EPRI | ELECTRIC POWER RESEARCH INSTITUTE

ESIC Energy Storage Request for Proposal Guide

3002017242

ESIC Energy Storage Request for Proposal Guide

3002017242

Technical Update, December 2019

EPRI Project Manager
E. Minear

Electric Power Research Institute
3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 • USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com

DISCLAIMER OF WARRANTIES AND LIMITATION OF LIABILITIES

THIS DOCUMENT WAS PREPARED BY THE ORGANIZATION(S) NAMED BELOW AS AN ACCOUNT OF WORK SPONSORED OR COSPONSORED BY THE ELECTRIC POWER RESEARCH INSTITUTE, INC. (EPRI). NEITHER EPRI, ANY MEMBER OF EPRI, ANY COSPONSOR, THE ORGANIZATION(S) BELOW, NOR ANY PERSON ACTING ON BEHALF OF ANY OF THEM:

(A) MAKES ANY WARRANTY OR REPRESENTATION WHATSOEVER, EXPRESS OR IMPLIED, (I) WITH RESPECT TO THE USE OF ANY INFORMATION, APPARATUS, METHOD, PROCESS, OR SIMILAR ITEM DISCLOSED IN THIS DOCUMENT, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, OR (II) THAT SUCH USE DOES NOT INFRINGE ON OR INTERFERE WITH PRIVATELY OWNED RIGHTS, INCLUDING ANY PARTY'S INTELLECTUAL PROPERTY, OR (III) THAT THIS DOCUMENT IS SUITABLE TO ANY PARTICULAR USER'S CIRCUMSTANCE; OR

(B) ASSUMES RESPONSIBILITY FOR ANY DAMAGES OR OTHER LIABILITY WHATSOEVER (INCLUDING ANY CONSEQUENTIAL DAMAGES, EVEN IF EPRI OR ANY EPRI REPRESENTATIVE HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES) RESULTING FROM YOUR SELECTION OR USE OF THIS DOCUMENT OR ANY INFORMATION, APPARATUS, METHOD, PROCESS, OR SIMILAR ITEM DISCLOSED IN THIS DOCUMENT.

REFERENCE HEREIN TO ANY SPECIFIC COMMERCIAL PRODUCT, PROCESS, OR SERVICE BY ITS TRADE NAME, TRADEMARK, MANUFACTURER, OR OTHERWISE, DOES NOT NECESSARILY CONSTITUTE OR IMPLY ITS ENDORSEMENT, RECOMMENDATION, OR FAVORING BY EPRI.

THE FOLLOWING ORGANIZATIONS PREPARED THIS REPORT:

Electric Power Research Institute

This is an EPRI Technical Update report. A Technical Update report is intended as an informal report of continuing research, a meeting, or a topical study. It is not a final EPRI technical report.

NOTE

For further information about EPRI, call the EPRI Customer Assistance Center at 800.313.3774 or e-mail askepri@epri.com.

Electric Power Research Institute, EPRI, and TOGETHER…SHAPING THE FUTURE OF ELECTRICITY are registered service marks of the Electric Power Research Institute, Inc.

Copyright © 2019 Electric Power Research Institute, Inc. All rights reserved.

ACKNOWLEDGMENTS

The Electric Power Research Institute (EPRI), prepared this report.

Principal Investigators
E. Minear
S. Willard
P. Ip

The following organization(s), under contract to the Electric Power Research Institute (EPRI), supported editorial review of the initial publication of this report:

Hoffman Power Consulting
P.O. Box 580
Morgan Hill, CA 95038

P. Maloney
V. MacLaren-Wray

This report describes research sponsored by EPRI.

The authors would like to thank the participants of the Energy Storage Integration Council (ESIC) Procurement Task Force and Grid Integration Working Group for providing valuable verbal and written contributions to the initial guide and this revision:

Ben Ealey, EPRI
Mike Simpson, EPRI
Chuck Hookham, Consumers Energy
Claudio Lima, AGX, LLC
Ayesha Bari, Entergy
Eva Gardow, FirstEnergy
Michelle Lim, Xcel Energy
Jaclyn Whiteman, Duke Energy
Charlie Vartanian, MEPPI
Kevin Fok, LG Chem
Morgan Smith, EPRI
Eric Mannarino, EPRI

This publication is a corporate document that should be cited in the literature in the following manner:

ESIC Energy Storage Request for Proposal Guide. EPRI, Palo Alto, CA: 2019. 3002017242.

ABSTRACT

Energy storage is becoming an important element of integrated grid planning, with an increasing need for utilities to solicit proposals for new storage products and installations. Preparing a comprehensive request for proposals calls for recognizing some of the particular characteristics of storage. Additionally, new capabilities and value streams are being added as technology vendors and the industry identify how storage can better support grid flexibility. This rapidly evolving industry means that new storage systems can be procured at different levels of specificity and communicating utility objectives and requirements clearly is important for assessing proposals on consistent, level basis. Recognizing the need for a practical reference for developing requests for proposals (RFPs), industry participants in the Energy Storage Integration Council (ESIC) have collaboratively developed this guide. The goals are to highlight the range of special needs appropriate to storage, outline the process of informing potential bidders of project requirements, and support development of the scope of work in order to help establish an efficient, effective, and fair bidding process. The guide provides an outline of request for proposal sections, examples of information to include in order to communicate project requirements clearly, and references to other ESIC tools and templates that can support the procurement process.

Keywords
Energy storage
ESIC
Procurement
Request for proposal
RFP

EPRI ELECTRIC POWER RESEARCH INSTITUTE

EXECUTIVE SUMMARY

Deliverable Number: 3002017242

Product Type: Technical Update

Product Title: ESIC Energy Storage Request for Proposal Guide

PRIMARY AUDIENCE: Electric utility distribution and transmission system owners/operators considering incorporating energy storage in new integrated grid development.

SECONDARY AUDIENCE: Energy storage suppliers, regulatory agencies.

KEY RESEARCH QUESTION

As the costs of energy storage have fallen and the range of applications for energy storage has broadened, a need has developed for a practical guide to preparing requests for proposals (RFPs) for new energy storage projects.

RESEARCH OVERVIEW

This report is a practical reference guide for entities looking to procure storage through clearly communicating project goals, requirements, and scope to potential bidders. It outlines common sections of a RFP and highlights storage-specific information that may be included in those sections. It also provides links to related Energy Storage Integration Council (ESIC) tools that can be used to facilitate the procurement process. To develop this guide, RFPs for similar projects were reviewed for parallel characteristics, and the special requirements of storage were recognized in designing an approach to conducting an RFP process for storage. The development of this document was supported by participants in the ESIC Working Group 3, Grid Integration, which includes utilities, suppliers, consultants, and researchers.

KEY FINDINGS

- Designing RFP documents is made easier by access to templates. Incorporating elements from the ESIC Technical Specification Template and the ESIC Energy Storage Cost Template and Tool facilitates effective communication with potential bidders and clarification of project requirements and pricing. (Sections 2.3.4, 2.4.1, and 2.4.2.)
- Energy storage RFPs share many essential components of the general RFP process, but it is important to recognize specific storage-related considerations such as communication and control requirements, performance requirements, and warranties that will help in aligning all parties on project requirements and expectations, and support the proposal evaluation process. This is especially true as new capabilities and value streams are being added and technology vendors and the industry need to identify how storage can better support grid flexibility. This rapidly evolving industry means that new storage systems can be procured at different levels, each with an increasing level of specificity. (Sections 2.3.5, 2.3.6, and 2.3.7.)

- A clear recognition of the responsibilities of parties engaged in a complex project that affects multiple areas of grid operations is an important element to planning an energy storage project. (Appendix C includes a Division of Responsibility Matrix Template.)
- RFP should define all key terms and acronyms, from those applicable to technical requirements terms to those addressing financial elements or the proposal evaluation process. This ensures that all participants will interpret the RFPs requirements in the same way and are aligned on the expectations for site acceptance and performance throughout the life of the project. (Section 2.3.4 and 2.3.6, Appendix A)

WHY THIS MATTERS

The energy storage market is still rapidly evolving, and preparing a comprehensive request for proposals calls for recognizing some of the particular characteristics of storage. In addition, because many suppliers in the energy storage industry are relatively new to working directly with electric utilities, clearly communicating utility requirements is especially important.OW TO APPLY RESULTS

This report can be used as a foundation for preparing energy storage RFPs. The templates provided are supported by explanatory information, and users are encouraged to access other resources available from ESIC, and to adapt these materials to reflect more precisely the conditions of their own needs for energy storage.

LEARNING AND ENGAGEMENT OPPORTUNITIES

- The ESIC Technical Specification Template streamlines defining requirements for an energy storage project, and supports establishing and clearly defining the work scope in an RFP.
- The ESIC Energy Storage Cost Template and Tool can be used to communicate proposal pricing and what is included in an offer.
- These templates and other published resources, together with further information about ESIC, can be found at epri.com/esic. ESIC is an open technical, forum. To enroll as an active participant, send full contact information to esic@epri.com.

EPRI CONTACTS: Erin Minear, Technical Leader, eminear@epri.com

PROGRAM: Energy Storage and Distributed Generation

Electric Power Research Institute
3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com
© 2017 Electric Power Research Institute (EPRI), Inc. All rights reserved. Electric Power Research Institute, EPRI, and
TOGETHER...SHAPING THE FUTURE OF ELECTRICITY are registered service marks of the Electric Power Research Institute, Inc.

