APPENDIX A
SOUTHERN CALIFORNIA PUBLIC POWER AUTHORITY
STANDALONE ENERGY STORAGE SYSTEM SPECIFICATIONS
PROJECTS - FOR LADWP TRANSMISSION RELIABILITY
FOR
[Project Name]

A. LADWP Objective

LADWP intends to deploy various ESS totaling at least 1 GW of capacity across the proposed sites, inside and outside LA City boundaries in order to meet the RPS (Renewable Portfolio) Goals set by the City of Los Angeles. As of February 2022, LADWP intends to deploy 1000 MW of energy storage by 2030.

For all submittals, the following requirements apply.

1. Seller shall have site control or have plans to secure site control
2. Seller may propose one of the following contracts depending land ownership:
    a. Seller-owned land: Energy Service Agreement or Power Purchase Agreement (ESA/PPA) with buyout option
        i. Expected COD: 2024-2030
        ii. Must interconnect to LADWP Grid (if LADWP-related proposal). Seller shall submit an interconnection request through the LADWP Large Generator Interconnection Process and a deposit prior to proposal submission, as well as provide evidence of submission in the proposal. Interconnection and its costs are Seller's responsibility
        iii. For proposals with Buyout option, proposals must include Long Term Service agreements (LTSA) for services such as:
            1. Operation & Maintenance
            2. Transmission Service
            3. Operating Agent agreement
    b. LADWP-Owned Land—See Exhibit 3 for Soft Close Dates
        i. Location 1: Build-Own-Operate-Transfer (BOOT) or ESA/PPA. See Exhibit 3 for details.
        ii. Locations 2-5: BOOT. See Exhibit 3 for details
        iii. Interconnection will be discussed separately from this Appendix A.

B. Energy Storage System (ESS) Project Requirements

1. ESS requirements provided in this document shall apply to stand-alone storage projects. For purposes of this Appendix A, "stand-alone storage projects" include those capable of operating but not electrically paired with any specific source of generation. The requirements for ESS paired with a renewable energy resource are provided in SCPPA Renewable Energy Resource and Energy Storage Solutions RFP and LADWP is not seeking proposals from ESS paired with a renewable energy resource under this Appendix A, for this RFP.

2. The ESS requirements in this Appendix A are meant to be technology agnostic, provided that the ESS project:

   2.1. is a stand-alone energy storage project.

   2.2. meets all of the requirements and technological specifications provided in this Appendix A.

   2.3. As such, any requirements or technological specifications that cannot be met shall be explicitly stated in the proposal.

   2.4. Shall interconnect at transmission level only (greater than 100kV).

   2.5. shall interconnect to LADWP at LADWP point of interconnection with revenue grade metering.

3. The term of the agreement for all projects is 15 years for Lithium-ion battery energy storage systems (BESS), or 30 years for other Energy Storage Systems (ESS), unless otherwise specified.

4. ESS shall be a commercially available technology capable of absorbing energy, storing it for a period of time, & afterwards dispatching the energy. Buyer shall provide all energy.

5. Seller shall be an experienced project developer with at least one member of the development team having (a) completed at least one project of similar technology to the Buyer, or (b) begun construction of at least one other project similar to the proposal being submitted.

6. The ESS shall be installed, delivered, repaired and maintained by Seller; however, Buyer shall have full operational control over the ESS. Buyer will provide Seller payments for services provided. Buyer and Seller shall make good faith effort to pursue any available federal or state incentives to increase price competitiveness for the project or its application, and payment(s) will be structured to consider any incentives/tax credit that may be granted. Seller will provide Buyer with all operational requirements, limitations, and restrictions.

7. The ESS shall be developed and installed in accordance with all applicable laws, best industry practices and standards for the applicable technology.

7.1. Contingent on Seller's proposal including a battery technology such as lithium-ion batteries, Seller shall provide an emergency response plan for fire safety at or before COD.

8. All proposals shall explicitly provide operational capabilities and operating restrictions of proposed technology and include all control modes that ESS is capable of performing (see Table 1 for details)

9. Seller must have control of the project site and relevant structures and provide evidence of site control or provide a plan to acquire such site control for proposed project.

10. Proposals shall have energy density of at least approximately 1 kWh per square foot and have commercial operation dates (COD) between Dec 2024 and Dec 2030. Seller shall specify project energy density in kwh per square foot and footprint; project energy density shall include the energy storage, Balance-of-plant, and all other associated facilities.

11. Seller's proposal must identify the ESS capacity, which must include a minimum duration of four (4) hours of storage and discharge capability (short duration storage); Buyer specifically encourages proposals for longer durations such as medium (5-9 hours) to long duration storage (10+ hours). See Exhibit 3 for location-specific duration requirements for LADWP-owned facilities/land.

12. If the proposal includes a Battery Energy Storage System (BESS) product, the BESS proposal shall include, at minimum, information on each of the following elements:

    12.1. battery storage modules and racks;

    12.2. power conversion and transformation equipment;

    12.3. battery management systems;

    12.4. equipment for communication,

    12.5. thermal regulation,

    12.6. environmental conditioning and safety;

    12.7. control systems and related software;

    12.8. enclosures;

    12.9. and incidental and related equipment.

    12.10. BESS shall also comply with the target response times in the NERC Inverter-Based Resource Performance Guideline, as published during the anticipated design period, based on the BESS' proposed COD.

13. The Seller shall be obligated to maintain full ESS power and energy rating for the entire term of the agreement with Buyer, pursuant to 15.2.

    13.1. End of term ESS capacity shall match Seller's Guaranteed ESS capacity. If ESS capacity falls below the contractual value, the ESS will be considered not available. If the ESS energy is overbuilt, Buyer would like the option to utilize the additional energy at additional cost, with real-time telemetered capacity and energy values provided via SCADA.

    13.2. End of term ESS Energy shall meet the applicable requirement below:

        13.2.1. Contingent on the term of the contract being 10 years or more, Lithium-ion BESS shall maintain its proposed Guaranteed ESS energy until 5 years before the end of the contract term; afterwards, Guaranteed ESS energy (MWh) may degrade by up to 4% of nameplate energy per year. Seller shall provide a degradation curve for agreement term.

        13.2.2. Other ESS shall maintain its Guaranteed Energy for the duration of the term. For clarification, this 15.2.2 clause applies to all non-lithium-ion technologies.

    13.3. Pursuant to 15.2, ESS Energy (MWh) shall be maintained via initial oversize, replacement and/or augmentation, at the Seller's discretion. Seller shall be subject to liquidated damages if the Guaranteed ESS parameters (i.e. MW, MWh, RTE, Ramp Rate, Response Time) in proposal is not maintained for the term of agreement.

14. The ESS shall be capable of continuous discharge from 100% State of Charge (SOC) to 0% SOC and continuous charge from 0% SOC to 100% SOC at the Guaranteed MW rate. Pursuant to 15.2, 100% SOC shall be equal to the Guaranteed Energy Amount (MWh) during the Term.

15. Buyer shall have ability to:

    15.1. The ability to set specific SOC and MWh values for the ESS to achieve by a set time (specific charge and discharge rate to be determined by the ESS without Buyer input).

    15.2. Ability to specify a charge and discharge MW set point that shall supersede existing operations/schedules for the ESS to immediately provide.

    15.3. Communicate/connect with and control the ESS via LADWP SCADA, on DNP3 protocol.

16. Enhanced Generation Following Option

    Buyer requests ESS to have following optional function.

