CPUC Energy Storage Proceeding R.10-12-007

Energy Storage Phase 2 Interim Staff Report

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Table of Contents

1. Introduction

1.1 Executive Summary

This Interim Staff Report provides an update on the California Public Utilities Commission's efforts to address energy storage policy, building upon the analysis framework adopted by the Commission as part of Rulemaking (R.) 10-12-007. This proceeding responds to AB 2514, which directed the Commission to determine whether energy storage procurement targets should be established for regulated load-serving entities.

The report outlines several areas of action and seeks stakeholder comments. The comments are expected to become part of the rulemaking's record and support a future Commission decision(s) related to energy storage. The Commission is interested in considering whether steps need to be taken to reduce barriers to the deployment of storage, including specifically considering the need for procurement policies for energy storage, a cost-effectiveness evaluation of storage, and explicitly designating storage as a "preferred resource" in Commission procurement priorities. In addition, the Commission's review of energy storage policies overall in this proceeding may identify or reaffirm the need for specific policy action in related proceedings.

Commission Staff have reviewed a variety of energy storage Use Cases to further refine our understanding of the need for policy actions in support of energy storage deployment. The purpose of this Interim Staff Report is not to make specific recommendations on any of the barriers or policy options at this point in time, but rather to seek comment from stakeholders based on the work prepared in the proceeding up until this point. Staff expects stakeholder comments, future workshops, and subsequent staff proposals to all be part of the record of this proceeding.

The report includes the following key components:

(1) A Set of Energy Storage Use Case documents

Staff provides a set of seven (7) energy storage Use Case documents that illustrate how energy storage may be used in California's electric utility system. [1] These Use Cases are meant to identify the monetized and non-monetized benefits of storage, any barriers toward market implementation, and potential policy options for removing those barriers. These Use Cases provide insights into the types and potential value of services that storage can provide for Generation (Wholesale Markets), Distribution and Customer-Side-of-the-Meter applications. The Use Cases also establish a basis for conducting preliminary cost-effectiveness analysis, which will inform Commission decisions about procurement and other policies that relate to meeting the objectives of AB 2514. The Use Case documents were developed as a result of

[1] The set of Use Cases is included as Appendix A. These documents may be found on the Commission's Energy Storage web page: http://www.cpuc.ca.gov/PUC/energy/electric/storage.htm

workshops and informal small working groups consisting of volunteer stakeholder parties collaborating with Energy Division staff.

(2) Barriers to Energy Storage Adoption

In Phase 1, Staff and stakeholders identified a wide range of distinct challenges to deployment of energy storage systems, grouped into nine broad categories. Phase 2 has taken this approach to the next level through the Use Case analysis, which identified with more specificity some barriers that apply to the Use Cases. Focusing on the barriers that are most applicable to each individual Use Case, it is possible to identify potential resolutions that stakeholders believe should be considered for appropriate action, either in this proceeding or some other forum.

(3) Energy Storage Policy Issues for Consideration in this Proceeding

Three policy issues may be subject to resolution via some policy action in this proceeding. As parties comment on these issues, a record will be developed for possible action in a future decision in this proceeding.

a. Interpreting Energy Storage as a Preferred Resource

The concept of including energy storage as a "preferred resource" was identified as an option for consideration in the initial Staff White Paper of July 2010. Subsequently, in workshops and comments, various parties continued to express a desire to do so, as a way of signaling the benefits that storage may bring to the utility system.

b. Establishing Energy Storage Procurement Targets

The major issue for consideration in this proceeding is whether procurement targets for energy storage are appropriate and, if so, how much should be procured. To further develop a record to determine whether and how to order a storage procurement target for Load-Serving Entities (LSEs) to meet by 2015, staff has scheduled a workshop on January 14, 2013. Potential procurement options include global storage targets, pilots/market tests, or as part of a portfolio of resources.

c. Energy Storage Cost-Effectiveness

The third policy issue for consideration in this proceeding relates to evaluating cost-effectiveness. The Commission would clearly benefit from a cost-effective methodology specific to storage. However, determining a global cost-effectiveness analysis for storage, based on the tests traditionally used by the Commission for demand-side resources, is very challenging because of the wide variety of storage technologies, applications and project-specific operational and non-operational factors that impact measurement of costs and benefit streams. Staff and stakeholders continue to work on developing an appropriate methodology and tailor available computer models to this purpose.

(4) Review of Other Energy Storage Policy Actions

a. Policy Actions and Options in Related Proceedings

The Final Staff Proposal for Phase 1 identified a n umber of related proceedings in which energy storage is being considered, especially the Long-Term Procurement Planning (LTPP) and Resource Adequacy (RA) rulemakings. In a ddition, treatment of energy storage has become an issue in other forums, includ ing the Renewable Portfolio Standard rulemaking, Rule 21 interconnections, and such initiatives as the Self-Generation Incentive Program. This report provides a status of how energy storage issues are being handled in these proceedings.

b. Policy Actions and Options Involving other Agencies

Since energy storage has multiple uses across the e lectric system value chain, it is difficult to adopt a comprehensive policy within an y one of the energy agencies such as the Commission, the California Energy Commission (C EC), California Independent System Operator (CAISO), and the Federal Energy Reg ulatory Commission (FERC). This section reviews some of the major regulatory and ma rket issues being addressed in these forums.

c. Policy Actions and Options for Future Consideration

In the Use Cases, Parties offered a number of poten tial solutions to barriers which extend beyond the time-frame for the current Rulema king. At the present time, Staff is unable to incorporate these issues into the current framework. With more information, these issues may be addressed in Commission proceedings in the future.

(5) Next Steps

The Interim Staff Report also lays out next steps t o be taken in this proceeding and poses some questions for parties to consider in their comments on this Interim Report.

2. Procedural Development

On December 16, 2010, the Commission opened R. 10-1 2-007 (the Rulemaking or this Proceeding) to implement the provisions of Assembly Bill (AB) 2514, Skinner, (Stats. 2010, ch. 469). AB 2514 established Public Utilities Code (PU) Code §2836 which directs the CPUC to determine appropriate targets, if any, for each Load-Serving Entity (LSE) as defined by PU Code § 380(j) to procure viable and cost-effective energy storage systems and sets dates for any targets deemed appropriate to be achieved.

Phase 1 of this Proceeding concluded with the formal adoption of a Staff Final Proposal on August 2, 2012, in Decision (D.) 12-08-016. [2] In order to support the analysis of energy storage issues going forward, Commission Staff proposed the adoption of an energy storage "end use" framework, which focused on the most likely applications for energy storage on the utility system, with an emphasis on "priority scenarios" that match Commission policy goals. It also provided a Regulatory Framework for addressing storage related issues in other proceedings, particularly the Resource Adequacy (RA) and Long-Term Procurement Planning (LTPP) rulemakings. Phase 1 activities were more fully described in the Final Proposal.

Phase 2 formally commenced with a Pre-Hearing Conference on September 4, and a Phase 2 Scoping Memo was issued on October 1, 2012, establishing the general direction and schedule for the initial activities of Phase 2. Staff was asked to continue with the analysis of energy storage end uses with particular focus on these aspects: cost-effectiveness, market needs, barriers, ownership model, and procurement target (if necessary).

In continuing the analysis from Phase 1, Staff conducted workshops and informal activities with stakeholders throughout the fall of 2012. These activities were intended to define the parameters of Use Case analysis and the issues to be addressed in Phase 2.

An initial Staff workshop was held on August 20, 2012, as a general discussion of the status of the proceeding and elements of proposed Use Cases covering major applications for energy storage.

Other workshops that have been conducted as part of Phase 2 were:

September 7, 2012: Procurement Rules and Policies
This joint workshop for Energy Storage (R. 10-12-007) and LTPP (R. 12-03-014) began to explore the definition and valuation of energy products and resources that can meet Local Capacity Requirements (LCR) and System Need, including preferred resources such as demand response, and distributed generation, alongside conventional generation. A major issue of discussion was whether storage should be considered a preferred resource for LCR procurement purposes.

