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TO PARTIES OF RECORD IN RULEMAKING 10-12-007

This is the proposed decision of Commissioner Michael R. Peevey. It will not appear on the Commission's agenda sooner than 30 days from the date it is mailed. The Commission may act then, or it may postpone action until later.

When the Commission acts on the proposed decision, it may adopt all or part of it as written, amend or modify it, or set it aside and prepare its own decision. Only when the Commission acts does the decision become binding on the parties.

Parties to the proceeding may file comments on the proposed decision as provided in Article 14 of the Commission's Rules of Practice and Procedure (Rules), accessible on the Commission's website at www.cpuc.ca.gov. Pursuant to Rule 14.3, opening comments shall not exceed 15 pages.

Comments must be filed pursuant to Rule 1.13 either electronically or in hard copy. Comments should be served on parties to this proceeding in accordance with Rules 1.9 and 1.10. Electronic and hard copies of comments should be sent to ALJ Yip-Kikugawa at ayk@cpuc.ca.gov and electronic copy only to Commissioner Peevey's advisor, Audrey Lee at al4@cpuc.ca.gov. The current service list for this proceeding is available on the Commission's website at www.cpuc.ca.gov.

/s/ JANET A. ECONOME for
Karen V. Clopton, Chief
Administrative Law Judge

KVC:gd2

Attachment

Decision **PROPOSED DECISION OF COMMISSIONER PEEVEY**
(Mailed 7/2/2012)

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking Pursuant to Assembly Bill 2514 to Consider the Adoption of Procurement Targets for Viable and Cost-Effective Energy Storage Systems.	Rulemaking 10-12-007 (Filed December 16, 2010)

DECISION ADOPTING PROPOSED FRAMEWORK FOR ANALYZING ENERGY STORAGE NEEDS

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DECISION ADOPTING PROPOSED FRAMEWORK FOR ANALYZING ENERGY STORAGE NEEDS

1. Summary

This decision adopts the Energy Storage Framework Staff Proposal (Staff Proposal) submitted by Staff on March 31, 2012. A second phase of this proceeding shall be initiated to analyze the priority scenarios contained in the Staff Proposal. This proceeding remains open.

2. Background

On December 16, 2010, the Commission opened Rulemaking (R.) 10-12-007 to implement the provisions of Assembly Bill (AB) 2514 (Stats. 2010, ch. 469). AB 2514 directs the Commission to determine appropriate targets, if any, for each load-serving entity (LSE) as defined by Pub. Util. Code § 380(j) to procure viable and cost-effective energy storage systems (ESS) and sets dates for any targets deemed appropriate to be achieved.[1] Although AB 2514 directs the Commission to open such a proceeding by March 1, 2012 (§ 2836(a)), the Commission chose to open it sooner, explaining that it "see[s] the enactment of AB 2514 as an important opportunity for this Commission to continue its rational implementation of advanced sustainable energy technologies and the integration of intermittent resources in our electricity grid."[2]

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[1] Unless otherwise stated, all statutory references are to the Public Utilities Code.

[2] OIR at 1.

As stated in the Order Instituting Rulemaking (OIR), the purpose of this proceeding is to:

1. review, analyze and establish, if appropriate, opportunities for the development and deployment of energy storage technologies throughout California's electricity system;
2. remove or lessen any barriers to such development and deployment;
3. review and weigh the associated costs and benefits of such development and deployment; and,
4. establish how those costs and benefits should be distributed.[3]

The OIR, however, did not establish a precise scope. Rather, parties were directed to file initial comments responding to the guidance provided in the OIR and the Commission's Policy and Planning Division's white paper on Electric Energy Storage.[4] These comments, along with an initial workshop, would then serve as the basis for developing a more precise scope of the proceeding.

Pursuant to the OIR, comments were timely filed by: A123, Alliance For Retail Energy Markets (AReM), Beacon Power Corporation (Beacon), Brookfield Renewable Power, Inc. (Brookfield), California Hydropower Reform Coalition, California ISO (CAISO), Calpine Corporation (Calpine), California Energy Storage Alliance (CESA), Consumer Federation of California (CFC), Division of Ratepayer Advocates (DRA), Environmental Defense Fund, Ice Energy, Inc., Marin Energy Authority, Nevada Hydro Company, Pacific Gas & Electric

[3] OIR at 5.

[4] The white paper is Attachment A of the OIR.

Company (PG&E), San Diego Gas & Electric Company (SDG&E), Southern California Edison Company (SCE), Vote Solar Initiative (VoteSolar), Walmart Stores, Inc. & Sam's West, Inc., Western Power Trading Forum, and Xtreme Power.

An initial workshop was held on March 9, 2011. A duly noticed prehearing conference was held on April 21, 2011. The Assigned Commissioner and Administrative Law Judge's (ALJ) Scoping Memo and Ruling (Scoping Memo) was issued on May 31, 2011. The Scoping Memo determined that the proceeding would be divided into two phases - the first phase would develop the overall policies and guidelines for ESS, while the second phase would develop the costs and benefits for ESS and establish how they should be allocated.[5]

On June 28, 2011, a second workshop was held. The purpose of that workshop was to address ESS currently in use and the barriers and impediments to further widespread use of storage. The workshop presentations were entered into the record on July 21, 2011.[6] Comments on the documents were filed on August 29, 2011; reply comments were filed on September 16, 2011.

On December 12, 2012, Commission Staff (Staff) issued its Initial Energy Storage Framework Staff Proposal (Initial Proposal). Comments on the Initial Proposal were filed on January 31, 2012; reply comments were filed on February

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[5] *Scoping Memo and Ruling of Assigned Commissioner and Administrative Law Judge* (*Scoping Memo*), filed May 31, 2011, at 3.

[6] See *Administrative Law Judge's Ruling Entering Documents into Record and Seeking Comments*, filed July 21, 2011 (ALJ July 21 Ruling).

21, 2012. Staff issued its Final Energy Storage Framework Staff Proposal (Final Proposal) on April 3, 2012.

3. Scope

The Scoping Memo identified the following eight issues to be considered in the first phase:[7]

1. How are energy storage technologies currently being used?
2. What policies are needed to encourage effective energy storage that would meet the goals of AB 2514?
3. How can energy storage technologies be best integrated into the utilities' existing portfolios?
4. How could energy storage technologies be integrated with the Commission's loading order and other overarching policies?
5. What current state or federal policies impede the more widespread utilization of energy storage or serve as barriers to the development of energy storage systems?
6. Is it possible to develop a single unifying policy for energy storage?
7. Are there certain energy storage applications/attributes that should be encouraged?
8. How should the ownership model of energy storage be considered?

[7] Scoping Memo at 4.

Although this decision addresses many of these issues, we find that issues concerning specific storage technologies and how they will be integrated into existing Commission procurement policies will need to be considered as part of the Staff's framework to analyze energy storage going forward. As such, these issues will be incorporated into ongoing analysis and consideration in the second phase of this proceeding.

4. Parties' Comments

Parties' comments can be divided into the following main topics:

1. Proceeding Focus
2. Barriers to Energy Storage Deployment
3. Procurement Targets

Additionally, several parties raised concerns regarding the need to establish funding for pilot and research and development (R&D) projects and the integration with California's renewables portfolio standard (RPS) mandates.

