and resale value, and other project aspects of import to property owners.
- **Third-party financing.** Outreach with nonprofit and philanthropic institutions to secure financing for property owners with less capital.
- **Third-party energy vendors.** Solicitation of third-party energy system vendors who are interested in finding project sites.



- **Incentives.** Informational materials regarding state, federal, nonprofit, philanthropic, and private programs that incentivize program participation, which may include:
  - *State programs:* SGIP; California Climate Investment Fund; California Energy Commission Energize Innovation Fund; California 2022 Building Energy Efficiency Standards;
  - *Federal programs:* Department of Energy's Smart Grid Investment Grant, newly funded via the 2021 Infrastructure Investment and Jobs Act; technical assistance and funding through the Pacific Northwest National Laboratory's Energy Storage for Social Equity; and
  - *Nonprofit and philanthropic programs:* such as the Kresge Foundation's Financing Resilient Power.

## 11. CRITERIA FOR SUCCESS

When implementing VNEM+, LADWP should monitor whether it is designed appropriately for its intentions. We recommend the following objectives and key results:

- **Objective:** VNEM+ should deliver financial benefits to low-income renters (defined as 80 percent of median family income for the area).
  - **Key Result:** At least 20 percent of total tenants served by VNEM+ should qualify as low-income. Twenty percent is suggested because affordable housing is often at most 20% of units in a market-rate building.
- **Objective:** VNEM+ should receive proper engagement from affordable housing developers and multifamily building owners who house low-income renters.
  - **Key Result:** LADWP should enter meaningful discussions about applying for VNEM+ with at least five affordable housing developers; if the housing developers do not apply, then LADWP should seek feedback about how to make the program more appealing.

# Appendix: Impact on Overall LADWP Expenditures

The impact of VNEM+ on overall annual expenditures depends on four components:

1. **Annual purchasing expenses:** The operating expenditures of purchasing energy from VNEM+ participants, which depends greatly on (i) their energy dispatching profile over the course of the average day and (ii) the base price of energy;
2. **Annual resale revenue:** The revenue generated by reselling energy purchased via VNEM+, which depends on residential retail rates (currently around $0.17/kWh);
3. **Annual system-wide benefits:** The savings to LADWP provided by greater deployment of distributed energy resources (calculated at $0.09/kWh strictly for distributed solar without storage), reducing the need for system-wide upgrades; and, finally,
4. **Other costs:** Capital and operating expenditures associated with installing distributed solar and storage systems on the LADWP grid, including inspections, equipment upgrades, and staffing.

The first, second, and third components are covered below. The fourth component ("Other costs") is not covered due to a lack of data regarding LADWP capital and operating expenditures. A summary of the following analyses is presented in Table 2.



### Component 1: Annual Purchasing Expenses

Purchasing expenses depend on the BPE paid to projects, as well as the energy dispatching profile of all projects over the course of the average day. **Annual purchasing expenses would range from $405,360 to $1,773,450.**

In the following analysis, we assume that:

- The 3 MW of pilot program capacity is fully subscribed;
- Every kW of deployed solar+storage has maximum productivity of 1689 kWh/year per kW[3]; and,
- All projects exhibit the same energy dispatching profile across two cases (refer to "Economic compensation" for more information on multipliers):
  - **Non-peak dispatch:** All energy is discharged at times when the multiplier is only 1.0x; and,
  - **Peak-only dispatch:** All energy is discharged at the maximum possible multiplier (2.0x in the winter/fall, 3.0x in the spring/summer).

With these assumptions in mind, Table 3 lays out the annual purchase expenses and profits associated with both dispatching profiles across several hypothetical BPEs:

| | Non-peak dispatch | Peak-only dispatch |
|---|---|---|
| Base price of energy per kWh | Annual energy purchase expense | Annual energy purchase expense |
| $0.08 | $405,360 | $1,013,400 |
| $0.10 | $506,700 | $1,266,750 |
| $0.12 | $608,040 | $1,520,100 |
| $0.14 | $709,380 | $1,773,450 |

*Table 3: Annual energy purchasing expenses for 3 MW in VNEM+ participation, by base price of energy (BPE), over two different energy dispatch profiles.*

### Component 2: Annual Resale Revenue

Annual program revenue is based on the fact that purchased energy is sold back into the grid for general ratepayer consumption. **Annual resale revenue amounts to $861,390**[4], given the below assumptions:

- The 3 MW of pilot program capacity is fully subscribed;
- Every kW of deployed solar+storage has maximum productivity of 1689 kWh/year per kW[5]; and,
- All energy that LADWP purchases through the pilot program is immediately resold at a retail rate of $0.17 per kWh.

### Component 3: Annual system-wide benefits

**LADWP would receive approximately $500,000 in annual system-wide benefits if all 3 MW of program capacity were filled**, as shown in Table 4.

Researchers at UCLA reported in 2019 that LADWP receives $0.091 in "avoided costs" (i.e., system-wide benefits) for every kWh in solar deployed for FiT. We can expect that per kWh system-wide benefits would be higher for solar+storage systems, especially ones that are well-coordinated and integrated into the grid's needs, as discussed in the callout, "The value stack of energy storage."

Across several hypothetical per kW system-wide benefit rates, with $0.91 per kWh as a baseline, we can estimate annual savings for 3 MW of solar+storage. These estimates are shown in Table 4.

#### The value stack of energy storage

The total value of grid investments made obsolete by investment in a single energy asset has a tangible financial value called "avoided costs." Avoided costs represent system-wide savings for LADWP and ratepayers alike.

Energy storage is highly effective at creating avoided costs. In other words, investment in an energy storage system can often remove the need for investments in several different energy assets. It can reduce the need for peaker plants; render hard assets like lines and poles obsolete; serve as voltage stabilizer and frequency regulator; capture excess renewable energy; replace electricity that has dissipated after traveling through transmission and distribution lines; provide resilience during blackouts and extreme weather; reduce household demand; and more. This "value stack" is best realized when energy storage systems are installed, charged, and dispatched in specific ways.

| Hypothetical rates of grid benefit | Annual system-wide benefits |
|---|---|
| **$0.091 per kWh** | **$461,097** |
| **$0.095 per kWh** | **$481,365** |
| **$0.100 per kWh** | **$506,700** |
| **$0.105 per kWh** | **$532,035** |

*Table 4: Annual program costs by base price of energy (BPE) and dispatch profile.*



# Endnotes

1 Energy Efficiency for All, "Affordable Homes First: Advancing a Green New Deal for Los Angeles Renters," May 2019, 53, https://assets.ctfassets.net/ntcn17ss1ow9/6odry-owizjhI5BAPMW0vkL/e894ff0b40ee1e368d9818114c32a6fe/EEFA-LA-REPORT-Affordable-Homes-First.pdf.

2 Ben Sigrin et al., "Chapter 4. Customer-Adopted Rooftop Solar and Storage," *LA100—The Los Angeles 100% Renewable Energy Study*, National Renewable Energy Laboratory, March 2021, 42, https://www.nrel.gov/docs/fy21osti/79444-4.pdf.

3 *Id.*

4 (3 MW) × (1000 kW per MW) × (1689 kWh per year per kW) × ($0.17 per kWh) = $861,390.

5 *Id.*

ASPEN TECH
POLICY HUB

The Aspen Institute
2300 N St. NW, Suite 700
Washington, DC 20037
202 736 5800