September 24, 2012: Cost-Benefit Analytical Tools
This workshop introduced two evolving tools for evaluating the costs and benefits of energy storage in particular applications: the Energy Storage Valuation Tool (ESVT) developed by the Electric Power Research Institute (EPRI) with consultant E3; and several storage-related models developed by DNV KEMA (such as ES Select developed under contract with the Sandia National Laboratory). The intent of the workshop was to introduce the models and their capabilities with an interest in seeing how they might be applied as screening tools for cost-benefit analysis of storage Use Cases.

October 16, 2012: Developing Energy Storage Use Cases (1)

[2] These documents may be found on the Commission's Energy Storage web page: http://www.cpuc.ca.gov/PUC/energy/electric/storage.htm

This workshop provided a first run-through of draft documents being developed by parties and stakeholders to provide standardized analysis of st orage Use Cases that respond to the four "priority scenarios" identified in the Phase 1 Staff Report. Besides providing a description of energy storage applications that may be most appropriate for utili ty system operational and resource needs, the Use Cases are meant to identify with some specificity m onetized and non-monetized benefits of storage, barriers toward market implementation, and potentia l policy options for removing barriers. Stakeholders initially introduced 18 potential Use Case documents, which were considered for narrowing to eliminate duplication.

December 3, 2012: Developing Energy Storage Use Cases (2)

This workshop continued the refinement of Use Cases , based on the initial discussions and recommendations for consolidation in to three (3) m ajor categories of uses that offered distinct sets of applications, benefits and operational characterist ics. In all, seven (7) Use Case documents resulted from this effort.

December 4, 2012: Policy Options

This workshop provided an initial discussion of pro curement options and potential actions meant to reduce barriers to adoption and/or enhance market o pportunities for energy storage systems in California. These policy options are more fully described in this Report.

3. Energy Storage Use Cases

There are seven Energy Storage Use Case documents a ttached to this Staff Report that fall into three major categories: Transmission Connected Storage, D istribution-Level Storage, and Demand-Side or Customer-Sited applications. The development of the Use Case approach, the development of the documents, and an overview of each Use Case are pro vided below. The Use Cases are helpful in that they provide some clarity to the importance of addressing particular policy barriers.

3.1 Use Cases Reflect Priority Scenarios

In D. 12-08-016, the Commission approved an approach for analysis of energy storage via "end uses":

> *"We believe that focusing on the end uses, and appl ying them to specific scenarios will reduce the risk that this potential resource will be under valued. More importantly, this approach will allow us to identify those relevant situations wher e storage could be utilized and whether it would be appropriate to set targets to encourage th e cost-effective deployment of energy storage systems. Identification of relevant situat ions will facilitate the inclusion of energy storage as needs are identified in other proceedings, such as RA, RPS and LTPP."*

In translating this direction to a practical approa ch for Phase 2, Staff determined that the most valu able way to understand the variety and value of energy s torage end uses would be to create a set of Use Case documents related to already established Commi ssion policy priorities (a.k.a., Priority Scenarios),

including: renewable energy integration, local service reliability, peak reduction, and demand-side management.

Besides providing a description of energy storage applications that may be most appropriate for utility system operational and resource needs, Use Cases are meant to identify with some specificity the monetized and non-monetized benefits of storage, barriers impeding market implementation, and potential policy options for removing those barriers.

3.2 Why Use Cases?

Use Cases were initially developed in the Computer Software and Information Technology fields to help identify, clarify and organize high-level system requirements. Use Cases are generally vision documents that help clarify a goal or vision of a project or a solution. Increasingly, the Use Case model is being employed in many different fields, because it enables business analysts and product development teams to collaborate and determine the requirements of a project.

Commission Staff adopted the Use Case approach to help clarify Priority Scenarios for energy storage adoption. Use Cases provide a simple method and consistent format to decide and describe the purpose of a project – in this case, the application associated with energy storage. Use Cases are documents that illustrate the context that allows us to easily picture where and how storage can be used in the utility system, thus promoting clearer decision-making.

Additionally, Use Cases for storage match the major operating characteristics of a storage technology to meet the needs of specific identified applications, assess the relevant values and benefit streams of that application against its expected costs or the costs of alternatives to providing the needed service, and identify barriers that might hinder this use, while providing a strategy for how to overcome those barriers.

3.2.1 Disclaimer on Use Cases

The purpose of describing Use Cases is not to fully specify the exact nature of each and every energy storage project and their relevant technologies (i.e., specifications of a particular device, how a particular project is designed, or how it is to be developed, financed and built). Instead, Use Cases describe major characteristics of storage in particular applications.

In addition, the incorporation of the Use Cases does not constitute endorsement by the Commission. The documents were developed by Staff and Stakeholders in collaboration as a tool to define goals and purpose: that is, the defining problems we are trying to solve.

Establishing these goals lays the foundation for the scope of analysis. The Use Cases themselves may continue to evolve as more information about storage characteristics, costs and benefits comes to light.

3.3 Use Case Development

Informal working groups representing the energy storage community, primarily California Energy Storage Alliance (CESA) and its members, the investor-owned electric utilities, Pacific Gas and Electric (PG&E) Southern California Edison (SCE) and San Diego Gas & Electric (SDG&E), other parties to the

storage rulemaking, and Staff identified six potent ial Use Cases that relate to the Priority Scenarios and Primary Benefits that were described in the Phase 1 Staff Proposal. In some cases, there may be multiple primary benefits and a number of secondary benefits that should be taken into account. These initial six Use Cases have since evolved into seven Use Case documents grouped into three major categories described later in the document.

Use Case	Primary Benefit
Distribution Deferral	Avoids upgrade cost
Community Energy Storage	Local service reliability
Distributed Peaker	Energy cycling for peak load per iods
Variable Energy Resource-sited	Renewables integration
Bulk Generation	Electricity/Capacity
Demand-Side Management	End-use bill management - (u tility/3rd party owned)

3.3.1 Elements of Use Cases

Each of the Use Cases follows a standardized templa te that describes which major category of applications is documented while providing more spe cifics about the particular problem storage solves. Other elements of the Use Cases include: possible a lternative approaches or technologies that can resolve the problem, specific benefits attributable to this use of storage as well as a detailed listi ng of barriers to deployment and potential resolutions to those barriers. In addition, there is a section o n "Real World Projects" to identify and briefly descr ibe examples of existing or planned energy storage projects currently in commercial operation or close to deployment.

Finally, the Use Cases include a set of questions m eant to crystallize the most important lessons and outcomes of the analysis:

- Is energy storage operationally viable for this use?
- What are the potential benefits of energy storage? Can these benefits be monetized via existing market structures? If not, how should they be valued?
- Is energy storage cost-effective for this use?
- What barriers are preventing or slowing deployment of energy storage in this use?
- What are the policy options to address the identifi ed barriers encountered by energy storage?
- Should procurement target or other policies to enco urage energy storage deployment be considered for this use?

The answers to these questions can inform policy ma kers about policies to support the development of storage technologies. The Use Cases also highlight the need for certain policy barriers to be addressed or removed, as further described in this Report.

3.4 Developed Use Case Overview

Initially Stakeholders argued for a wide variety of Use Cases to explore many different applications f or energy storage, and the result was that 18 separate draft documents were prepared by participants. At the October 16, 2012, workshop to review these init ial drafts, stakeholders agreed that the multiple

documents contained a great deal of overlap and duplication. Staff and stakeholders determined that consolidation of Use Cases was necessary, and each Use Case should contain a more detailed analysis of the most relevant benefits and barriers to adoption.

In particular, for the Use Cases to be distinguishable, the distinction between Primary Benefits and Secondary Benefits needed to be clarified, while ruling out inconsistent or duplicative values to allow for more accurate cost-benefit analysis to be done later.

The development of Use Cases continued via informal working groups in three areas of focus that generally represented the major functional areas of the electric grid: Transmission Connected Storage, Distribution-Level Storage, and Demand-Side or Customer-Sited applications. Within the three major categories, several Use Cases were identified as offering a distinct set of operational characteristics, bundles of benefits, and barriers.

