



**Arizona Public Service Company**

**2018 Battery Energy Storage  
Request for Proposals (“RFP”)**

June 29, 2018

**TABLE OF CONTENTS**

A. OVERVIEW ..... 3

    1. Introduction ..... 3

    2. General Information ..... 3

    3. Proposal Requirements ..... 3

    4. Additional BESS Characteristics ..... 5

    5. Pricing ..... 7

    6. Commercial Experience ..... 7

    7. Collateral ..... 8

B. RFP SCHEDULE AND PROCESS ..... 9

    1. RFP Schedule ..... 9

    2. Independent Monitor (IM) ..... 9

    3. Confidentiality Agreement ..... 10

    4. APS Contact ..... 10

    5. Required Documents ..... 10

    6. Proposal Fee ..... 11

C. EVALUATION PROCESS ..... 12

    1. Evaluation for Compliance with Proposal Requirements ..... 12

    2. Screening Evaluation ..... 12

    3. Short List Selection of Proposal(s) ..... 13

    4. Detailed Evaluation of Short List ..... 13

    5. Final Evaluation and Selection ..... 13

    6. Right to Terminate Negotiations ..... 13

    7. Regulatory Approval ..... 13

D. MISCELLANEOUS TERMS AND CONDITIONS ..... 14

    1. General ..... 14

    2. APS Safety Standards ..... 14

APPENDIX A ..... 16

APPENDIX B ..... 17

## A. OVERVIEW

### 1. Introduction

Arizona Public Service Company (APS) is a regulated public utility that generates, transmits and distributes electricity for sale in Arizona. APS is headquartered in Phoenix, Arizona. As Arizona’s largest and longest-serving electric company, APS generates safe, affordable and reliable electricity for more than 1.2 million commercial and residential customers in 11 of Arizona’s 15 counties.

Through this Request for Proposals (RFP), APS is soliciting proposals (each, a “Proposal”) for the engineering, procurement, construction, maintenance and warranty (collectively referred to herein as “EPC Services”) of one or more new battery energy storage systems (BESS) to be integrated with existing APS-owned solar photovoltaic generation (AC coupled). Installation of such BESS(s) is intended to, among other things, help APS maintain a reliable power supply during peak demand periods and provide a flexible response to variable load requirements associated with increasing intermittent energy resources.

Any person or entity responding to this RFP is referred to herein individually as a “Respondent” and collectively as “Respondents.” A Respondent may consist of one or more persons or entities.

### 2. General Information

- a. Scope of Solicitation. In this RFP, APS seeks competitive Proposals for EPC Services for approximately 106 MWAC BESS(s) in accordance with the requirements set forth herein. APS will own and operate any BESS resources developed pursuant to this RFP.
- b. Affiliate Bids. APS corporate affiliates are NOT eligible to submit a Proposal in this RFP.
- c. Additional Services. APS is NOT seeking Proposals for services beyond those that are specified in this RFP or the associated BESS Term Sheet.

### 3. Proposal Requirements

The following requirements apply to all Proposals. As specified in Section B(5) below, failure to satisfy these requirements may result in a Proposal being eliminated from further consideration.

- a. Use of PowerAdvocate and Timely Document Submittal. APS is utilizing PowerAdvocate, a third party web-based platform, to host this RFP. APS

encourages each Respondent to carefully review the PowerAdvocate Terms of Use, which are located at <https://www.poweradvocate.com/web/terms-of-use.html> before submitting a Proposal.

Respondents are required to timely submit all deliverables specified in Section B(5) below. Respondents should carefully review the due dates specified in Section B(1) below; any deliverable submitted (including being uploaded in PowerAdvocate, as applicable) after the respective due date will be considered non-responsive and will not be evaluated.

- b. Transaction Structure. The proposed transaction will be subject to a battery energy storage agreement that satisfies the terms specified in the BESS Term Sheet found on the “Download Documents” tab in PowerAdvocate.
- c. Technology. The proposed BESS must utilize Lithium-ion batteries. APS is NOT seeking Proposals utilizing technologies such flow batteries, flywheels, compressed air energy storage system (CAES), fuel cells, or lead acid batteries.
- d. Commercial Operation. Each Proposal must provide for commercial operation no earlier than January 1, 2020 and no later than May 31, 2020. As specified in the BESS Term Sheet. APS expects to receive liquidated damages as a remedy in the event of failure to achieve commercial operation by the stated deadline
- e. Eligible Solar Sites. APS has identified the following AZ Sun sites as suitable for the BESS installation(s) being requested in this RFP: Paloma; Cotton Center; Desert Star; Gila Bend; and Hyder I and Hyder II (see map located in the “Download Documents” tab in PowerAdvocate). Respondents may submit a Proposal for BESS projects at any of the following combination of sites ONLY:

Option 1: Paloma (17 MW)

Option 2: Paloma *and* Cotton Center (34 MW)

Option 3: Paloma, Cotton Center *and* Desert Star (44 MW)

Option 4: Paloma, Cotton Center, Desert Star *and* Gila Bend (76 MW)

Option 5: Paloma, Cotton Center, Desert Star, Gila Bend *and* Hyder I & II (106 MW)

*In addition, a Proposal for more than one site (the Paloma site identified as “Option 1” above) must include all combinations that come before that proposed combination in the list above. For example, a Proposal for “Option 3” must also include Proposal information and pricing for each of “Option 1” and “Option 2.” Similarly, a Proposal for “Option 4” must also include Proposal information and pricing for each of “Option 1,” “Option 2,” and “Option 3.”*

- f. Capacity. APS will consider Proposals for total BESS capacity of approximately 106 MWAC, installed on up to five (5) sites as described in Section A(3)(e) above (Hyder I & II are considered one (1) site for purposes of this RFP). Each Respondent must offer in its Proposal(s) the full capacity for each site or combination of sites (as listed in Section A(3)(e) above). APS will not accept Proposals that offer partial capacity values.
- g. Technical Requirements. Proposals must adhere to the complete set of Technical Requirements specified in the attached Appendix B, and also found in the “Download Documents” tab in PowerAdvocate.

#### 4. Additional BESS Characteristics

APS requires that the following BESS characteristics be addressed in each Proposal. Respondents should carefully review each of below items and ensure that their Proposals are sufficiently responsive. In some cases there is an established requirement for a given characteristic; in other cases Respondents have the opportunity to make their most competitive offer for a given characteristic.

