

**APPENDIX B**

**SOUTHERN CALIFORNIA PUBLIC POWER AUTHORITY**

**FOR**

[Project Name]

This document contains requirements specific for LADWP proposals.

Note: Where requested, Seller shall check appropriate box indicating whether Seller agrees or disagrees with provision as stated. If Seller disagrees, Seller shall provide description of specific point(s) of disagreement and proposed counterproposal, where applicable. This request for proposal is for standalone energy storage or storage pairing with existing solar facility in LADWP system.

The Los Angeles Department of Water and Power (“LADWP”) and the “Buyer” shall be used interchangeably.

The ESS requirements are meant to be technology agnostic, provided that the ESS meets all of the requirements and technological specifications provided in this Appendix B. Otherwise please list your justification in the respective comments.

The requirements in this Appendix shall apply to Energy Storage System (ESS) paired with a renewable energy resource only. Stand-alone storage projects shall be submitted to the Standalone Storage RFP.

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| **Date** |  |
| **Buyer** | Southern California Public Power Authority, and, together with Seller, the “***Parties***” and each, a “***Party****.”* |
| **Seller** | (**“**Seller”) |
| 1. **Energy Storage System Requirements** | |
| **1.1.** | Shall interconnect at transmission level only (greater than 100kV).  Agree  \_\_\_\_ kV Disagree  Comments: |
| **1.2.** | Shall be interconnected to the Buyer’s Point of Interconnection (POI) with revenue grade metering.  Agree  Disagree  Comments: |
| **1.3.** | The renewable energy resource(s) and ESS must be integrated into LADWP as a network resource for serving load in the LADWP’s balancing authority area, if the proposal is intended for LADWP.  Agree  Disagree  Comments: |
| **1.4.** | The ESS shall consist of commercially available technology.  Agree  Disagree  Comments: |
| **1.5.** | The 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 and capacity or (b) begun construction of at least one other project similar to the proposal being submitted. Please include the prime proposer and all sub recipient's experiences with their respective roles in each project using a separate file, named Exhibit D.  Agree  Disagree  Comments: |
| **1.6.** | The ESS shall be installed, commissioned, and maintained by the Seller. The Buyer shall have full operational control over the ESS.  Agree  Disagree  Comments: |
| **1.7.** | The ESS shall be developed and installed in accordance with all applicable laws and best industry practices and standards for the applicable technology. Please list out them in a separate file named Exhibit E.  Comments: |
| **1.7.1.** | The Buyer and the Seller shall make good faith effort(s) to pursue any available Federal and/or State incentives to increase price competitiveness for the Project or its application. Payment(s) shall be structured to consider any incentives/tax credit that may be granted.  Comments: |

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| **1.7.2.** | Contingent on the Seller’s proposal including a battery technology such as lithium-ion batteries, the Seller shall provide an Emergency Response Plan (ERP) for fire safety at or before the Commercial Operation Date (COD) If ERP is available at the time of proposal submission, please include it in Exhibit F.  Agree  Disagree  Comments: |
| **1.8.** | All proposals shall explicitly provide operational capabilities and operating restrictions of the proposed technology and include all control modes that ESS is capable of performing (see Exhibit A, Table 1 for details).  Agree  Disagree  Comments: |
| **1.9.** | ESS shall have a minimum capacity of one half of the total renewable resource capacity, with a minimum duration of four (4) hours at the POI or otherwise specifically stated in the requirement for each project. The Buyer will consider durations longer than 4 hours, if it is economically feasible.  Agree  \_\_\_\_ MW / \_\_\_\_ MWh Disagree  Comments: |
| **1.10.** | If the proposal includes a Battery Energy Storage System (BESS), the BESS proposal shall include, at minimum, information on each of the following elements: |
| **1.10.1.** | Provide details regarding the battery storage modules and racks  Answer: |
| **1.10.2.** | Provide details regarding the power conversion and transformation equipment  Answer: |
| **1.10.3.** | Provide details regarding the battery management systems  Answer: |