Based on stakeholders input, several of the individual uses were bundled together into a single document, while others in the major categories are treated in separate documents because of significant differences from the others. In all, Staff has received seven distinct Use Cases for consideration, each is further described below.

3.4.1 Transmission Connected Energy Storage

This first of three Use Case categories describes the use of transmission connected energy storage systems, primarily used to provide grid-related services to markets under the control of the CAISO. There are four distinct sets of applications for this use:

1 a) Bulk Storage System

Energy storage for Bulk Storage System operates as an independent asset, similar to a power generator but not necessarily located at a generation facility, and is controlled independently of other generation sources. It accomplishes charging and discharging functions through market participation in energy and ancillary services. These systems typically have multiple hours of energy storage capability and also can provide resource adequacy to the system (subject to meeting duration requirements).

1 b) Ancillary Services Storage

Energy storage for Ancillary Services operates independently of other generation sources. Through market participation, it bids or schedules for charging and discharging, while primarily providing ancillary services. The types and amounts of ancillary service that can be provided under this scenario are highly dependent on the operating characteristics of the technology and that specific resource.

1 c) On-Site Generation Storage

Energy storage for On-Site Generation Storage is located on-site of a non-intermittent generation resource, mostly base-load or flexible resource. Energy storage is used to enhance the ability of the on-site generator to participate in wholesale markets. If some technologies choose to operate independently of the on-site generation source, that participation would be counted in the bulk storage system or as ancillary services storage.

1 d) On-Site Variable Energy Resource Storage

Energy storage On-Site Variable Energy Resource (VE R) Storage is located on-site of an intermittent generation resource such as wind and solar. These storage deployments are used to enhance the capacity, energy, or ancillary services revenues of that generator. Some technologies, such as batter ies, may choose to operate a part of the battery indepen dently of the on-site generation source. That participation would be counted in either the bulk s torage system or ancillary services storage. Other technologies, such as thermal energy storage employ ing molten salt or other media also allow for shifting of output to better match system needs.

Note: Currently, each of these applications is trea ted in a single Transmission Connected Storage document, although one or more may be broken out into a separate document in the future.

3.4.2 Distribution-Level Energy Storage

Distribution-Level Energy Storage is the second of three Use Case categories, where distributed energy storage systems placed on distribution circuits offer several specific advantages that cannot be met with large bulk storage products or more traditional industry solutions. Storage units can be sited locally with minimum permitting at a substation or closer to load to help improve service reliability by discharging to serve the load of a specific distribution substatio n or feeder circuit for multiple hours. Also, energ y storage systems may be able to help resolve issues rising from deeper penetration of customer-owned solar photovoltaic (PV) systems. Additionally, sto rage at the distribution level can help solve local voltage and reactive power problems that can occur at the substation or feeder level and thus improve the stability and efficiency of the distribution eq uipment for the utility. There are three distinct Use Cases identified for this category:

2) Distributed Peaker

Storage as Distributed Peaker describes a hypothetical network of distribu ted energy storage systems functioning effectively as both a solution for local substation specific problems and a distributed peaking plant that connects to and charges off the distribution system to deliver local capacity, ancillary services, and energy to congested nodes in the distribution network.

3) Distributed Storage Sited at Utility Substation

The Distributed Storage Sited at Utility Substation Use Case describes an energy storage system that connects to the distribution grid at a substation l evel and is owned and operated by a utility. This application primarily offers benefits for grid oper ations and control for mitigating intermittency associated with distributed energy resources (such as PV systems connected to the distribution system) and for protecting the transmission system from distribution system disturbances.

4) Community Energy Storage

Community Energy Storage is typically associated wi th a cluster of customer load, whether residential, campus-like complexes, or commercial development. This Use Case describes an energy storage system connected to the distribution grid on the secondary side of distribution transformers. Battery capaci ty may be combined to serve the load in aggregate, or may be dispersed through a residential or commercial development, and may serve the following functions:

- Providing storage capacity for excess output from small-scale renewable energy sources;
- Providing smoothing and power quality regulation for intermittent resources;
- Providing back-up power capability during outages.

Note: Each of these applications is treated in a Use Case separate document to recognize differences in scale, or ownership models.

3.4.3 Demand-Side (Customer-Sited) Energy Storage

Demand-Side (a.k.a. Customer-Sited) Energy Storage is the third of the three Use Case categories. Electrical distribution system operation and maintenance costs are expected to increase with the growing penetration of utility customer-sited solar generation and electric vehicles. Customer-sited distributed energy storage systems may be able to provide a variety of benefits to both the energy end-users and utility operators. Through a variety of utility rate-based applications and demand response type programs, customers and third-party service providers gain more control over utility bill energy and demand costs while load-serving entities gain better awareness of interconnected generation, local electrical grid conditions, and provide control strategies to help defer network upgrades. There are several variations on energy storage uses located on the customer side of the meter:

5 a) Customer Bill Management

Storage for Customer Bill Management is primarily used for peak load reduction in order to reduce demand charges. When coupled with renewables, the system may provide firming of the renewable output. The storage device may also mitigate grid outages and/or supply backup power to the customer.

5 b) Customer Bill Management with Market Participation

Storage as Customer Bill Management with Market Participation is similar to Bill Management, but with the addition of wholesale market participation by the storage device. The storage device optimizes operation to provide maximum benefit to the grid and the utility customer by reducing peak load, firming renewable output, and selling ancillary services into the CAISO market when possible. Optimal operation will depend upon the storage device, the utility, the customer, and the location of the system. When selling into ancillary services markets, the storage device will generally participate in only one market at a time.

5 c) Behind the Meter Utility Controlled

Behind the Meter Utility Controlled energy storage is located on a utility customer's site, operated by the utility for the benefit of the grid. Energy storage is used to provide benefits to the distribution system while participating in CAISO markets such as Frequency Regulation. Storage devices may be operated by the utility to provide the same benefits as Community Energy Storage, but incorporate additional benefits for the end customer. When selling services into wholesale markets, the storage device will generally participate in only one market at a time. Benefits may be shared with the customer through a cooperative ownership agreement with the utility, or they may be aggregated through a third

party. These two cases have been distinguished because regulatory policies and interconnection processes are likely to vary widely.

6) Permanent Load Shifting (PLS)

Storage for PLS is defined as "routine shifting from one time period to another during the course of a day to help meet peak loads during periods when energy use is typically high and improve grid operations in doing so (economics, efficiency, and/or reliability)." Energy storage is a proven way to achieve permanent load shifting, allowing energy to be stored, in the form in which it will be used, during off-peak periods and used during peak periods. Storage systems allow building owners to run their buildings' air conditioning during the peak periods using energy stored during off-peak demand periods, often times resulting in lower costs of operations through avoidance of demand charges or high on-peak rates.

7) EV Charging

This Use Case describes energy storage that supports an Electric Vehicle (EV) charging station by performing real-time energy balancing, time of use energy management, and load shifting. The energy storage system may provide frequency regulation as a secondary benefit. When deployed with renewable energy systems, energy storage devices may firm renewable energy supply.

Note: The first four applications are treated in a single Use Case document, while PLS and EV Charging are addressed in separate documents.

3.5 Preliminary Analysis of Use Cases

The most important value derived from the Use Case approach is to gain a better appreciation of the multiplicity of energy storage applications and to begin the process of identifying particular sets of operating characteristics and bundles of benefits, which in combination suggest the most valuable uses for storage in the electric grid. The process of first expanding the potential universe of Use Cases, then consolidating them to eliminate duplication and substantial overlap has proved beneficial. The resulting set of Use Case documents describes distinct operational end uses within the three broad categories.

Although there remains some overlap in terms of descriptions of potential benefits, the exercise has allowed for a more precise recognition of which benefit streams are most applicable to each Use Case. Making the distinction between Primary Benefits and Secondary Benefits, while ruling out inconsistent or duplicative values, may allow for more accurate cost-benefit analysis. It also allows for identification of other benefits, which may not be easy to monetize but may still be of value, for example providing flexibility in procurement planning for uncertain future conditions.