CONTENTS

ABSTRACT ..... **V**

EXECUTIVE SUMMARY ..... **VII**

1 **INTRODUCTION** **1-1**

1. 1 Overview 1-1

1.2 Background 1-1

1.3 Important Terms and Acronyms 1-1

2 **THE KEY COMPONENTS OF AN EFFECTIVE REQUEST FOR PROPOSAL** **2-1**

2.1 Introduction 2-1

2.1.1 Purpose and Background 2-1

2.1.2 Project Description 2-1

2.1.3 Definitions of Terms and Acronyms 2-2

2.2 Proposal Process Overview 2-2

2.2.1 Confidentiality 2-2

2.2.2 Pre-Bid Qualifications 2-2

2.2.3 Schedule 2-3

2.2.4 Notice of Intent to Bid 2-3

2.2.5 Pre-Bid Information Session and Communication 2-4

2.2.6 Proposal Preparation and Submission 2-4

2.2.7 Participation Requirements 2-4

2.2.8 Evaluation Criteria, Proposal Evaluation Matrix 2-4

2.2.9 Disclosure of Proponents 2-5

2.3 Scope of Work 2-5

2.3.1 Scope of Supply 2-5

2.3.2 Division of Responsibility Matrix 2-5

2.3.3 Deliverables/Submittals 2-6

2.3.4 Technical Specification – Buyer Requirements 2-6

2.3.5 Communication and Control Integration Specification 2-8

2.3.6 Performance Requirements 2-10

2.3.7 Warranty 2-11

2.3.8 Owner Standards 2-11

2.3.9 Safety/Codes, Regulations and Standards 2-11

2.4 Required Proposal Submittals: Project-Specific Elements 2-12

2.4.1 Pricing 2-12

2.4.2 Technical Specification – Bidder Offering 2-13

2.4.3 Drawings 2-13

2.4.4 Project Schedule 2-13

2.4.5 List of Project Clarifications, Assumptions, Exclusions, and Exceptions 2-14

2.4.6 Subcontracting Plan 2-15

2.4.7 Diverse Supplier Statement 2-15
2.4.8 List of Major Equipment Suppliers 2-15
2.5 Required Proposal Submittals: Qualifications and Contract 2-15
2.5.1 Statement of Knowledge, Experience and References 2-15
2.5.2 Safety Plan and Record 2-16
2.5.3 Financial Statement 2-16
2.5.4 Conflicts of Interest 2-16
2.5.5 Legal Claims 2-16
2.5.6 Business Ethics Statement 2-16
2.5.7 Non-Disclosure Agreement 2-16
2.5.8 Contract Terms and Conditions 2-16
2.5.9 Bidder's Exclusions and Exceptions 2-16
_3_ NEXT STEPS IN THE RFP PROCESS 3-1
_4_ REFERENCES 4-1
_A_ GLOSSARY SELECT TECHNICAL PARAMETERS AND DEFINITIONS A-1
_B_ EXAMPLE BIDDER QUALIFICATION FORM B-1
_C_ DIVISION OF RESPONSIBILITY (DOR) MATRIX TEMPLATE C-1

LIST OF FIGURES

Figure 2–1 Example of a technical specification table 2-8
Figure 2–2 Example of pricing sheet from ESIC Energy Storage Cost Template and Tool.....2-12

LIST OF TABLES

Table 2–1 Example of RFP schedule 2-3
Table 2–2 Basic example of bidder's project schedule 2-14
Table 3–1 Simplified weighting-factor list 3-3

1
INTRODUCTION

1. 1 Overview

This request for proposal (RFP) guide is designed to be used by electric utilities or other entities that plan to seek competitive bids for engineering, procurement, and construction (EPC) contracts for energy storage installations. By providing clear guidelines and RFP templates, the guide should further the goal of standardizing the issuance of RFPs. For equipment suppliers and other respondents to an energy storage RFP, the guide may also serve to improve clarity, including streamlining the communication process for RFPs. It may also help bidders formulate more effective proposals, whether they are companies offering comprehensive storage products or coalitions of companies working together to respond to bids. The combined result is intended to make the RFP evaluation process more transparent and efficient. In general, this guide anticipates that the utility, acting as buyer in an RFP process, will own the system. An RFP for a power purchase agreements (PPA) has some overlap with utility-owned systems, but presents unique requirements that are not addressed in this guide.

1.2 Background

Energy storage is a rapidly-growing element in electric utility planning, with over 777 MWh of energy storage deployed in the United States in 2018[1]. Utilities around the country are increasingly turning to energy storage to meet a variety of needs, from capacity requirements and frequency regulation to renewable energy integration and asset deferral. Several states have set energy storage procurement targets and utilities such as Georgia Power, Southern California Edison, Arizona Public Service, and Hawaiian Electric Company have included storage in their integrated resource plans. With continued growth in energy storage and particularly growth led by utilities, it becomes important to establish guidelines for developing RFPs, so that utilities issuing the RFPs and potential bidders share a clear and comprehensive understanding of the RFP process. Those issuing RFPs need to be well-prepared for the complexities of the typical RFP process, taking account of project details, information sharing, and contracting issues. This guide is one tool to help smooth the path towards creating an effective RFP, to save valuable time and resources for evaluating bids and completing the project itself.

1.3 Terms and Acronyms in this Guide

It is important to have an understanding of key terminology used in this guide. As subsection 2.1 notes, the RFP itself should contain a section similar to this one so that all parties share a common set of terms.

RFI: Request for information, typically an invitation to potential bidders to provide information on their products, services, and qualifications in preparation for preparing a RFP (see below).

RFP: Request for proposal, a formal document specifying the requirements for a specific project for which bids are being sought for evaluation.

Bidder: Any individual company or joint consortium of companies submitting a proposal in response to an RFP.

Buyer or Owner: The company (in this case, the utility company) issuing the RFP.

Other acronyms used in this document:

AHJ	Authority Having Jurisdiction
AIA	American Institute of Architects
ANSI	American National Standards Institute
BESS	Battery Energy Storage System
CAEs	Clarifications, Assumptions, and Exceptions
COD	Commercial Operation Date
CSR	Codes, Standards, & Regulations
DNP3	Distributed Network Protocol
DOR	Division of Responsibility
EPC	Engineering, Procurement, and Construction
EPRI	Electric Power Research Institute
ESIC	Energy Storage Integration Council
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
ISO	Independent System Operator
kW	Kilowatt
kWh	Kilowatt-Hour
MESA	Modular Energy Storage Architecture
MW	Megawatt
MWh	Megawatt-Hour
NERC	North American Electric Reliability Corp.
NDA	Non-Disclosure Agreement
NETA	New Electricity Trading Arrangements
NFPA	National Fire Protection Association
NOI	Notice of Intent

NTP	Notice to Proceed
O&M	Operation and Management
PCS	Power Conversion System
RACI	Responsible, Accountable/Approval, Consult, and Inform
SCADA	Supervisory Control and Data Acquisition
UL	UL (formerly Underwriters Laboratories)

2
THE KEY COMPONENTS OF AN EFFECTIVE REQUEST FOR PROPOSAL

2.1 Introduction

2.1.1 Purpose and Background

A well-structured request for proposal (RFP) includes relevant background information on the project that will enhance the Bidders' understanding of the Buyer's needs and result in improved proposal quality. In general, this background should include a brief description of the company's business operations and its overall energy strategy. For an energy storage RFP, information such as driving factors for adding new storage, minimum requirements for storage specifications, and the Buyer's experience with storage will inform the Bidders' technical designs and project plan. In particular, the introductory section should provide an overview of the intended use cases for the energy storage facility and indicate the flexibility of those use cases. If any background analysis has been performed, the results can be included in this section or incorporated in the scope of work and specifications.

2.1.2 Project Description

The introduction should also include the critical descriptions of the project up for bid. Each project will have unique characteristics, depending on the particular use case, so any special features needed or special needs to be served should be called out here. A basic project description will include:

- A high-level outline of the scope of work, referring the bidders to details in the full Scope of Work section (See subsection 2.3.)
- The intended project location
- Any general installation details relevant to project design, such as indoor vs. outdoor placement, interconnection details, metering, and other relevant details
- The desired system rating, specifying both rated discharge/charge power (kW) and available energy capacity (kWh)
- The intended application or service to be provided by the system, or markets with which the system must interact (some indication of duty cycle)
- Project life of the system
- The planned commercial operating date and any key milestone dates
- Photos or maps of the site noting any known special considerations, such as specific zoning or wetlands designations
- Reference drawings of the existing infrastructure at the site
- Key project contacts (project manager, interconnection coordinator, AHJs, etc.)

2.1.3 Definitions of Terms and Acronyms

As modeled in the Introduction to this guide, the front matter of the RFP should define all key terms and acronyms which appear in the RFP, from those applicable to technical requirements terms to those addressing financial elements or the proposal evaluation process. This ensures that all participants will interpret the RFPs requirements in the same way and thus streamline the process of sharing information. It can also help ensure alignment of expectations for site acceptance and performance throughout the life of the project.

Resources to support the development of key terms list include the ESIC Energy Storage Technical Specification Template [2] which provides an exhaustive list terms and definitions of performance parameters which may be included in warranty and performance guarantee contracts. (See Section 2.3.4 for more detail). Additionally, the ESIC Energy Storage Test Manual [3] is a resource for description of functional requirements. A glossary of select terms and definitions from these resources is provided in Appendix A.

2.2 Proposal Process Overview

This portion of the RFP gives Bidders a clear picture of the stages under which the proposal process will proceed. Ideally, this information will ensure that proposals are submitted in a timely manner, that supplemental information can be sought and received without any delays, and that all participants will compete fairly.

2.2.1 Confidentiality

For many projects, the Buyer may need to share otherwise-sensitive information with potential bidders in order to obtain effective proposals with accurate costs. Here, the RFP should incorporate the Buyer's established definitive confidentiality statement or non-disclosure agreement (NDA) that bidders must sign in order to participate in the RFP. The Buyer should include the forms for that NDA in the RFP packet and ensure that all participants read, sign, and date the agreement before any confidential information is shared.