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| **1.10.4.** | Provide details regarding the equipment for communication  Answer: |
| **1.10.5.** | Provide details regarding the thermal regulation system  Answer: |
| **1.10.6.** | Provide details regarding the environmental conditioning and safety  Answer: |
| **1.10.7.** | Provide details regarding the control systems and related software  Answer: |
| **1.10.8.** | Provide details regarding the enclosures  Answer: |
| **1.10.9.** | Provide details regarding the incidental and related equipment  Answer: |
| **1.10.10.** | The 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.  Agree  Disagree  Comments: |
| **1.11.** | The Seller shall be obligated to maintain full ESS power and energy rating for the entire term of the agreement, as following: |

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| **1.11.1.** | The Seller shall ensure that the ESS capacity (MW) and ESS Energy (MWh) matches the Guaranteed ESS Capacity and Energy throughout the Agreement term. If the ESS capacity falls below the Guaranteed values at any time, the ESS will be considered unavailable.  Agree  Disagree  Comments: |
| **1.11.2.** | ESS Agreement term shall be equivalent to renewable energy resource Agreement term.  Agree  Disagree  Comments: |
| **1.11.3.** | The Seller shall provide a degradation curve for the term of the Agreement. Contingent on an Agreement term of 10 years or more, Lithium-ion BESS shall maintain its energy to match the Guaranteed ESS Energy until 5 years before the end of the Agreement term; afterwards, the energy may degrade by up to 3% of the Guaranteed ESS Energy per year.  Agree  Disagree  Comments: |
| **1.11.4.** | Non-Lithium-ion ESS energy shall match the Guaranteed ESS Energy for the term of the Agreement.  Agree  Disagree  Comments: |
| **1.11.5.** | Pursuant to 1.11.3, the Seller shall be subject to liquidated damages if the Seller’s Guaranteed ESS parameters of performance testing of section 5.2, are not maintained for the term of the Agreement.  Agree  Disagree  Comments: |

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| **1.12.** | The ESS shall be capable of continuous discharge from 100% State of Charge (SOC) to 0% SOC and continuous charge from 0% to 100% SOC at the Guaranteed MW Capacity. 100% SOC shall be equal to the Guaranteed Energy Amount (MWh) for the entire Agreement term, pursuant to 1.11.3.  Agree  Disagree  Comments: |
| **1.13.** | The Buyer shall have the following: |
| **1.13.1.** | The ability to set specific SOC and MWh values for the ESS to achieve by a set time. The required charge and discharge rate shall not be set by the buyer.  Agree  Disagree  Comments: |
| **1.13.2.** | The ability to specify a charge and discharge MW set point that shall override existing operations/schedules to execute immediately.  Agree  Disagree  Comments: |
| **1.13.3.** | The ability to connect, communicate, and control the ESS via LADWP SCADA, on DNP3 protocol.  Agree  Disagree  Comments: |
| **1.14.** | The Seller shall be responsible for the ESS complying with applicable policies and requirements for Energy Imbalance Market (EIM). Specific requirements shall be discussed between the Seller and Buyer during negotiations.  Agree  Disagree  Comments: |
| **1.15.** | The ESS shall be registered with the California Independent System Operator (CAISO) following the New Resource Implementation (NRI) Process. The Seller shall assume such resource will become a Participating Resource in the Buyer’s portfolio.  Agree  Disagree  Comments: |

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| **1.16.** | The ESS is subject to the following use limitations: |
| **1.16.1** | Lithium-ion BESS shall provide a minimum of 365 equivalent cycles per calendar year or 366, as applicable for leap years. The number of cycles for other technologies shall be negotiated separately. Cycling during performance tests shall not be included in the minimum cycles per year. The Buyer will pay a fee to use additional cycles over the minimum requirement.  Agree  Disagree  Comments: |
| **1.16.2.** | Up to 5% grid charging shall be available annually to enhance operational flexibility. Grid charging means, energy used to charge the ESS, excluding the energy from the paired renewable resource. Energy for grid charging shall be provided by the Buyer.  Agree  Disagree  Comments: |
| **1.16.3.** | ESS shall be capable of providing between +0.8 power factor and -0.8 power factor with respect to facility capacity at the POI.  Agree  Disagree  Comments: |
| **1.17.** | The ESS shall comply with the latest version of applicable codes and standards at detailed engineering phase, including, but not limited to the following. The Seller shall indicate which codes, if any, they cannot meet and why. Please add any additional applicable code and standard in the comment section below: |
| **1.17.1.** | IEEE Standards 1547, 1547.1, 693, 519,  Agree  Disagree  Comments: |