3.6 Next Steps for Use Cases

The Use Cases as developed to date are valuable, but there has not yet been an attempt to conduct a quantitative cost-benefit analysis. As explained further below, stakeholders continue to vet the relative appropriateness of the cost-effectiveness models available from independent consultants, and stakeholders and Staff have not yet attempted to apply the models to the Use Cases. This effort is further described in 5.3.1.

Additionally, while each Use Case has attempted to identify a "real world" example of existing energy storage projects that most closely relate to that Use Case, the documents themselves do not offer detailed analysis of those projects. In part, this is due to a lack of operational data from relatively new projects or projects still to be put into commercial operation. It is anticipated that the Use Cases will continue as "living documents" that are updated as new information becomes available.

4. Barriers to Energy Storage Adoption

Staff and stakeholders identified a wide range of challenges to deployment of energy storage systems. The purpose of this categorization is to provide an organized process to inform how challenges to electric energy storage deployment could be addressed, either within this proceeding, in conjunction with other Commission proceedings, or in coordination with other state and federal agencies.

4.1 Barriers Analysis Approach

In Phase 1, Staff and stakeholders have identified a wide range of distinct challenges to deployment of energy storage systems, grouped into nine broad categories. The nine categories are:

1. Lack of definitive operational needs
2. Lack of cohesive regulatory framework
3. Evolving markets and market product definition
4. Resource Adequacy accounting
5. Lack of cost-effectiveness evaluation methods
6. Lack of cost recovery policy
7. Lack of cost transparency and price signals (wholesale and retail)
8. Lack of commercial operating experience
9. Lack of well-defined interconnection process

Each of these generalized barriers was more fully described in the Phase 1 Final Proposal. Phase 2 has taken this approach to the next level through the Use Case analysis, which has identified with more specificity to the Use Cases. Focusing on the barriers that are most applicable to each individual Use Case, it is possible to identify potential resolutions that stakeholders believe should be considered for appropriate action, either in this proceeding or some other forum.

See Table 1 below for some examples of the kinds of recommendations made in Use Cases that relate to each of the previously identified barriers. Most of the barriers appear to apply to all of the Use Cases, although the specific form of barrier may differ. Please refer to the individual Use case documents for a much more detailed analysis of the barriers, how they apply to each use, and possible resolutions suggested by the stakeholders.

In a few instances, the Use Case indicated that some barriers were not applicable. For example, in the case of substation-sited Distributed Storage and Community Energy Storage, the expectation of utility ownership of the facilities and the Primary Benefits of grid operations meant that barriers related to evolving markets, price signals, interconnection policies and resource adequacy values do not apply.

Similarly, for Permanent Load Shifting, which is co nsidered a mature application, the barrier related to commercial operating experience was not considered applicable.

4.2 Barriers Resolution Proposals

Focusing on the barriers that are most applicable t o each individual Use Case, it is possible to ident ify potential resolutions that stakeholders believe sho uld be considered for appropriate action, either in this Proceeding or some other forum. The potential resolutions range from highly specific proposals t o more generalized ideas, which would require more an alysis, workshops, and potentially Commission decisions to put into effect.

Based on the specifics included in each of the Use Cases, there appear to be a set of high-level proposals related to each of the barriers that may lends them selves to more concrete proposals. Table 1 below includes several of the recurring resolutions examples of barrier resolutions identified in the various Use Cases. In several cases, resolutions are already i n progress in other Commission proceedings. In othe r instances, the proposed resolutions are outside the jurisdiction of the Commission

Table 1: Barrier Resolutions Recommendations

Barriers Identified	Suggested Resolutions
1. Operational Need	a) Add flexible capacity requirement for RA/LCR resour ce needs b) Allow portfolio approach to utility resource procur ement applications *These resolutions are best addressed in the relevan t Commission proceedings, LTP (see sections 6.1.1 and 6.1.2 below).*
2. Cohesive Regulatory Framework	a) Address FERC Avista decision limitations in F ederal rules b) Include storage in long-term RPS integration studies *Of the above, a) lies outside of the Commission's j urisdiction, while b) may be an issue in the RPS proceeding (see section 6.1.3 belo w).*
3. Evolving Markets	a) Separate contract for retrofit/additional cap acity *This proposal has been raised in the LTPP proceedin g (see section 6.1.1).*
4. Resource Adequacy (RA) Value	a) Establish Net Qualifying Capacity (NQC) value for storage in RA b) Allow multi-year contracting in RA *These proposals are discussed below (see 6.1.2).*
5. Cost Effectiveness Analysis	a) Project-specific scoring system for evaluatin g non-monetized benefits of bids b) Improved analysis and valuation of dispatch/a ncillary services/avoided integration costs *These proposals are being considered as part of the cost-effectiveness analysis (see 5.3).*

6. Cost Recovery Policies	a) Consider utility ownership incentives (i.e., rate-base recovery or rate of return premium) *This has been raised as an issue for future conside ration (see 8.1).*
7. Cost Transparency & Price Signals	a) Create spot market for ramping b) Real-time pricing tariffs *Of these proposals a) lies outside of the Commissio n's jurisdiction and is in the domain of CAISO, while b) could be raised in future Commission proceedings (see 8.1).*
8. Commercial Operating Experience	a) Pilot and demonstration projects could also he lp to establish cost-effectiveness of different uses and technologies. *This is one of the proposals up for consideration a s a procurement option (see 5.2).*
9. Interconnection Processes	a) Allow fast-tracki ng of storage paired with photovoltaic (PV) systems *Identified in Rule 21 proceeding as an issue for re solution (see 6.1.5).*

4.3 Policy Options

Through analysis of the barriers and potential reso lutions identified in the Use Cases, Staff has formulated a set of policy options for parties to c onsider and advise how to address them in the remaining schedule of this proceeding. As part of the storage policies workshop on December 4, 2012, stakeholders reviewed these options and discussed their relevance and priority.

Options for action fall into four categories:

- Issues for Consideration and Resolution in the Energy Storage Proceeding
- Potential Actions in Related Proceedings
- Policies that Involve Other Entities' policies
- Policies for Future Consideration by the Commission

These four categories are further discussed in the next four sections.

5. Issues for Consideration and Resolution in the Energy Storage Proceeding

The three policy issues described in some detail in this section are under consideration for further action in this proceeding. As parties comment on these issues, a record will be developed for possible action in a decision in this proceeding.

5.1 Interpreting Energy Storage as a Preferred Resource

The Energy Action Plan of 2005 (EAP) is a joint age ncy document intended to guide the procurement decisions of the State of California. The term "pre ferred resource" is a term of art that emanated fro m

the EAP, which stated a policy that California should meet future electric resource needs in the following "Loading Order":

- Energy efficiency
- Renewable resources
- Clean fossil fuels

In subsequent versions of the EAP resources at the top of the loading order came to be known as preferred resources. Although the term was not defined, it is commonly illustrated as including all cost-effective energy efficiency, demand response, renewable energy, and combined heat & power (CHP).

The concept of including energy storage as a preferred resource was identified as an option for consideration in the initial Commission Staff White Paper of July 2010.

For storage used for behind-the-meter load shifting application, the Commission previously designated it as a preferred resource in D. 12-04-045. Subsequently, in workshops and comments, various parties have expressed a desire to do so for "supply-side" storage (shorthand term for Transmission Connected Storage systems that act as generators), as a way of signaling benefits that storage may bring to the utility system.

However, the interest in doing so is not unanimous. For instance, during the September 7 Joint Workshops for Storage and LTPP, Southern California Edison (SCE) stated: *"Storage technology has not been specifically identified as a preferred resource, but its operational characteristics warrant consideration as part of 'least cost best fit' procurement solutions"* (SCE Presentation, page 13).