2.2.2 Pre-Bid Qualifications

Depending on the anticipated response to a request for proposal, the Buyer may consider adding a pre-bid qualification step. In this step, each potential bidder is required to submit in advance certain information to verify that specific minimum criteria are met. This preliminary screening helps ensure the Buyer's supply chain or procurement group would allow a contract with a given company. An example Bidder Qualification Form is in Appendix B and a sample list of pre-qualification requirements is as follows:

- An established record of safe operations
- Project Experience
- Sound finances, supported by a financial statement
- Freedom from conflicts of interest
- Absence of legal claims against the bidder
- A business ethics statement aligned with that of the Buyer
- Acceptability of Bidder's non-disclosure agreement (if any)

2.2.3 Schedule

The RFP process is typically bound by scheduling milestones. Efforts and activities of all participants in the RFP project are aligned in a logical progression with specific dates on which a contract will be put into effect. A sample schedule of solicitation milestones is provided in Table 2-1 below. Target dates for each stage of the process should take into account constraints built into the Buyer's own schedule, allow sufficient time for bidders to prepare all the items requested in the RFP, and drive participants to keep the process moving forward. RFP milestones will vary depending on the scope and scale of the specific project, the number and diversity of participating groups, and the Buyer's normal commercial procurement strategy.

Table 2–1
Example of RFP schedule

RFP Schedule	Date
RFP Issued	
Informational Meeting/Webcast	
Intent to Bid Due	
Site Visit	
Deadline for Written Questions	
Responses to Written Questions	
Proposals Due	
Selection of Shortlist	
Q&A Meeting/Webcast with Shortlisted Bidders	
Interviews with Shortlisted Bidders	
Notification of Successful/Unsuccessful Bid(s)	
Target Contract Execution	

2.2.4 Notice of Intent to Bid

The intent to bid formalizes the bidder's plan to be a part of the RFP process. Depending of the specific needs of the Buyer, the level of detail needed in a notice of intent (NOI) may vary from requiring only basic contact information and identification of the RFP to which the notice applies, along with a simple signature, to including more project-relevant information. Typically, the RFP will include a form for the desired Notice of Intent, thus requesting a common set of information from those potential bidders who have decided to proceed.

By first surveying all possible Bidders through a request for information (RFI) process and then requesting that interested Bidders formally confirm their interest, the Buyer can gauge the level of interest among suppliers and estimate the overall response rate to the RFP. Having an estimate

of how many incoming bids are likely allows the Buyer to prepare the proper level of resources for bid evaluation.

2.2.5 Pre-Bid Information Session and Communication

Pre-bid information sessions may be scheduled as in-person meetings, webinars, site visits, or a combination of those. A cycle of written questions and responses with predetermined dates should be incorporated to provide an open communication channel for clarification of the RFP process and sharing of questions and answers among all interested parties. Pre-bid sessions provide the detailed information that serious potential bidders need to fully understand the scope of work and schedule. These communications prior to the submitting of proposals help to align all bidders on the desired scope and minimize differing assumptions among proposals. In the course of these meetings and communications, the Buyer may decide to extend the bidding cycle or adjust critical milestone dates, such as the proposal due date, in response to information shared by bidders.

2.2.6 Proposal Preparation and Submission

This section is designed to work in concert with the RFP schedule, above. It includes the logistics and timing of how the Bidder's proposal submission will proceed and may include:

- The due date for proposals
- A definition of the shelf life of the proposal
- A description of the steps to take for Bidders to submit questions or Buyer's issuance of addenda
- An explanation of how updated documentation on the RFP (including answers to questions) will be distributed
- A clear delineation of the steps required for a successful proposal submittal, which may include:
    - Directions for participating in preparatory meetings
    - A required or recommended format for the proposal
    - Completion of forms (provided as templates in the RFP)
    - The means by which RFPs will be accepted (mail or specified electronic delivery)
- Contact information for administrative and technical questions about the proposal process

2.2.7 Participation Requirements

Depending on the situation, the Buyer may desire to set some particular requirements for participation in the project. These requirements may vary from local requirements that contractors be licensed in a particular jurisdiction, that bidders must demonstrate sufficient diversity to meet local regulations, that foreign ownership of companies must be below some given threshold, to measurable recycling or sustainability goals, ethics compliance reviews, or any other requirements the Buyer needs to have met in order to draft a contract.

2.2.8 Evaluation Criteria, Proposal Evaluation Matrix

Buyer's priorities are critical for Bidders to know at the decision-making stage. Providing at the outset specific information on how bids will be evaluated helps Bidders understand the priorities

of the Buyer and encourages them to build a project execution plan and assign a team that can best satisfy those needs. Criteria used for evaluation should be clearly linked to the specified requirements, especially the components of the Required RFP Submittals in subsections 2.4 and 2.5.

The criteria may be an unranked list of key topics with points awarded for each item, or involve a matrix with percentage scores assigned. The Buyer should have a clear idea of the weighting they will place on various priorities in the criteria set, as Bidders will have strengths and weaknesses within that set of criteria.

2.2.9 Disclosure of Proponents

Typically, an RFP will require that Bidders provide certain disclosures, such as contractor licensing status or appropriate financial information. The RFP should incorporate a form or questionnaire that all Bidders must complete.

2.3 Scope of Work

The scope of work (SOW) provides substantial detail on all expected products and services that are required for the complete integration of an energy storage project. The scope should identify responsible parties for each task within the scope and for related tasks which are outside the scope, such as those to be performed by the utility itself. Additionally, performance and functional requirements, characteristics of other physical components or software, warranties, and other specifications help to ensure the successful deployment and operation of a project.

2.3.1 Scope of Supply

This section includes a written description of the project scope. The scope should detail the Buyer's actions, Bidder's responsibility in engineering, procurement, shipping and receiving, construction, interconnection, testing and commissioning, performance guarantees, operations and maintenance, decommissioning. Here, the scope needs to be as specific as possible, detailing demarcation points of such as controls, power, and auxiliary power wiring. If applicable, this section should note any items specifically excluded from the scope of work, such as tasks that remain the Buyer's responsibility under the project. Timing considerations need to be documented so that the project installation proceeds without interference or conflict between different parties working at the site. Other sections under scope of work may be referenced to add supporting detail.

2.3.2 Division of Responsibility Matrix

A division of responsibility (DOR) matrix can supplement the scope of supply and provide additional detail on the interactions among groups involved in the bidding process, including the Buyer, Bidders and third parties providing equipment or services to Bidder. For example, the scope of supply may indicate that the Bidders are responsible for stamped electrical drawings, but a responsibility matrix will clarify that the Buyer's engineering department is responsible for reviewing and approving the design and drawings.

A DOR matrix becomes more important when there are multiple responsible parties involved. For example, when the Buyer, property owner, energy storage system supplier, and installation contractor are different entities, they may each have overlapping responsibilities. The DOR matrix can support clear distinctions between roles of these parties. Appendix C provides a

detailed template for a DOR matrix template, in the form of a standard Responsible, Accountable/Approval, Consult, and Inform (RACI) table.

2.3.3 Deliverables/Submittals

This subsection should include a list of deliverables or submittals the Bidder (or contracted energy storage system supplier) is responsible for throughout the project. It should provide sufficient descriptions for each item on the list to ensure that all participants understand the requirements, and this part of the RFP should also specify the required frequency of reporting. Potential requested deliverables include:

- Progress reports
- Schedule updates
- Invoices
- Safety/EHS reports
- Equipment submittals
- Drawings: 30% Design, 60% Design, Issued for Permit, Issued for Construction, As-Built
- Design calculations
- Permits
- Equipment manuals covering installation, operation and maintenance
- Commissioning test reports and turn-over packages, including measurements, set points QA/AC documentation, and final Buyer sign-off sheets
- Change orders
- Requests for Information (RFIs)
- Warrantees

2.3.4 Technical Specification – Buyer Requirements

A project technical specification prepared by the Buyer may be extremely detailed or broad and high-level. The choice will depend on the scope of supply and the Buyer's certainty about the design parameters of the storage solution. The Buyer's experience level with energy storage integration will also affect this choice. The ESIC Technical Specification Template [2] was developed to facilitate information sharing between Buyers and Bidders. This template can be used as the starting point for preparing a list of requirements or targets or to request information from Bidders. The Buyer can also use this tool to differentiate between those parameters that must be adhered to and those that have flexibility. The template is organized into several categories well-suited to an RFP. The following table, excerpted from the ESIC Energy Storage Implementation Guide [4], describes key considerations for these categories.

Categories	Key Parameters and Considerations
Facility and ESS Performance	Setting minimum requirements and general target parameters for your project will ensure more effective responses to the project solution needs. This is especially critical from a financial and reliability perspective. Conversely, over-specifying performance requirements can overly restrict respondents from proposing innovative solutions. Striking a balance and clearly distinguishing "needs" from "wants" is helpful for the supplier community to optimize system design and make viable offers.

Installation	Installation specifications should address project site size and other characteristics. Physical protection schemes and devices that will be integrated with the installation must be considered, such as transportation, containment, physical security, and clearances. The structural and civil engineering characteristics of the site may require thorough analysis to understand the extent of site development needed to accommodate the storage system.
Interconnection	Interface requirements to connect either to a utility-specified transformer or to the voltage level at the chosen site. The interconnection protection scheme and devices that will be integrated with the installation must be considered. The capacity or power quality–related constraints should be considered. If an interconnection study has not yet been performed, a list of required specifications regarding generator response times and ride-through capabilities or even delivery of a simulation model may be requested.
Balance of System	Auxiliary load requirements for the energy storage technology should be stated, including pumps, heaters, chillers, fans, or controls. The power source, whether fed directly from the ESS, from a dedicated power source, or a combination of the two, should be considered. These loads can affect overall facility efficiency and power output.
Controls, Communication, and Cyber Security	Communication, control, and cybersecurity requirements are increasingly important in the integrated grid. Each project may have different requirements, such as limitations on remote monitoring, simultaneous control functions, encryption, and so on.
Mechanical and Environmental	Ambient conditions of the project site, weather-affected load conditions of the system, and sound emissions of the system should be communicated to that ensure the proposed system meets the project requirements.
Safety	Safety measures required to meet project's needs should be illustrated clearly, along with identification or expected authority having jurisdiction (AHJ), which could include a list of applicable codes, standards and regulations (CSRs), safety documentation, fire protection requirements, hazard protection requirements, and contractor safety requirements.
Operations and Maintenance	Operational characteristics, such as startup and shutdown time, site access, and security provisions, should be defined to determine whether the ESS satisfies the criteria for intended use. Planned maintenance requirements should be taken into account, as well as estimates of the potential impact of unplanned maintenance.