- a. Battery duration. Proposals should include a battery duration of three (3) consecutive hours for the proposed life of the BESS.
- b. Battery cycles. Each proposed BESS must be able to complete one (1) cycle per day, with the ability to cycle two (2) times per day at APS’s option not to exceed three hundred six five (365) cycles per year for each year during the term of the BESS agreement. Respondents are encouraged to reference the Time of Day Heat Map found in Appendix A as an indication of APS charge/discharge times; *provided, however, that APS makes no representation that it will adhere to any particular charge/discharge schedule, regardless of the information included in Appendix A.*
- c. Enclosure. Each Proposal must specify whether the BESS enclosure will be a modular enclosure or a permanent building, and should include Respondent’s rationale for selecting the type of enclosure that it proposes. Respondents should reference the site plan for each location that is located at the “Download Documents” tab in PowerAdvocate because any proposed enclosure must fit within the boundaries established on the applicable site plan. In addition, the geotechnical report for each site is also available at the “Download Documents” tab in PowerAdvocate, and may also be useful to Respondents for determining the most suitable enclosure for a given site.
- d. Ancillary Services. Respondents may include in their Proposals additional ancillary services (i.e., frequency regulation (up and down) and spinning reserve) not otherwise requested by APS in Section C(1) of Appendix B. Respondents that propose any additional ancillary service must include those in the Proposal price and must also specify the line item cost for each in the “Pricing” tab in PowerAdvocate.

- e. Warranty. Each Proposal must specify Respondent’s standard parts and labor warranty offering, including the cost and terms for coverage of site construction, the BESS and all component parts, the BESS enclosure, communications equipment, and the battery management system located in the Commercial Tab, General Company Information” in PowerAdvocate. The warranty must include a component replacement policy (parts and labor) to ensure that the system continues to perform in accordance with the BESS duty cycle as set forth herein for the entire design life. In addition to providing the cost and terms of its standard warranty offering, Respondents must also provide the cost and terms of a ten (10)-year warranty offering in the “Pricing Tab” within PowerAdvocate . In the event that a Respondent’s standard warranty is itself a ten (10)-year warranty, Respondent should state that it in its Proposal. In any case, the warranty period must begin upon final acceptance of the BESS by APS.
- f. Maintenance. Each Proposal must include a full preventative maintenance plan along with corresponding maintenance schedule for five (5) years, expressed in annual dollars and based on the nameplate capacity at each proposed site, in the “Pricing Tab” within PowerAdvocate.
- g. Performance Guarantees.

Each Respondent must specify in its Proposal(s) the following performance guarantees for each site included in the Proposal. The information must be included in the “Battery Energy Storage System(s) Performance Guarantees(tab 2), located in the “Technical Data” folder in PowerAdvocate.

- i. Guaranteed Annual Availability: The Respondent must guarantee annual Availability of at least ninety-six percent (96%). Proposed availability for the summer months (June – September, Tier 3 on the Time of Day Heat Map found in Appendix A) must be at least ninety-seven percent (97%).
- ii. Guaranteed Power Capacity: MW(AC) over a continuous full discharge of the BESS, measured at the medium voltage meter, net of auxiliary loads, for the full proposed life of the BESS.
- iii. Guaranteed Energy Capacity: MWh(AC) of energy delivered over a full continuous discharge at \_X\_ MW, where X = the Guaranteed Power Capacity, for the full proposed life of the BESS.
- iv. Guaranteed Round Trip Efficiency: Output Energy/Input Energy as measured at the medium voltage meter and Auxiliary Load meter expressed as a percentage, for the full proposed life of the BESS.
- v. Auxiliary Load Guarantee: Maximum amount of auxiliary load to be consumed on an annual basis, expressed in kWh per site, measured at the auxiliary load meter, for the full proposed life of the BESS.

- h. Interface for Communication and Cyber Security with APS systems. Respondent will be responsible to design, procure, install and integrate with existing solar generation control systems to provide necessary communication and security using DNP3 protocols for APS to remotely communicate with each BESS.
- i. Project Permits. In addition to the general compliance requirements referenced in Section D(1)(a) below, Respondents are responsible for complying with the permitting requirements in each jurisdiction where any proposed BESS will be located, including but not necessarily limited to the Town of Gila Bend, City of Buckeye, unincorporated community of Hyder, Maricopa and Yuma Counties and the State of Arizona. Respondents are encouraged to review the site information and geotechnical reports for each site included in the “Download Documents” tab in PowerAdvocate as part of any permit planning and analysis. Construction Power and Auxiliary Power. APS does not require that initial Proposals include the costs of Construction Power or Auxiliary Power; however, these costs will be required of any Shortlisted Respondent and will be expected to be provided without any markup.
- j. Interconnection. Any proposed BESS must deliver capacity and energy by directly interconnecting to the APS system at each proposed project site. Respondent must meet the APS Interconnection Requirements (Rev 8.2) which can be found at [www.aps.com/DG](http://www.aps.com/DG). APS Electric Service Requirements can be accessed via [www.aps.com/ESRM](http://www.aps.com/ESRM). APS does not require that initial Proposals include interconnection costs; however, these costs will be required of any Shortlisted Respondent and will be expected to be provided without any markup.

## 5. Pricing

Pricing contained in any Proposal must include all costs associated with the EPC Services and any other work necessary to deliver the proposed BESS(s) to APS consistent with Respondent’s Proposal and all of the requirements specified in this RFP and the associated BESS Term Sheet. All Proposal terms, conditions and pricing will remain binding until the execution of a binding agreement (if any) between APS and the respective Respondent as a result of this RFP, as well as any applicable regulatory approval (as referenced in Section C(7) below). All prices must be clearly stated in United States Dollars, and entered per proposal in the “Pricing” tab(s) in PowerAdvocate.

## 6. Commercial Experience

Each Respondent must demonstrate in its Proposal that it has successfully developed and constructed a minimum 10 MW/3-hour duration BESS using the same technology and key equipment components included in its Proposal and located at a single project site within the United States. Respondent must also be able to demonstrate, as of August 31, 2018, that it has twelve (12) months of production history for such BESS. If the Respondent consists of one or more entities, APS will evaluate the experience of the entities collectively in determining if this requirement has been met. A Respondent that consists of one or more entities must show in its Proposal the legal and operational relationship among the entities and must state how such legal and operational relationship supports the Proposal being submitted.

**7. Collateral**

The following fixed collateral requirements apply to all Proposals; provided, however, that APS may take into account Respondent’s credit rating, proposed construction costs, and APS’s own credit analysis to determine any necessary adjustments to collateral for final contracting.