    ESS shall be able to take multiple inputs (i.e. meter data from local generation resources and weather forecast) and ramp output to compensate for expected impact on the area's generation. In the case of weather-related impact on generation, the ESS shall predictively ramp output ahead of the expected decreased generation.

    Weather forecast provider to be discussed outside this Appendix A. Examples provided below for reference.

    16.1. Assume LADWP is deploying a standalone ESS at Beacon Site, which is in the Mohave Desert Area. LADWP has several existing renewable resources in proximity to the Beacon site, including solar and wind resources.

    16.2. If weather forecast anticipates decreased renewable generation in the Mohave Desert area due to factors such as increased cloud cover on solar facilities in the area or decreased wind at wind farms, Beacon ESS shall pre-emptively increase output to compensate for expected lost generation and maintain POI output as far as possible. Lost generation means the gross total decrease in the Mohave Desert area's output across several facilities including Beacon ESS.

    16.3. If weather forecast anticipates increased generation (i.e. solar) in the Mohave Desert area, Beacon ESS shall increase charging to offset increased generation to reduce expected curtailment, possibly via grid charging.

    16.4. If a renewable facility encounters a problem and generation decreases, Beacon ESS should react to the meter data input and ramp up output to compensate.

17. All ESS metering shall comply with the applicable metering policies and requirements from the LADWP Bulk Electric System Meter Policy.

18. The ESS shall be registered with the California Independent System Operator following the New Resource Implementation (NRI) Process. Seller shall assume such resource will become a Participating Resource in Buyer's portfolio.

19. The ESS system is subject to the following use limitations:

    19.1. Lithium-ion BESS shall provide a minimum of 366 equivalent throughput cycles per calendar year. Through-put cycles for other technologies shall be negotiated separately. Cycling during performance testing shall not be included in the minimum equivalent throughput cycles per year.

    19.2. All energy for charging the ESS will be solely provided by Buyer. Title to any such charging energy shall remain with Buyer at all times and Buyer shall have control of such charging energy at all times; provided that Seller shall have custody of such energy while it is stored by the Project.

19.3. Short duration ESS shall be able to perform throughput cycles of at least one cycle per day.

19.4. ESS operating range shall not have limits, to the extent allowed by manufacturer warranty and safety codes.

19.5. Buyer requests option for ESS to provide between +0.8 power factor and -0.8 power factor with respect to facility capacity at the point of interconnection.

20. The ESS must comply with the most current iteration of applicable codes and standards at detailed engineering phase, including, but not limited to the following. Seller shall indicate which codes, if any, they cannot meet and why.

    20.1. IEEE Standards 1547, 1547.1, 693, 519,

    20.2. UL Standards 9540, 9540A, 2054, 62133, 1741, 1741SA

    20.3. NFPA Standards 855, 68, 69, 72, 70, 1

    20.4. IFC 2018/2021

    20.5. UN/DOT 38.3

    20.6. NEC

    20.7. ANSI C84.2006

    20.8. IEC 62933-5-2

    20.9. Local AHJ (Authority Having Jurisdiction) requirements

    20.10. The ESS shall be programmed in accordance to NERC Standard PRC – 024-2, in consultation with LADWP.

21. ESS shall have MESA-ESS communication standards capability as well as DNP3 communication protocol capability separately.

22. The ESS shall establish a connection to external communications in the form of at least: one console for LADWP Energy Management System (EMS) and one console for local control.

23. The ESS shall have Back-up Automatic Generation Control (AGC).

24. Seller to provide real-time reporting of ESS status to Buyer via SCADA including, but not limited to:

    24.1. ESS throughput cycles available

    24.2. specific grid charge percentage availability for the year

24.3. specific MW available for charge and discharge

24.4. MWh available for discharge

25. Seller shall provide D-Curve for all 4 quadrants (MVAR output vs. MW output) at all power factors to Buyer.

26. ESS Round-Trip Efficiency at rated capacity shall be explicitly provided in the proposal including auxiliary loads

    26.1. Auxiliary loads and station service load to be separately metered from BESS. Auxiliary load energy to be supplied by Buyer, or cost of such energy to be borne by Buyer, as applicable. Buyer will provide or compensate Seller for station service load energy up to an agreed-upon amount. Specific auxiliary and station service loads to be discussed separately.

27. All ESS Warranty assumptions, required standby time prior to operation, and any other system operational limitations shall be explicitly stated in the proposal.

28. Seller shall be responsible for compliance with applicable environmental rules and regulations, including but not limited to, hazardous material removal, dust mitigation/control measures, as will be further defined and explained in the agreement between Buyer and Seller. Specific hazardous materials shall be defined separately in MSDS (Material Safety Datasheet).

29. Seller shall be responsible for disposal and end of life considerations; Buyer reserves the right to obtain cost of recycling and/or disposal of all project equipment at end of life from Seller during the Agreement Term. Seller shall provide expected ESS degradation curve and project decommissioning plan.

    29.1. Project Decommissioning plan shall include key system and installation information that helps inform about system decommissioning, end-of-life disposal/recycling process with potential vendors, environmental sustainability effort

    29.2. Seller shall also provide documented guidelines and procedures for safe handling and disposal of damaged or defective battery cells and modules, if applicable.

30. During contract term, Seller must meet any applicable change in law, as defined below:

    "Change in Law" means a change in any federal, state, local or other law (including any environmental laws, RPS Law or EPS Law), resolution, standard, code, rule, ordinance, directive, regulation, order, judgment, decree, ruling, determination, permitting conditions, certification conditions, authorization, approval of a Governmental Authority or WREGIS, including the adoption of any new law, resolution, standard, code, rule, ordinance, directive, regulation, order, judgment, decree, ruling, determination, permit, certificate, authorization, or approval, or the issuance of any replacement or substitute law, resolution, standard, code, rule,

ordinance, directive, regulation, order, judgment, decree, ruling, determination, permit, certificate, authorization, or approval, in any case which is binding on a Party, the Parties, or the Facility or any of the products sold therefrom.

C. Pricing

1. Seller's price shall consist of the following for PPA/ESA projects:

1.1.1. Fixed Price: A price for the availability of the ESS, subject to availability and performance guarantees in $/kW-month, i.e. capital cost, and debt service.

1.1.2. Fixed O&M Charge: A price for the maintenance and repair for the ESS in $/kW-month, such as labor costs, rent/lease on property/land, insurance, overhead, etc.

1.1.3. Variable O&M Charge and Variable Asset Replacement Charge: A price for the maintenance and repair of the ESS in $/MWh, such as major component replacement (i.e. inverter), maintenance for ESS usage, consumables, etc.

2. Buyout Price: Seller shall also provide a price for the sale of the ESS from Seller to Buyer from year five and onward, in 1 year increments, if applicable. Seller is encouraged to include pricing for buyout at year 1 to 4 as well.

Required Information

Seller shall provide the following information, as available or applicable (Seller may indicate N/A if not included in proposal)**:**

1.1. Project Description, including:

1.1.1. Description & table of ESS configuration options

1.1.2. Services/benefits provided (energy, capacity, ancillary services such as frequency regulation, etc.)

1.1.3. Legal Site Description

1.1.4. Site Plan Drawing

1.1.5. General Arrangement/Site Map with Balance of Plant: to be used for reference purposes; Seller may update as needed if proposal is selected.

1.1.6. Electrical Single Line Diagram

1.1.7. Fire Detection, Notification, Suppression, and Protection systems

1.1.8. Description of Technology Maturity and supporting documents with details such as commissioned projects & location (if any), size and duration of commissioned projects, etc.