The Buyer's Technical Specification in an RFP is used by the Buyer to communicate the minimum requirements for all Bidders and to indicate additional desired elements or recommended requirements. As described in subsection 2.4.2, the Bidder's Technical Specification will detail how their bid meets, exceeds, or is exempt from the Buyer's required specifications and will provide specific information about the particular system being offered. The ESIC Technical Specification Template [2] is a publicly available document and can be downloaded at epri.com/esic. A sample specification table developed in that template appears in Figure 2-1.

ESS Performance							
Items	Parameters	Definitions	Units	Buyer Requirement	Buyer Designation	Supplier Provided Values	Reference to Test Manual
PES1	Rated Active Continuous Discharge Power	The maximum steady state power at which the ESS can continuously discharge for the energy storage component's entire specified SOC range.	kW	500	Contract Requirement		3.1.4
PES2	Rated Active Continuous Charge Power	The maximum steady state power at which the ESS can continuously accept for the energy storage component's entire specified SOC range.	kW	500	Response Required		3.1.4
PES3	Rated Reactive Power	The maximum continuous reactive power (Active Power = 0) that the ESS can provide before overheating.	kVAR	Supplier to Specify	Response Required		3.1.4
PES4	Rated Apparent Power	The maximum continuous active or reactive power (leading and lagging) that the ESS can provide without exceeding maximum operating temperature.	kVA	600 (preferred)	Response Required		3.1.4
PES5	Available Discharge Energy - BOL	Specify the accessible energy that can be provided by the ESS when discharging at rated power at the BOL.	kWh	2000	Contract Requirement		3.1.2
PES6	Available Discharge Energy - EOL	Specify the accessible energy that can be provided by the ESS when discharging at rated power at the EOL.	kWh	Supplier to Specify	Response Required		3.1.2
PES7	Recommended Discharge Energy - BOL	The quantity of manufacturer-defined usable energy at BOL to maximize life of the asset when subjected to daily or more frequent cycling.	kWh	Supplier to Specify	Response Required		
PES8	Recommended Discharge Energy - EOL	The quantity of manufacturer-defined usable energy at EOL to maximize life of the asset when subjected to daily or more frequent cycling.	kWh	Supplier to Specify	Response Required		
PES9	Rated AC Current	The maximum 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.	Amps	Supplier to Specify	Response Required		
PES10	System Power Factor Range	Specify leading and lagging power factor range.	-	Supplier to Specify	Response Required		3.1.4
PES11	Output Voltage Range	The range of AC grid voltage under which the ESS will operate in accordance with the ESS specifications	Vac		Optional		

1 - About & Help | 2 - Informational Summary | 3 - Performance - Facility | 4 - Performance - ESS | 5 - Installation | 6 - Interconnection | 7 - BOS | 8 - Controls | 9-Mechanical and Environ ...

Figure 2-1
Example of a technical specification table

2.3.5 Interoperability and Cyber Security Specification

Communication, control, and cybersecurity requirements are important considerations for the specification of an energy storage system solution, because they define how the energy storage solution is expected to operate to meet needs and achieve value. Energy storage controls have specific integration and connectivity requirements which should be called out in the Bidder's proposal in detail. The Buyer can provide Bidders with the information they need (e.g., SCADA points and protection gear) and the specifications that must be satisfied and the control functions that must be provided. For example, the non-proprietary Modular Energy Storage Architecture (MESA) incorporates an example of a list of distributed network protocol (DNP3) points [5]. Key topics such as physical and cyber security must also be addressed, with Buyer's standard protocols and procedures for commissioning to be outlined.

There is a tradeoff between value, specificity, and time to integrate. In general, functional predictability is inversely proportional to the flexibility the vendor has in developing the solution. As the functional specification becomes more specific, the more the utility knows about the system and can be more confident it will seamlessly interoperate with their other systems (Figure 2-2).

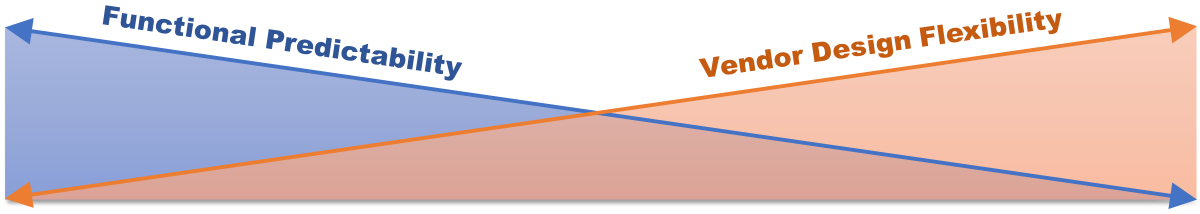

Figure 2-2
The relationship between ease of integration and vendor flexibility is inversely-proportional.

However, this is not always preferred or the best choice. It depends on preference. The more flexibility a vendor has in their communication and control implementation the more the vendor can innovate in how to reach a utility's end goal. However, this may come at a cost of interoperability with grid and control systems.

The next couple sections provide an overview of example designs and the tradeoffs that occur. This includes value, application, or functional specificity.

Value or Application

A specification that focuses only on value or high-level application is likely more focused on a specific end-result, targeted performance, or grid-service. This may include providing black-start support, frequency regulation, or absorbing excess solar generation. The specification may define a use case and ask the vendor to provide suggestions on what the control parameters and interfaces look like. This allows the vendor to have maximum flexibility in the system design to meet the requested value. The risk is that, if the specification is not highly developed, the system may not meet the Buyer's interoperability and functional expectations. In this case, the Buyer may be responsible for any delays and/or change-orders incurred by the Bidder to adjust the performance or communication interfaces to better meet previously mistaken or implied goals.

When specifying a value-based RFP, providing good definitions of the objectives for the use-case along with specifications and documentation of existing communications systems is integral to reducing the number of change orders required during the project. It is important to list industry standards and best practices in the RFP to help provide this level of specification when it may be otherwise unknown to the Buyer or ambiguously understood between the Buyer and Bidder.

Functional

A specification that focuses at a functional level is clearly defined and identified. It may call out specific smart inverter functions/modes, specify expected operational sequences, indicate communication protocols and associated information models, and provide relevant performance metrics or certification requirements. This provides the utilities with the highest chance that the system will meet performance or interoperability requirements because the RFP is prescriptive. The tradeoff is that it can be restrictive. If the RFP is too specific it may discourage vendors from sending proposals if they do not meet all the requirements, increase the cost of the bids, minimize competitive innovation, or result in system specifications that leave value on the table.

In general, if a RFP is focused at the functional-specificity level, the system is more likely to meet performance or interoperability requirements but may not be as inclusive of other options.

Bridging the Gap

The risks outlined above may be mitigated when prioritizing specifications that reference existing systems, standards, and codes to describe functional-level targets. Vendors, manufacturers, and utilities are more likely to agree on the desired system characteristics when widely-available examples and interpretations can be referenced. This makes integration and interoperability simpler because new terms and requirements do not have to be explained each time a new stakeholder is introduced. In solar/storage domain these are often in the form of grid codes. Examples with communications requirements includes IEEE 1547-2018 and California Rule 21 phase 1-3.

Communications Specificity

Because security in general is an ongoing concern and in particular cyber-security is essential now that controls and communications incorporate data transfer, cloud storage, and Wi-Fi

connectivity, all RFPs should include parameters for final physical and cyber security of the planned facility and how such will be audited for compliance during the commissioning process.

In most energy storage RFPs, this portion of the Bidder's proposal should demonstrate that the Buyer will have access to real time data for monitoring as well as the necessary control systems, if controls are a part of the required system. The Buyer should clearly define (1) how performance will be measured and monitored via SCADA or other monitoring/control means including power metrics and measures; (2) safety requirements; (3) key controls parameters (e.g., thermal runaway protection), balance of plant interfaces (e.g., fire protection), data collection, and alarm protocols.

Additionally, the Buyer may choose to request that the proposals include provision of the source code to the buyer, should the Bidder be awarded. Though some vendors may have a lot of valuable intellectual property in their controls, certain non-compete contract clauses can ensure that the vendor maintains rights to their property while the Buyer can better support maintenance and troubleshooting of their system.

If a Buyer cannot grant full remote access to the system, that should be stated in the RFP documents. In such cases, the Buyer should consider granting Bidders remote access via a closely monitored virtual private network. Describing remote access specifications in advance helps to ensure a transparent solicitation process by enabling Bidders to prepare or procure the appropriate equipment of resources.

Lastly, it is important the Buyer clearly define how its operations and maintenance staffs will interface with the energy storage system and controls and its expectations for topics such as redundancy, failure modes, resilience to loss of offsite power/power supply, and availability.

2.3.6 Performance Requirements

The RFP should set minimum requirements for acceptance of the performance and functional attributes of the system. This can vary from initial site acceptance testing to annual performance validation. ESIC's Energy Storage Test Manual [3] provides test protocols for verifying performance and functional requirements. Specific information in this section may include:

- List of metrics or functions being tested
- How the testing will be performed, including list of metering and monitoring points
- Penalties for non-compliance
- Frequency of testing/validation

A complete manual of test procedures does not necessarily need to be applied for every energy storage system. The degree of testing necessary will depend on the perceived risk factors and the level of investment for the cost of testing to be practical. In commercial production of energy storage, it may be appropriate for a representative unit to undergo third-party verification testing for characterization and compliance, whereas additional units may undergo less comprehensive factory acceptance and site acceptance/commissioning testing to increase confidence that a specific energy storage unit is within its specifications.