4.1. Proceeding Focus

There is general agreement from parties that the focus of this proceeding should be technology neutral and provide a framework to analyze energy storage and how energy storage integrates with other proceedings and initiatives both at the Commission and at other state and federal agencies. To this end, SCE had presented an applications-based approach at the June 28 workshop. This approach would bundle certain operational benefits as applied to the electric system and match each application to storage technology types.[8] SCE proposes

[8] ALJ July 21 Ruling, Attachment C.

that identification of specific applications and associated uses/value streams of storage would allow the Commission and parties to identify the issues and impediments presented for each application and the responsible regulatory agency (Commission, Federal Energy Regulatory Commission (FERC), CAISO, etc.). This analysis would then allow the Commission to assess and prioritize whether and how it could assist in resolving the application-specific issues. SCE notes that each application has unique issues based on its location and operational uses and the benefits of the application cannot be evaluated without taking this into consideration. "[C]onsidering how storage will actually be used on the electric system, rather than addressing storage as a nebulous concept, is necessary to identify barriers and evaluating costs and benefits as the Commission hopes to do in this proceeding. Considering applications for storage is also technology neutral, both as to whether energy storage is the best solution to solve a particular problem and as to what storage technology is the best fit when storage is the right answer."[9]

Parties' comments suggest that there is general agreement with SCE's application-based approach. DRA agrees with SCE that "opportunities and barriers to energy storage should be evaluated using an application-specific approach, and that this methodology should be a central and common first step for addressing storage related issues."[10] CFC notes "an application specific

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[9] *Reply Comments of Southern California Edison Company on Administrative Law Judge's Ruling Entering Documents into Record and Seeking Comments in R.10-12-007 (SCE Sept. 16 Comments)*, filed September 16, 2011, at 5.

[10] *Comments of Division of Ratepayer Advocates on Administrative Law Judge's Ruling Entering Document into Record and Seeking Comments (DRA August 29 Comments)*, filed August 29, 2011, at 3.

approach can be an important step to avoid unnecessary spending."[11] Similarly, Green Power states "in order to develop fair tariffs the first step has to be to identify applications for specific kinds of installations."[12]

Nonetheless, some parties expressed concern with an application-based approach. Sierra Club believes that an application-based approach would "result in a perpetual undervaluing of the multiple benefits of energy storage, since IOUs [investor-owned utilities] would be limited to looking only at specific applications outside the context of the Commission's power to establish a general value for purposes of rate recovery for energy storage."[13] It further notes: "By matching energy storage to one specific application, the multifunctional role of energy storage is limited to a single or preferred task, and the additional functions may be overlooked or lack a market to monetize the value of the additional function."[14] VoteSolar believes SCE's application-based approach is "overly cautious" and believes that "[a] number of best fit/least regret ESS promoting actions can be taken now, rather than waiting until after the

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[11] *Opening Comments of the Consumer Federation of California to Administrative Law Judge's Ruling Entering Document into Record and Seeking Comments (CFC August 29 Comments)*, filed August 29, 2011, at 5.

[12] *Comments of the Green Power Institute in Response to the ALJ's Ruling on Barriers to Storage (Green Power August 29 Comments)*, filed August 29, 2011, at 2.

[13] *Reply Comments of Sierra Club California on Administrative Law Judge's July 21, 2011 Ruling Entering Documents into Record and Seeking Comments (Sierra Club Sept. 16 Comments)*, filed September 16, 2011, at 7.

[14] *Sierra Club Sept. 16 Comments* at 8.

conclusion of what seems to be an extremely deliberative and time intensive process proposed by SCE."[15]

Several parties also maintain that the focus of the proceeding should not be simply "more storage" as an end result, but rather how storage could be used to address certain problems. SCE asserts that "energy storage may provide means to solve particular challenges, but it is not an end in itself. The focus of any energy storage policy should be the potential of energy storage as a useful tool to address problems or satisfy broader policy goals, thus providing value to customers, not simply to require a specific amount of energy storage."[16] Similarly, SDG&E supports "implementing energy storage in the most efficient and effective manner that allows the State to achieve its desired goals, while minimizing any barriers that could impede the usage and development of ESS, and ultimately increase cost to the customer."[17]

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[15] *Comments of the Vote Solar Initiative (VoteSolar Aug. 29 Comments)*, filed August 29, 2011, at 2.

[16] *SCE Sept. 16 Comments* at 5.

[17] *Comments of the San Diego Gas & Electric Company on Administrative Law Judge's Ruling Entering Document into Record and Seeking Comments (SDG&E Aug. 29 Comments)*, filed August 29, 2011, at 3.

There is also disagreement over whether this proceeding should be proactively assisting in the commercial deployment of operational energy storage projects[18] or considering all storage and non-storage alternatives equally.[19] A similar disagreement exists over whether energy storage should be added to the loading order. In advocating its addition, CESA states "[e]nergy storage is a valuable asset class that can improve overall electric power system efficiency, much in the same way that [demand response] can improve overall system efficiency by reducing super peaks in demand and managing load as a balancing resource."[20] DRA disagrees with CESA's recommendation to add storage to the loading order, as "[storage] benefits must be determined for specific application(s), on a case by case basis."[21]

4.2. Barriers to Energy Storage Deployment

Parties identified a number of perceived impediments or barriers to the deployment of energy storage technologies. While not all of the identified barriers are within the Commission's jurisdiction, the Commission may still assist in resolving them. The barriers identified by parties can be grouped into the following nine categories.

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18 *Opening Comments of the California Energy Storage Alliance to Administrative Law Judge's Ruling Entering Document into Record and Seeking Comments (CESA Aug. 29 Comments)*, filed August 29, 2011, at 4.

19 See, e.g., *Comments of Pacific Gas and Electric Company on Presentations Made at the June 28, 2011 Workshop in the Energy Storage OIR (PG&E Aug. 29 Comments)*, filed August 29, 2011, at 4.

20 *Reply Comments of the California Energy Storage Alliance to Administrative Law Judge's Ruling Entering Document into Record and Seeking Comments (CESA Sept. 16 Comments)*, filed September 16, 2011, at 6.

21 *DRA August 29 Comments* at 5.

4.2.1. Lack of Definitive Operational Needs

Parties note that operational needs are under consideration in other Commission proceedings (e.g., the long-term procurement planning (LTPP) and the RPS proceedings) and have not yet been determined. While there is general agreement that this uncertainty impacts the development and deployment of ESS, parties differ in how this barrier should be addressed.

Brookfield recommends that operational requirements to maintain California's electric grid system should be analyzed and determined before any ESS products and services can be defined.[22] It believes that this would allow the Commission to better anticipate future needs that would promote the development and deployment of larger-scale ESS. Similarly, Sierra Club proposes that energy storage procurement targets adopted in this proceeding should serve as an input for the LTPP proceeding planning assumptions.[23]

DRA disagrees with this proposition and states that any need for a specific procurement target should be addressed as part of the LTPP or Resource Adequacy (RA) proceedings.[24] PG&E argues that once a resource need is determined, "a competitive procurement process will determine what combination for resource (supply or demand-side), including energy storage, is best able to meet the identified resource need."[25]

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[22] *Comments of Brookfield Renewable Power Inc. on July 21, 2011 Ruling Entering Documents into Record and Seeking Comments (Brookfield Aug. 29 Comments)*, filed Aug. 29, 2011, at 1-2.

[23] *Sierra Club Sept. 16 Comments* at 6.

[24] *DRA Aug. 29 Comments* at 1.

[25] *Reply Comments of Pacific Gas and Electric Company to Comments Submitted on August 29, 2011 for the Energy Storage OIR (PG&E Sept. 16 Comments)*, filed Sept. 16, 2011, at 10.