<b>Project Size</b>	<b>Required Project Collateral</b>
<b>17 MW</b>	<b>\$5,000,000</b>
<b>34 MW</b>	<b>\$10,000,000</b>
<b>44 MW</b>	<b>\$13,000,000</b>
<b>76 MW</b>	<b>\$22,000,000</b>
<b>106 MW</b>	<b>\$30,000,000</b>

Collateral must be posted in the form of a letter of credit or cash deposit no later than five (5) days after contract execution and must remain in effect through the duration of the applicable warranty period that begins with final acceptance of the facility.



**B. RFP SCHEDULE AND PROCESS**

**1. RFP Schedule**

The following schedule applies to this RFP:

Activity	Date
Press release issued	June 28, 2018
RFP issued	June 29, 2018
Confidentiality Agreement due	July 18, 2018 at 2:00 p.m. (AZ time)
Site Tour for Respondents who submit Confidentiality Agreements only	August 1, 2018 (estimated)*
Respondent Proposal & RFP Proposal Fee due	August 31, 2018 at 2:00 p.m. (AZ time)
Shortlisted Respondents notified	October 5, 2018
Final selection	November 7, 2018
Execution of BESS Agreement	January 21, 2019

\* The Site Tour date listed here is for planning purposes only at this time. APS will provide additional information about the Site Tour through PowerAdvocate Messaging after the July 18, 2018 Confidentiality Agreement deadline.

**2. Independent Monitor (IM)**

In accordance with the Arizona Corporation Commission (ACC) Procurement Rules, APS has engaged an IM to provide feedback to APS regarding the objectivity, transparency, and fairness of the RFP and the associated Proposal evaluation process. The IM will have access to all documentation provided by the Respondents in response to this RFP and will produce a final report summarizing its observations for use by APS, which may be submitted to the ACC in connection with APS’s regulatory requirements. The IM is obligated to maintain the confidentiality of all information that it receives. Respondents and potential Respondents must not contact the IM directly.

### 3. Confidentiality Agreement

APS requires that each Respondent, along with any other persons or entities acting as partners (whether legally formed or otherwise) of the Respondent or in a joint venture arrangement with the Respondent (in each case, a “Respondent Partner”), execute the Confidentiality Agreement (CA) provided on Power Advocate prior to being granted access to this RFP document. This prerequisite is necessary as the RFP sites are located on APS-owned property where proprietary information and data pertaining to existing APS facilities will be disclosed. **If you have accessed this RFP document in error – i.e., you have not yet executed and uploaded the CA (either directly, or through another representative of Respondent, or as a Respondent Partner as that term is defined in the CA), you are required to immediately contact APS through the “APS Contact” listed in Section B(4) below and follow the instructions given to you. Failure to do so may compromise any Proposal with which you are associated and subject you and/or your associated Respondent or Respondent Partner to legal remedies.**

### 4. APS Contact

The PowerAdvocate messaging tool is the sole means for communication for this RFP and will be monitored and responded to by APS. Respondents that experience any difficulty should contact:

Arizona Public Service Company

**Attention: Sobia Naqvi**

**Email: [Sobia.Naqvi@aps.com](mailto:Sobia.Naqvi@aps.com)**

### 5. Required Documents

Respondents are required to use PowerAdvocate to enter or upload all requested information and documents no later than the dates specified in Section B(1) above. Respondents are encouraged to submit Proposals and associated documents as early as possible to avoid filing delays due to heavy use of PowerAdvocate immediately prior to submission deadlines. APS will not grant extensions to the RFP schedule and will not accept Proposals or other documents after their respective due dates. For a Respondent’s Proposal to be considered complete and eligible for further consideration, the Respondent must timely post to PowerAdvocate the following documents:

- a. Executed CA posted in PowerAdvocate from Respondent no later than July 18, 2018 at 2:00 PM Arizona time;
- b. A complete response to each question posed, and a legible copy of each document requested, in the “Commercial,” “Technical,” and “Pricing” tabs in PowerAdvocate;
- c. Completed Proposal, including a detailed Executive Summary of the Proposal. A sample Executive Summary can be found in PowerAdvocate under the “Download Documents” tab;

- d. Executed certification page which demonstrates that the signatory has full authority to bind the Respondent to all of the terms and conditions contained in its Proposal (Respondents must use the certification page posted by APS on PowerAdvocate);
- e. Completed “2018 APS BESS Technical Data Input” spreadsheet for each project site (located in “Download Documents” tab in PowerAdvocate);
- f. A development plan for each project site, including schedules shown in weeks, based on an assumed date for contract execution (which must be stated in the schedule);
- g. A copy of the BESS Term Sheet, redlined to reflect Respondent’s required modifications, if any, understanding that APS expects minimal, if any, redlines to the posted BESS Term Sheet and that Proposals containing significant substantive changes will be viewed less favorably by APS and may be eliminated from further consideration;
- h. Site plan for each project site that specifies the location of any proposed building or modular enclosure and associated project equipment; and
- i. An electrical one-line diagram of each BESS facility.

**6. Proposal Fee**

A non-refundable RFP submission fee (the “Proposal Fee”) of ten thousand dollars (\$10,000.00) must be submitted with each Proposal.

**APS must receive the Proposal Fee no later than August 31, 2018 as specified in Section B(1) above. The only form of payment APS will accept is a Fed Funds Wire Transfer using the information below.** Any costs or fees associated with wiring the funds must be paid directly by the Respondent.

Company:	Arizona Public Service Company
Bank:	Wells Fargo
ABA/Routing No.:	121000248
Account No.:	4159540921
OBI Field:	114903; AR114903222; 2018 RFP Bid Fee; Respondent’s name

## C. EVALUATION PROCESS

APS will apply both quantitative and qualitative criteria to evaluate Proposals, as follows:

### 1. Evaluation for Compliance with Proposal Requirements

- a. Compliance with Proposal Requirements. APS will review Proposals for compliance with the Proposal Requirements described in Section A above.
- b. Failure of Proposal to meet Proposal Requirements. APS may reject any Proposal that fails to meet the Proposal Requirements specified in Section A or that otherwise contains incomplete or inaccurate responses as determined by APS in its sole discretion. APS may, in its sole discretion, ask a Respondent for clarification or remediation of its Proposal prior to making a final determination regarding acceptance or rejection of the Proposal.