In the list of preferred resources, a common element is contribution to state policies to reduce greenhouse gas (GHG) emissions. There continues to be debate about whether supply-side energy storage in and of itself reduces GHG emissions. However, in AB 2514, the Legislature made certain findings with regard to operational benefits of storage. Taken together, these statutory findings of the value of storage may present an argument for considering energy storage as a "preferred resource" for policy and procurement purposes:

> SECTION 1. The Legislature finds and declares all of the following:
> (a) Expanding the use of energy storage systems can assist electrical corporations, electric service providers, community choice aggregators, and local publicly owned electric utilities in integrating increased amounts of renewable energy resources into the electrical transmission and distribution grid in a manner that minimizes emissions of greenhouse gases.
> (b) Additional energy storage systems can optimize the use of the significant additional amounts of variable, intermittent, and offpeak electrical generation from wind and solar energy that will be entering the California power mix on an accelerated basis.
> (c) Expanded use of energy storage systems can reduce costs to ratepayers by avoiding or deferring the need for new fossil fuel-powered peaking powerplants and avoiding or deferring

> distribution and transmission system upgrades and expansion of the grid.
> (d) Expanded use of energy storage systems will reduce the use of electricity generated from fossil fuels to meet peak load requirements on days with high electricity demand and can avoid or reduce the use of electricity generated by high carbon-emitting electrical generating facilities during those high electricity demand periods. This will have substantial cobenefits from reduced emissions of criteria pollutants.
> (e) Use of energy storage systems to provide the ancillary services otherwise provided by fossil-fueled generating facilities will reduce emissions of carbon dioxide and criteria pollutants.
> (f) There are significant barriers to obtaining the benefits of energy storage systems, including inadequate evaluation of the use of energy storage to integrate renewable energy resources into the transmission and distribution grid through long-term electricity resource planning, lack of recognition of technological and marketplace advancements, and inadequate statutory and regulatory support.

As part of comments on this Report, Staff seeks com ments on whether supply-side energy storage should be designated as a "preferred resource." Sin ce the EAP is a joint agency document, the Commission cannot modify the Loading Order set fort h in the EAP without collaboration with other agencies. However, the Commission could indicate th at it intends to treat energy storage as a preferre d resource in utility procurements for energy & capacity, to the extent feasible under the law.

5.2 Procurement Targets

The major issue for consideration in this proceedin g is whether procurement targets for energy storage are appropriate and, if so, how much should be proc ured and in which applications. Staff has planned an additional workshop on January 14, 2013 to further discuss the issue of procurement targets.

In considering this question, the Legislature provided this guidance to the Commission in PU Code 2836.2:

> In adopting and reevaluating appropriate energy storage system procurement targets and policies pursuant to subdivision (a) of Section 2836, the commission shall do all of the following:
> (a) Consider existing operational data and results of testing and trial pilot projects from existing energy storage facilities.
> (b) Consider available information from the California Independent System Operator derived from California Independent System Operator testing and evaluation procedures.
> (c) Consider the integration of energy storage technologies with other programs, including demand-side management or other means of achieving the purposes identified in Section 2837 that will result in the most efficient use of generation resources and cost-effective energy efficient grid integration and management.
> (d) Ensure that the energy storage system procurement targets and

policies that are established are technologically viable and cost effective.

Staff has identified a number of challenges that ha ve thus far prevented a robust analysis of whether a procurement target should be established:

- Much of the information about the performance, cost and performance of storage systems that would be necessary to conduct a thorough analysis is not readily available.
- Obtaining relevant operating data from existing sto rage facilities and storage pilot projects is hampered by the fact that the operation al experience in California is limited, with many pilots currently under development or pla nned for well into the future. The CAISO has only begun simulation testing for the mar ket systems that will allow greater participation by energy storage systems in wholesal e market and to provide ancillary services.
- Analysis of the integration of energy storage with demand-side management, as described in AB 2514, is also at a nascent stage. The CEC, for example, is currently funding a multi-year research project to investigate the value of storage with automated demand resources (ADR) in providing value to wind a nd solar operations. Results from that research are still more than a year away. The CEC has applied to the Commission for approval of integration research funding via th e Energy Program Investment Charge (EPIC) program, which will include potential fundin g for *beginning* such studies in the 2013-2016 timeframe.

Staff expects that at the January 14, 2013, worksho p, stakeholders will provide presentations that specifically address the criteria quoted in the leg islation above, while providing more discussion aro und the following options. Specifically, Staff will see k presentations and discussion related to the follo wing procurement options:

- Procurement targets as a fixed percentage of load-s erving entities' load, structured as a capacity (Megawatt) threshold, or for specific appl ications for storage. Also, as noted by legislative analysis of AB 2524, the Commission's determination could also result in a finding that no target level is appropriate.
- Pilots or "Market Tests" focused on specific priori ty applications or end uses, to correspond with the expressed intent of further developing the tools for cost-effectiveness analysis.
- Setting aside a dynamically adjusted portion of pro curement for Local Capacity Requirements (LCR) or System need determination for "preferred" resources, specifically including storage (this could also be referred to a s the "portfolio" approach). This approach would need to be executed in coordination with reso urce authorization actions taken primarily in the LTPP proceeding.

The workshop will also allow for presentations abou t the operational experience of existing energy storage projects in California and updates to relev ant pilot and demonstration projects, and an update

to CAISO market simulations that have a bearing on energy storage's ability to participate in wholesale and ancillary services markets.

5.3 Cost-Effectiveness Methodologies

The third policy issue for consideration in this proceeding is cost-effectiveness evaluation. The Commission would clearly benefit from a cost-effective methodology specific to storage. Such a methodology would help the Commission evaluate proposed storage projects or policies. The Commission has a history of adopting cost-effectiveness methodologies for energy efficiency, demand response, and energy efficiency. However, determining a global cost-effectiveness methodology for storage, under these tests is very challenging because of the wide variety of storage technologies, applications and location specific, operational specific, factors that impact measurement of costs and benefit streams.

Many of the initial comments and responses to Phase 1 Final Staff Proposal point to the need to conduct any cost-effectiveness analysis based on specific applications, with location, primary use, technology, ownership, etc., all critical elements of cost-effectiveness analysis.

Cost-effectiveness of hypothetical storage applications is challenging because of the lack of accuracy of key cost and benefit inputs. Cost effectiveness has generally been done based on actual project inputs. Nonetheless, analysis conducted based on a hypothetical case with price/cost estimates and other assumptions could offer useful guidance in considering policy options and for determining what kind of cost-effectiveness requirements the Commission might prescribe for future utility storage projects or procurements.

Staff conducted a September 24 workshop and subsequent informational meetings to introduce three existing modeling tools from EPRI/E3, DNV KEMA and Navigant. These three tools might be appropriate for energy storage cost-effectiveness analysis by the Commission.

The EPRI/E3 model is called "Energy Storage Valuation Tool" (ESVT). The DNV KEMA model is called Energy Storage Select (ES Select), but it would be used in combination with other KEMA models or programs (KERMIT, Storage Distribution Tool, and Storage Peaker Tool, in particular).

Based on input from various parties, Staff proposes that both ESVT and ES Select models may provide useful – if not determinative – analysis for certain Use Cases, or for an assessment of system level impacts of a portfolio of storage resource additions.

5.3.1 Applying Cost-Effectiveness Models to Use Cases

Because the available models were originally developed for different purposes, additional work will need to be done to use the models for policy purposes in this proceeding. Some of the work remaining includes defining with more precision the applicable costs and benefits for each Use Case (Primary and Secondary) and refining the underlying assumptions about system operations to provide appropriate analysis of the Use Cases. The Commission also needs to ensure transparency about modeling assumptions prior to applying computer models that are available to the Use Cases.

Some stakeholders have argued for a cost-effectiveness methodology that does not rely on computer models, but rather is based on a simplified calculation that compares the values and benefits of storage (including currently unmonetized planning and/or societal values) against the known costs of traditional resources that might be used to provide the same major benefits.

More understanding of how such a methodology would be derived – and whether it would be sufficient to meet the requirements of AB 2514 – is necessary before the Commission can decide upon the most reasonable approach to determining cost-effectiveness for storage.