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| **1.17.2.** | UL Standards 9540, 9540A, 2054, 62133, 1741, 1741SA  Agree  Disagree  Comments: |
| **1.17.3.** | NFPA Standards 855, 68, 69, 72, 70, 1  Agree  Disagree  Comments: |
| **1.17.4.** | IFC 2018/2021  Agree  Disagree  Comments: |
| **1.17.5.** | UN/DOT 38.3  Agree  Disagree  Comments: |
| **1.17.6.** | All applicable codes from the National Electric Code  Agree  Disagree  Comments: |
| **1.17.7.** | ANSI C84.2006  Agree  Disagree  Comments: |
| **1.17.8.** | IEC 62933-5-2  Agree  Disagree  Comments: |
| **1.17.9.** | Local AHJ (Authority Having Jurisdiction) requirements  Agree  Disagree  Comments: |

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| **1.17.10.** | The ESS shall be programmed in accordance to NERC Standard PRC – 024-2, in consultation with the Buyer.  Agree  Disagree  Comments: |
| **1.18.** | The communication for the ESS shall comply with the following: |
| **1.18.1.** | The ESS shall have MESA-ESS communication standards capability as well as DNP3 communication protocol capability separately.  Agree  Disagree  Comments: |
| **1.18.2.** | The ESS shall establish a connection to external communications in the form of at least one console for the Buyer’s Energy Management System (EMS) and one console for local control.  Agree  Disagree  Comments: |
| **1.18.3.** | The ESS shall have backup Automatic Generation Control (AGC) capability. Specific Requirements shall be discussed between the Buyer and the Seller during negotiations.  Agree  Disagree  Comments: |
| **1.19.** | The Seller shall provide monthly regular reporting of ESS status to the Buyer via SCADA including, but not limited to the following: |
| **1.19.1.** | ESS throughput cycles available in cycles and MWh  Agree  Disagree  Comments: |
| **1.19.2.** | Specific grid charge percentage availability for the year  Agree  Disagree  Comments: |

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| **1.19.3.** | Specific MW and MVAR available for charge and discharge  Agree  Disagree  Comments: |
| **1.19.4.** | MWh available for charge and discharge  Agree  Disagree  Comments: |
| **1.19.5.** | MWh discharged year to date  Agree  Disagree  Comments: |
| **1.19.6.** | Estimated time needed to charge from the current SOC to another Operator-specified SOC  Agree  Disagree  Comments: |
| **1.19.7.** | Estimated Round-trip Efficiency, based on total MWh charged and discharged per month. For clarification, this does not establish the round-trip efficiency of the ESS for purpose of the annual performance tests or declaring commissioning.  Agree  Disagree  Comments: |
| **1.20.** | The Seller shall provide D-Curve for all 4 quadrants (MVAR output vs MW output) at all power factors to the Buyer in Exhibit G.  Agree  Disagree  Comments: |
| **1.21.** | All ESS warranty assumptions, required standby time prior to operation, and any other system operational limitations shall be explicitly stated in the comment section below section if any.  Agree  Disagree  Comments: |
| **1.22.** | The Seller shall be responsible for environmental liability, and hazardous materials removal, as will be further defined and explained in the Agreement between the Buyer and the Seller during negotiations. Specific hazardous materials shall be defined separately in Safety Data Sheet (SDS). Please include it in Exhibit H, if any.  Agree  Disagree  Comments: |
| **1.23.** | The Seller shall be responsible for disposal and end of life considerations. The Buyer reserves the right to obtain cost of recycling and/or disposal of all project equipment at end of life from the Seller during the Agreement term. The Seller shall provide expected ESS degradation curve in Exhibit I.  Agree  Disagree  Comments: |
| **1.23.1.** | The Project decommissioning plan shall include key system and installation information that helps inform the Buyer about system decommissioning, end-of-life disposal/recycling process with potential vendors in Exhibit J.  Agree  Disagree  Comments: |
| **1.23.2.** | The Seller shall also provide guidelines and procedures for safe handling and disposal of damaged or defective battery cells and modules in Exhibit K, if applicable.  Agree  Disagree  Comments: |
| 1. **Metering** | |
| **2.1.** | The metering protocol for the ESS shall comply with the following: |
| **2.1.1.** | The Metering shall be on the high side of the project transformer and adjusted for losses from the facility to the POI.  Agree  Disagree  Comments: |