### 2. Screening Evaluation

- a. Price Screening and Initial Quantitative Analysis. For Proposals that remain in consideration following the evaluation specified in Section C(1) above, APS will then screen and rank them by price. Proposals with prices significantly higher than other Proposals with similar characteristics may be removed from further consideration at APS's discretion. APS will then perform an initial quantitative analysis (such as leveled busbar cost) on the remaining Proposals to identify and rank superior Proposals, and select the highest ranked for further portfolio analysis.
- b. Portfolio Analysis. APS will utilize production cost modeling software to evaluate how well the selected Proposals meet APS system reliability requirements while minimizing projected APS system costs. Proposals will be modeled as if they were added to the APS resource portfolio with costs expressed on a present value of revenue requirements ("PVRR") basis.

Inputs and assumptions utilized in the production cost modeling are proprietary to APS and will not be disclosed to Respondents; however, they will be provided to the Independent Monitor ("IM") referenced in Section B(2) in advance of the modeling to ensure the inputs and assumptions are reasonable and are not changed or applied differently to different Proposals.

- c. Qualitative Analysis. The qualitative analysis is comprised of a comprehensive risk assessment of the Proposal considering numerous factors including, but not limited to, technology, project viability, developer experience, safety record, quality assurance and quality control ("QA/QC") experience, credit risk, counterparty viability, supply-chain risk, and contract risk related to the development of the proposed resource. APS will also consider the Respondent's proposed modifications to the relevant pro forma term sheet. Proposals that request fewer changes to the pro forma term sheet will be evaluated more favorably than those that request more changes (either in number or scope).

### **3. Short List Selection of Proposal(s)**

At APS's sole discretion, Proposals that are judged acceptable following the quantitative and qualitative evaluation described in Section D(3) above may be selected for further detailed evaluation ("Shortlisted"). APS will notify Shortlisted Respondents, along with those Respondents whose Proposals were eliminated from further consideration, in accordance with the RFP schedule set forth in Section B(1) above.

### **4. Detailed Evaluation of Short List**

APS may conduct meetings or phone calls with each Shortlisted Respondent individually in order to gain a greater understanding of the Respondent and the Proposal. APS may also require a Shortlisted Respondent to submit resource-specific or Respondent-specific pro forma financial statements by year for the applicable resource development and construction period. Information requested would include income statements, balance sheets and statements of cash flows. APS may then re-evaluate the Proposal based on new information provided in response to the request or as a result of the meetings and calls. APS will perform any such reevaluation in a manner similar to the evaluation process described in Sections C(1)-(3) above.

### **5. Final Evaluation and Selection**

Following the meeting and potential re-evaluation process described above, APS may make a final selection of one or more Proposals for negotiation of an agreement in a form substantially similar to that set forth in the BESS Term Sheet. APS will notify Shortlisted Respondents whose Proposals are eliminated from further consideration in accordance with the RFP schedule, set forth in Section B(1) above.

### **6. Right to Terminate Negotiations**

APS reserves the right, in its sole discretion, to determine that no Proposals warrant selection for negotiation. APS may also, in its sole discretion, determine that further negotiation with a selected Respondent is unlikely to result in a final agreement between the parties. In either event, APS reserves the right at any time to terminate negotiations, begin or continue negotiations with other Respondents, begin a new solicitation, and/or cancel this RFP.

### **7. Regulatory Approval**

Any agreement that is executed as a result of this RFP will be binding in accordance with its terms. APS's performance under any such executed agreement may be conditioned upon actions and/or approvals by regulatory authorities, satisfactory to APS in its sole discretion.

## D. MISCELLANEOUS TERMS AND CONDITIONS

### 1. General

- a. Compliance. Each Respondent is responsible for acquiring and/or verifying that it is in compliance with all licenses, permits, certifications, studies, reporting requirements and approvals required by federal, state and local government laws, regulations and policies in order for it to contract for and perform in accordance with its Proposal(s).
- b. Costs. Respondent is liable for all of its costs and APS is not be responsible for any of Respondent's costs incurred in responding to this RFP or in connection with the negotiation and execution of any contract as a result of the RFP process.
- c. Reservation of rights. APS reserves the right to accept or reject in its sole discretion any or all Proposals for any reason at any time after submittal. APS also reserves the right to select an offer that is not the lowest price, if APS determines that in its judgment the overall Proposal may result in the greatest value to APS's customers.
- d. No Liability. Respondents that submit Proposals do so without legal recourse against APS or its officers, directors, employees, agents, contractors or the IM based on APS's rejection of any Proposal or for failure to execute any agreement in connection with this RFP. Neither APS, nor any of its officers, directors, employees, agents, or contractors, nor the IM, will be liable to any Respondent or to any other party, in law or equity, for any reason whatsoever relating to APS's acts or omissions arising out of or in connection with this RFP.
- e. Return of Documents. None of the materials received by APS from Respondents in response to this RFP will be returned. All Proposals and exhibits will become the property of APS, subject to the provisions of the CA referenced in Section B(3) above.