In addition, issues related to public access of computer models used in Commission proceedings (as defined by PUC § 1821-1822 and Rules of Practice and Procedure Rule 43.1) must be addressed to ensure due process and confidence in the outcomes of any analysis and ensure consistency with existing cost-effectiveness methodologies.

Staff plans to focus on the EPRI and DNV KEMA tools to conduct further analysis for the Use Cases. Collaboration with the workgroup participants to develop consensus inputs to the model and generate cost-effectiveness results is ongoing. The timeframe for conducting this model-based analysis is likely to be January to March 2013.

There has been some preliminary discussion of whether all Use Cases should be analyzed through the tools or some subset. While Staff would like to run all the Use Cases through all the models, that may not be feasible due to time constraints, resource constraints and limitations within the tools. Staff therefore proposes that the Use Cases be analyzed using the models in order of priority, with the goal to complete them all if that proves possible. Staff welcomes comments from stakeholders on what a priority order may look like.

Staff expects to continue to work on a process for defining the criteria for an appropriate cost-effectiveness methodology in the next few months. In addition, Staff is reviewing how to ensure the available computer modeling tools are more transparent, within the limits of the ability to share some proprietary aspects of the models, before they can be applied to all or some of the Use Cases.

6. Policy Actions in Related Proceedings

Storage policy is also being developed in several related proceedings. The actions in these other proceedings will advance the deployment of storage, and so these actions are recapped here. In addition, these actions help address many of the barriers identified in Phase 1 and again in the Use Cases. Work on storage-related issues in these proceedings is generally underway, as described below, but parties may comment on whether more needs to be done to advance energy storage deployment.

6.1 Energy Storage in Regulatory Forums

The Final Staff Proposal for Phase 1 identified a number of related proceedings in which supply-side energy storage is being considered. The Commission is expected to assess electric system operational needs in year 2020 within the LTPP proceeding to determine the capacity and operating characteristics needed to meet renewable integration requirements, with a focus on the newly established 33%

renewable portfolio standard (RPS) [3]. Among the issues currently before the Commission in the proceedings devoted to resource procurement include how to define and whether to require operational "flexibility" in resources acquired to meet RA, LCR needs, or System needs. A second "flexibility" matter is how to value flexibility characteristics (either operational or other types, such as "optionality") of resources, especially storage, in markets and in evaluations of responses to solicitations or Requests for Offers (RFOs).

In addition, there are several other regulatory areas in which issues related to energy storage systems, including proceedings to consider reform of policies governing procurement to meet RPS mandates, in interconnection policies, and in specialized incentive programs, such as the Self-Generation Incentive Program (SGIP).

Generally, Staff has determined that these proceedings represent the best forums for dealing with issues related to energy storage within their context. For example, determinations of market need for new resources, which may include energy storage, is best left to the LTPP proceeding. However, parties may comment on whether storage issues are being adequately dealt with and what further actions might be taken in this proceeding to address the issues.

Below is the current status of major Commission proceedings that involve energy storage.

6.1.1 Long-Term Procurement (R. 12-03-014)

Local Capacity Resource Needs Determination

A proposed decision (PD) on Track 1 issues defining local capacity requirements for Southern California Edison's (SCE) Los Angeles Basin area and other matters, was issued on December 20, 2013. The PD would authorize SCE to procure between 1,000 MW and 1,200 MW of conventional gas-fired resources, "at least" 50 MW of energy storage, and up to 450 MW of preferred resources, or energy storage, in order to meet local capacity requirements by 2021.

LTPP Planning Assumptions

The Commission approved D. 12-12-010 on LTPP standardized planning assumptions and scenarios on December 20, 2012, adopting assumptions that will be used to forecast system reliability needs for California's electric grid. System needs are subject to Track 2 of LTPP, and bundled needs are the subject of Track 3, along with any potential revisions to RFO evaluations.

Next, the scenarios will be provided to the CAISO and all other parties by for use in operating flexibility modeling. After this modeling assessment is completed, the proceeding is expected to make a need determination and assess the alternatives for filling any net short position. A need authorization to fill any net short would occur in late 2013.

[3] The Commission is currently implementing SB 2, which established the 33% Renewable Portfolio Standard, in R.11-05-005.

As with the Track 1 LTPP decision establishing a ca pacity need in local areas, any system need determinations in Track 2 of the proceeding could p rovide for additional markets for energy storage resources.

Joint Workshop on LTPP and Energy Storage

A joint workshop for Energy Storage (R. 10-12-007) and LTPP (R. 12-03-014) was held on September 7, 2012, and explored the definition and valuation of energy products and resources that can meet LCR and System Need, including preferred resources such as demand response, and distributed generation, alongside conventional generation. A major issue d iscussed was whether storage should be considered a preferred resource for LCR procurement purposes.

Representatives of investor-owned utilities, energy storage developers, demand-response providers and environmental stakeholders were asked to discuss id eas for assigning economic and non-economic benefit valuations for a variety of "flexibility ch aracteristics" that may not be explicitly considere d or properly valued in the process to evaluate offers submitted in response to utility RFOs.

An Administrative Law Judge (ALJ) Ruling in R. 12-0 3-014 posed questions for comment, based on the presentations of the workshop (see Ruling of Septem ber 14, 2012, in R. 12-03-014), and asked for discussion of various scenarios for procurement policies. These comments were reflected and addressed in the LTPP Track 1 PD.

There were three specific recommendations involving storage made as part of the workshop that may bear further examination in this proceeding.

1. SCE proposed a novel method for assigning a "net qualifying capacity" value to storage.
2. CESA proposed a "Model All-Source" procurement structure focused on evaluation of benefits attributable to storage and other types of non-traditional resources.
3. CESA and storage developers raised the issue of whe ther there are barriers that inhibit RFO respondents, including storage developers, from offering retrofit/incremental offers, despite the benefits of lower cost and flexibility they might provide.

Parties may comment on these recommendations for p otential action in this proceeding or to support recommendations for action in the LTPP.

6.1.2 Resource Adequacy (R. 11-10-023)

In D. 12-06-025 the Commission adopted local procur ement obligations for 2013. The decision declined to adopt either approaches for flexible resource ca tegorization proposed by the CAISO or the Energy Division, but left in place temporarily a modified "bucket approach." [4]

Calculating Net Qualifying Capacity for RA

The issue of defining a qualifying capacity (QC) value for energy storage was an issue raised in Phase 1 of the RA proceeding. The Phase 1 decision pointed ou t that the existing QC methodology distinguishes

[4] See D. 12-06-025 for a full discussion of this iss ue.

resources by whether they are dispatchable, non-dispatchable, or wind/solar: "Storage is not called out specifically, but depending on whether it was dispatchable or non-dispatchable, storage would count towards RA obligations under the existing QC methodology."

One possible next step could be a revision to the RA Guidebook clarifying how the QC methodology would be applied to energy storage resources.

Defining Flexible Capacity

Parties were directed to continue to refine approaches to identifying the characteristics and need for flexibility for RA resources. A Joint Parties' Proposal on flexible capacity procurement was forwarded on October 29, 2012, to be in place for 2014-17, while a more lasting solution could be worked on. According to the proposal, "flexible capacity need" is defined as the need of the ISO to meet ramping and contingency reserves, based on three-hour continuous ramping capability.

The proposal also stated that more time was needed to design a flexible capacity counting mechanism applicable to preferred resources, including energy storage. "If preferred resources can meet characteristics of the interim proposals, they should be eligible to count toward a? Load Serving Entity's (LSE's) flexible capacity procurement obligation," the proposal stated.

The Scoping Memo on December 6, 2012, established the issues to be addressed in Phase 2 of the proceeding. With regard to flexible capacity requirements, the Scoping Memo set out a list of questions for comment by December 20, 2012. Staff was directed to put forth a proposal on RA program refinements and on flexible capacity by January 17, 2013, with workshops to be held January 23, 2013.

Although the treatment of energy storage was specifically deferred in this proposal, several parties have addressed storage in their comments, seeking a more specific proposal for ensuring that storage's flexibility characteristics are considered in the interim and long-term policies.