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| **2.1.2.** | All ESS metering shall comply with the applicable metering policies and requirements from the LADWP Bulk Electric System Meter Policy.  Agree  Disagree  Comments: |
| **2.1.3.** | Energy Losses due to the resistive losses, pumps, power conversion system, transformers, battery management systems, and battery thermal regulation inefficiencies shall be borne by the Seller.  Agree  Disagree  Comments: |
| **2.1.4.** | All Station Service, O&M and parasitic load (i.e., HVAC) shall be absorbed by the Seller with a separate meter. The Seller shall be responsible for all costs associated with station service and parasitic loads.  Agree  Disagree  Comments: |
| **2.1.5.** | Auxiliary load meters shall comply with the LADWP Bulk Electric System Meter Policy  Agree  Disagree  Comments: |
| 1. **Pricing** | |
| **3.1.** | The Seller shall provide a $/MWh price adder for the ESS, separate from the renewable resource price.  Agree  $ \_\_\_\_\_\_\_ / MWh Disagree  Comments: |

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| 1. **Availability Guarantee** | The ESS shall maintain monthly availability of 98% as described in Exhibit B (the “Monthly Guaranteed Availability”) for the entire term of the Agreement. If the ESS fails to achieve the Monthly Guaranteed Availability, then the Seller shall remedy such failure by paying liquidated damages, as described in Exhibit B, an amount proportional to ESS unavailability and performance. If ESS Monthly Guaranteed Availability falls below 90% beyond the agreed cure period, not including planned outage or curtailment at the Buyer’s discretion, the ESS shall be considered in default.  Agree  Disagree  Comments: |
| **4.1.** | Planned Outage Allowance for maintenance and/or augmentation shall be mutually agreed upon by both the Seller and the Buyer during negotiations. See Exhibit B for Availability Formula.  Agree  Disagree  Comments: |
| **4.2.** | The Seller shall provide notification via email to the Buyer communicating anticipated start and end dates of any outages, subject to the Buyer’s approval  Agree  Disagree  Comments: |
| **4.3.** | The Buyer shall be able to curtail renewable energy resources paired with ESS without a phone call notification. The Buyer shall have direct control of ESS.  Agree  Disagree  Comments: |
| **4.4.** | If SCADA control for ESS is not available or ESS is not visible via SCADA to the Buyer’s Energy Control Center, then the ESS shall be considered unavailable, unless otherwise specified by the Buyer.  Agree  Disagree  Comments: |
| **4.5.** | The Seller shall coordinate the timing of ESS augmentation with the Buyer to ensure optimal timing and minimal interference and disruption to the Buyer.  Agree  Disagree  Comments: |
| 1. **Performance Guarantee** | |
| **5.1.** | The Seller shall guarantee the performance of the ESS for selected parameters (“Guaranteed ESS Parameters” in 5.2) for the term of the Agreement in accordance with the Performance Test requirements and procedures. If the ESS does not pass the Annual Performance Test, the Payment from the Buyer to the Seller shall be reduced by the liquidated damages amount until ESS passes a subsequent Performance Test (separate from the Annual Performance Test).  Agree  Disagree  Comments: |
| **5.2.** | Provide Guaranteed ESS Parameters listed in Exhibit C (ESS Specifications Datasheet). The Seller shall conduct performance testing at the COD and during Annual Performance Test to compare against expected values provided in Exhibit C. All parameters measured at the POI. The Seller shall provide the comparison report to the Buyer.  Agree  Disagree  Comments: |
| **5.3.** | Payment for ESS shall be performance-based and made in full if all performance parameters are met. A monthly performance report shall be submitted by the Seller to the Buyer as a pre-requisite for payment. Invoices shall be paid after the Buyer approves the monthly performance report. Payment shall be reduced for underperformance. Performance parameter baselines and cure period shall be negotiated between the Buyer and the Seller. The Seller shall be in default if ESS performance does not meet mutually agreed baselines after the cure period.  Agree  Disagree  Comments: |