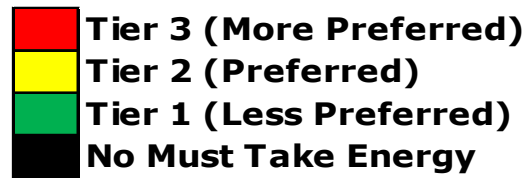
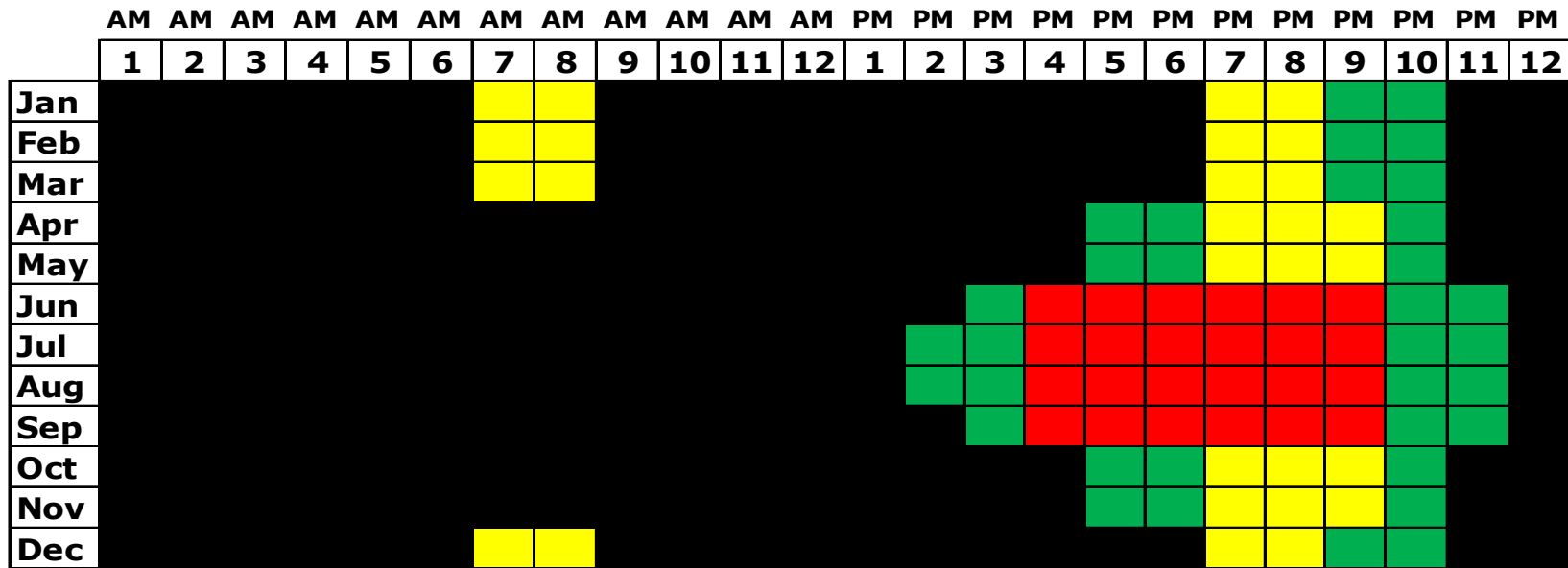
### 2. APS Safety Standards

Any agreement executed with APS will be conditioned upon the Respondent subscribing to ISNetworld, a third party safety assessment system utilized by APS. If not already a subscriber, the Respondent will be required to: (a) subscribe to ISNetworld (subscribe at [www.ISNetworld.com](http://www.ISNetworld.com)); (b) furnish ISNetworld with the information requested by ISNetworld in connection with each subscription; and (c) maintain a subscription with ISNetworld with a "GREEN" status for the duration of the agreement with APS. Subscribing to ISNetworld and furnishing such information will be a condition precedent to the full execution of an agreement. There is a fee for this subscription which must be paid by the Respondent. Respondent must reply to questions on this subject located under the heading "Respondent Project Management", in the "Respondents Experience(tab 2)" tab in the Commercial Data folder found in PowerAdvocate.



APPENDIX A

**Time of Day Relative Net Load Heat Map**





## **APPENDIX B**

### **Technical Requirements**

**This document may also be found in the “Download Documents” tab in PowerAdvocate**

## **APPENDIX B**

### **Technical Requirements**

In accordance with Section A(3)(g) of the RFP, the following technical requirements shall apply to all Proposals. Where noted, Respondents shall provide requested information in the designated tabs in PowerAdvocate. Failure by Respondent to comply with the requirements specified herein, or to provide requested documents, may result in Respondent's Proposal being eliminated from further consideration.

#### **A. General Technical Requirements**

1. Design life: BESS design life of at least fifteen (15) years.
2. Design temperature: BESS, with consideration given to auxiliary power forecasts, must be designed and capable of operating at 114° F and twenty percent (20%) humidity, at 100% of the proposed AC capacity, for a minimum of three (3) consecutive hours for the duration of the proposed design life of the BESS.
3. APS charging characteristics: APS expects to charge the BESS from the existing solar photovoltaic generation system for the first five (5) years following commercial operation, after which APS must have the option to charge the BESS from each of the existing solar photovoltaic system and the grid. Switchgear and breaker design and controls should include capability for APS to remotely operate either of these configurations.
4. UL-rated equipment: Respondent must offer developed, pre-engineered, field proven, UL-listed, and field serviceable and replaceable modular BESS systems and components rather than offering a custom designed solution to be developed in response to this RFP. For any certification not yet acquired, the Proposal shall include a plan for acquiring each UL listing, together with a time line for doing so. Any shortlisted Respondent will be required to provide copies of all certifications associated with the BESS.
5. Duration guarantee: In addition to the general warranty requirements specified in Section A(4)(e) of the RFP, each Proposal shall also guarantee 3-hour BESS duration for the full proposed design life of the BESS.

#### **B. Specific Technical Requirements**

1. Major equipment: Each BESS shall include the following major equipment: battery modules, battery management system (BMS), power conditioning system (PCS), thermal management system (TMS), control and communications systems (CCS), site energy controller (SEC) and step-up transformer(s) to primary 12.47 kV, (Medium Voltage, or MV). Additional equipment shall include: enclosures, disconnects, transfer switches, wiring, conduit, mounting hardware, connectors,

protective devices, grounding, junction boxes, instrumentation and all other items needed for a fully functional, self-contained utility-interactive BESS to meet the requirements set forth in this Appendix B.

2. Auxiliary load: Auxiliary load includes all loads necessary to operate and protect the system, such as controls, PCS, cooling systems, fans, pumps, life safety, back-up power, instrumentation, controls, communications and heaters, are considered auxiliary loads internal to the system. APS will build an auxiliary load power system at each site to provide three phase, 480/277 VAC power to each, depending on the available service voltage available at each site as further described in Section B(6)(d) below. Auxiliary power shall be separately metered by an APS-provided meter (the Aux Power Meter).
3. Common coupling: The “Point(s) of Common Coupling” at each site shall be defined as terminal pads in the Respondent-provided MV switchgear for termination of the APS’s conductors. The transformer will provide solidly-grounded Wye output to the APS side. Respondent is to provide one spare transformer (N+1) for each unique voltage to be used as a back-up for all sites that the Respondent proposes (To be clear, this means one spare transformer type required for BESS operation. This is needed to avoid replacement transformer lead time associate with transformer malfunction). Each site’s main meter provided and installed by APS (the Medium Voltage Meter or MV Meter) will be located at the MV switchgear using a consolidated bus.

Each BESS shall be rated in terms of net delivered AC power and energy to the Point(s) of Common Coupling. All system loads and losses, including wiring losses, transformer losses, losses through the contactor/static switch, and auxiliary loads, are considered internal to the system and the system ratings are net of these loads and losses as measured (or calculated if not measured) via the Medium Voltage Meter and Aux Power Meter. All performance tests for the purposes of validating product guarantees shall be measured at the APS-provided Medium Voltage Meter and Aux Power Meter.