Multi-Year contracting for RA resources

The ability to finance and develop any type of resource is critically dependent on its ability to secure long-term off-take commitments. The RA market generally sets requirements on a year-ahead basis. However, flexibility is expected to be a need for the California system for the foreseeable future, and a limitation on contracting with resources capable of providing such flexibility may be a market barrier to deeper storage penetration.

Some parties argue that this is an issue that is not unique to Energy Storage, and that LTPP-driven procurements will naturally lead to long-term contracts sufficient to address financing concerns. Therefore, a long-term contracting mechanism in the RA market itself may not be appropriate at this time.

6.1.3 Renewable Portfolio Standard (R. 11-05-005)

R. 11-05-005 is the rulemaking addressing implementation of California's RPS. In D. 12-11-016, the Commission conditionally accepted 2012 RPS procurement plans. The decision declined to adopt

proposals from CESA to 1) address costs and benefit s of using energy storage for integration of RPS-eligible resources in procurement, 2) to include en ergy storage technologies as a design option in RPS - eligible projects in procurement plans, RFOs and bi d evaluation factors, or 3) to clarify the definiti on of ancillary services as included in RPS bid evaluatio ns. The order indicated such issues may be address ed in Phase 2 of the Storage Rulemaking, or within the context of least-cost/best fit (LCBF) methodologie s to be addressed in the RPS proceeding.

An Assigned Commissioner's Ruling issued October 5, 2012, sought comments on potential RPS procurement reforms. One issue related to energy st orage in that ACR was proposed standards of review for existing contracts seeking modification to technologies, or to add energy storage. "Notabl y, any contract amendments or amended and restated con tracts that change the project's technology (e.g., solar photovoltaic vs. solar thermal) must be re-bid into the next RPS solicitation. This also includes major modifications to existing technology that potentially change the economics of the project, such as the incorporation of storage." Parties were asked to comment on the proposal, with initial comments due November 20, 2012, and reply comments were due December 7, 2012.

A ruling addressing these comments is pending.

6.1.4 Self-Generation Incentive Program

The Investor Owner Utilities (IOUs) require that energy storage systems install a separate revenue meter and separate inverters, even if integrated with dis tributed generation eligible for customer-side incentives. The costs of installing dual meters an d inverters could pose a significant barrier to the deployment of energy storage projects in SGIP or otherwise.

Although the SGIP Program Administrators have been working with storage developers to find ways to lower metering costs, energy storage is not eligibl e for net energy metering at this time, and thus is not entitled to the same exemptions afforded under PUC §2827 - including interconnection and application review fees.

6.1.5 Rule 21

As part of the recently approved settlement, Rule 2 1 has been amended to include energy storage as a resource to make sure that Rule 21 functions effect ively for all technology types. Some additional barriers remain to cost-effective deployment of sto rage that might be addressed in the ongoing Rule 21 proceeding.

For example, distributed generation facilities that otherwise meet all of the Fast Track screens but exceed either the 15 percent of peak load or 100 pe rcent of minimum load screens, are required to pursue a "detailed review" process under Rule 21. E nergy storage facilities co-located with distribute d generation (especially PV units) can be operated in a manner that effectively reduces system output so that an otherwise ineligible distributed generation facility could pass the 15 percent of peak load or 100 percent of minimum load screen.

There are no operating parameters or tariff terms within Rule 21 that explicitly lay out how a distributed generation facility that uses an energy storage system can meet the Load screen for the Fast Track process.

This issue of how energy storage may meet the load screen criteria was one of the "interconnection" barriers identified in the Energy Storage Use Cases for customer-side of the meter applications. A working group in the Rule 21 proceeding is currently looking into possible resolution options.

6.1.6 Electric Program Investment Charge (EPIC)

On November 1, 2012, the CEC, PG&E, SCE and SDG&E filed their required 2012-2014 [5]Investment Plans for research & development programs funded via ratepayer contributions to the EPIC program.

The four EPIC Investment Plan applications represent a total of $466.5 million of spending to be focused on Applied Research, Technology & Demonstration (T&D), and Market Facilitation programs in the spending period (generally, 2013-2016). Utility spending is entirely in the T&D category.

A preliminary estimate of EPIC program areas that are specific to Energy Storage indicates that as much as $61 million of the CEC project budget could be applied to energy storage research projects. Also, as much as $10 million of PG&E's funds, and $5 million of SCE's funding could be allocated to projects that advance energy storage technology and/or deployment opportunities. SDG&E's plan references energy storage in several areas, but it appears its proposed projects are for systems to support a variety of Smart Grid technology improvements, including but not limited to storage.

None of the budgets specifically break out expected spending for energy storage, and what is finally allocated will depend entirely on competitive bids and award structures. The estimates above derive from assessing a pro-rated share of budget figures for projects identified within defined categories in the plans.

The EPIC Investment Plans are currently under review by the Commission, with a decision expected by mid-2013.

7. Policy Options that Involve Other Agencies

The Staff Final Proposal in Phase 1 of R. 10-12-007 concluded that since energy storage has multiple uses across the electric system value chain, it is difficult to adopt a comprehensive policy within any one of the energy agencies such as the Commission, the CEC, CAISO, and the FERC. Coordination is therefore especially needed both across policy proceedings at the Commission, as well as between regulatory agencies. Examples include:

- CAISO's "Pay for Performance" stakeholder initiatives, including CAISO's current proceeding;

[5] The four applications have been consolidated for review: CEC (A. 12-11-001); SDG&E (A.12-11-002); PG&E (A. 12-11-003); and SCE (A. 12-11-004).

- Renewable Integration: Market and Product Review (P hase 2), which addresses renewable integration policies such as Pay for Performance, load-following, and daily market settlements;
- A related effort includes CAISO implementation of FERC's two-part frequency regulation compensation for capacity held in reserve, and performance.

7.1 CAISO

The CAISO is progressing with the creation of rules governing "pay for performance" for fast-acting Frequency Regulation resources as a result of FERC Order No. 755.

The new tariff was filed with FERC on April 27, 201 2, and received conditional approval September 20, 2012. A market simulation is scheduled for February 2013, with potential implementation May 2013

CAISO was granted a request for rehearing on Novemb er 19, 2012. It sought rehearing because the September 20 order required the CAISO to implement Order No. 755 by the end of 2012. CAISO claims it is not able to change implementation plans. FER C has not yet formally acted on the issue beyond accepting the rehearing request.

Non Generation Resources

The ISO Market Simulation concluded on September 27 , 2012, and demonstrated that the ISO could manage a non-generation storage resource under Regu lation Energy Management based on the resources operating midpoint and positive and negat ive range. Non-Generator Resource (NGR) Modeling continues and storage resources are underg oing operational testing. CAISO expects to see NGR certified for Regulation Energy Management (REM) in Q1 2013.

A dozen Structured Scenarios were tested and passed with non-physical resources (modeling only). Additional scenarios will be tested in a production pilot mode with physical resources once the code i s released in the Q1 2013 timeframe.

Renewables Integration

CAISO began Phase 1 of the Renewable Integration – Market and Product Review, (RI-MPR) in September 2010, to identify short-term solutions fo r integrating renewable resources onto the grid. Among issues looked at in the initiative was to low er the energy bid floor to provide additional incentives for market participants, including varia ble energy resources (VER), to submit decremental (DEC) bids that reduce scheduled capacity, enabling the ISO to manage over-generation and congestion more efficiently and transparently.

As a result of stakeholder input, CAISO will lower the bid floor to (negative) - $150/MWh the first ye ar and to -$300/MWh in the following year. The objecti ve of this rule change is to foster additional dispatch flexibility over time from thermal and ren ewable resources as well as new storage technologies. In particular, the bid floor accounts for the opportunity cost of curtailment faced by w ind and solar resources and the scheduling coordinators that bid them into the market.