4.2.2. Lack of Cohesive Regulatory Framework

Parties note that California's electricity markets are under the jurisdiction of various regulatory state and federal agencies. Consequently, there is a risk that the value of utilizing energy storage is not fully recognized.

As noted by SDG&E, "the different functions storage may provide are not mutually exclusive, and may come under different regulatory structures, including CPUC, FERC, CAISO, etc. The existing inadequate markets under these jurisdictions for these projects could impede realizing the value of all the services that or [sic] cost-effective energy storage systems are capable of achieving."[26] Sierra Club echoes this conclusion, noting "the current regulatory framework for energy policy in California does not recognize the benefits of energy storage."[27]

SCE disagree that the overlap of regulatory agencies presents a barrier. "Insofar as [the CAISO and the Commission] continue to coordinate efforts, this [overlap of jurisdiction] should not represent a barrier to energy storage."[28] SCE therefore recommends that the Commission focus on addressing barriers that fall within the Commission's jurisdiction, while supporting coordination with

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[26] *SDG&E Aug. 29 Comments* at 5.

[27] *Comments of Sierra Club California on Administrative Law Judge's July 21, 2011 Ruling Entering Documents into Record and Seeking Comments (Sierra Club Aug. 29 Comments)*, filed August 29, 2011, at 2.

[28] *SCE Aug. 29 Comments* at Appendix B, page 1.

agencies that have jurisdiction over other barriers, rather than prioritizing the order in which barriers should be addressed.[29]

4.2.3. Evolving Markets and Market Production Definitions

Several parties note that the electricity market is currently defined by a variety of products, with each product subject to different rules and, quite often, regulated by different agencies. However, they believe that energy storage often does not fall clearly under the current market product definitions. As a result, parties contend it is not possible to consider energy storage consistently across various proceedings. As PG&E notes, "the types of products and markets that will be available in the future are evolving. … While these potential new products may expand opportunities for participation by energy storage devices, the precise set of products available in the future is uncertain."[30]

4.2.4. Resource Adequacy Accounting

A large number of parties identified the RA accounting rules as a barrier to more widespread energy storage deployment. SCE notes that there are no rules "for determining how to establish [RA] capacity value for a storage device."[31] Brookfield echoes this statement, noting "the current process of procuring only generic capacity through the RA process will not ensure that specialized needs of

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[29] *Comments of Southern California Edison Company to the California Public Utilities Commission on Administrative Law Judge's Ruling Entering Documents into Record and Seeking Comments in R.10-12-007 (SCE Aug. 29 Comments)*, filed August 29, 2011, at 2.

[30] *PG&E August 29 Comments* at 5-6.

[31] *SCE Aug. 29 Comments* at 3.

the grid are met under the 33% RPS, including any specific value that can be provided by ESS."[32]

Parties generally agree that this barrier should be addressed in the Commission's RA proceeding, but note that there should be coordination with this proceeding. CESA urges that "protocols be developed and approved through the annual [RA] proceedings to allow storage devices that meet the relevant standards to participate."[33] SCE further advocates that "[a]ny rules that emerge from the annual RA proceeding for energy storage should also vary by energy storage application."

4.2.5. Lack of Cost-Effectiveness Evaluation Method

Many parties believe that the unique operational aspects of energy storage pose a challenge in recognizing all relevant benefits, as many of these benefits are not part of current calculation methods. Parties argue that as a result, the total benefit of energy storage is significantly underestimated.[34] SDG&E further notes that the multi-functionality of energy storage "limits the ability of establishing a single process" for valuing storage. "Establishing a generic approach could mislead the evaluation process or stall the investment on this type of infrastructure."[35]

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[32] *Brookfield Aug. 29 Comments* at 5.

[33] *CESA Sept. 16 Comments* at 4.

[34] See, e.g., *DRA Aug. 29 Comments* at 6; *PG&E Aug 29 Comments* at 4.

[35] *SDG&E Aug 29 Comments* at 5.

There is general consensus that development of an evaluation methodology should be included in the second phase of this proceeding. PG&E notes "the industry needs valuation methodologies that can be used in planning processes that reflect the true operational benefits to the electric system."[36] Sierra Club further notes that developing a methodology to value energy storage's multiple benefits is needed to comply with AB 2514.[37]

SCE disagrees that the lack of a methodology for determining cost effectiveness represents a barrier to the deployment of energy storage. "[C]ost effectiveness is largely a function of technology development and maturity relative to other technologies that can provide comparable services, and as such, it should not be classified as a 'barrier.'"[38] CESA disputes this assertion, arguing that increased grid reliability is a value that needs to b accounted for through a cost-benefit methodology. CESA contends that distribution system planners need to use a valuation methodology to give proper weight to reliability benefits.[39] PG&E argues "[t]he industry needs valuation methodologies that can be used in planning processes that reflect the true operational benefits to the electric system."[40] Sierra Club also notes "[b]y developing a mechanism that values energy storage, the Commission can assess the cost-effectiveness of energy storage."[41]

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[36] *PG&E Sept. 16 Comments* at 6.

[37] *Sierra Club Sept. 16 Comments* at 1.

[38] *SCE Aug. 29 Comments* at Appendix B, page 1.

[39] *CESA Sept. 16 Comments* at 7.

[40] *PG&E Sept. 16 Comments* at 6.

[41] *Sierra Club Sept. 16 Comments* at 1.

4.2.6. Lack of Cost Recovery Policy

The ability for energy storage to meet transmission, generation and distribution needs also means that its services can be recovered under cost-based or market-based rates. Sierra Club maintains that "[w]ithout a mechanism for fitting energy storage into the existing regulatory and cost recovery structure, there will be regulatory barriers and inadequate methods for valuing and paying for energy storage."[42] PG&E contends that this issue does not need to be addressed here, noting "because of the potential for certain storage technologies to provide multiple services, and the possibility that storage could simultaneously recover costs under both cost-based and market-based rates, FERC has asked for comments on whether current accounting and reporting requirements for activities and costs relating to the operation of new electric energy storage resources provide sufficient transparency."[43]

A major concern giving rise to this perceived barrier appears to be the need for energy storage developers to have long-term, financeable revenue streams. Consequently, several parties advocate that the Commission adopt long-term contracts for energy storage. Brookfield states that "without adequate procurement channels and incentives that allow purchases to secure and reflect the value provided by these features, and without the ability of developers to receive sufficient compensation for their development efforts, developers will not commit capital and lenders will not finance these large scale projects."[44] DRA also states "[a]llowing storage to enter into long-term contracts is consistent

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[42] *Sierra Club Aug. 29 Comments* at 3.

[43] *PG&E Aug. 29 Comments* at 7.

[44] *Brookfield Aug. 29 Comments* at 5.

with DRA's position to remove any barriers that prevent storage from competing directly with other resources."[45]

SCE disagrees with adopting a long-term contracting mechanism for energy storage. While long-term contracting is an issue on which the Commission needs to focus, "it does not represent a unique barrier for storage technologies, and to the extent the Commission wishes to address this issue, it should do so in a separate and new Commission proceeding.[46]

4.2.7. Lack of Cost Transparency and Price Signals

Parties identifying this potential barrier believe that more cost transparency and more accurate price signals could "level the playing field" for energy storage to address system needs. SDG&E believes that "[e]nsuring that parties see the actual cost and prices for storage will allow parties to determine the appropriate values for case specific energy storage applications."[47] Due to the ability for energy storage to be utilized at both the generation and customer level, parties note there is a need consider both wholesale and retail price signals.