4. Rated energy and round trip efficiency: The BESS shall be capable of charging and discharging real power, and dispatching both leading and lagging reactive power at full AC capacity rating. The system shall be capable of discharging from 100% to 0% of rated energy (MWh) throughout the BESS life. Rated energy refers to the discharge energy available from the battery at constant rated power, net of auxiliary loads, as measured at the Medium Voltage Meter and Aux Power Meter at each sites. It is expected that battery charge energy at constant rated power will be higher to account for internal losses. The BESS Rated Energy shall be defined as:

*BESS Rated Energy ( AC MWh)*

*= MV main meter (discharge cycle) – Aux. meter (discharge cycle)*

The Respondent shall guarantee annual round trip efficiency (RTE) for the entire life of the system. RTE is defined as the follows:

$$RTE = \frac{\text{Output Energy}}{\text{Input Energy}}$$

$$= \frac{MV \text{ main meter}(\text{discharge cycle})}{MV \text{ Meter}(\text{charge cycle}) + Aux \text{ Meter}(\text{charge cycle}) + Aux \text{ Meter}(\text{discharge cycle})}$$

5. Lithium-ion modules: Lithium-ion battery cells must be replaceable as discrete modules. All proposed systems must be pre-engineered and field certified for US installations. Designs using experimental or otherwise undocumented components are not permitted. All local and national code compliance is required. The BESS must comply and be listed for UL1642, UL1741 (Supplement A), UL 1973 and UL9540.
6. Ratings: The following are fundamental BESS unit ratings. Note that power, energy, and ampacity ratings apply through the full operating temperature range, as defined for the applicable site unless otherwise noted.
  - a. AC Voltage: interconnection voltage is 12.47/7.2 kV<sub>AC</sub>, ±5%, depending on established APS system voltage at the source substation
  - b. Auxiliary Voltage: Auxiliary voltage is three phase, 480/277 VAC
  - c. Power and Energy: System ratings are defined in kVA<sub>AC</sub> or MVA<sub>AC</sub> and kWh<sub>AC</sub> or MWh<sub>AC</sub>
  - d. Auxiliary Power:
    - i. APS will provide auxiliary power to each site at three phase, 480/277 VAC. Respondent shall design the BESS so that all controls, PCS, cooling systems, fans, pumps, and heaters, breakers, fuses, relaying, panels, enclosures, junction boxes, conduits, raceways, wiring and similar equipment required for operation is rated for and fed by the aux power.
    - ii. Respondent shall provide an estimate of the annual total auxiliary power consumption (MWh AC/yr) using the Heat Map found in Appendix A of the RFP as representative of anticipated duty cycling.\* Use Design Temperature found in Section A(2) above.
    - iii. Respondent shall provide an Auxiliary Load Guarantee of annual auxiliary power consumption using the Heat Map found in

Appendix A of the RFP as representative of anticipated duty cycling\* and the design temperature specified in Section A(2) above. APS and Respondent shall develop a mutually agreeable methodology to adjust the auxiliary load guarantee based on the actual weather profile in any given year.

*\*Note that the information contained in Appendix A is indicative only and that APS makes no representation that it will adhere to any particular charge/discharge cycling schedule regardless of such information. This note applies to Section B(11) below as well.*

- e. Self-Discharge: Respondent shall provide the self-discharge rate (% per month) of the BESS, assuming the BESS sits in idle mode at 100% SoC until self-discharge has fully drained the BESS.
  - f. Basic Wire Insulation Level: The AC wiring system equipment shall have a basic insulation level rated for 105 kV or higher and shall otherwise comply with UL 1741 or ANSI C62.41.2-2002 standards.
  - g. Audible Noise: The maximum sound level generated at each site originating from the BESS and any associated equipment supplied by the Respondent shall be limited to the lesser of any applicable jurisdictional ordinance or the APS standard of less than 80dBA.
  - h. Metering and Telemetry: Respondent shall provide its own CT's for protection and metering. For APS-provided meters, APS shall provide, install and wire the metering CT's/PT's, telemetry equipment (if applicable), and shall perform all testing associated with the installation.
7. System protection requirements:
- a. Respondent shall adhere to rules and regulations of APS's Interconnection Requirements, which may be found at: [www.aps.com/DG](http://www.aps.com/DG)
  - b. Protection and control system to be provided with ability to interface to existing feeder substation and adjacent solar installation SEL relays for transfer trip based on SEL Mirrored-Bit Communications.
8. Instrument and control wiring: Control and instrumentation wiring shall be designed and installed to minimize any and all electrical noise and transients. All cabling shall be new and continuous for each run; splices are not acceptable. All conductors shall be copper. All cabling which may be exposed to mechanical damage shall be placed in conduit, wireway, overhead tray, or other enclosures suitable to APS. Wires shall have identifying labels or markings on both ends. The labels shall identify the opposite end destination. Control and instrumentation wiring shall be separated from power and high voltage wiring by use of separate compartments or enclosures or by use of separate wireways and

appropriate barrier strips within a common enclosure as required by the NEC. BESS and PCS control and instrumentation system wiring shall be bundled, laced and otherwise laid in an orderly manner. Wires shall be of sufficient length to preclude mechanical stress on terminals. Wiring around hinged panels or doors shall be extra flexible (Class K stranding or equivalent) and shall include loops to prevent mechanical stress or fatigue on the wires. Insulation and jackets shall be flame retardant and self-extinguishing and shall be capable of passing the flame test of IEEE Standard 383 or IEEE 1202. Raceway and cable systems shall not block access to equipment by personnel.

9. Modular Replacement: The BESS PCS, control, batteries and current sensors shall be modularized and connected in a manner that enables field replacement of each module. The physical and electrical arrangement shall permit module replacement with the isolation breaker/contactors closed and the PCS disconnected.

10. Physical Characteristics:

- a. Systems shall meet all applicable Occupational Safety and Health Administration (OSHA), National Electric Code (NEC), IEEE, ANSI, CBC and National Fire Protection Association (NFPA) requirements for electrical and fire safety.
- b. Systems shall be designed to minimize footprint and volume. Systems may also be designed to include subsurface components or modules, provided relevant operating and environmental factors normally addressed for submersible equipment are considered to assure full life-cycle performance requirements are met.
- c. All components shall be contained within weatherproof, tamper resistant, metal enclosures suitable for mounting outdoors on a concrete, fiberglass or equivalent pad with a minimum NEMA 3R rating if installed in a standalone outdoor application, or within a shelter that meets all seismic, safety, and fire resistance requirements stated in this specification.
- d. Any enclosures shall be dust tight to at least the NEMA 3R rating, except as designed to allow forced air exchange with the atmosphere.