7.2 CEC

Interpretation of Loading Order to include supply-side and distribution Energy Storage

This issue is distinguished from the previously dis cussed option to include Energy Storage as a Prefer red Resource, in that a formal redefinition of the Load ing Order would necessarily involve actions by the agencies and entities which created the Energy Action Plans. These entities include the Commission, the CEC, the CAISO, and the Governor's Office.

Certification of energy storage systems by CEC

The CEC has a robust program of providing independe nt certification for many different types of energy devices, for instance, it has established criteria for certification of energy inverters, and currentl y has applied such certification to over 1,000 inverter d evices from multiple vendors. The energy storage market, particularly for smaller, residential techn ologies, might benefit from a similar certification program.

Define energy storage as an "addition or expansion of renewable energy generation" facilities.

Despite the recent Rule 21 settlement changes, inte rconnection policies and tariff treatment for energ y storage paired with solar PV continue to represent a barrier to deployment, in that additional costs f or metering or the interconnection evaluation process may be a factor that pushes projects out of viabili ty. It may also violate PUC 2827 (g) prohibiting charge s for interconnection for net energy metering eligi ble generation.

One solution being explored in the context of State law is to interpret the use of energy storage as a n "addition or enhancement" to existing renewable ele ctrical generation facilities, under the definition provided by PUC § 25741(a)(1). Parties to Rule 21 have agreed that the best way to deal with this is sue is to defer to the CEC, which could address it in a future revision of its RPS Guidebook.

8. Policies for Future Consideration

In the Use Cases, parties offered a number of poten tial solutions to barriers which extend beyond the time-frame for the current Rulemaking. These issues need more information and may be addressed in Commission proceedings in the future.

8.1 Other Policies that Go Beyond the Current Procee ding

At the present time, Staff is unable to incorporate these issues into the current analytical framework , but considers it important to briefly describe them:

- *Consider Utility ownership incentives or regulatory rate recovery options, including rate-of-return premiums as incentives to encourage utility procurement*

  Rather than a "command and control" requirement for procurement, pilots or set-asides in competitive solicitations, the Commission might con sider incentive mechanisms to spur utility and customer development of energy storage systems. Such incentives could take the form of a more certain process for the approval and rate-base d recovery of costs, or even a premium on

rates-of-return for storage investments, similar to those afforded by Federal regulators for transmission investments that meet certain criteria.

- *Allow co-existence of market-oriented and ratebased end uses on same asset*

Energy storage is unique in that the same system could provide services that might be defined as any one of several utility functions: transmission, generation, distribution, or demand-side. Federal rulings, however, have imposed a barrier to single projects acting in more than one capacity, i.e., a rate-based transmission asset would not be able to participate in competitive wholesale markets as would generators—even if it can supply market services competitively. Although an issue for resolution at the Federal level, California could enunciate a policy position that would attempt to alleviate this limitation.

- *Allow on-bill financing of small storage paired with PV/EV as an incentive for end-user procurement*

The State is already considering the use of on-bill financing to reduce initial financial hurdles to energy efficiency and residential PV units. A similar program could also apply to energy storage systems used in combination with PV or EVs.

- *Consider storage in Electric Vehicle incentives*

Currently the State is considering new policies and potential incentives to encourage deployment of EVs. The EV Charging Use Case makes an argument for the value of energy storage associated with EV charging, whether on an aggregated or individual basis. Incentives could also include energy storage systems for this purpose.

- *Push development of revised standards in IEEE 1547 and NIST CBO-003-1*

There is an ongoing update process for IEEE 1547 safety and reliability standards which includes a focus on energy storage. The Commission has been monitoring progress, but is not actively engaged. Alternatively, if the existing standards are considered a barrier to deployment of storage or use of the devices full capabilities, California could consider adopting its own standards that go beyond the national standards.

9. Next Steps

Much valuable progress has been made in Phase 2 of the Storage Rulemaking, particularly in identifying and documenting applications of energy storage that are most applicable to the major functions of the electric utility system. This analysis has directly pointed to identifying with more specificity than before, the benefits of storage in particular Use Cases, the barriers to storage deployment in those uses, and policy options for resolving many of those barriers.

However, much work remains to be done in order to fully develop a record to support a decision that meets the requirements of AB 2514. Given the realities of the regulatory process, and the possibility that evidentiary hearings may be called to resolve certain issues of fact, Staff anticipates that there is a window of about six months to continue to perform Staff-driven analysis on the issues raised in this Report.

9.1 Work Products to be Developed by Stakeholders/Parties & Energy Division Staff

Staff expects to develop several additional work products in the coming months. These tasks should lead to discrete documents that can be entered into the record of this proceeding, and will perhaps be instructive to other proceedings or jurisdictions as they works though similar issues. Examples of work products that may be developed include:

- Glossary of Commonly Used Terms - Some parties have expressed a desire for a common set of definitions to terminology that is frequently used in this proceeding. Some work on this has been done, and this task could be completed in 1st Quarter 2013.
- Energy Storage Cost-Effectiveness Evaluation – a document that outlines how cost-effectiveness for storage will be approached, complete with (1) categories of benefits to be considered, (2) categories of costs to be considered, and (3) a set of underlying assumptions to be used in the analysis. A first draft may be completed January/February 2013.
- Summary of cost-effectiveness results from exercising the modeling tools – completed in 1st Quarter 2013.
- Finalized Use Cases to incorporate cost-effectiveness analysis (recognizing that these documents may continue to evolve to fit future process needs) – 2nd Quarter 2013.
- Evaluation of pros and cons of procurement and policy options, with Staff recommendations if appropriate – 2nd Quarter 2013, for consideration in Final Decision, October 2013.
- Long-term energy storage policy development roadmap to map out resolution of energy storage barriers and policy issues that extend beyond this Rulemaking— 3rd Quarter 2013.

9.2 Questions for Parties to be Answered in Comments to this Staff Report

Parties to this Rulemaking may comment on any aspect of this Interim Report, but Staff is especially interested in comments on the following questions. Comments on Procurement Options should refer to presentations made during the January 14, 2013, workshop.

1. *Use Cases*
   - Do the Use Cases provide an adequate representation of the range of valuable applications that energy storage currently provides to the electric grid?
   - Besides the section on cost-benefit analysis, which is still a work-in-progress, is there some critical element missing from the Use Cases?

2. *Preferred Resources*
   - Why should Energy Storage be considered a "preferred resource"?
   - Does the Commission need to work with Joint Agencies to modify the Loading Order or will a Commission policy statement suffice?
   - What are the implications of designating Energy Storage as a "preferred resource" in this Proceeding for other procurement proceedings?

3. *Cost-Effectiveness Methodologies*

- What models should be pursued for running the cost-effectiveness test?
- Is there a simplified approach to cost-effectiveness that would meet the Commission needs?
- To address Staff's concern that it may not be the b est use of resources to run all of the Use Cases through cost-effectiveness models, is there a priority criteria or prioritized list of Use Cases that can be utilized?
- If not, how can we ensure that the analysis gets do ne for all the Use Cases in a timely manner?

4. *Policy Options*
    - Does Staff's priority listing of Policy Options acc urately represent the most important issues facing storage in the identified proceedings?
    - Are suggested actions for resolution of barriers th e best approach to advancing energy storage deployment?

5. *Related Proceedings*
    - Does the list of issues in related proceedings capt ure the work being done in the other proceedings described?
    - Is there more that should be done in the identified proceedings to advance energy storage deployment, aside from establishing procurement targets?

Appendix A: Energy Storage Use Case Documents

1. Transmission Connected Energy Storage

1 a) Bulk Storage System

1 b) Ancillary Services Storage

1 c) On-Site Generation Storage

1 d) On-Site Variable Energy Resource Storage

2. Distribution-Level Energy Storage: Distributed Peaker

3. Distributed Storage Sited at Utility Substation

4. Community Energy Storage

5. Demand-Side (Customer-Sited) Energy Storage

5 a) Customer Bill Management

5 b) Customer Bill Management with Market Participation

5 c) Behind the Meter Utility Controlled

6. Permanent Load Shifting

7. EV Charging

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