4.2.7.1. Wholesale Price Signals

Parties note that within the CAISO wholesale market, prices do not reflect the true value of energy storage. According to SCE, "storage systems are not currently rewarded for speed or accuracy under current CAISO ancillary service product definitions."[48]

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[45] *DRA Aug. 29 Comments* at 2.

[46] *SCE Sept. 16 Comments* at 12.

[47] *SDG&E Aug. 29 Comments* at 4.

[48] *SCE Aug. 29 Comments* at 12.

There is further concern that current wholesale markets do not properly value how energy storage addresses the intermittent nature of some renewable resources. For example, CESA notes that the RPS procurement process does not address the differential values between a "firmed, shaped, or dispatched" renewable product with storage and a "pure renewable product" without firming, shaping, and dispatch capability.[49] PG&E believes that existing CAISO market practices mask the value that energy storage can provide toward integrating intermittent renewable generation.[50]

Parties generally recognize that technical and tariff changes are needed to allow energy storage to participate in the CAISO markets.[51] However, these changes lie within the CAISO's jurisdiction. Therefore, parties recommend that the Commission work with the CAISO to provide for greater transparency for integration charges.[52]

4.2.7.2. Retail Price Signals

Similar to their concerns at the wholesale level, parties believe that retail prices do not properly reflect the value of energy storage. As noted by SDG&E: "Energy storage could play different roles in the market place due to its multifunctional characteristics. However, not all of these roles operate in

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[49] *CESA Aug. 29 Comments* at 6.

[50] *PG&E Aug. 29 Comments* at 8.

[51] See, e.g., *DRA Aug. 29 Comments* at 4; *SCE Aug. 29 Comments* at 3; *CESA Aug. 29 Comments* at 5.

[52] See, e.g., *PG&E Aug. 29 Comments* at 8; *CESA Aug. 29 Comments* at 5.

markets that have accurate or efficient price signals."[53] SCE also notes "retail rates do not reflect time-based variations in the market price of electricity."[54]

Some parties advocate changes in retail rate design that would include time-variant rates. Sierra Club identifies rate design as the "biggest and most immediate barrier, since storage will only be built if it is paid for."[55] PG&E and DRA both caution that while time of use (TOU) rates could impact the cost-effectiveness analysis for energy storage, TOU rate design should not be considered within this proceeding.[56]

In an effort to address this barrier, CESA recommends that the Commission and the California Energy Commission work together to "develop load management standards and associated tariffs that incentivize deployment of energy storage."[57] PG&E appears to agree with this recommendation, noting that modifications to the Self Generation Incentive Program and the Permanent Load Shifting Program now provide incentives for the deployment of energy storage.[58]

4.2.8. Lack of Commercial Operating Experience

Parties note that many energy storage technologies are yet to be used on a commercial scale. "The nascent nature of some storage technologies and the lack

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[53] *SDG&E Aug. 29 Comments* at 5.

[54] *SCE Aug. 29 Comments* at 11.

[55] *Sierra Club Aug. 29 Comments* at 3.

[56] *DRA Aug. 29 Comments* at 3; *PG&E Sept. 16 Comments* at 3. See also, *SCE Sept. 16 Comments* at 10.

[57] *CESA Aug. 29 Comments* at 5.

[58] *PG&E Sept. 16 Comments* at 5.

of detailed information about application-specific costs … present barriers to more widespread understanding of storage systems."[59] There is general consensus that this barrier will diminish over time, as utilities gain more experience with energy storage. PG&E notes that it "currently has several pilot projects and programs to build experience and incent development of storage."[60]

Some parties have proposed that additional support for the development of emerging technologies, such as ESS, should be through pilot systems and R&D programs. The means by which this would occur, however, is in dispute. CESA contends "the Commission should order the utilities to open an immediate market opportunity to begin incorporating energy storage into its procurement planning by initiating pilot competitive solicitation process."[61] In contrast, PG&E recommends that the Commission continue to support pilot projects and fund feasibility studies for long lead-time storage technologies to enable implementations options if and when future resources needs and cost-effectiveness are determined.[62]

4.2.9. Lack of Well-Defined Interconnection Processes

Parties state that as a result of overlapping tariffs at the Commission (Rule 21) and the FERC (WDAT) and evolving technical standards, there is a lack of a well-defined interconnection process. However, parties further note that issues concerning interconnection should not be addressed in this proceeding.

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[59] *DRA Aug. 29 Comments* at 6.

[60] *PG&E Sept. 16 Comments* at 5.

[61] *CESA Aug. 29 Comments* at 4.

[62] *PG&E Aug. 29 Comments* at 9.

"[I]ssues concerning interconnection to the system are not necessarily unique to the storage applications."[63]

4.3. Procurement Targets

AB 2514 directs the Commission "to determine appropriate targets, if any, for each load-serving entity to procure viable and cost-effective energy storage systems to be achieved by December 31, 2015, and December 31, 2020."[64] Parties in favor of having the Commission establish procurement targets argue that it would assist in the widespread deployment of energy storage. CESA states that "it generally does support procurement targets, as a broad policy tool as the procurement targets imposed on load serving entities by California's Renewables Portfolio Standard program have proven quite effective to date."[65] Sierra Club further notes that these targets do not necessarily need to be based on a certain quantity of energy storage. Rather, it believes other criteria, such as reduced peak load or reduction in certain air pollutants, could be used.[66]

SCE, PG&E, and SDG&E all oppose setting specific procurement targets. SCE argues that a procurement mandate would not address legal and regulatory barriers, but rather would only serve to increase the return on investment of private storage developers. "Procurement mandates and subsidies may have short-term investment impacts, but in the long term are counterproductive by creating a cycle of dependency for storage developers and diverting efforts from

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[63] *SCE Aug. 29 Comments* at 11; see also *VoteSolar Aug. 29 Comments* at 3.

[64] Pub. Util. Code § 2836, subd. (a)(1).

[65] *CESA Sept. 16 Comments* at 3.

[66] *Sierra Club Sept. 16 Comments* at 12.

technological development to regulatory affairs."[67] SDG&E echoes this statement, arguing that adoption of a procurement mandate "could be a likely barrier for cost-effective development of energy storage systems."[68] DRA also cautions against setting a procurement target. "Picking arbitrary procurement levels, such as a MW [megawatt] level or a percentage level would most likely result in sub-optimal market solutions and increase costs to ratepayers without yielding commensurate benefits."[69]

5. Staff Proposal

As directed by the Scoping Memo, Staff reviewed parties' comments and submitted its Initial Proposal on December 2, 2011. Based on input from parties,[70] Staff submitted the Final Proposal on April 3, 2012.[71] The Final Proposal includes a Storage Barriers Regulatory Matrix, with summarizes the various barriers and policies faced by energy storage developers. Based on this matrix, Staff proposed a framework to analyze energy storage.

This proposed framework identifies 20 "end uses" for energy storage and where in the value chain storage is being used. The identified Energy Storage "End Uses" is presented in Table 1 below:

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[67] *SCE Aug. 29 Comments* at 16.

[68] *SDG&E Aug. 29 Comments* at 3.

[69] *DRA Aug. 29 Comments* at 3.