11. Cycle life:

- a. For each site proposed, the Respondent shall provide a 3-hour duration battery which may be augmented and which shall be guaranteed to maintain the full rated AC energy capacity at constant rated AC power for the entire proposed BESS life using the Heat Map found in Appendix A of the RFP as representative of anticipated duty cycling.\* Also use the design temperature found in Section A(2) above.
- b. If the proposed batteries are sensitive to the depth of discharge as well as annual average SoC, the Respondent must state the limitations associated

with the anticipated duty cycles as represented in the Heat Map located in Appendix A of the RFP.\*

- c. For purposes of estimating and demonstrating cycle life, one discharge cycle shall be defined in terms of energy discharged from the BESS at a continuous nameplate AC rating as measured at the APS MV Meter minus the energy measured at the Aux Power Meter. Similarly, one charge cycle shall be defined in terms of energy charged in the battery, so as to discharge the continuous nameplate AC rating as measured at the APS MV meter *minus* the energy metered at the Aux Meter. One full cycle refers to one complete charge and discharge cycle as described in Section B(4) above.
- d. The Respondent shall provide a graph or set of graphs that displays the relationship between energy capacity of discharge and the corresponding number of cycles available throughout the system life. This graph should indicate proposed augmentation if applicable.

12. Battery Management System (BMS): As a subcomponent of a BESS, a battery management system (BMS) shall be included to manage the operational health of the BESS and assure its safe and optimal performance as an interconnected asset to APS's electrical system. Primary functions include but are not limited to:

Monitoring:

State of Charge (SoC)

State of Health (SoH)

Voltage/Current

Temperature

Status

Charge/discharge management

Balancing

Warning and alarms

Internal protective measures

Logs of operations

Management of any software versions

Cyber Security management of the device itself

Data exchange with the Site Energy Controller

Safety assurance and monitoring for each site

13. Power Conversion System(PCS): PCS design and architecture shall be in accordance with Section 7.3 of APS Interconnection Requirements, which may be found at: [www.aps.com/DG](http://www.aps.com/DG). The PCS shall be capable of operating in all four power quadrants at rated power (kVA/MVA). Any combination of kW/MW and kVAR/MVAR output shall be possible that is consistent with the BESS's rated power. PCS shall be designed to operate using grid power provided through the auxiliary power system and shall not use power from the battery.

The PCS, in conjunction with the SEC, shall be capable of completely automatic, unattended operation, including self-protection, synchronizing and paralleling with the utility, and disconnect functions.

The control of the PCS shall be integrated with the overall SEC system. However, the PCS shall also include all necessary self-protective features and self-diagnostic features to protect itself from damage in the event of component failure or from parameters beyond safe range due to internal or external causes. The self-protective features shall not allow the PCS to be operated in a manner that may be unsafe or damaging. Faults due to malfunctions within the PCS, including commutation failures, shall be cleared by the PCS protection device(s).

All PCS components shall be designed to withstand the stresses associated with steady state operation, transient operation and overload conditions as implied by this specification. The Respondent shall be responsible for demonstrating that all relevant aspects of overvoltage stresses have been taken into account.

The PCS system shall include provisions for disconnection on both the AC and DC terminal for maintenance work. Conductor separation must be clearly visible; flags or indicators are not acceptable. These disconnects shall be capable of being locked open for maintenance work. Any PCS capacitors shall be provided with bleeder resistors or other such means of discharging capacitors to less than 50 volts within five (5) minutes of de-energization per UL1741 requirements.

14. Site Energy Controller (SEC): The Respondent shall include all necessary software applications and supporting hardware required to meet the specified functional requirements. Software algorithms, external data input capabilities, and user interfaces shall provide for user-specified variable input or set point values, as well as external data value streams required by programs directing the BESS operations.
  - a. The BESS shall include the necessary communication and telemetry hardware, and support communications protocols, to effectively provide the required services.
  - b. No single mode of failure shall result in loss of power to the control and data acquisition module.
  - c. The control shall include provisions for an orderly and safe shutdown in the absence of utility power.
  - d. The SEC shall be able to execute all required modes of operation with a response time in seconds or less, according to a preset or programmable hourly/weekly/monthly schedule. Over each scheduled time interval, individual modes and stacked modes shall be callable by APS. In addition, the SEC shall initiate the offline mode under the following conditions and remain in the offline state until a reset signal, either local or remote, is initiated:



Ground fault detection  
Arc Flash  
High and low current fault  
Local emergency machine off button operation  
AC circuit breaker trips that isolates the BESS from the grid  
Smoke/fire alarm and/or suppression operation  
Control logic trouble

15. Communications, operations and control functions:

- a. Each BESS shall have a local Site Energy Controller (“SEC”) to provide overall control of the BESS. The SEC is responsible to perform management of the for the following by priority in this order:
- b. Protect itself (isolate for any internal fault)
- c. Remain within power constraints (transformer and BESS ratings)
- d. Remain within voltage constraints
- e. Remain within operating temperature constraints
- f. Isolate in response to system anomalies
- g. Charge/discharge Real Power and Reactive Power in response to SEC programs or external commands
- h. In the event of an SEC failure, SEL relays shall trip the BESS’ main Over Current Protection Device (OCPD) off-line.
- i. Communicate status and diagnostic data to Respondent’s RTU
- j. The SEC Shall respond to commands issued remotely or locally, including but not limited to:

Change Modes (charge, discharge, etc.)  
Change Status (enable/disable)  
Reset Alarms  
System Reset/Restart

- k. Each BESS’s SEC shall have the ability to control its charge and discharge profile based on the instantaneous generation profile of each BESS’s adjacent solar generation, per Section 2 of this Appendix B.

16. Local Human Machine Interface (HMI):

- a. The SEC shall include a local HMI to permit local monitoring and control. All settings to enable the modes of operation must be viewable and settable, statuses viewable, operating parameters viewable, and logs configurable and viewable.
- b. Local password protection is required. Different login accounts shall be set up to allow for different types of operators (i.e. observer: read only, operator: read/write, and administrator: read/write/manage users).
- c. Meaningful control buttons and indicating lights shall be provided for monitor and control status and operations.
- d. All control and alarm functions available remotely shall also be available locally.