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| **Exhibit A: Energy Storage System Control Requirements** | |
| **1.** | The ESS shall have all the functions listed and outlined in the Exhibit A, Table 1 (“Control Modes”). The 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 Limitations, Control Mode setpoints and priorities (as specified and scheduled by the Buyer), and the ESS conditions (e.g. SOC, temperature, etc.) at the time of operation of such Control Mode(s). The 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 and discharge values and priorities, subject to those limitations and conditions. All functions should be operable from the Buyer’s EMS via DNP3.  Agree  Disagree  Comments: |
| **2.** | The following Control Modes are from the MESA-ESS Specification, and reference shall be made to either the MESA-ESS Specification or IEC 61850-90-7, or standard mutually agreed upon by the Buyer and the Seller. The following tables, Table 1 through 6, pertain to Lithium-ion BESS and not all sections may beapplicable to other ESS technologies. The Seller shall indicate the portions not applicable in the proposal.  Agree  Disagree  Comments: |

**Table 1—Control Modes**

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| **Control Mode Category** | **Control Mode** |
| Emergency Modes | 1. Voltage Ride-Through |
| 1. Frequency Ride-Through |
| 1. Dynamic Reactive Current |
| 1. Dynamic Volt-Watt |
| 1. Frequency-Watt (*Implement NERC Inverter- Based Performance Guideline)\** |
| 1. Frequency-Droop |
| Active Power Modes | 1. Charge-Discharge Storage |
| 1. Coordinated Charge-Discharge |
| 1. Active Power Limit |
| 1. Active Power Response (configurable as Peak Power Limiting, Load Following, or Generation Following modes) |
| 1. Automatic Generation Control |
| 1. Active Power Smoothing |
| 1. Volt-Watt |
| 1. Frequency-Watt Curve |
| 1. Pricing Signal |
| Reactive Power Modes | 1. Fixed Power Factor |
| 1. Volt-VAR Control |
| 1. Watt-VAR |
| 1. Power Factor Correction |