1.2. Financing Plan (please describe how Seller plans to secure financing or whether financing has been secured)

1.3. Seller's Milestone Schedule and Material Permits

1.4. Responses to all questions in SCPPA RFP Project Details.

1.5. Supply Plan Information (such as how and where to source materials and components)

1.6. Capacity and Ancillary Services Operating Restrictions

1.7. Pricing that conforms with Section C above

1.8. All information requested in item A with any exceptions to ESS Project requirements indicated with "N/A"

1.9. Contact Information of Authorized Representatives for Seller

1.10. Completed Exhibit 1

1.11. Evidence of Interconnection Application and Payment, if applicable

1.12. Evidence of Site control: Site Control Acknowledgement Letter and/or Site Owner's Acknowledgement Letter if applicable, or a plan to obtain site control

1.13. Project Decommissioning plan that includes key system and installation information that helps inform about system decommissioning, end-of-life disposal/recycling process with potential vendors, environmental sustainability effort, and estimated associated cost.

1.14. Documented guidelines and procedures for safe handling and disposal of damaged or defective battery cells and modules, if applicable

1.15. Project Emergency Response plan that describes the associated hazards and risks, training, and emergency actions to be taken

1.16. HAZOP (Hazard and operability) Study or equivalent.

1.16.1. HAZOP is used as part of a Quantitative Risk Assessment (QRA) or as a standalone analysis. HAZOP is a more detailed review technique than HAZID. The purpose of the HAZOP is to investigate how the system or plant deviate from the design intent and create risk for personnel and equipment and operability problems.

1.17. Additional Information:

1.17.1. Describe the type and technology of the proposed Energy Storage System (ESS). The ESS may include battery, compressed air energy storage (CAES), large pump hydro, pumped thermal ESS, thermal ESS, or other technologies that are commercially available.

1.17.2. 1.17.2. Describe the operational characteristics of the ESS, such as those stated below. Seller shall provide a high-level summary of method used to determine the characteristics/ratings provided in the RFP response, and a more detailed report upon Buyer's request. Examples of detailed reports include Independent Engineer report, empirical experience through other projects, pre-FEED/FEED (Front End Engineering Design) study, detailed equipment specifications, etc.

1.17.2.1. rated power and energy capacity

1.17.2.2. full charge & discharge duration – 4-hour minimum discharge time

1.17.2.3. total response time

1.17.2.4. operating temperature

1.17.2.5. round-trip efficiency

1.17.2.6. equipment dimensions and weight

1.17.3. Describe the maturity of the proposed technology. Briefly describe projects that utilize your proposed technology, including references. Provide performance data based on previous projects.

1.17.4. Describe the ESS useful life, degradation, maintenance plans, and end of life disposal/recycling program.

1.17.5. Provide operating limits of the technology (i.e. state of charge limitations)

1.17.6. Provide technology's capability (see table 1) in autonomous functions that are simultaneously active and can be prioritized in case of conflict. At a minimum:

1.17.6.1. Frequency Response (Real Power)

1.17.6.2. Fault Response (Reactive Power)

1.17.6.3. Voltage Control (Reactive Power)

1.17.6.4. State of Charge Management

1.17.6.5. Load Following

1.17.6.6. Generation Following

1.17.7. Describe the ESS physical sizing flexibility to fit in the locations listed in Exhibit 3

1.17.7.1. Provide maximum MWh that can fit in these areas.

1.17.7.2. Describe ESS project high level costs.

1.17.7.3. Provide proposed ESS earliest commercial operation date for each project(s)

1.17.8. List of all building codes, fire codes, and permits that ESS complies with at the local, state, and federal level. Seller shall also identify any permits that would be necessary for installation or operation of the ESS and associated equipment.

1.17.9. Describe any environmental impact of the ESS and any required environmental compliance or permits (CEQA, etc.). Examples of environmental permits are provided below:

1.17.9.1. If the equipment generates emissions of criteria pollutants (VOC, NOx, SOx, CO, PM), a permit-to-operate may be required by the local Air Quality Management District.

1.17.9.2. If an emergency generator is installed, a permit-to-operate is required if the engine driving the emergency generator is > 50 horsepower.

1.17.9.3. A stormwater discharge permit for the site.

1.17.10. Provide general warranty information for the useful life of the ESS.

D. Availability Guarantee

Throughout the Delivery Term, the ESS shall maintain monthly availability (the "Monthly Guaranteed Availability") in an amount not less than the following:

- 98% if proposed technology is lithium-ion battery or similar
- 90% for other technologies

If the ESS fails to achieve the Monthly Guaranteed Availability, then Seller shall pay a prorated amount based on capacity terms, ESS performance, and ESS availability. See Exhibit 2 for details. Additionally, Seller shall pay to Buyer, damages incurred by Buyer due to unavailability of ESS in an amount to be negotiated between Buyer and Seller.

If BESS Monthly Guaranteed Availability remains below ninety percent*, not including planned outages or lack of use at Buyer's discretion, after the agreed upon cure period, the Seller shall be considered in default.

*For technologies other than lithium-ion BESS, Monthly Guaranteed Availability Requirement for Default described above shall be modified on a case-by-case basis in discussions separate from this RFP. In no event shall the required availability be lower than seventy-five (75%).

1. Planned Outage Allowance for maintenance and/or augmentation per calendar year to be mutually agreed upon by both Seller and Buyer during negotiations. See Exhibit 2 for Availability Formula.

2. Other Availability requirements:

    2.1. Seller shall provide notification via email to LADWP Grid Operations communicating anticipated start and end dates of any outages, subject to LADWP approval.

    2.2. If SCADA control for ESS is not available or ESS is not visible via SCADA to LADWP Energy Control Center then the ESS will be considered unavailable (Availability = 0%).

    2.3. Seller shall coordinate the timing of ESS augmentation with Buyer to ensure optimal timing and minimal interference and disruption to Buyer.

E. Performance Guarantee

1. The Seller shall guarantee the performance of the ESS for selected parameters ("Guaranteed ESS Parameters" in E.2) for the term of the contract in accordance with the Performance Test Requirements (to be mutually agreed upon by the Buyer and Seller). If the ESS does not pass the Annual Performance Test, the entire ESS system will be considered not available until ESS does pass the Performance Test in a subsequent test.

2. The following Guaranteed ESS Parameters are to be provided by Seller to Buyer for comparison against expected values provided in Exhibit 1 during **annual performance testing and at COD**. All parameters measured at point of interconnection.

    2.1. Round-Trip Efficiency (RTE)

    2.2. Continuous Charge Capacity (MW)

    2.3. Continuous Discharge Capacity (MW)

    2.4. Guaranteed ESS Energy (MWh)

    2.5. Active Power Response Time (time required for ESS to ramp to full power from when signal is issued by Buyer).

    2.6. Up-ramp and down-ramp rate for Charge and Discharge operation (MW/time)

3. The following ESS parameters must match the expected values provided in Exhibit 1 to **declare COD**.

    3.1. Full-rated Continuous Power Rate (can ESS charge and discharge at full rated power capacity for sustained periods of time?)

    3.2. Half-rated Continuous Power Rate (can ESS charge and discharge at ½ of full rated power capacity for sustained periods of time?)