[70] Comments on the initial proposal were filed by Brookfield, CESA, CAISO, Calpine, CFC, DRA, Jack Ellis, MegaWatt Storage Farms, PG&E, SDG&E, Sierra Club, SCE and VoteSolar. Reply comments were filed by CESA, CFC, DRA, Mark B. Lively, Longview Energy Exchange, NGK Insulators (NGK), PG&E, SCE, SDG&E, Sierra Club, and VoteSolar.

[71] The Final Proposal is Attachment A of this decision.

TABLE 1

Energy Storage "End Uses"

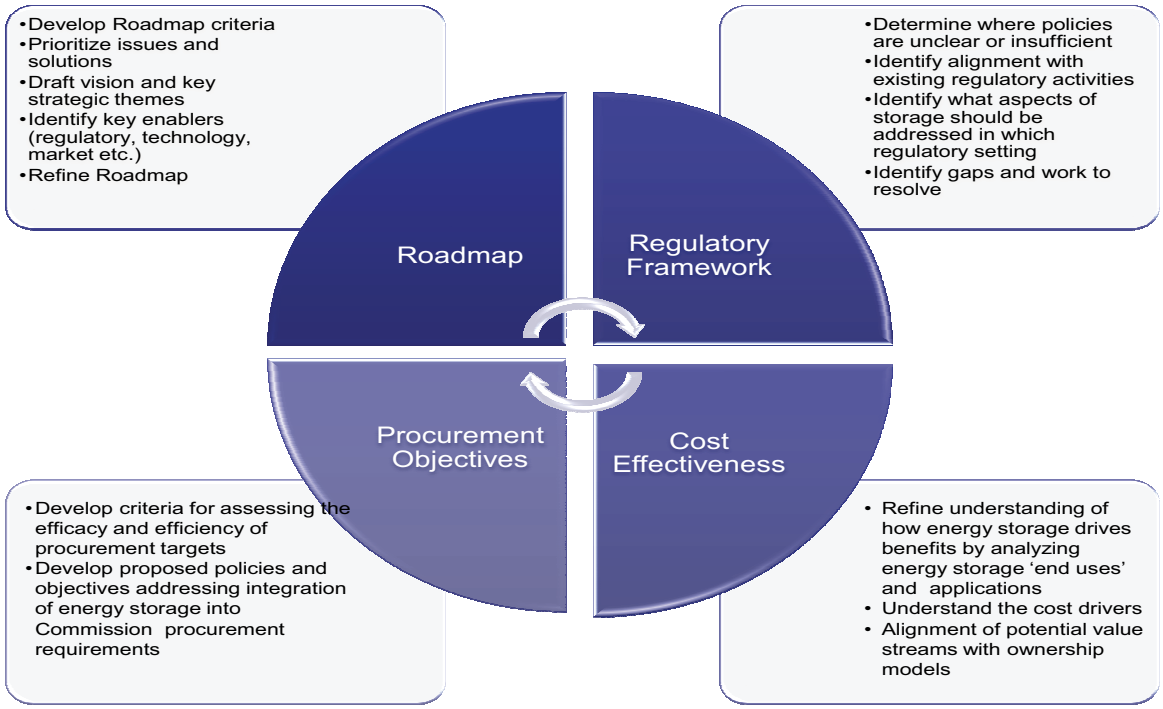
Category		Storage 'End Use'
Describes at what point in the value chain storage is being used		Describes what storage is being used for, i.e. its application.
ISO/Market	1	Ancillary services: frequency regulation
	2	Ancillary services: spin/ non-spin/ replacement reserves
	3	Ancillary services: ramp
	4	Black start
	5	Real time energy balancing
	6	Energy price arbitrage
	7	Resource Adequacy
Generation	8	Intermittent resource integration: wind (ramp/voltage support)
	9	Intermittent resource integration: photovoltaic (time shift, voltage sag, rapid demand support)
	10	Supply firming
Transmission/ Distribution	11	Peak shaving
	12	Transmission peak capacity support (upgrade deferral)
	13	Transmission operation (short duration performance, inertia, system reliability)
	14	Transmission congestion relief
	15	Distribution peak capacity support (upgrade deferral)
	16	Distribution operation (voltage / VAR support)
Customer	17	Outage mitigation: micro-grid
	18	Time-of-use (TOU) energy cost management
	19	Power quality
	20	Back-up power

The Final Proposal states that decomposing energy storage into various end uses will allow for more manageable analysis. Staff further stresses that analyzing each individual end use is not intended to eliminate analysis of energy storage comprehensively. "[By] focusing on the specific 'end uses' it will become apparent which aspects of energy storage are unique to specific applications and which aspects of storage are common across all uses."[72]

The analysis approach would consist of four major categories – regulatory framework, cost effectiveness, procurement objectives and energy storage roadmap – as pictured in Table 2 below:

Table 2

Energy Storage Analysis Approach



[72] Final Proposal at 15.

Staff states that its proposed analysis process will assist in framing energy storage policy. Notably, Staff states that the outcomes of the analysis "will be used to evaluate whether or not to adopt a procurement target or if other policy options are better suited to meet the objectives of AB 2514."[73]

Staff requests that the Final Proposal be adopted. Staff further recommends that as part of Phase 2 of this proceeding, the end uses identified in Table 1 above be prioritized and that those considered higher priority be analyzed first. To that end, the Final Proposal includes four basic "scenarios" for defining ESS, including different combinations of end uses. These scenarios are intended to align with existing state and Commission policy objectives particularly those related to increasing renewables and distributed generation, reducing greenhouse gas emissions, limiting peak growth and modernizing the grid. The four scenarios proposed by further analysis are:

1. Renewables Support/Dispatchability – Focus on how energy storage can be used to support renewable generation, both at the transmission level and at the distribution level to improve the dispatchability and value of the renewable resource.

2. Distributed Storage – Focus on distribution-level storage, particularly to support grid operation, and whether storage can be utilized as a distribution-level generation resource.

[73] Final Proposal at 17.

3. Demand-Side Management – Focus on energy storage at the customer level (behind-the-meter storage).[74]

4. Ancillary Services – Focus on energy storage systems at the transmission level to provide generator-like services for ancillary markets.[75]

6. Discussion

We find that the Final Proposal is a significant step forward in establishing policies for the procurement of viable and cost-effective energy storage. As highlighted in many of the comments, the multi-functional capabilities of energy storage mean that this resource cannot be evaluated and considered on a "one size fits all" basis. As such, we believe that there is a need to divide energy storage applications into separate, discrete functions. At the same time however, we agree with Staff and parties that energy storage attributes must be considered in a comprehensive manner to identify opportunities where storage could provide value to the electric system. Consequently, it is imperative that we develop a process that will allow this to occur. We believe that the Final Proposal does just that.

We commend Staff for their efforts in developing a framework that will allow us to analyze energy storage in a comprehensive manner and determine how this important resource can be integrated with our existing policies and properly valued. The Final Proposal outlines major policy issues for the Storage

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[74] Some aspects of this scenario are already being evaluated in other Commission proceedings.

[75] The Final Proposal notes that although this is primarily within the CAISO's jurisdiction, the Commission could collaborate with the CAISO to explore how distribution-level storage can participate in ancillary services through a utility tariff.

Proceeding, including establishing a framework for understanding existing policies and barriers facing storage in California.