17. Remote operations and communication:

- a. Each site BESS shall include a Respondent provided main RTU able to receive and send data from the SEC to the APS RTU.
- b. At each site, APS shall provide its own RTU to interface with Respondent's RTU.
- c. The data exchange between the RTUs shall occur using DNP3 protocol. Respondent's RTU shall be able to receive commands that are issued remotely by an APS external supervisory controller, delivered via APS's RTU. Supplier's and APS's RTUs shall exchange all required data and information internally and externally that are necessary to enable execution of all required operating modes, safety features, and communication of critical alarms.
- d. Each BESS shall remain functional in the absence or loss of communication from the APS remote controller.
- e. During an interruption to communications, the remote controller will make repeated attempts to re-establish communications at a set time interval (variable setting, default of 5 minutes). When communications have been re-established, the BESS and remote controller shall make any necessary updates to resume performance.
- f. Respondent is responsible for providing whatever communication telemetry is necessary to perform Respondent's commissioning, maintenance, and monitoring over the BESS life.
- g. APS is responsible for providing communication telemetry necessary for the information exchange on to and from the APS RTU.
- h. Respondent shall perform its own diligence on the communication bandwidth and capabilities at each site during the site visits.

18. Cooling systems: The site temperatures and the effect of temperature on component life shall be considered in developing the thermal design for all components, including the batteries and PCS. There may be several separate heat removal systems to accommodate the particular needs of BESS components and subsystems (e.g., PCS, transformers, etc.). Final rejection of all waste heat from the system shall be to the ambient air. Air handling systems shall include filters to prevent dust intrusion into the system.

19. Fire mitigation:

- a. The Respondent shall design the BESS to minimize any potential risks of fires.
- b. Where containers or shelters are used, provisions shall be included to extinguish internal container or shelter fires without the need to open container or shelter doors.
- c. All critical alarms/warnings shall be communicated through Respondent's RTU

20. Station DC system and uninterruptible power supply: Each BESS shall be equipped with a Station DC system and/or an UPS to power essential functions in the event of a total failure of auxiliary supply systems(s) if required for orderly shutdown. The provided DC system/UPS shall have a minimum duration of twenty-four (24) hours and shall comply with all applicable standards.

**C. BESS Operating Modes and Controls**

1. General: APS prefers that any BESS facility be capable of satisfying each of the following operating modes and controls, within the proposed design and self-protection parameters. APS expects that the BESS would be able to move between each mode of operation as needed. Each Proposal shall specify which of the operating modes and controls that Respondent is capable of providing, each of which shall be include in the Proposal price. Respondent shall complete the table titled “Battery Energy Storage System(s) Technical Mode Details”(tab 1) located in the “Technical” tab in PowerAdvocate. Respondent shall also specify the line item cost of each included operating mode or control, as well as the total cost for all included operating modes and controls, in the “Pricing” tab in PowerAdvocate.

**BESS Operating Modes and Controls:**

#	Operating Mode/Control	Description
<b>M0</b>	Off	BESS is offline, shut down, and disconnected from grid; BESS main breaker is open and waiting for the APS RTU command to close
<b>M1</b>	Offline, not ready to operate	BESS is offline; main breaker is closed but inverters are disconnected
<b>M2</b>	Grid connected, ready to operate	BESS is synchronized to the grid, but no power is flowing
<b>M3</b>	P & Q command	While synchronized to the grid, can dispatch/absorb real and reactive power according to commands; can prioritize real or reactive power response
<b>M4</b>	Battery control system	BESS capable of responding to remote generation control signals (communicated via APS RTUs) to charge and discharge the battery
<b>M5</b>	Solar charge	BESS capable of synchronizing on a real-time basis its charge profile with the adjacent solar photovoltaic generation. This mode shall enable the battery to absorb charge power through the Point of Common Coupling at a MW level equal to the instantaneous adjacent solar power generation. Solar generation signal shall be communicated to the SEC via the APS RTU.
<b>M6</b>	Solar discharge	BESS capable of synchronizing on a real-time basis its discharge profile with the adjacent solar photovoltaic generation (AC coupled). This mode shall enable the battery to discharge power through the Point of Common Coupling at a MW level that complements the instantaneous adjacent solar power generation. In solar discharge mode, the BESS will contribute an amount of power so that the combined output of the BESS and the adjacent solar photovoltaic generation (AC coupled) shall meet a pre-programmed threshold (such as 17 MW), net of aux loads. Solar generation and aux load signals shall be communicated to the SEC via the APS RTU.

<b>M7</b>	Stackable functions	BESS allows multiple modes to be enabled with programmable priorities and logic (i.e., which mode has priority in event that simultaneous modes are called)
<b>M8</b>	SoC management	BESS enables delivery and absorption of AC power to maintain required SoC within a preset range or limit
<b>M9</b>	Frequency response (Ancillary Service)	BESS capable of dispatching real power in response to a frequency event as measured by a local sensor provided by Respondent, characterized by a combination of frequency and time duration thresholds. Event threshold and time-lapse triggers shall be programmable by APS. Accuracy and tolerance of the local sensor shall meet APS standards.
<b>M10</b>	Volt/VAR (Ancillary Service)	BESS capable of dispatching/absorbing reactive power following a Volt/VAR curve that is configurable by APS
<b>M11</b>	Power factor control (Ancillary Service)	When synchronized to the grid, BESS capable of dispatching/absorbing reactive power in response to a power factor measurement, with the aim of controlling the power factor to a programmed point within ANSI limits
<b>M12</b>	Automatic voltage regulation (AVR) (Ancillary Service)	BESS holds a set-point voltage at the high side, within the VAR limits, by dispatching/absorbing reactive power

2. Interoperability with APS distribution system: The BESS control system shall meet the following requirements:
  - a. The control system shall comply with Section 12.1 of APS Interconnection Requirements, which may be found at: [www.aps.com/DG](http://www.aps.com/DG).
  - b. The control system shall allow full interoperability of BESS with existing distributed energy systems (including solar) and distribution circuit regulation systems
  - c. The control system shall co-ordinate with existing distributed energy systems (including solar) to mitigate the possibility of interconnect feeder overload
  - d. The Respondent shall work with APS for specific requirements on site by site basis; in particular those sites that have implemented a closed loop voltage control, where the BESS may need to implement voltage droop functionality
  
3. Recycling and Disposal: Respondent must include the cost of recycling and disposal in its Proposal price and also provide this cost in the “Key Equipment Pricing” section for each site under the “Pricing Data” tab in PowerAdvocate. Additionally, Respondent shall specify the process and list of contractors used to recycle and dispose of batteries removed from service for any reason at each site.