    3.3. Minimum Time required to charge from 0 to 100% SOC at full rated capacity

    3.4. Maximum Time required to charge from 0 to 100% SOC at full rated capacity

    3.5. Energy Available for immediate discharge at 100% SOC (MWh)

    3.6. Charge Ramp Rate (MW/[time])

    3.7. Discharge Ramp Rate (MW/[time])

    3.8. Discharge Ramp Rate after synchronization (%/sec)

    3.9. Self-Discharge (% SOC/day)

    3.10. Noise (dBA)

    3.11. Startup Time (min)

    3.12. Shutdown Time (min)

4. Payment for ESS product will be performance-based. Payment shall be made in full if all performance parameters are met. A performance report shall be submitted by Seller to Buyer as a pre-requisite to the payment of a monthly invoice. Monthly invoice shall be paid after Buyer approves monthly performance report. Payment shall be reduced for underperformance or failure to perform. Performance parameter baselines and cure period to be negotiated with Buyer and Seller. Seller shall be in default if ESS performance does not meet mutually agreed baselines after cure period.

F. Regulatory and Reporting Requirement

1. **NERC and LADWP CIP Requirement:** To the extent they are determined applicable, Seller shall comply with North American Electric Reliability Corporation standards and LADWP requirements, including Critical Infrastructure Protection standards for ESS.

2. **LADWP Internal Cyber Security Standards:** Seller shall comply with LADWP Internal Cyber Security and Physical Security Standards.

3. **WECC/NERC Generator Testing and Model Validation Requirement:** Seller to determine if ESS must comply with WECC Generator Testing and Model Validation Requirements, and if so, provide Buyer documentation of compliance.

4. **EIA Requirement:** Seller shall be responsible for U.S. Energy Information Administration data submittals and a copy of any submitted reports shall be made available to Buyer.

G. Energy Storage System Control Modes (The ESS Products)

1. The general purpose of the ESS is to provide the ESS Products, which consist of different control modes listed and outlined in the following Table 1 ("Control Modes"). Control Modes consist of settable functional parameters that trigger responses that the ESS can provide. The operation of any Control Mode or simultaneous Control Modes are subject to the ESS Operating Limitations, Control Mode setpoints and priorities as specified and scheduled by the Buyer, and the ESS conditions (e.g., state-of-charge, temperature, etc.) at the time of operation of such Control Mode(s). Buyer shall have the ability to provide Control Mode set points for charge and discharge of the ESS, as well as the ability to set specific MW charge/discharge values and priorities, subject to those limitations and conditions. All functions should be operable from the Energy Management System (EMS) via DNP3.

2. The following Control Modes are from the MESA-ESS Specification, and reference should be made to either the MESA-ESS Specification or IEC 61850-90-7, (or the applicable IEC 61850-90-7 replacement), or standard mutually agreed upon by the Buyer and Seller for further details with respect to each Control Mode. **Tables 1 through 5 are BESS-centric and not all sections may be applicable to all ESS technologies.** Seller shall indicate portions not applicable in proposal.

Table 1: Summary of Control Functions (The ESS Products)

Control Mode Category	Control Mode
Emergency Modes	1. Voltage Ride-Through
	2. Frequency Ride-Through
	3. Dynamic Reactive Current
	4. Dynamic Volt-Watt
	5. Frequency-Watt (*Implement NERC Inverter- Based Performance Guideline)**
	6. Freqency Droop
Active Power Modes	7. Charge-Discharge Storage
	8. Coordinated Charge-Discharge
	9. Active Power Limit
	10. Active Power Response (configurable as Peak Power Limiting, Load Following, or Generation Following modes)
	11. Automatic Generation Control
	12. Active Power Smoothing
	13. Volt-Watt
	14. Frequency-Watt Curve
	15. Pricing Signal
Reactive Power Modes	16. Fixed Power Factor
	17. Volt-VAR Control
	18. Watt-VAR
	19. Power Factor Correction

* A frequency function/set point is needed to facilitate LADWP's compliance to NERC Reliability Standard BAL-003-1.1, requirement R1 or its successor. That would be a temporary MW output or input triggered by a configured change in frequency.

The functionality set forth in Tables 2-5 below are covered in the various DNP 3.0 Control Modes in Table 1 above and will be implemented by such Control Modes. Setpoints to some Control Modes are included below to establish a common understanding of expected operations but Buyer shall have the right to direct changes to these setpoints at any time during the Agreement Term. In addition to the MESA Control Modes, the ESS shall implement the LADWP-specified "Frequency Rate of Change Response" in Table 2. The functionality set forth in Tables 2-5 are specific to BESS products however all other ESS products must provide exceptions to any of the following terms that cannot be met due to technological limitations.

Table 2 – AUTONOMOUS FUNCTIONS

AUTONOMOUS FUNCTIONS

Certain functions shall be available to be simultaneously armed and actively operated.

Frequency Rate of Change Response Control Mode

Monitor grid frequency on the ESS side of the Point of Delivery. Continuously compute rate of frequency change.

The ESS plant controller shall alternately have setpoints for positive or negative rate of change of frequency below or above which the ESS will respond with "Frequency Response Power" for a setpoint "Response Period".

After the Response Period, ramp the ESS to the average power for "Rolling Average Period" before the frequency went above or below frequency rate of change thresholds. The rate at which ESS ramps back to the average power prior crossing the thresholds shall be a setpoint "Recovery Ramp Rate". By responding with the active power from the ESS.

Set points required for Frequency Rate of Change Response:

Symbol	Value	Units
Δf_{trig}	Magnitude of frequency change to trigger response	mHz
Δt_{trig}	Maximum duration over which that change can accrue	sec
ΔP_{resp}	Magnitude of MW response per decihertz	MW/dHz
t_{resp}	Duration of MW response after triggered	sec

- Initiate frequency response if the magnitude of frequency change $|\Delta f|$ is at least Δf_{trig} within or at time interval Δt_{trig}.
- The response is a MW step change of amount $P_{resp} = \Delta P_{resp} \times -\Delta f \times k$, where k is the unit conversion between dHz and the units used for Δf.
- The response is recalculated throughout the frequency response period. Its magnitude increases if the magnitude of the frequency deviation increases as determined by comparing the current frequency and the starting frequency for calculation of Δf_{trig}. The response magnitude is not permitted to decrease.
- Frequency response ends at the expiration of response period t_{resp}.
- Ramp-out is at the same ramp rate as is used for active power control. No special ramp rate is needed for this mode.

Response time to the event shall comply with Table 2.1 in the NERC Inverter-Based Resource Performance Guideline for BESS products.

Table 2.1: Dynamic Active Power-Frequency Performance		
Parameter	**Description**	**Performance Target**
For a step change in frequency at the POM of the inverter-based resource…		
Reaction Time	Time between the step change in frequency and the time when the resource active power output begins responding to the change[31]	< 500 ms
Rise Time	Time in which the resource has reached 90 percent of the new steady-state (target) active power output command	< 4 seconds
Settling Time	Time in which the resource has entered into, and remains within, the settling band of the new steady-state active power output command	< 10 seconds
Overshoot	Percentage of rated active power output that the resource can exceed while reaching the settling band	< 5 percent**
Settling Band	Percentage of rated active power output that the resource should settle to within the settling time	< 2.5 percent**

** Percentage based on final (expected) settling value

Dynamic Reactive Current Support Mode Requirements
Monitor voltage at Point of Delivery
Default hold time (HoldTmms) for Dynamic Reactive Current Support Mode after voltage returns to inside the deadband is five (5) seconds. Default to Frequency Response and Frequency Rate of Change Response are higher priority than Dynamic Reactive Current Support.
Ability to respond in a minimum of 1-3 Cycles from detecting and to provide reactive power in response to Point of Delivery voltage falling below 0.8 pu.
Reactive Power Control Modes Requirements
Monitor voltage on ESS side at Point of Delivery.
While voltage remains between 1.1 and 0.8 pu respond to deviations in voltage outside a defined deadband with proportional reactive power.
Ramp rate (MVAR / Sec) for adjustment of reactive power.
Scheduled (day/night) fixed power factor setting for reactive power support.
State of Charge Management (Coordinate Charge/Discharge Control Mode) Requirements
Monitor ESS SOC and provide a mechanism to regulate SOC, principally to recover SOC after discharge events (both manual and automatic).