2.3.7 Warranty

Warranties for energy storage systems vary in coverage and duration. Including minimum requirements for warranties on major components, such as the battery, power conversion system (PCS), transformers, switchgear, and controls, helps ensure lifecycle costs are appropriately accounted for in the proposal evaluation. Warranty scope considerations include workmanship warranty requirements, responsibilities for diagnosis, replacement parts, on-site removal of equipment, installation of new hardware, and recommissioning. However, warranties will likely still vary in terms on maintenance, monitoring and other requirements, so additional detail should be provided if Buyer has certain requirements. Setting a minimum duration for the warranties can also help solicit some uniformity in response.

Special attention should be paid to the warranty terms. Many battery manufacturers not only prorate their warranties but also taper-off the minimum acceptable performance over time. There can also be operating conditions which, if exceeded, may void the warranty. These conditions can be environmental or usage conditions. Further, it is important obtain some assurance that the supplier will be able to meet those future obligations under the warranty. Often, extended warranties are available for a cost adder.

If procuring a system through a turnkey provider, such as an EPC firm, the Buyer should establish whether manufacturer warranties are to pass through to the Buyer or are to be maintained through the turnkey provider or other party. In some cases, an EPC contractor may provide a more comprehensive warranty above the warranty provided by the equipment vendor.

2.3.8 Owner Standards

In addition to the Technical Specifications, the Buyer should include all codes and standards with which the Bidder must comply. These may include:

- Construction standards and specifications
- Utility substation and or distribution standards
- Equipment and material standards and specifications
- Communication protocols and requirements
- Cyber security standards are and requirements
- Drawing standards or specifications
- Environmental considerations (e.g., temperature, humidity, altitude, snow load, wind, etc.)
- Minimum O&M/safety guidelines (e.g., arc flash, fire, labeling, ergonomics, other)

2.3.9 Safety, Codes, Regulations, and Standards

This section may address several different aspects of system design and safety. This could include a list of applicable codes, standards and regulations (CSR), fire protection requirements, hazard protection requirements, contractor safety requirements.

Specifying safety requirements and evaluating proposals can be challenging as it is not just the underlying technology, but integration of the system at all levels (e.g., module, rack, envelope, controls), that impact the safety and risk level. To help facilitate an objective discussion on product safety features, ESIC developed a reference hazard mitigation analysis that lays out common threat and consequence paths and the barriers to prevent or reduce this hazard. [6]

Bidders can communicate how their system mitigates the threats and consequences or why a particular hazard is not applicable.

Another way to mitigate risk is through the use of established codes and standards. The ESIC Safety Guide [7] has a list of CSRs related to energy storage which can be used as a starting point. Additionally, there are several codes and standards for storage that are newly released or under development. NFPA 855, UL9540, and UL 9540A all detail specific guidance for evaluation and/or design of ESS safety. The Department of Energy's Energy Storage Safety Collaborative Codes and Standards Update is a resource for recent codes and standards developments [8]. Buyers should consider the timing of the project and how that may align with code adoption by the authorities having jurisdiction. There may be additional CSRs, not specific to storage, related to construction or electrical design standards that are also applicable. The information in this section could also fall under the Technical Specification – Buyer Requirements or the Owner standards section. The Buyer must address a number of topics related to system interconnection as well, potentially including IEEE 1547/2030 alignment, Nationally Recognized Test Laboratory (NRTL) listings, reliability and operability/market North American Electric Reliability Corporation (NERC) or independent system operator (ISO) standards, state/local building codes including fire codes (e.g., National Fire Protection Association), and requirements imposed by the Buyer's property insurance carrier.

2.4 Required Proposal Submittals: Project-Specific Elements

The required submittal section contains a list or description of items a bidder must submit as part of the proposal package. This section should specify how the submittals are to be provided and the procedures by which submittals will be tracked and verified.

2.4.1 Pricing

The ESIC Energy Storage Cost Template and Tool [9] can be used as a fill-in pricing sheet by the Buyer, within its RFP. The Buyer can thereby communicate what is to be included as base supply or options as included in the scope or offer. The tool is available at www.epri.com/esic. The Buyer should identify other related pricing data (e.g., unit rates, breakdown of labor and equipment costs, others) that it desires from the bidders. Figure 2-2 presents an example of a pricing sheet, with a hypothetical vendor's information filled in.

Cost Data Entry Form

		Vendor Quote		
Cost Line Item	Cost Input Options	Vendor Input Value	Units	Vendor Quote
Battery/Storage Medium	**Included-Not Itemized**	**$100,000**	**USD**	**$100,000**
PCS	**Included-Not Itemized**	**$35,000**	**USD**	**$35,000**
ESS Balance of Plant	**Included-Not Itemized**	**$45,000**	**USD**	**$45,000**
UPS & Other Electronics			USD	Included-Not Itemized
ESS Thermal Management System			USD	Included-Not Itemized
Pre-Engineered ESS Structural Components (e.g. containers)			USD	Included-Not Itemized
Fire Detection			USD	Included-Not Itemized
Fire Suppression	Excluded		USD	Included-Not Itemized
Spare Parts	Excluded		USD	Included-Not Itemized
Control	**Included-Not Itemized**		**USD**	**$0**
Grid Integration Equipment	**Included-Not Itemized**		**USD**	**$0**
Project Management	**Included-Not Itemized**		**USD**	**$0**
Engineering	**Included-Not Itemized**		**USD**	**$0**

Figure 2-3

Example of pricing sheet from ESIC Energy Storage Cost Template and Tool

The Buyer should not only encourage the Bidders to base their proposals on the RFP pricing sheet, but to also offer any options that could add further value, including technology, cost savings, schedule reductions, or other value-added insights from its experience that could assist the Buyer. Many projects have been contracted as a result of value-added options offered by an experienced and capable bidder.

2.4.2 Technical Specification – Bidder Offering

This submittal requirement is where the Bidder would provide details on the technical parameters of the system. The ESIC Technical Specification Template [2] described in subsection 2.3.4 can also be used as a submittal document. The Bidder would confirm they can meet the specified requirements and include Buyer-requested information specific to the Bidder's design or technology.

2.4.3 Drawings

Preliminary drawings may be requested by the Buyer at the time of the bid, principally as a means of confirming that the Bidders understand such and have included comprehensive pricing for the work in their scope. This can help clarify and confirm that the offer details meet the Buyer criteria. For example, if a site requires multiple revenue and performance meters, the relay and meter diagram or single line would indicate how many meters are included and their electrical location(s). Examples of drawings often requested for inclusion in a proposal include:

- Single line
- Relay and metering diagram
- Site plan
- Geotechnical design
- Grading (civil or topographical) design
- General arrangement.

Additional drawing requirements expected during the project design submittals may also be listed in this section.

2.4.4 Project Schedule

The project schedule includes the Bidder's distinct milestones for meeting contract obligations or receiving payment. This is not the same as the RFP schedule, though the RFP's process schedule may include desired project milestones including commercial operation date (COD) that must be reflected therein. In general, bidders will tend to follow the desired project schedule, but some may provide a more detailed breakdown and others may propose to perform the work more quickly. Schedules may also include project management details, such as float (or slack time) along the critical path, as well as the measures that the Bidder will undertake to manage both costs incurred and schedule performance. Any Buyer requirements for software use, metrics (e.g., schedule and cost performance indices, earned value, milestone verification), and alignment between the scheduled deliverables and Buyer payments to Bidder should be defined.

The RFP may define critical milestones which must be included in the project schedule, as suggested by Table 2-2. Where target dates are known, the RFP should specify those dates, or provide date ranges to help bidders formulate their schedules. Definitions of metrics defining how each milestone is achieved can be included in this subsection as well as in 2.1.3 Definitions of Terms in order ensure the consistent understanding.

The RFP should also specify any penalties for failing to meet the schedule as well as incentives, if any, for superior performance.

Table 2–2
Basic example of bidder's project schedule

Milestone	Metric for Milestone Satisfaction	Date
Contract Executed	*For example:* All parties in receipt of signed contracts	
Drawing and Submittal Review	*For example:* 30% and/or 60% drawing review	
Design and Engineering Complete	*For example:* Stamped final drawings approved by owner	
Permits Issued	*For example:* All required permits received by owner	
Site Mobilization	*For example:* Owner issues Notice to Proceed (NTP) with construction	
Major Equipment Delivery	*For example:* Battery, inverter, switchgear, and transformer received in specified condition	
Substantial Completion	*For example:* Request for Trial Operations Approval Submitted to ISO	
Performance Acceptance Test	*For example:* Performance and functional tests complete, contract requirements satisfied	
Commercial Operation Date	*For example:* ISO issues Certificate of Compliance and approves proposed COD	

Note: In the contract, each milestone should be accompanied by a specific metric for satisfaction. A few illustrative examples are provided.

2.4.5 List of Project Clarifications, Assumptions, Exclusions, and Exceptions

Requesting a list of clarifications, assumptions, exclusions, and exceptions made in preparing the bid helps to ensure the proposal meets the intended project objectives. Ideally, most of differences in clarifications or assumptions will be resolved during the pre-bid information sessions so that, for example, Bidders participating in the information sessions will be sure to adhere to that common set of assumptions, such as assumed project site conditions. Any differences from the RFP's requirements that could affect price, schedule, performance or other contract terms should be called out and highlighted in this section. Such facts are critical for the Buyer to know during bid evaluation, but may be technology- or solution-specific so may not have been included in the general specifications or in other bidders' packages. These are not necessarily negatives in a bid, but may be essential to understanding a particular Bidder's needs and expertise. For example, one Bidder might need remote access to a particular set of data at a

certain frequency in order to maintain a warranty, and Buyer would need to verify that they can uphold the warranty requirements.