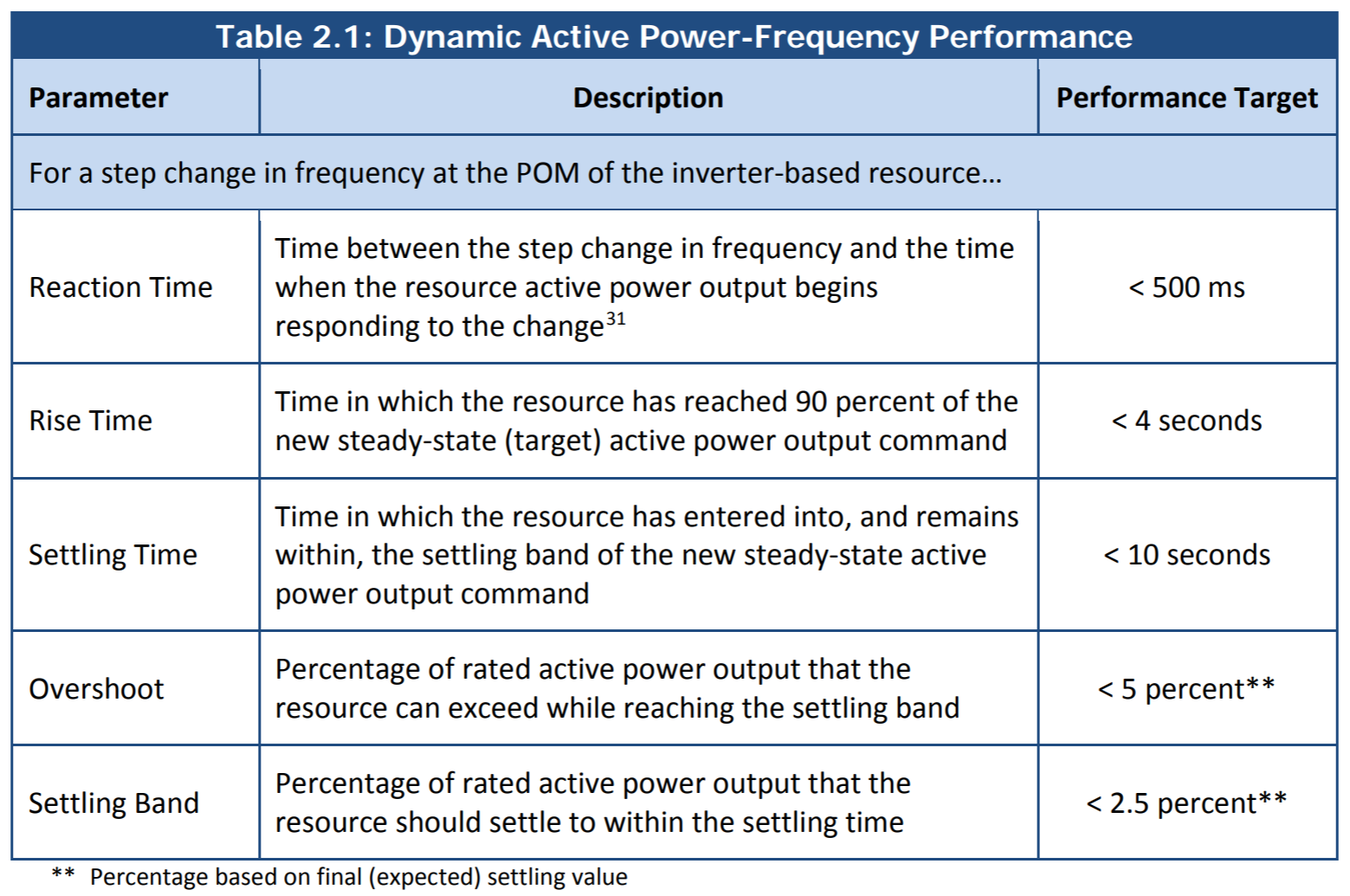
\* A frequency function/set point is needed to facilitate the LADWP’s compliance to NERC Reliability Standard BAL-003-1.1, requirement R1 or its successor. That would be a temporary MW output or input triggered by a configured change in frequency. Further details shall be provided during negotiations.

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 the 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 Buyer-specified “Frequency Rate of Change Response” in Table 2. The functionality set forth in Tables 2-5 may be specific to Li-ion BESS, however all other ESS products must document exceptions & deviations to any of the following terms that cannot be met due to technological limitations in the proposal/bid.

**Table 2 – AUTONOMOUS FUNCTIONS**

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| **AUTONOMOUS FUNCTIONS** | | |
| *Multiple Control Modes from Table 1 shall be available to be simultaneously armed and operated as needed.* | | |
| **Frequency Rate of Change Response Control Mode**  Monitor grid frequency on the ESS side of the Point of Interconnection. 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 “Response Period” setpoint.  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 “Recovery Ramp Rate” setpoint.  The following parameters should be settable by the Buyer. | | |
| Symbol | Value | Units |
| Δftrig | Magnitude of frequency change to trigger response | MHz |
| Δttrig | Maximum duration over which that change can accrue | sec |
| ΔPresp | Magnitude of MW response per decihertz | MW/dHz |
| tresp | Duration of MW response after triggered | sec |
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| * Initiate frequency response if the magnitude of frequency change |Δf| is at least Δftrig within or at time interval Δttrig. * The response is a MW step change of amount Presp = ΔPresp × –Δf × 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 Δftrig. The response magnitude is not permitted to decrease. * Frequency response ends at the expiration of response period tresp. * 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 proposals. The Seller will update the values with the latest version of the Guideline at the project design phase. | | |

**Table 3 – DYNAMIC ACTIVE POWER-FREQUENCY PERFORMANCE**



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| **Dynamic Reactive Current Support Mode Requirements** |
| Monitor voltage at Point of Interconnection |
| 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 Interconnection 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 (Coordinated 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 4 – EXTERNAL OVERRIDE CONTROLS**

| **Provide functionality to trigger manual discharge, using the following parameters:** |
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| 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 5 – CONNECTION AND DISCONNECTION FROM LADWP GRID**