Table 3 – EXTERNAL OVERRIDE CONTROLS

Provide functionality to trigger manual discharge, using the following parameters:
Continuous discharge power
Operator set point discharge time
Operator set point “On” ramp rate (MW / min or immediate)
Operator set point “Off” ramp rate (MW / min or immediate)
Reactive power set point (MVAR)
Reactive power set point timer (Hours)
Power factor set point
In addition to the MESA-ESS specification of Charge/Discharge Storage Control Mode, provide the following functionality when the ESS is in Charge/Discharge Control Mode:
10 seconds maximum response time after receiving external command to execute manual discharge or apply reactive power
If present conditions do not permit requested discharge (e.g., SOC is too low), BESS shall report the maximally conforming parameters which are available over DNP 3.0.
During manual discharge or manual reactive control, ESS shall indicate which, if any, autonomous functions are disabled or degraded.
After manual discharge cycle is complete, ESS shall resume autonomous functions including automatic SOC management.

Table 4 – CONNECTION AND DISCONNECTION FROM LADWP GRID

CONNECTION AND DISCONNECTION FROM LADWP GRID
While voltage and frequency remain within the specified voltage and frequency windows, the ESS shall remain connected to the LADWP grid unless instructed otherwise by disconnection signal or otherwise unavailable. System will stay connected and operational pursuant of Monthly Guaranteed Availability of the Agreement.
Provide function for commanded disconnection from LADWP grid both remotely and via local HMI. This is to be used for routine disconnection when sufficient warning is available to permit normal standard disconnect procedures by the ESS.
Provide functionality to accept an emergency disconnect input in the form of a dry contact. If instructed to open the ESS must immediately cease operation.

Startup and connection time from an “Off” or “Disconnected” state to “Connected and Idle” shall be no more than 300 seconds if the BESS/inverter thermal management loads are energized and the inverters are not set to “Sleep Mode”. If the BESS is “Disconnected” but the main breaker is still closed, the BESS shall provide Buyer a timeout setpoint that causes the BESS to transition to a “Disconnected” state with the breaker closed but the inverters set to “Sleep Mode” after a Buyer setpoint number of minutes. The time to return from “Disconnected” and “Sleep Mode” to “Connected and Idle” shall be no more than 600 seconds if the BESS main breaker is closed and thermal management loads are energized. If a “Disconnected” or “Off” state opens the BESS main breaker, which removes battery and inverter thermal management power, then startup and connection time will be dependent on local temperature conditions and may exceed 600 seconds. The BESS shall report estimated time to “Connected and Generating” at all times. Inverters in “Sleep Mode” represents state where inverters are not switching and not synchronized to the grid.
4 seconds maximum time for ESS Point of Delivery disconnection after receiving emergency stop signal.
Behavior of ESS while the control systems are powered by a UPS, or an alternative auxiliary power supply, when the mains power line is shorted or opened shall be to disconnect until normal operations are restored.
Behavior of ESS when the mains power returns while the control systems are still powered by the UPS or an alternative power source shall be to reconnect as directed by Buyer.
The ESS shall have a microprocessor-based relay protection system (such as SEL 351) with CTs and PTs to detect overcurrents and to disconnect the AC breaker.

Table 5 – REMOTE MONITORING AND CONTROL

REMOTE MONITORING AND CONTROL Requirements
1 second sampling time for ESS-LADWP communication mechanism for data transfer during faults/triggered actions.
Connection to external communications systems via one console for LADWP EMS and one console for local control
Heartbeat timer to ensure communication path is online and processor is functioning
Minimum available metrics via both data transfer and operator control updated by event driven data or buffers.

REMOTE MONITORING AND CONTROL Requirements
Current operational status
Total real power (MW)
Total reactive power (MVAR)
Total complex power (MVA)
SOC (expressed as percent), defined as ESS Energy Available for discharge / Contractual ESS Energy Amount MWh)
Current power capabilities in all quadrants
Voltage and frequency as measured at Point of Delivery
Operation mode
Fault codes / description
Contractor to supply points list and sampling frequency
2 seconds maximum response time for implementing changes to set points

Exhibit 1: LADWP ESS Specifications Template

This template to be filled out by Seller for all applicable fields. Please indicate N/A for non-applicable items

Specification Parameter	Definition	Units	Expected Value
Rated Continuous Discharge Power	The rate at which the ESS can continuously deliver energy for the energy storage component's entire *specified* SOC range.	MW	
Rated Apparent Power	The real or reactive power (leading and lagging) that the ESS can provide into the AC grid continuously without exceeding the maximum operating temperature of the ESS.	MVA	
Rated Continuous Charge Power	The rate at which the ESS can capture energy for the energy storage component's entire* SOC range. *The percent state of charge when the charge rate may be reduced near top of charge at end of life (EOL)	MW %	**99% of rated/proposed value**
Rated Continuous AC Current	The AC current that the ESS can provide into the grid continuously and can be charged by the grid continuously without exceeding the maximum operating temperature of the ESS.	A	
Output Voltage Range	The range of AC grid voltage under which the ESS will operate in accordance with the ESS specification.	p.u.	
Total Response Time	Time between when the external signal (command) is received at the ESS boundary (site controller) and continuing until the ESS recharge/discharge power output (electrical or thermal) reaches 100 ± 2% of its rated power.	seconds	

Specification Parameter	Definition	Units	Expected Value
System Round-Trip Efficiency	Total round-trip efficiency from beginning of life (BOL) to end of life (EOL), defined as the ratio of the delivered output energy of the ESS to the absorbed input energy required to restore it to the initial state of charge under specified conditions.	%	
Ramp Rate	The maximum rate, expressed in megawatts per minute, that the ESS can change its input and output power. This may vary in multiple dimensions such as state of charge (SOC) and/or other parameters of the system that may be broken out into multiple line item values	MW/min	
Enclosure Type	A description of the system enclosure including that supplied with the system, provided as a part of the site installation and/or comprised of building assemblies associated with the installation.		
Equipment Footprint	Length x Width (L x W) of equipment only (Includes ESS and all ancillary units as required) in intended layout	ft^2	
Height	Equipment height plus safe clearance distances above the equipment	ft	
Weight	Weight per individual sub-system (PCS, ESS, accessories, etc.), including maximum shipping weight of largest item that will be transported to the project site. Include total weight of each major component once assembled on site.	lb	
Maximum Equipment Structural Loading	Maximum weight per loaded area for any one piece of equipment	Lb/ft^2	
Rated Discharge Energy	Specify the accessible energy that can be provided by the ESS at its AC terminals when discharged at its beginning of life (BOL) and end of life (EOL).	MWh	
Minimum Charge Time	The minimum amount of time required for the ESS to be charged from minimum SOC to its rated maximum SOC.	Hr	

Specification Parameter	Definition	Units	Expected Value
Typical Recharge Time	This should include any time for rest a period needed between a full or partial charge or discharge cycle.	Hr	
Expected Availability of System	Percentage of time that the system is in full operation performing application specific functions taking into account both planned and unplanned down-time.	%	
Expected Term of the Warranty	For ESS	Yr	