The Final Proposal has identified a number of significant barriers, including the lack of a cohesive regulatory framework and the difficulty in adopting a comprehensive policy across all regulatory agencies. Some policy barriers that have been identified include the current flux state of policies at both FERC and the CAISO that could provide opportunities for storage in frequency regulation markets, as well as the continuing processes for dealing with renewable energy integration. An important first step in addressing the lack of a cohesive policy has been to identify the major proceedings, both at the Commission and at other agencies, which impact energy storage. This summary, which is found on page 12 of the Staff Proposal, will allow us to ensure consistency within our own proceedings, and identify areas where we should actively participate to influence policy determinations at other agencies.

While parties had been critical of various aspects of staff's initial proposal, the Final Proposal now addresses their main concerns. One of these is including a definition of "energy storage" which will be used as a common starting point for all parties. This definition is the language contained in Pub. Util. Code § 2835(a), which states:

> (1) "Energy storage system" means commercially available technology that is capable of absorbing energy, storing it for a period of time, and thereafter dispatching the energy. An "energy storage system" may have any of the characteristics in paragraph (2), shall accomplish one of the purposes in paragraph (3), and shall meet at least one of the characteristics in paragraph (4).

> (2) An "energy storage system" may have any of the following characteristics:
>
> (A) Be either centralized or distributed.
>
> (B) Be either owned by a load-serving entity or local publicly owned electric utility, a customer of a load-serving entity or local publicly owned electric utility, or a third party, or is jointly owned by two or more of the above.
>
> (3) An "energy storage system" shall be cost effective and either reduce emissions of greenhouse gases, reduce demand for peak electrical generation, defer or substitute for an investment in generation, transmission, or distribution assets, or improve the reliable operation of the electrical transmission or distribution grid.
>
> (4) An "energy storage system" shall do one or more of the following:
>
> (A) Use mechanical, chemical, or thermal processes to store energy that was generated at one time for use at a later time.
>
> (B) Store thermal energy for direct use for heating or cooling at a later time in a manner that avoids the need to use electricity at that later time.
>
> (C) Use mechanical, chemical, or thermal processes to store energy generated from renewable resources for use at a later time.
>
> (D) Use mechanical, chemical, or thermal processes to store energy generated from mechanical processes that would otherwise be wasted for delivery at a later time.

We agree with Staff that this is the appropriate definition to be used. As with the objectives in the proceeding, this definition is technology-neutral and focuses on the attributes of energy storage and potential applications throughout the electric system.

We realize that several parties are concerned that the proposed framework and iterative nature of the analysis approach could delay the implementation of energy storage systems. However, we believe that this concern has been addressed thorough the prioritization of end-uses. This prioritization would allow us to evaluate energy storage opportunities in a manageable manner. We believe that focusing on the end uses, and applying them to specific scenarios will reduce the risk that this potential resource will be undervalued. More importantly, this approach will allow us to determine the need for storage in relevant situations and set targets, if necessary, to meet this need. Therefore, the proposed framework should not prevent progress in policies for individual end-uses or applications, as analyses and results become available, while the larger evaluation continues.

Due to the variety of applications for storage and the lack of a cohesive regulatory framework, it would be difficult if not impossible to develop a single unifying policy for energy storage. However, the proposed scenarios in the Final Proposal would allow focused analysis of barriers and policy options. This approach will also allow us to consider the whether one ownership model (i.e., ownership of the ESS by utility, end-use customer, third-party entity or some combination via joint ownership) is more beneficial in certain situations than others. Moreover, this approach would allow for the development of a cost-effectiveness methodology that properly addresses the unique characteristics of energy storage.

We agree that the recommended scenarios contained in the Final Proposal represent the appropriate starting point for Phase 2 of this proceeding. This determination is based in part on Staff's willingness to revisit and revise priorities as they gain additional information on the end-uses.

For these reasons, we adopt the Final Proposal. A second phase of this proceeding shall be initiated to analyze the priority scenarios contained in the Staff Proposal.

7. Comments on Proposed Decision

The proposed decision of the assigned Commissioner in this matter was mailed to the parties in accordance with Section 311 of the Public Utilities Code and comments were allowed under Rule 14.3 of the Commission's Rules of Practice and Procedure. Comments were filed on _____, and reply comments were filed on _____ by _____.

8. Assignment of Proceeding

Michael R. Peevey is the assigned Commissioner and Amy C. Yip-Kikugawa is the assigned Administrative Law Judge in this proceeding.

Findings of Fact

1. Assembly Bill 2514 directs the Commission to open a proceeding to determine appropriate targets, if any, for each load-serving entity to procure viable and cost-effective energy storage systems.

2. Energy storage is multi-functional and can be used at the transmission, generation, and distribution levels.

3. The multi-functional nature of energy storage means that it is subject to regulation from various state and federal agencies.

4. It is not possible to adopt a single, comprehensive energy storage policy that would apply across all storage functions and regulatory agencies.

5. Parties generally agree that any adopted energy storage policy should be technology neutral.

6. Parties identified nine perceived barriers to the more widespread deployment of energy storage systems.

7. The Final Proposal includes a proposed framework to analyze energy storage based on "end uses" for storage and where in the value chain storage is being used.

8. The Final Proposal's analysis approach would consist of four major categories – regulatory framework, cost effectiveness, procurement objectives and energy storage roadmap.

9. The Final Proposal recommends four basic "scenarios" for analyzing energy storage based on existing state and Commission policy objectives.

Conclusions of Law

1. The Final Proposal should be adopted.

2. A second phase of this proceeding should commence as soon as possible to analyze the priority scenarios identified in the Final Proposal.

O R D E R

IT IS ORDERED that:

1. The Energy Storage Framework Staff Proposal (Attachment A of this decision) is adopted.

2. Rulemaking 10-12-007 remains open.

This order is effective today.

Dated _____, at San Francisco, California.

ATTACHMENT A

Energy Storage Framework Staff Proposal

CPUC Energy Storage Proceeding R.10-12-007

Energy Storage Framework Staff Proposal

Elizaveta Malashenko

Rebecca Lee

Chris Villarreal

Ted Howard

Aloke Gupta

Contents

1. Introduction

This proposal outlines the California Public Utilities Commission (CPUC) Staff approach to addressing energy storage policy considerations, including an analysis framework and a plan for developing policies and guidelines pertaining to energy storage. This proposal is based on the analysis of barriers to adoption of electric energy storage that have been identified thus far in the course of the electric energy storage proceeding (R.10-12-007). The purpose of the CPUC Staff proposal is not to resolve any of the barriers at this point in time, but rather to outline a roadmap for how they can be addressed. Additionally, the CPUC Staff proposal defines the steps to be taken in the next phase of this proceeding.

1.1.Background

On December 16, 2010, the CPUC opened Rulemaking (R.) 10-12-007 (Storage OIR) to implement the provisions of Assembly Bill (AB) 2514 (Stats. 2010, ch. 469). AB 2514 directs the CPUC to determine appropriate targets, if any, for each load-serving entity as defined by Pub. Util. Code § 380(j) to procure viable and cost-effective energy storage systems and sets dates for any targets deemed appropriate to be achieved. On May 31, 2011, the Assigned Commissioner and Administrative Law Judge (ALJ) issued a Ruling and Scoping Memo (Scoping Memo) which identified the issues to be considered in this proceeding and set a procedural schedule. Since the issuance of the Scoping Memo, the CPUC Staff facilitated two workshops to obtain additional information pertaining to energy storage. The first workshop, held on June 28, 2011, was a general discussion of energy storage systems and the second workshop, held on July 31, 2011, focused on barriers and impediments to widespread use of energy storage. Following the second workshop, the ALJ issued a ruling seeking additional comments from the parties. Based on the discussion during the workshops and the comments filed by parties, CPUC Staff has developed a proposal for an approach to address energy storage considerations.