2.4.6 Subcontracting Plan

A subcontracting plan gives the Buyer information about the extended team that is being formed for a project. With energy storage projects, this section may be very important, as the Bidder may include EPC firms, developers, or integrators with various subcontracting and procurement structures. If any subcontractors are likely to be involved in the project, the deadlines or milestone markers should be adjusted to allow sufficient time for the Bidder to complete execution of subcontractor contract(s) after the primary contract is executed.

2.4.7 Diverse Supplier Statement

Some Buyers may have desired criteria relating to the use of local labor or the inclusion of diversity elements such as businesses owned or run by women, members of a minority, disadvantaged or disabled individuals, or military veterans. Such requirements may flow from the Buyer's internal corporate priorities or be external to the company – for example, a municipal utility must follow contracting guidelines established by the city council. Requesting a diversity statement makes Bidders aware of these local criteria and allows them time to respond to that set of criteria early in their own team-building process.

2.4.8 List of Major Equipment Suppliers

Each bidder should provide a specific list of the equipment suppliers being used, their factory and manufacturing process certifications, and any product specifications. Minimum standards, such as "buy America" requirements or other foreign sourcing restrictions, should be set in the RFP and bidders should note where they have met or exceeded those standards.

2.5 Required Proposal Submittals: Qualifications and Contract

If the Buyer elects to conduct a pre-qualification process, then all approved bidders will be expected to satisfy company qualification requirements. However, the final proposal package should include a complete set of detailed qualification documentation. Any updates to company status or procedures, whether they would improve the company's standing or not, should be incorporated in this final submittal.

2.5.1 Statement of Knowledge, Experience and References

The section is fairly typical in an RFP, but given energy storage is still an emerging field with many new participants entering the field, demonstrated experience with a list of references should be stated as a critical component for proposal evaluation. Experience could be based on design and installation of a particular storage technology, understanding of utility interconnection or infrastructure design, familiarity with local codes and standards, and any other specific criteria suited to the particular project. Experience on similar scale projects and with a specific type of storage technology – particularly if a relatively new technology such as a flow battery is being proposed – should be well documented. In this section of the RFP, the Buyer may include specific requests for items such as resumes of key team members, project management experience and capability, and related project experience. This may be redundant if issued as part of a pre-qualification step described in subsection 2.2.2.

2.5.2 Safety Plan and Record

A company's safety history may be used as part of the qualification process. Jobsite safety can be a potential risk area for a project, and selecting a supplier with a good safety record and well-established safety plan and practices can help to mitigate some of the risk.

2.5.3 Financial Statement

This section includes bidder information needed to satisfy the Buyer of the secure financial status of the Bidders, including information which may reveal any conflicts of interest (see subsection 2.5.3). Requesting such financial information is not unique to energy storage projects, but rather is something that should be included for any major capital project. In this section, Bidders may also be asked to include their guarantees or warranties of financial ability to complete the project as bid.

2.5.4 Conflicts of Interest

Bidders should note any potential conflicts of interest for the project and contract award or future execution. If potential conflicts of interest were identified during pre-qualification, Bidders may take the opportunity in the final proposal submittal to clarify and resolve those possible issues.

2.5.5 Legal Claims

This section requests from Bidders any pending legal claims, liens, or liabilities they may face. Such information will affect the Buyer's proposal review. Because new issues may have arisen or old ones may have resolved, this section may differ somewhat from that submitted during pre-qualification.

2.5.6 Business Ethics Statement

Each Bidder should include their business ethics statement, so that the Buyer can be assured that their standards align. Bidder may have updated their statement during discussions with the Buyer at the pre-qualification stage.

2.5.7 Non-Disclosure Agreement

If a non-disclosure agreement was not required to receive proposal details, (see subsection 2.2.1) it may be included as part of the proposal submittal package.

2.5.8 Contract Terms and Conditions

The RFP should include Buyer's standard or project-specific contract terms. The bidder should be requested to review and comment on those terms, in particular to specify changes it must obtain in order to proceed if awarded the contract. To this end, the RFP may include a section highlighting nonnegotiable contract terms or identifying unacceptable amendments to the terms. If the RFP includes a complete copy of Buyer's Terms and Conditions, bidders can incorporate that text, possibly with some modifications, in their responses to the RFP. Bidder conformance with Buyer's contract terms, with no more than minimal changes, may be a defined evaluation criterion.

2.5.9 Bidder's Exclusions and Exceptions

To the extent that Bidder requires amendments to the Buyer's standard terms and conditions, those adjustments should be called out in a document highlighting any such differences. Careful bidders will also note specific exclusions to clarify areas that they recognize as beyond the scope

of work, such as items in the overall project plan that have been identified as the Buyer's own responsibility.

3
NEXT STEPS IN THE RFP PROCESS

The focus of this guide is the preparation of the RFP; however, that preparation should be done within the context of the overall procurement process, which will proceed towards comparing responses to the RFP, conducting negotiations with the preferred bidder(s), and coming to a final decision. If the RFP is developed with a broad understanding of the company's planning objectives and selection procedures, the RFP will serve that whole process, making the ultimate decision-making step transparent and relatively painless.

Each company issuing an RFP likely has in place an internal process for evaluating purchases and contracts, and the decision stage of an RFP process will need to adhere to such company norms. As a general rule, the evaluation of proposals in response to an RFP is improved by allocating the work of evaluation among committees or working groups having the appropriate subject matter expertise. Overall, the goal is to ensure results that are fair, impartial and transparent while also reaching conclusions efficiently. A typical division of labor could define committees by responsibility area, such as:

- Engineering and Design
- Construction
- Commissioning
- Environmental, Health, and Safety
- Operations
- Financial Concerns
- Business Ethics, including NDAs and conflicts of interest
- Contracts

A common pitfall in the evaluation of RFP responses is a failure to assess bids on a consistent basis. To guard against this possibility, a scoring metric should be devised and applied consistently across committees. Certain requirements might be assigned higher weight, to reflect company priorities, as illustrated by the simplified weighting factors in Table 3-1. Such preferences should be communicated to Bidders as part of the RFP. For example, there may be a corporate need to demonstrate community involvement in new projects or a city project approval process which rewards job creation. Most crucially, low cost is rarely the only criterion for awarding bids. In any case, a company issuing RFPs in other areas likely has internal protocols for proposal evaluations, to which the energy storage project team will need to adhere.

In addition to grading proposals with quantitative responses, the Buyer may choose to supplement scoring processes with qualitative decision-making methods in which subjective metrics are assigned to each Bidder along with the objectives ones. For example, past experiences or impressions of a Bidder during previous engagements with the Buyer could be averaged and weighted into the scoring rubric by polling reviewers. Often, the value in qualitative decision-making is in the discussion of assigned values, rather than the final numerical result, though they can make an effective tie-breaker when needed.

Table 3–1
Simplified weighting-factor list

Category	Evaluation Factor	Weighting
Cost factors	Installed Costs	20
	Operating Cost	5
	Projected Savings	5
Business factors	Financial Strength	12
	Business Structure and Team	8
Technical Factors	Design Strategy	5
	Meeting Project Specifications	10
	O&M Plan and Approach	5
Experience factors	Project Management Approach	5
	Contractor Expertise	10
	Project Experience	10
Other Goals	Support for customers with solar	5
Total Proposal		100

In rare cases, the highest-scored Bidder(s) and the Buyer might not be able to come to a final agreement on contract terms. The evaluation process, therefore, needs to have in place a procedure for selecting a new leading Bidder. Whether this procedure is simply to move on to the next-highest score or to reopen discussions with two or more top bidders, it should be clear to all stakeholders what the process would be, including measures to respect bidders' time and cost investments.

Throughout the RFP process, communication is key. In addition to laying out basic requirements such as the technical specifications of a project and the financial health of the Bidders, the Buyer should make clear from the beginning how the RFP will be evaluated. In the evaluation process, detailed records should be kept to document each step of the evaluation process. There should also be a clear understanding from the start of the RFP process the extent to which discussion of bids may take place prior to award decisions. In many RFPs, and particularly for storage RFPs, it is helpful to make accommodations for clarifications by Bidders during the evaluation process. If lines of communication are well-established at the outset and maintained throughout, the RFP process should proceed smoothly and yield good outcomes for the Buyer while encouraging all Bidders through a fair and transparent series of interactions.

4
REFERENCES

1. Wood Mackenzie Power & Renewables/ESA U.S. Energy Storage Monitor
2. *ESIC Energy Storage Technical Specification Template v3.0*. EPRI, Palo Alto, CA: 2019. 3002013531. https://www.epri.com/#/pages/product/000000003002013531/.
3. *ESIC Energy Storage Test Manual.* EPRI, Palo Alto, CA: 2019. 3002013530. https://www.epri.com/#/pages/product/000000003002013530/.
4. *ESIC Energy Storage Implementation Guide*. EPRI, Palo Alto, CA: 2019. 3002013533. https://www.epri.com/#/pages/product/000000003002013533/.
5. MESA Standards Alliance. "MESA Standards." MESA: Open Standards for Energy Alliance. http://mesastandards.org/mesa-standards/.
6. *ESIC Energy Storage Reference Hazard Mitigation Analysis*. EPRI, Palo Alto, CA: 2019. 3002017136. https://www.epri.com/#/pages/product/000000003002017136/.
7. *Energy Storage Safety: 2016, Guidelines Developed by the Energy Storage Integration Council for Distribution-Connected Systems.* EPRI, Palo Alto, CA: 2016. 3002008308. https://www.epri.com/#/pages/product/000000003002008308/.
8. U.S. Department of Energy, ES Safety Collaborative. https://www.sandia.gov/energystoragesafety-ssl/codes-standards/status-of-codes-and-standards/
9. *ESIC Energy Storage Cost Template and Tool v2.0*. EPRI, Palo Alto, CA: 2018. 3002013529. https://www.epri.com/#/pages/product/000000003002013529/.