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| **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 to 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 the 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 Interconnection 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 6 – REMOTE MONITORING AND CONTROL**

| **REMOTE MONITORING AND CONTROL Requirements** |
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| 1 second sampling time from ESS-to the Buyer communication mechanism for data transfer during faults/triggered actions. |
| Connection to external communications systems via one console for Buyer 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.** |
| 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 under real time conditions/ Guaranteed ESS Energy (MWh) |
| Current power capabilities in all quadrants |
| Voltage and frequency as measured at Point of Interconnection |
| 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 B: Availability and Liquidated Damages Formulas**

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

x 100%

**For any calendar month where the Availability is less than the Monthly Guaranteed Availability, the liquidated damages for such month shall be calculated as follows and deducted from the monthly payment from the Buyer to the Seller:**

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The Buyer may discuss capping liquidated damages a proportion of the monthly payment during negotiations.

The following defined terms shall apply:

* **EDR** (ESS Damage Rate): $/MWh rate for liquidated damages, to be negotiated.
* **A: Planned Outage Hours exceeding 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 maintenance hours allowance, and
    - 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 Guaranteed ESS capacity in MW.
  + Maintenance hours allowance and augmentation hours allowance shall be mutually agreed upon by the Buyer and the Seller during negotiations.
  + Any augmentation or major overhaul of the ESS shall be included in proposal of scheduled outage hours.
  + Pre-defined years in which augmentation and/or major overhaul will take place shall also be provided to the Buyer in advance.
  + Any partial outage for maintenance during an hour shall count as a full hour for purposes of this definition.
* **B: Forced Outage Hours**
  + Forced Outage Hoursmeans the number of hours in a calendar month during which the BESS is subject to a forced outage or an outage not communicated to the 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 Guaranteed 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
* **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 ESS Parameters in the Annual 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 worst performing Guaranteed ESS Parameter in section 5.2, calculated as Actual Measured value/ Guaranteed value.
    - Such parameter shall first be rounded to the nearest increment of [ ] before calculating (2).
  + C shall apply in the Liquidated Damages formula only if the ESS fails the Annual 1 Test.
* **D: Total Hours in the Month**
  + Total Hours in the Month means twenty-four (24) hours multiplied by the number of days in such month, while accounting for Daylight Savings Time.

## **Exhibit C: ESS Specifications Datasheet**

## The Seller shall complete the provided ESS Specifications Datasheet with specific technical information as applicable. Please indicate N/A for non-applicable items.