System Ratings and Limits

Specification Parameter	Description	Units	Expected Value
WMax	The maximum real power that the ESS can deliver to the grid, in Watts. May be the same as continuous discharge rate	MW	
VAMax	The maximum apparent power for ESS, in Volt-Amperes.	MVA	
VARMax	The maximum reactive power the ESS can produce or absorb, in VARs.	MVARs	
WChaMax	The maximum real power the ESS can absorb from the grid, in Watts (e.g. battery storage charging). Note that WChaMax may or may not differ from WMax.	MW	
VAChaMax	The maximum apparent power the ESS can absorb from the grid, in Volt-Amperes (e.g. battery storage charging). Note that VAChaMax may or may not differ from VAMax.	MVA	

Specification Parameter	Description	Units	Expected Value
Rated charge Energy	The accessible energy that can be provided by the ESS at its AC terminals when charged at its beginning of life (BOL) and end of life (EOL).	MWh	
ARtg	A nameplate value, the maximum AC current level of the ESS, in RMS Amps.	RMS Amps	
Rated Continuous Discharge Power	The rate at which the ESS can continuously deliver energy for the entire specified SOC range of the storage device that comprises the ESS.	MW	
Rated Apparent Power	The real or reactive power (leading and lagging) that the ESS can provide into the AC grid continuously without exceeding the maximum operating temperature of the ESS.	MVA	
Overload Discharge Power	The magnitude of temporary real power (reactive power = 0) and the duration that the ESS can provide this power before overheating.	MW	
Rated Continuous Charge Power	The rate at which the ESS can capture energy for the entire SOC range of the storage device that comprises the ESS.	MW	
Rated Continuous Reactive Power (MW)	The magnitude of continuous reactive power (Real Power = 0) and the duration that the ESS can provide this power without overheating.	MVar	
Overload Charge Power (MW)	The maximum grid overload capability of the ESS.	MW	
Overload Reactive Power	The magnitude of temporary reactive power (Real Power = 0) and the duration that the ESS can provide this power before overheating.	MVar	
Rated Continuous AC Current	The AC current that the ESS can provide into the grid continuously without overheating, including the AC current that the ESS can be charged by the grid continuously without overheating.	A	

Specification Parameter	Description	Units	Expected Value
Overload AC Current	The temporary AC current that the ESS can provide into the grid and the duration that it can support this current before overheating.	A	
Output Voltage Range	The range of AC grid voltage under which the ESS will operate in accordance with the ESS specification.	Vac	
Voltage Unbalance Limit	Voltage unbalance requirements as per ANSI C84. 2006.		
Output Frequency Range	The range of frequency under which the ESS will operate according to its specification.	Hz	
AC Breaker	Description of how the ESS is protected from over-currents by an AC breaker.		
Grounded or Isolated Output	Specify grounded or isolated output.		
Phase Imbalance limits (on PCS, XFMR, etc.)	Load current imbalance that is acceptable on the output of the ESS without overheating or de-rating the rated power capability of the power systems.	%	
Current THD into Resistive Load (IEEE 519)	Total harmonic current of the ESS power output into a resistive load.	%	
Power Conversion System Switching Frequency	Nominal switching frequency at which the ESS power switching devices operate.	Hz	
Low Voltage (Fault) Ride Through Performance	Include a chart of the magnitude of ESS terminal voltage with respect to the time before the ESS disconnects or losses synchronization.	Chart	

Specification Parameter	Description	Units	Expected Value
High Voltage Ride Through Performance	Include a chart of the magnitude of ESS terminal voltage with respect to the time before the ESS disconnects.	Chart	
Withstand Voltage (per Device)	Include a chart of the magnitude of ESS terminal voltage with respect to the time before the ESS is damaged.	Chart	
Ramp Rate	The maximum rate, expressed in megawatts per minute, that the ESS can change its input and output power. This may vary in multiple dimensions such as state of charge (SOC) and/or other parameters of the system that may be broken out into multiple line item values.		

System Efficiency

Specification Parameter	Description	Units	Expected Value
System Round-Trip Efficiency	Total round-trip efficiency from beginning of life (BOL) to end of life (EOL), defined as the ratio of the delivered output energy of the energy storage system to the absorbed input energy required to restore it to the initial state of charge under specified conditions.		
	Provide the total round-trip efficiency under the following conditions, at the beginning of life (BOL).		
	100% DoD Cycles, @ 50% SOC, Full rated power. Start at 50% SOC, discharge to 0%, charge to 50% SOC, at full rated power (50-0-50). Or, 50-100-50 % SOC pattern.	%	
	100% DoD Cycles, @ 50% SOC, Half rated power.	%	
	100% DoD Cycles, @ 50% SOC, Quarter rated power.	%	
	20% DoD Cycles, @ 50% SOC, Full rated power.	%	
	20% DoD Cycles, @ 50% SOC, Half rated power.	%	
	20% DoD Cycles, @ 50% SOC, Quarter rated power.	%	
	Provide the total round-trip efficiency under the following conditions, at the end of life (EOL).		
	100% DoD Cycles, @ 50% SOC, Full rated power.	%	
	100% DoD Cycles, @ 50% SOC, Half rated power.	%	

Specification Parameter	Description	Units	Expected Value
	100% DoD Cycles, @ 50% SOC, Quarter rated power.	%	
	20% DoD Cycles, @ 50% SOC, Full rated power.	%	
	20% DoD Cycles, @ 50% SOC, Half rated power.	%	
	20% DoD Cycles, @ 50% SOC, Quarter rated power.	%	

Discharge Characteristics

Specification Parameter	Description	Units	Expected Value
Minimum Discharge Time	The minimum amount of time required for the ESS to be discharged from maximum SOC to its rated minimum SOC.	h	
Recommended Discharge Power	Recommended discharge power while staying within the manufacturer's rated guidelines on SOC and internal temperatures.	MW	
Typical Discharge Time	This should include any time for rest periods needed between a full or partial discharge or charge cycle.	h	

Charge Characteristics

Specification Parameter	Description	Units	Expected Value
Minimum Charge Time	The minimum amount of time required for the ESS to be charged from minimum SOC to its rated maximum SOC.	h	
Recommended Charge Power	Recommended charge power while staying within the manufacturer's rated guidelines on SOC and internal temperatures.	MW	
Typical Recharge Time	This should include any time for rest a period needed between a full or partial charge or discharge cycle.	h	

Cycle Life

Specification Parameter	Description	Units	Expected Value
Cycle Life	The numbers of cycles that the energy storage system can perform until end-of-life (EOL), independent of calendar life degradation, at specified depth of discharge after which electricity storage becomes inoperable or unusable for a given application.		
	Specify cycle life at full-rated power.	Qty.	
	Specify cycle life at half-rated power.	Qty.	
	Specify cycle life at quarter-rated power.	Qty.	
End of Life Criteria	The condition of the ESS at the end of life in terms of capacity, impedance, efficiency, and other pertinent parameters.	Charts	
Cycle Life Under Customer Application Load Profile	Chart of the degradation rate of capacity and impedance (if applicable) with respect to a measurable duty in the customer application (such as watt-hour through-put or cycles). Specify Charge/Discharge, DoD, and EOL conditions.	Charts	