A
GLOSSARY SELECT TECHNICAL PARAMETERS AND DEFINITIONS

Example terms and definitions were excerpted and adapted from the ESIC Energy Storage Technical Specification Template [2] and ESIC Energy Storage Test Manual [3].

1. **Active Frequency Regulation:** Systems is are capable of receiving, responding to, and dispatching the ESS in 4 seconds or less at the requested power within the specified tolerance of the dispatch signal as measured at the PCC.
2. **Active Power Smoothing:** Systems is capable of receiving, responding to, and dispatching the ESS in 1-second or less at the requested power within the specified tolerance of the dispatch signal as measured at the PCC.
3. **Autonomous Frequency Regulation**: A process in which energy storage systems automatically charge or discharge in response to variations in the measured grid frequency (Hz) that are due to short-term imbalances between electricity generation and consumption.
4. **Autonomous Power Smoothing:** A process in which energy storage systems automatically produces or absorbs power in order to smooth the changes in the power level of the referenced electrical connection point.
5. **Auxiliary Load:** Source of electric power consumption by plant components associated with the operation of an ESS, but not directly a result of charging and discharging losses. This may include, but is not limited to, controls, cooling systems, fans, pumps, and heaters necessary to operate and protect the system.
6. **Auxiliary Energy:** This represents the electric energy delivered to satisfy auxiliary loads not accounted for at the PCC meter (i.e. separately metered) as an ESS is functioning. It should be reported in kWh as an average integration of the auxiliary load over charge, discharge, or idle periods.
7. **Available Discharge/Charge Energy Capacity:** The maximum amount of usable energy in kWh, less any unaccounted auxiliary loads, that the ESS can supply (discharge capacity) or store (charge capacity) during a single cycle between maximum state of charge and minimum state of charge as stated in ESS supplier specifications.
8. **Average State of Charge:** The average percentage state of charge of the system over its operational life *(or a specified time period)*[1],
9. **Duty Cycle:** A charge/discharge profile that represents the demands associated with a specific application that is placed on an ESS.
10. **End of Life:** The condition of the ESS at the end of life in terms of remaining capacity, impedance, efficiency, and other pertinent parameters. *(To be specified by project)*

[1] It is important to specify the respective duration for any average state of charge rating.

11. **Float Charge:** For electrochemical batteries; recharging during which batteries are connected to a constant-voltage supply that maintains the cell in fully charged condition. (ESA Working Terminology)
12. **Full Duty Cycle**: The sequence of a full energy discharge followed immediately by a full energy charge. (ESA Working Terminology)
13. **Hibernation State:** The energy storage system is disconnected from the PCS preventing charge and discharge. Only essential loads associated with warm-up and initialization are powered. ESS has warmed up and initialized all sub-systems.
14. **Load or Generation Following:** Variable dispatch of that matches either A) the charge level to consumption by a designated circuit, or B) the discharge level to the power generated by a DER
15. **Minimum State of Charge (Min SOC)**: The point at which no more useful AC energy can be delivered by the ESS, expressed in percent of nominal capacity, typically expressed as 0%.
16. **Maximum State of Charge (Max SOC)**: The point at which no more useful AC energy can be stored by the ESS, expressed in percent of nominal capacity, typically expressed as 100%.
17. **Peak Power Limiting:** The process in which an ESS delivers active power in response to measured power flows through a metered point on a grid, with the aim of reducing peak power flow through that point or connected assets and meters.
18. **Point of Common Coupling (PCC)**: The point of interconnection between the ESS and the utility used for determining the actual AC power supplied to or provided from the utility grid.
19. **Ramp Rate:** The rate, expressed in megawatts per minute, at which the interchange schedule is attained during the ramp period. Generator Ramp Rate: The rate, expressed in megawatts per minute, that a generator changes it output [10].
20. **Rated Continuous Power:** The maximum specified active, reactive, or apparent power *(as noted)*, sustained continuously for a maximum specified time duration while transfer of electric energy is performed *at a specified measurement location*.
21. **Remote Signal Latency:** The difference between the time when the master controller, utility supervisory control and data acquisition (SCADA), or equivalent system sends a control signal to the time when the control signal is received by the ESS controller.
22. **Response Time**: The time in seconds it takes an ESS to reach 100% of rated continuous power during charge or to discharge 100% of rated continuous power during discharge from an initial power measurement when the ESS is at rest [3].
23. **Roundtrip Efficiency:** Ratio of the delivered discharge energy to the delivered charge energy in a Full Duty Cycle at *(specified measurement location, e.g. PCC, PCS output)*, including ESS parasitic loads.
24. **Self-Discharge Rate:** Rate at which an ESS loses energy when the storage medium is disconnected from all loads, except those required to prohibit it from entering into a state of permanent non-functionality.

25. **Settling Time:** The duration between the time at which a step change in control signal input occurs and the time at which the ESS power output settles to within ±5% of the required control output.
26. **Startup Time:** The period of time that an ESS takes to go from a shutdown state to a state in which the ESS is ready to respond to a command. Startup Time shall include any manufacturer required warm-up and initialization times.
27. **State of Charge (SOC):** The degree to which storage is charged relative to the maximum possible amount of energy (Ah) that can be stored by the system, typically expressed as a percentage. (ESA Working Terminology)
28. **System Latency:** The time between when the control signal is sent and the ESS discharge or charge power value changes by more than 1% of the control signal.
29. **Volt-VAR Regulation:** The ESS, while synchronized to a grid can deliver reactive power in response to a voltage measurement at a pre-determined point on a grid. ESS can perform volt-VAR regulation based on system voltage as defined in the International Electrotechnical Commission Technical Report IEC 61850-90-7.

B
EXAMPLE BIDDER QUALIFICATION FORM

Note – This is an example only, with tables and questions provided to highlight items related to energy storage and safety.

A. COMPANY (BIDDER) INFORMATION

B. FINANCIAL INFORMATION

C. INSURANCE

D. LEGAL

E. SERVICES PROVIDED

E.1 Please list your top three customers (work experience references) that you have performed work for in the Energy Storage field.

COMPANY NAME	CONTACT NAME	ADDRESS	CONTACT PHONE	CONTACT EMAIL

E.2 Please list your top three suppliers (work experience references) that have performed work for you or provided Energy Storage equipment to your projects.

SUPPLIER	CONTACT NAME	CONTACT PHONE

E.3 What type of Storage work does your company typically self-perform versus subcontract?

E.4 Typically what percentage of your Energy Storage work/scope of supply would come from (State) based companies?

F. PRIOR ENERGY STORAGE EXPERIENCE:

F.1 Bidder's Energy Storage Project Implementation Experience

List 3 Major Relevant Projects (Completed or Ongoing):

PROJECT #1	
Name of Energy Storage Project	
Project Description	
Project Owner	
Project Owner Contact Information	
Bidder's Role (Prime/Subcontractor/CM)	
Name of Prime Contractor (if by others)	
Project Location (Country/State/County/City)	
Bidder Scope of Work	
Value of Bidder's Scope of Work	
Project Duration	
Project Completion Date	
PROJECT #2	
Name of Energy Storage Project	
Project Description	
Project Owner	
Project Owner Contact Information	
Bidder's Role (Prime/Subcontractor/CM)	
Name of Prime Contractor (if by others)	
Project Location (Country/State/County/City)	
Bidder Scope of Work	
Value of Bidder's Scope of Work	
Project Duration	
Project Completion Date	
PROJECT #3	
Name of Energy Storage Project	
Project Description	
Project Owner	
Project Owner Contact Information	
Bidder's Role (Prime/Subcontractor/CM)	

Name of Prime Contractor (if by others)	
Project Location (Country/State/County/City)	
Bidder Scope of Work	
Value of Bidder's Scope of Work	
Project Duration	
Project Completion Date	

G. EMPLOYEES

H. MAJOR PLANT AND EQUIPMENT

I. LIMITATIONS

J. QUALITY CONTROL / QUALITY ASSURANCE

J.1 List ISO or other quality certifications held (i.e. JIT, Value Engineering, SOW, Six Sigma, Supply Alliances, LEAN, or others):

J.2 Do you have a written Quality Assurance/Quality Control Program?

YES ☐ **NO** ☐

If yes, please attach Table of Contents.

J.3 Methodology for bringing innovation and cost savings opportunities to customers Please explain and attach separate sheets if necessary.

K. SAFETY PROGRAM

K.1 Please briefly explain your typical safety program.

K.2 Do you have a written Safety Manual?

YES ☐ **NO** ☐

If yes, please attach Table of Contents.

K.3 Please list your company's Experience Modification Rate (EMR); Incident Rate calculated by the number of Reportables x 200,000 / total man-hours; and Frequency Rate calculated by the number of lost time cases and restricted duty cases x 200,000 / total man-hours.

YEAR	HOURS MAN-HOURS	EMR	INCIDENT RATE	FREQUENCY RATE
2017 (YTD)				
2016				
2015				
2014				

K.4 Please list the three most frequent Reportable Incidents reported on construction sites for your company.

YEAR	MOST FREQUENT REPORTABLE	2ND MOST FREQUENT REPORTABLE	3rd MOST FREQUENT REPORTABLE
2017 (YTD)			
2016			
2015			
2014			

K.5 Has your firm been cited for any OSHA regulation infractions in the last three years?

YES ☐ **NO** ☐

If yes, please explain:

K.6 Indicate the number of fatalities your company has experienced during the past three (3) years, plus the current year.