|  |  |  |  |
| --- | --- | --- | --- |
| **ESS Technical Specifications**  Indicate N/A if not applicable or available. | |  |  |
|  |  |
| **Specification/Parameter** | **Description** | **Unit** | **Value** |
| Project Name |  |  |  |
| Energy Storage Technology Type |  |  |  |
| RTE (%) |  | % |  |
| Availability Guarantee (%) |  | % |  |
| Minimum Generation Capacity |  | MW |  |
| Rated Continuous Discharge Real Power (MW) | The rate at which the ESS can continuously deliver energy for the energy storage component’s entire specified SOC range. | MW |  |
| Rated Continuous Charge Real Power (MW) | 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 |  |
| Rated Storage Energy (MWh) |  | MWh |  |
| Energy Density (kWh/sq. ft.) |  | kWh/sq. ft. |  |
| Total Footprint (Acres) |  | Acres |  |
| Total Footprint (sq. ft.) |  | Sq. ft. |  |
| Response Time, Cold Start-up (seconds) |  | seconds |  |
| Response Time, Warm Start-up (seconds) |  | seconds |  |
| Useful Life (years) |  | years |  |
| Charge Ramp Rate (MW/min) |  | MW/min |  |
| Discharge Ramp Rate (MW/min) |  | MW/min |  |
| Minimum Charge Time (hours) | The minimum amount of time required for the ESS to be charged from minimum SOC to its rated maximum SOC. | hours |  |
| Typical Charge Time (hours) | This should include any time for rest a period needed between a full or partial charge or discharge cycle. | hours |  |
| Degradation (%/year) |  | %/year |  |
| Cycles Limitation (cycles) |  | cycles |  |
| Rest Period between Cycles (hours) |  | hours |  |
| Warranty Term (years) |  | years |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Expected Planned Down-Time for Maintenance (hr/yr) | Expected time required for regular maintenance and types of maintenance. | hr/yr |  |
| Expected Service Period between Regular Maintenance (days) | Specify | days |  |
| System Internal Minimum Temperature (°F) | System internal temperature if charging medium requires a certain temperature to work optimally (i.e. thermal storage) | °F |  |
| System Internal Maximum Temperature (°F) |  | °F |  |
| System Minimum Ambient Temperature (°F) | Minimum ambient 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 Ambient Temperature (°F) | Maximum ambient temperature at which the system can operate at its rated capacity (also consider min/max temp limits when in standby or when idle). | °F |  |
| Range of Operational Humidity Range (%RH) | Range of humidity in which the ESS can operate according to its full specifications. | %RH |  |
| Sound Emissions – 6 ft High, 3 ft from Perimeter (dB) | Audible Noise dB at 3 ft distance (nearfield). | dB |  |
| Sound Emissions – 6 ft High, site boundary; approximately 40ft from ESS (dB) | Audible Noise dB at site boundary (approx. 40 ft). | dB |  |
| PM – Airborne Particulate Matter (lb/MWh) | Type, amount of emitted airborne particulates and under which conditions with respect to the energy through-put. | lb/MWh |  |
| Gas Emissions (lb/MWh) | Provide Type & amount of gas emitted, under which conditions with respect to the energy through-put. Examples include criteria pollutants (NOX, SOX), greenhouse gases (CO2, CH4, N2O, etc.) and fugitive emissions from cooling equipment and circuit breakers (refrigerants, SF6). | lb/MWh |  |
| System Operational Altitude Range | System Operational Altitude Range | ft. |  |
| Fluids Containment Necessary (Moat, Tank, or Pond) | Type, amount, and under which conditions. |  |  |
| Output Voltage Range (p.u.) | The range of AC grid voltage under which the ESS will operate in accordance with the ESS specification. | p.u. |  |
| Self-Discharge Rate (%/hour) | when battery is shut down/in storage state | %/hour |  |
| Standby Loss Rate (%/hour) | when battery is on standby, ready to respond (not cold start) | %/hour |  |
| Rated Continuous Reactive Power (MVar) | The magnitude of continuous reactive power (Real Power = 0) and the duration that the ESS can provide this power without overheating. | MVar |  |
| Rated Continuous Apparent Power (MVA) | 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 AC Current (A) | 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 |  |
| Max Real Power (WMax) | The maximum real power that the ESS can deliver to the grid, in Watts. May be the same as continuous discharge rate | MW |  |
| Max Apparent Power (VAMax) | The maximum apparent power for ESS, in Volt-Amperes. | MVA |  |
| Max Reactive Power (VARMax) | The maximum reactive power the ESS can produce or absorb, in VARs. | MVARs |  |
| Max Charging Real Power (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 |  |
| Max Charging Apparent Power (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 |  |
| Overload Discharge Power (MW) | The magnitude of temporary real power (reactive power = 0) and the duration that the ESS can provide this power before overheating. | MW |  |
| Overload Charge Power (MW) | The maximum grid overload capability of the ESS. | MW |  |
| Overload Reactive Disharge Power (MVar) | The magnitude of temporary reactive power (Real Power = 0) and the duration that the ESS can discharge before overheating. | MVar |  |
| Overload Reactive Charge Power (MVar) | The magnitude of temporary reactive power (Real Power = 0) and the duration that the ESS can charge before overheating. | MVar |  |
| Artg (RMS Amps) | A nameplate value, the maximum AC current level of the ESS, in RMS Amps. | RMS Amps |  |
| Auxiliary Power Components Required |  |  |  |
| Total Auxiliary Power Required |  | kW |  |
| Average Auxiliary Power Required - Continuous |  | kW |  |
| Total Auxiliary Power Required - Peak Power (Locked Rotor, etc.) | A nameplate value, the maximum AC current level of the ESS, in RMS Amps. | kW |  |