Environmental Operating Conditions

Specification Parameter	Description	Units	Expected Value
System Minimal Operational Temperature	Minimal temperature at which the system can operate at its rated capacity (also consider min/max temp limits when in standby or when idle).	°F	
System Maximum Operational Temperature	Maximum temperature at which the system can operate at its rated capacity (also consider min/max temp limits when in standby or when idle).	°F	
System Maximum Operational Altitude	Maximum altitude at which the system can operate at its rated capacity (also consider min/max temp limits when in standby or when idle).	ft	
Mechanical Stress - Outdoor - Expected Period between Major Exterior Refinishing	Estimated time before exterior refinishing when operated in the intended customer application.	Yr	

Specification Parameter	Description	Units	Expected Value
Mechanical Stress - Outdoor - Snow Load Rating	Rated weight per area of snow before damage occurs to ESS components.	lb/ft^2	
Mechanical Stress - Outdoor - Ice Load Rating	Rated thickness of ice on top of ESS components before damage occurs.	in	
Mechanical Stress - Outdoor - Wind Speed Limit	Rated wind speed before damage to the ESS occurs.	mph	
Mechanical Stress - Outdoor - Flood Tolerant (Height)	Rated flood tolerance height.	Mft	
Mechanical Stress - Outdoor - Other	Other known outdoor mechanical stresses to consider for the project site.		
System Operational Altitude Range	Rated maximum altitude at which the ESS can perform according to its full specifications.	ft	
Range of Operational Humidity Range (%RH)	Range of humidity in which the ESS can operate according to its full specifications.	%RH	
Storage Humidity Range	During construction phase and spare part storage requirements.	%RH	

Emissions & Environmental Impact

Specification Parameter	Description	Units	Expected Value
Sound Emissions – 6 ft High, 3 ft from Perimeter	Audible Noise dB at 3 ft distance (nearfield).	dB	
Sound Emissions – 6 ft High, site boundary (approximately 40ft from ESS)	Audible Noise dB at site boundary (approx. 40 ft).	dB	
Fluids Containment Necessary (Moat, Tank, or Pond)	Type, amount, and under which conditions.		

PM – (Airborne) Particulate Matter	Type, amount of emitted airborne particulates and under which conditions with respect to the energy through-put.	lb/MWh	
Gas Emissions	Provide Type & amount of gas emitted, under which conditions with respect to the energy through-put. Examples include criteria pollutants (NO_X, SO_X), greenhouse gases (CO_2, CH_4, N_2O, etc.) and fugitive emissions from cooling equipment and circuit breakers (refrigerants, SF_6).	lb/MWh	

Auxiliary Power System & Components

Specification Parameter	Description	Units	Expected Value
Auxiliary Power Components Required	The type of auxiliary power components required for the ESS if applicable. May include the power required for cooling fans, oil pumps, and other ancillary equipment that is needed for the functioning of the ESS to charge or discharge ESS. 120/240 VAC and 480/277 VAC auxiliary power is provided at ESS unitized substation (transformer and breaker) as well as 125 VDC control power.		
Total Auxiliary Power Required	Specify by each auxiliary power component. Item A Item B Item C	kW (ea)	
Average Auxiliary Power Required - Continuous	Aux continuous power (used to estimate system tare losses and to size the continuous rating of a power transformer or other thermally tolerant devices).	kW	
Total Auxiliary Power Required - Peak Power (Locked Rotor, etc.)	Aux peak power (locked rotor, etc.) used to size the ratings of in-line fuses and wiring and other thermally intolerant assets).	kW	
Aux Nominal Voltage	Specify	Vac	
Auxiliary VAC Wiring	Auxiliary number of phases (1, 2, or 3).	No of Phases	
Aux Circuit Breaker Rating	Recommended breaker rating for auxiliary power circuits.	A	

Thermal Management

Specification Parameter	Description	Units	Expected Value
Type (HVAC, Chiller, Blower, etc.)	Thermal management systems that are used to heat or cool the ESS (if applicable).		
Liquid Type Required (if Any)	Liquid used to transport heat from one part of the system to another (if applicable).		
Expected 100% Capacity Availability of Thermal System	Amount of heat (watts) the thermal system can remove (or add) from (to) the ESS when the thermal system is operating at 100% capacity.	W	
Redundancy	Redundancy built into the cooling system (if any). Percentage of ESS that will shut down if all or part of the cooling system were to fail or shut down for maintenance. Length of time the ESS can operate under partial capability conditions and specify conditions.	%, hr	

Maintenance

Specification Parameter	Description	Units	Expected Value
Availability of System	Percentage of time that the system is in full operation performing application specific functions taking into account both planned and un-planned down-time.	%	
Expected Unplanned Down-Time of System for Repair	Mean Time Between Failures (MTBF) or actual field failure data welcome.	Hr	
Expected Planned Down-Time for Maintenance	Expected time required for regular maintenance and types of maintenance.	hr/yr	
Expected Service Period between Regular Maintenance	Specify	days	
Expected Time to Perform Regular Maintenance	Specify	Days	
Expected Service Life before Major Replacement	Specify	years	
Equipment Storage Requirements	Environmental requirements to be maintained around spare parts and system components prior to installation and/or during temporary storage, (temperature, humidity, leak containment, etc.) e.g. IEC 60721-3-1.		

Start Up/Shut Down Characteristics

Specification Parameter	Description	Expected Value
Average Start Up Time	Typical start up time under the specified conditions. List for both cold start and from standby mode.	
Maximum Start Up Time	Seconds	
Typical Shut Down Time	Seconds	
Maximum Shut Down Time	Seconds	
Control Power UPS Back-Up Time	Expected minimum autonomy time on back-up power; amount of time an ESS' control system(s) can operate off back-up power (i.e. a UPS) in the event of power loss or other interruption to the ESS' external power supply.	
System Behavior when Main Power Is Interrupted	Behavior of system while the control systems are powered by a UPS, or an alternative auxiliary power supply, when the mains power line is shorted or opened.	
System Behavior when Mains Power Returns	Behavior of system when the mains power returns while the control systems are still powered by the UPS or an alternative power source.	

Exhibit 2: Availability and Liquidated Damages Formula

The Availability for each calendar month shall be calculated as follows:

$$Availability = \frac{D-(A+B+C+E)}{D} \text{ x } 100\%$$

For any calendar month where the Availability is less than [ ]%, the Liquidated damages for such month shall be calculated as follows:

$$Liquidated\ Damages\ =\ P_{MWh}\ x\ EDA$$

where

$$P_{MWh} = [(A + B + C + E) - D * (1 - GA)] * MW_R$$

$$MW_R = Guaranteed\ Continuous\ Discharge\ Rate$$
$$GA = Guaranteed\ Monthly\ Availability, expressed\ as\ decimal$$

Liquidated Damages shall be capped at some proportion (%) of said payment.

The following defined terms shall apply:

- **EDA** (Energy Storage Damage Amount: $/MWh rate for liquidated damages.
- **Term A - Planned Outage Hours exceeding General Maintenance Hours Allowance and Augmentation Hours Allowance.**
    - **Planned Outage Hours** means number of hours in a calendar month that the ESS is subject to a Scheduled Outage for ESS general maintenance or augmentation purposes, less:
        - the remaining hours of the General Maintenance Hours Allowance, or
        - the remaining hours of the Augmentation Hours Allowance
    - Such Planned Outage Hours shall be pro-rated by multiplying
        - (1) the Planned Outage Hours and
        - (2) the percentage of the ESS that is unavailable (calculated by dividing the number of MWs unavailable, in increments of [ ] MWs, over the ESS capacity in MW.
    - General Maintenance Hours Allowance and Augmentation Hours Allowance shall be mutually agreed upon by Buyer and Seller.
    - Any augmentation or major overhaul of the ESS shall be included in proposal of planned outage hours.