YEAR	NUMBER OF FATALITIES
2017 (YTD)	
2016	
2015	
2014	

K.7 Does the company have a written Corporate Statement concerning Safety and Quality that is signed by your CEO/President?

YES ☐ **NO** ☐

If yes, please attach a copy.

K.8 Have you been inspected by OSHA and other industrial safety enforcement agencies in the past three years, including the current year?

YES ☐ **NO** ☐

If yes, please explain:

K.9 Does the company have a written Hazard Communication Plan?

YES ☐ **NO** ☐

K.10 Does the company have disciplinary actions for Safety Violations?

YES ☐ **NO** ☐

K.11 Does the company have a written policy/program for Fitness for Duty that is signed by your CEO/President?

YES ☐ **NO** ☐

L. ENVIRONMENTAL

M. PERSONNEL RISK ASSESSMENT

C
DIVISION OF RESPONSIBILITY (DOR) MATRIX TEMPLATE

In the pages that follow, a series of tables presents a template for an energy storage project's division of responsibility matrix. The design follows the RACI organizational work flow model, in which each active agent plays a defined role at each stage in the project:

- R: This is the party **Responsible** for carrying out the task itself--usually there is either only one "R" for a task, or multiple "R" parties are closely-coordinated to ensure a clear chain of responsibility.
- A: This is the party held **Accountable** for ensuring that the task is completed and completed according to specifications--usually, this will be the person or agency that signs off on task completion.
- C: This is a **Consultant** with subject matter expertise that will be sought out for input and will provide information and opinions--in the context of a RACI plan, a "C" party may be an in-house expert, a supplier with special knowledge, or an outside consultant.
- I: This is an agent that other actors need to **Inform** about project activities, particularly upon completion of a task or a deliverable--this category includes managers or parties working on related projects or endeavors affected by the project.

The diagram provides a graphical view that clearly communicates interrelationships among roles and the flow of responsibilities through the project cycle. The aim is to achieve efficient project management with accurate time-and-cost control, task-focused of resources, and flexible response to changes. For convenience, these same tables may be accessed and adapted to a particular project using this Excel workbook:

ESIC DOR Matrix Template

PROJECT NAME:
PROJECT DESCRIPTION:
OWNER:
LOCATION:
PLANNED IN-SERVICE DATE:

The following DOR can be used as a template for assigning responsibility for different aspects of an energy storage project. As responsibilities can vary widely depending on ownership engagement/expertise, capabilities of suppliers/contractors, type of project, and financial obligations, it is critical that the overall contracting strategy and regulatory requirements be identified upfront. As an example, if the owner is a regulated utility and the ahead-of-meter BESS will be included in its rate base, responsibilities will be quite different than a behind-the-meter microgrid installation for a commercial customer. Each box in the following DOR table is typically filled in with the initials of the primary responsible party (e.g., the "R" in a conventional responsible/approval/consult/inform (RACI) structure).

Responsible Parties: OR = Owner, SR = ESS Supplier, CR = ESS installation contractor
Approval Parties: OA= Owner, SA = ESS Supplier, CA = ESS installation contractor
Consulting Parties: OC = Owner, SC = ESS Supplier, CC = ESS installation contractor
Inform Parties: OI= Owner, SI = ESS Supplier, CI = ESS installation contractor

Task Description	Design Criteria (Prelim Design)	Detailed Design	Purchase Specification	Procure or Supply	Installation	Testing/ Commissioning
ENGINEERING AND SPECIFICATION						
Development, Siting, and Origination						
Locational Data (seismic, temp., humidity, environment)						
Design Life, Cycles of Operation, Constraints						
Reliability, Availability, and Capacity Factor						
Codes and Standards Requirements						
Environmental Controls/Compliance						
Noise and Air Emissions Limits						
Operation and Maintenance Requirements						
Emergency Response Needs (e.g., spills, fires)						
Owner's Safety/Lock-out/Tag-out Requirements						
Signage, Tagging, Labeling, Nomenclature						
Interconnection Study						
Electrical Design (Stamped drawings and schedules for permit and construction)						
Protection Design, including settings						
Civil Design (Stamped drawings and calculations)						
Structural Design (Stamped drawings and calculations)						
SCADA Design						
Lightning Study						
SWPPP Design						

Task Description	Design Criteria (Prelim Design)	Detailed Design	Purchase Specification	Procure or Supply	Installation	Testing/ Commissioning
Record/As-built drawings						
Permitting						
PROJECT MANAGEMENT						
Management Organization and Staffing						
Project Management Plan (PMP)						
Reporting, Mandatory Meetings, Conflict Resolution						
Site Control/Accessibility						
Project Schedule Controls/Metrics (e.g., earned value)						
Cost Controls and Change Management						
Document Control Requirements/Procedures						
Submittals to Owner						
Regulatory submittals (if required)						
Other submittals between parties						
Quality Assurance						
Legal (Subcontracts and Supplier Management)						
OWNER-FURNISHED EQUIPMENT (OFE)						
Existing Facilities Terminal Points						
Project Equipment by Owner						
OFE Document Control						
OFE Shipping, Delivery, Unloading, Materials Mgmt.						
ESS EQUIPMENT						

Task Description	Design Criteria (Prelim Design)	Detailed Design	Purchase Specification	Procure or Supply	Installation	Testing/ Commissioning
Battery (cells, trays, racks, containers, other)						
Battery (or storage medium) management system (BMS)						
Power conversion system (PCS, including inverter(s), controls, external communications)						
ESS control system (interfaces, controllers, communications, others)						
ESS mechanical and structural commodities						
ESS raceway, wire, commodities						
ESS shipping/transportation (note where transfer of ownership occurs, i.e. Inco Terms)						
ESS rigging and offloading						
ESS temporary storage prior to installation						
ESS spare parts						
Balance of plant spare parts						
PREPARATION/STRUCTURAL WORK (SITE/BUILDING)						
Foundation or building (new or modifications)						
Excavation and grading						
Site access road						
Fencing						
Finishing (gravel)						
Site Restoration						

Task Description	Design Criteria (Prelim Design)	Detailed Design	Purchase Specification	Procure or Supply	Installation	Testing/ Commissioning
MECHANICAL SYSTEMS WORK						
Heating, ventilating, and air conditioning						
Fire protection						
Safety systems (e.g., spill protection, other)						
Materials (Anchor bolts, steel structures, other commodities)						
Painting and coating (if required)						
ELECTRICAL SYSTEMS/INTERCONNECT WORK						
Step up Transformers						
Switches (Disconnect, Recloser)						
Circuit Breaker						
Switchgear						
Bus and instrument transformers						
Materials (Cable, Conduit, Fittings, Boxes, Other Commodities)						
Metering and enclosures						
Protective relaying, synchronization						
Grounding, bonding, lightning/surge protection						
Existing substation upgrades						
Existing system interfaces (including other generation, load centers, auxiliary power circuit, other)						
UPS hardware and interface						
Transfer switch						
Lighting						

Task Description	Design Criteria (Prelim Design)	Detailed Design	Purchase Specification	Procure or Supply	Installation	Testing/ Commissioning
Medium voltage AC power supply						
Low voltage AC power supply						
DC power supply						
Service Station Transformer						
INSTRUMENTATION/CONTROLS/ COMMUNICATIONS WORK						
NERC CIP requirements						
Third party communications provider (if required)						
Telecommunications protocol/architecture						
Hardware supply (controls, facility)						
Wiring (fiber, copper, grounding including routing and terminations), wireless hardware						
Closed circuit and other monitoring						
Alarm/historian protocol						
SCADA Equipment and Enclosure						
Telemetry						
Interface with building energy management or control rooms (if required)						
HMI						
Communication and fiber wiring and switches						
Relays and panel						
Control panel						
Monitoring Equipment						

Task Description	Design Criteria (Prelim Design)	Detailed Design	Purchase Specification	Procure or Supply	Installation	Testing/ Commissioning
CONTRACTOR'S SITE SERVICES (through Acceptance)						
Furnish and install all temporary facilities (including sanitary facilities, parking management, other)						
Furnish construction equipment to access/use utilities during const./SU&C phases						
Housekeeping, facilities/materials management						
Site safety, signage, first aid, fire prevention						
Compliance with all environmental/building permits						
Site document control						
Site quality assurance						
Site Security						
Site Inspection						
Site Management						
Construction Management						
STARTUP, COMMISSIONING & ACCEPTANCE						
Factory Acceptance Testing						
ESS Startup Procedures/Plans						
BOP Startup Procedures/Plans						

Task Description	Design Criteria (Prelim Design)	Detailed Design	Purchase Specification	Procure or Supply	Installation	Testing/ Commissioning
ESS Commissioning and Testing						
BOP[1] Commissioning and Testing						
ESS Site Acceptance Testing						
BOP[1] Site Acceptance Testing						
Turnover Package Preparation and Submittal to Owner						
ESS Performance Testing						
Supplier and Contractor Warranty Management						
ESS Training						
ES Operation and Maintenance						

The Electric Power Research Institute, Inc. (EPRI, www.epri.com) conducts research and development relating to the generation, delivery and use of electricity for the benefit of the public. An independent, nonprofit organization, EPRI brings together its scientists and engineers as well as experts from academia and industry to help address challenges in electricity, including reliability, efficiency, affordability, health, safety and the environment. EPRI members represent 90% of the electric utility revenue in the United States with international participation in 35 countries. EPRI's principal offices and laboratories are located in Palo Alto, Calif.; Charlotte, N.C.; Knoxville, Tenn.; and Lenox, Mass.

Together…Shaping the Future of Electricity

© 2019 Electric Power Research Institute (EPRI), Inc. All rights reserved. Electric Power Research Institute, EPRI, and TOGETHER…SHAPING THE FUTURE OF ELECTRICITY are registered service marks of the Electric Power Research Institute, Inc.

3002017242

Electric Power Research Institute
3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 • USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com