On December 12, 2011, a draft CPUC Staff proposal was released to the service list in R.10-12-007 for comment by parties. Parties responded with opening comments on January 31, 2012 and reply comments on February 21, 2012.

1.2. Executive Summary

The parties in R.10-12-007 have identified a number of barriers to widespread use of electric energy storage technologies. Some of the identified barriers are under direct CPUC jurisdiction and may be addressed in existing or future proceedings. For those barriers that are under the jurisdiction of other state or federal agencies, the CPUC may be able to use its technical expertise as a stakeholder in those forums to address the barriers in a coordinated fashion. CPUC Staff has summarized these barriers and has identified best forums for these barriers to be addressed. In order to support the analysis of energy storage issues going forward, CPUC Staff proposes the adoption of an energy storage 'end use' framework. This framework will be utilized in a number of future activities, including defining the cost-effectiveness evaluation methods and defining Resource Adequacy value. CPUC Staff believes that this analysis framework, along with a plan for addressing identified barriers, will set a foundation for

expanding the ability of energy storage to gain wider adoption. Specifically, CPUC Staff believes that the creation of a Resource Adequacy value and development of other rules allowing storage providers to participate more effectively in the utilities' procurement programs will mitigate many of the identified barriers. This effort will need to be coordinated with the California Independent System Operator (CAISO) to encourage policies and define products to enable electric energy storage systems to participate in its markets similar to other generation facilities. In parallel, the CPUC will continue to evaluate electric energy storage to make a determination whether or when an energy storage portfolio standard could be adequate.

1.3. Definition of Energy Storage System

Some parties identified confusion around the concept of energy storage (given the wide range of technologies and uses being considered for implementing storage systems) and indicated a need to include a standard definition of energy storage systems[1] that are the subject of the Storage OIR.

CPUC Staff proposal references the statute creating the Storage OIR, Assembly Bill (AB) 2514 (Stats. 2010, ch. 469), which provides guidance on defining energy storage systems. The applicable language is quoted below (reformatted for clarity):

> (1) "Energy storage system" means commercially available technology that is capable of absorbing energy, storing it for a period of time, and thereafter dispatching the energy. An "energy storage system":
>
> - may have any of the characteristics in paragraph (2),
> - shall accomplish one of the purposes in paragraph (3), and
> - shall meet at least one of the characteristics in paragraph (4)
>
> (2) An "energy storage system" may have any of the following characteristics:
>
> (A) Be either centralized or distributed.
>
> (B) Be either owned by
>
> - a load-serving entity or local publicly owned electric utility,
> - a customer of a load-serving entity or local publicly owned electric utility, or
> - a third party,
> - or
> - is jointly owned by two or more of the above.
>
> (3) An "energy storage system" shall be cost effective and either
>
> - reduce emissions of greenhouse gases,
> - reduce demand for peak electrical generation,
> - defer or substitute for an investment in generation, transmission, or distribution assets, or
> - improve the reliable operation of the electrical transmission or distribution grid.
>
> (4) An "energy storage system" shall do one or more of the following:

[1] Brookfield Renewable Energy Partners January 31, 2012 comments at p.2.

(A) Use mechanical, chemical, or thermal processes to store energy that was generated at one time for use at a later time.
(B) Store thermal energy for direct use for heating or cooling at a later time in a manner that avoids the need to use electricity at that later time.
(C) Use mechanical, chemical, or thermal processes to store energy generated from renewable resources for use at a later time.
(D) Use mechanical, chemical, or thermal processes to store energy generated from mechanical processes that would otherwise be wasted for delivery at a later time.

2. Energy Storage Adoption Barriers

Following a series of CPUC Staff-facilitated workshops, the assigned ALJ issued a ruling on July 21, 2011, requesting comments from parties regarding barriers to electric energy storage deployment. Parties offered a wide range of distinct challenges for consideration, which CPUC Staff has grouped into nine broad categories. 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 CPUC proceedings, or in coordination with other state and federal agencies. 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 barrier category is discussed in the following subsections, including summary of parties' comments and proposed next steps.

2.2. Lack of definitive operational needs

2.2.1 Summary of Party Comments

The CPUC is currently assessing electric system operational needs in year 2020 within the CPUC's long-term procurement planning (LTPP) proceeding (R.10-05-006). As part of the LTPP proceeding, the CPUC and the CAISO are conducting a study to determine the likely capacity and operating characteristics needed to meet renewable integration requirements, with a focus on the newly established 33% renewable portfolio standard (RPS)[2]. Results so far indicate a wide range of potential needs, or lack

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

thereof, under various scenarios.[3] The lack of a definitive conclusion to the study presents a challenge to determining to what extent energy storage technologies can indeed play a part in addressing grid system needs, including integration.[4]

2.2.1 Proposed Next Steps

CPUC Staff will continue to collaborate with other entities, including CAISO, to identify electric system needs and where electric energy storage could play a role to fill those needs. As system needs are identified in the LTPP proceeding, the CPUC should consider whether energy storage technologies could address these needs. The CPUC plans on issuing a decision regarding system needs in R.10-05-006 in 2012 and after that point we will solicit comments from the parties on how to best proceed.

2.3. Lack of cohesive regulatory framework

2.3.1 Summary of Party Comments

California's electricity markets are currently operated under the premise that energy cannot be stored in a practical cost-effective manner. This operational limitation can be traced to the history of energy market development and the way jurisdictional boundaries are drawn between regulatory agencies. 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 CPUC, the California Energy Commission (CEC), CAISO, and the Federal Energy Regulatory Commission (FERC).[5] Coordination is therefore especially needed both across policy proceedings at the CPUC, as well as between regulatory agencies.

2.3.1 Proposed Next Steps

CPUC Staff has completed the initial process of identifying proceedings which have implications for energy storage (see Figure 1: Storage Barriers Regulatory Matrix). Going forward, CPUC Staff will continue to identify proceedings both within the CPUC and other agencies that have implications for energy storage and encourage collaboration on energy storage issues. CPUC Staff will also use the 'end use' framework outlined in Section 3 of this proposal to facilitate discussion among the agencies of how address the multiple-use nature of energy storage.

In particular, the CPUC will monitor and participate in the CAISO "Pay for Performance" stakeholder initiatives, including CAISO's current proceeding, Renewable Integration: Market and Product Review (Phase 2), which addresses renewable integration policies such as Pay for Performance, load-following, and daily market settlements. A related effort includes FERC's two-part frequency regulation compensation for capacity held in reserve, and performance.

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[3] See CAISO presentation at joint IOU/E3 presentation

[4] Brookfield August 29, 2011 comments at 2; PG&E August 29, 2011 comment at 5; and Sierra Club August 29, 2011 comments at 7.

[5] Brookfield August 29, 2011 comments at 4; SDG&E August 29, 2011 comments at 5; SCE September 16, 2011 comments at 5.

Other proceedings which could impact energy storage in California include FERC's Orders 890 and 719, enabling non-generation technologies such as storage to compete with generation technologies to provide grid reliability and ancillary services. CPUC Staff will also monitor a current FERC Notice of Inquiry that addresses third party sales of ancillary services and accounting and financial reporting requirements for increased transparency of cost allocation for energy storage. This proceeding seeks to facilitate competitive markets for ancillary services and is considering classification of energy storage assets.