- Pre-defined years in which augmentation and/or major overhaul will take place shall also be provided.
- Any partial outage for maintenance during an hour shall count as a full hour for purposes of this definition.

- **Term B – Forced Outage Hours**
  - **Forced Outage Hours** means the number of hours in a calendar month during which the BESS is subject to a Forced Outage or an outage not communicated to Buyer in advance as Planned Outage Hours, excluding not being visible on the SCADA system. Such Forced Outage Hours shall be pro-rated by multiplying:
    - The duration of the Forced Outage and
    - the percentage of the BESS that is unavailable, calculated by dividing the number MWs unavailable, in increments of [ ] MWs, over the ESS capacity in MW.
  - Outages due to factors that are not in the control of Seller shall not be counted as Forced Outage Hours in the calculation of the availability; including
    - Force Majeure,
    - Buyer Default,
    - Grid outages
  - Any partial outage during an hour shall count as a full hour for purposes of this definition, i.e. 7h 25min → 8h.

- **Term C - Performance Shortfall Hours**
  - "Performance Shortfall Hours" means the number of hours in a calendar month (exclusive of any Planned Outage Hours and Forced Outage Hours) during which the ESS is not capable of meeting the Guaranteed Continuous Discharge Power Rate measured in each performance test; provided, that such Performance Shortfall Hours shall be prorated by multiplying:
    - (1) the Performance Shortfall Hours; and
    - (2) the percentage shortfall of the applicable Guaranteed ESS Parameter, calculated as Actual Measured value/ Guaranteed value).
    - The Continuous Discharge Power Rate shall first be rounded to the nearest increment of [ ] MWs before calculating (2).

- Term C shall apply in the Liquidated Damages Formula only if the ESS fails the annual Performance Test.

- **Term D = "Total Hours in the Month"**, which means twenty-four (24) multiplied by the number of days in such month.
- **Term E = "SCADA Failure Hours",** which means the number of hours Buyer is unable to access real-time meter data from the ESS or change the ESS' operation due to SCADA equipment failure.

Exhibit 3: Locations on LADWP-Owned Land for Energy Storage Deployment

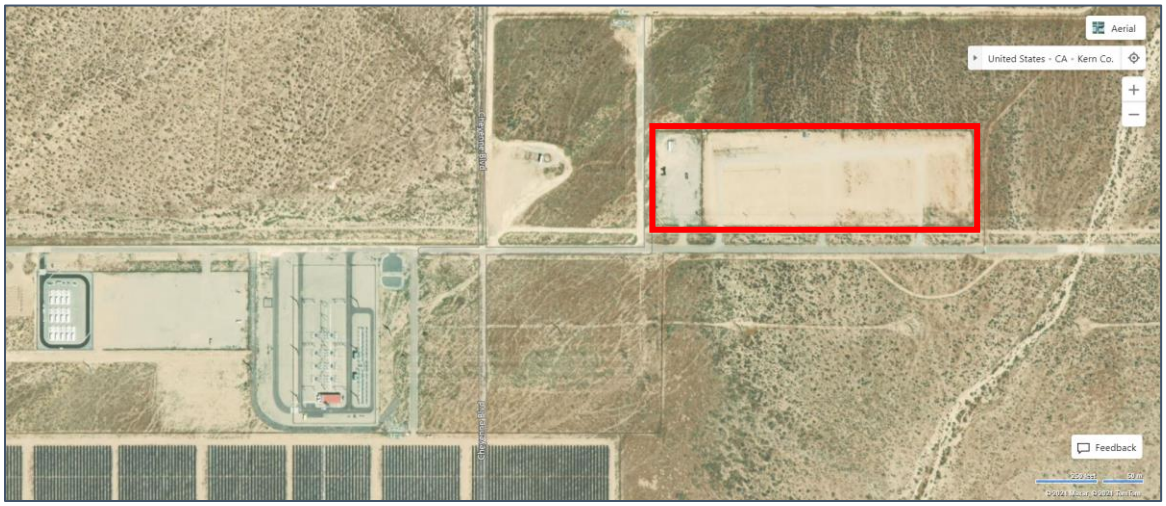
Assume all dimensions are approximations. The following are potential locations for ESS deployment on LADWP-owned land. Available land is subject to change.

- Assume interconnection voltage is 230kV for all locations in Exhibit 3.
- Assume LADWP has site control for locations 1-5 if proposal is BOOT. Site control for PPA/ESA at location 1 may be discussed separately.
- All locations will require a Project Labor Agreement (PLA) and compliance with LADWP's Business policies (i.e. Prevailing Wage Rate) if proposal is selected. Refer to SCPPA RFP for details.
- **Soft Close Dates:** LADWP will review all proposals received to-date on soft close dates to determine if there are suitable proposals for negotiations.

Location 1 - LADWP-Owned Land Near Beacon Substation

- Location: Mojave, CA. 35°15'28.38"N, 118°1 0.94"W
- 9.8-acre rectangular plot, 1340ft x 320ft
- Minimum Capacity: 25MW
- Required Duration: 8 hours or more
- COD: Q2 2026 or earlier
- Technology: Not Lithium-ion BESS, specifically targeting long duration energy storage.

- Requires transmission tie line (Seller's responsibility)
- Acceptable Contract Structures:
    - Build-Own-Operate-Transfer (BOOT): 1-year demonstration period after COD, may purchase project if performance is satisfactory
    - Energy Service Agreement (ESA/PPA): 20-year term with buyout option starting year 5 after COD
- Soft Close Date for proposals: July 1, 2022 & November 1, 2022

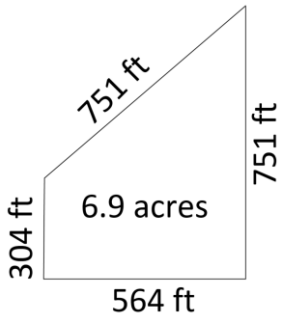


The following applies to locations 2-5:

- Required Duration: 4 hours or more
- Expected COD: 2027-2030
- Project ownership by Buyer (i.e. BOOT)
- Optional Long-Term Service agreement (LTSA)
- Expected Interconnection Voltage: 230kV
- Soft Close Date for proposals: November 1, 2022

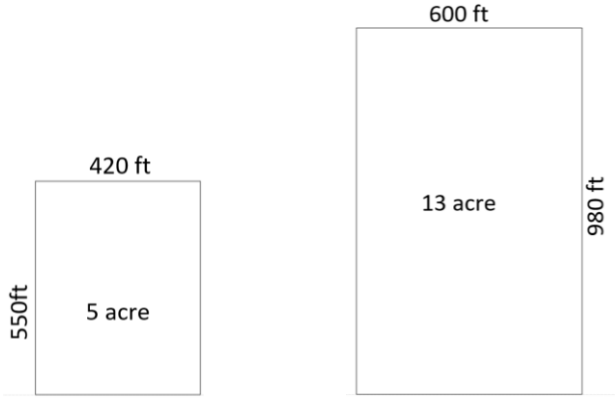
Location 2

- Total area: 6.9 acres
- Minimum Capacity: 50MW



Location 3

- Total area: 18 acres (2 plots)
- Minimum Capacity: 55MW
- Longer duration encouraged.



Location 4

- Total area: 2.75 acres
- Minimum Capacity: 100MW

Location 5

- Total area: 6.2 acres
- Minimum Capacity: 50MW