Furthermore, from a broad policy perspective, the CPUC will collaborate with the CEC to ensure that energy storage policy from this proceeding is in alignment with the Integrated Energy Policy Report.

2.4. Evolving markets and market product definition

2.4.1 Summary of Party Comments

There are many vehicles by which regulations affect the energy markets, but energy storage is often not consistently considered across the corresponding proceedings. For example, the CPUC set rules governing utility transactions for short-term to multi-year energy, capacity, fuel, and energy financial services in the LTPP proceeding. At the same time, the CPUC set rules on how utilities purchase renewable power, which are predominantly transactions of highly structured long-term energy products in the RPS proceedings. The Resource Adequacy (RA) program, in comparison, drives the one-year forward capacity market. In addition, the CAISO operates an integrated day ahead forward market for energy and ancillary services and a real-time imbalance market. The CAISO is currently reviewing how to define market products that are technology/resource neutral and more accurately reflect the needs of grid balancing when the penetration of intermittent resources increases.[6] Energy storage often does not clearly fall under market products as they are defined and evolving markets with updated product definitions provide an opportunity to better incorporate energy storage.

2.4.2 Proposed Next Steps

CPUC Staff has begun the process of identifying proceedings which have implications for energy storage (see Figure 1: Storage Barriers Regulatory Matrix). As wholesale markets and market definitions evolve, a policy framework for energy storage can guide how energy storage fits into each layer of the electric system value chain, irrespective of how specific market products are ultimately defined. CPUC Staff will continue to participate in CAISO's stakeholder processes to encourage policies and market design that is technology neutral.

2.5. Resource Adequacy accounting

2.5.1 Summary of Party Comments

[6] See CAISO webpage on the Renewables Integration Market Product Review.

A large number of parties have identified RA accounting rules as a barrier to broader energy storage deployment.[7] In the current RA methodology, no value has been assigned to storage-based services. Additionally, the current process of requiring load-serving entities to procure generic RA capacity does not account for grid operational characteristics necessary to operate the grid with an expected high penetration of intermittent renewable resources.

2.5.2 Proposed Next Steps

The first important outcome of this rulemaking should be to begin the process of having RA value assigned to energy storage as part of the new RA rulemaking (R.11-10-023), based on the current work in progress in that rulemaking to revise the RA methodology to include operational and performance requirements. The 'end use' framework outlined in Section 3 of this proposal identifies the broad uses for storage. The CPUC will need to determine whether and how RA can be attributed to each of the 'end uses' or their combinations. The RA treatment for energy storage is preliminarily in the scope of R.11-10-023.[8] CPUC Staff anticipates close coordination between R.10-12-007 and R.11-10-023 regarding the RA rules for energy storage.

2.6. Lack of cost-effectiveness evaluation methods

2.6.1 Summary of Party Comments

Many parties identified uncertainty around cost-effectiveness evaluation methods as a major barrier to adoption of storage.[9] In particular, they state that the unique operational aspects of energy storage pose a challenge in recognizing all relevant benefits and quantifying them. Parties express a concern that some of the benefits, particularly flexibility, optionality, and environmental, are not part of the current calculation methods and the total benefits of energy storage, therefore, end up being significantly underestimated.

2.6.2 Proposed Next Steps

Phase 2 of this proceeding will consider the appropriate methodology for evaluating costs and benefits of energy storage. The CPUC has utilized cost-benefit tests in previous energy efficiency[10], distributed generation[11], and demand response[12] proceedings. The CPUC will seek general consistency with these decisions, while recognizing that modifications to these methodologies will be required to reflect the unique attributes of energy storage.

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[7] Brookfield August 29, 2011 comments at 5; CESA September 16, 2011 comments at 4; DRA August 29, 2011 comments at 2; PG&E August 29, 2011 comments at 6; PG&E September 16, 2011 comments at 6; SCE August 29, 2011 comments at 3; Sierra Club August 28, 2011 comments at 4; Sierra Club September 16, 2011 comments at 1; SDG&E August 29, 2011 comments at 5.

[8] R.11-10-023 Appendix A at 2. See http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/146362.pdf

[9] CFC August 29, 2011 comments at 10;DRA August 29, 2011 comments at 6;PG&E August 29, 2011 comments at 4.

[10] The avoided cost methodology adopted in D.05-04-024, as modified by D.06-06-063.

[11] The avoided cost methodology adopted in D. 09-08-026.

[12] The avoided cost methodology adopted in D. 10-12-024.

2.7. Lack of cost recovery policy

2.7.1 Summary of Party Comments

Because energy storage could potentially provide transmission, distribution, and generation services, it is possible for it to recover cost under both cost-based and market-based rates.[13] Thus, without a clear way to fit energy storage into the existing regulatory and cost recovery structure, it will be difficult to both value and pay for energy storage.[14] Certain parties have proposed a long-term contracting mechanism similar to the RPS to help energy storage projects financing, as the CAISO market dynamic is insufficient to attract investments.[15] Other parties, however, believe that the CPUC should first clearly define cost responsibility and ownership structure, which could then make it easier to determine cost allocation.[16]

2.7.2 Proposed Next Steps

This proceeding should consider how storage applications across different grid functions can inform cost recovery policy that falls within the CPUC's ratemaking jurisdiction (distribution service and energy commodity procurement), and if appropriate, consider revising the regulatory and cost recovery guidelines to facilitate the use of storage assets for multiple applications where feasible to maximize the benefits of storage.

2.8. Lack of cost transparency and price signals (wholesale and retail)

2.8.1 Summary of Party Comments

Parties helped to identify three aspects of today's energy market and planning and procurement processes where more cost transparency and accurate price signals could help "level the playing field" such that energy storage could be a potential solution to grid operational problems. These areas where cost /price transparency could be improved are: (1) within the CAISO energy and ancillary market design to better reflect the cost of integrating intermittent resources (and the allocation of those costs) and locational value[17]; (2) within utility procurement planning and contract evaluation process; and (3) in retail rate design, where the need to balance various objectives within regulatory and legislative constraints[18] can be a challenge to reconcile with the desire to accurately reflect the locational and time of day cost of delivering electrical service.

2.8.2 Proposed Next Steps

[13] PG&E August 29, 2011 comments at 7.
[14] Sierra Club August 29, 2011 comments at 3.
[15] Brookfield August 29, 2011 comments at 5; CESA September 16, 2011 at 5; DRA August 29, 2011 comments at 2.
[16] CFC August 29, 2011 comments at 10; SCE September 16, 2011 comments at 12.
[17] PG&E January 31, 2012 comments at 4.
[18] PG&E January 31, 2012 comments at 4.

Of the three areas listed, the latter two fall within the CPUC jurisdiction and can be addressed in coordination with other proceedings (see Figure 1: Storage Barriers Regulatory Matrix).

2.9. Lack of utility operating experience

2.9.1 Summary of Party Comments

Energy storage, in many cases, represents a nascent set of technologies, which have yet to be utilized on a commercial scale. PG&E, SCE and SDG&E are currently evaluating the value propositions and useful life-time for advanced energy storage assets.

2.9.2 Proposed Next Steps

This particular challenge will be resolved over time, as utilities gain additional operating experience with energy storage. The CPUC can assist this process by pursuing a policy framework that promotes a technology-neutral competitive environment where energy storage can be a viable commercial option. Additionally, utilities should get more operating experience through tests and pilots that are part of the Smart Grid deployment and ARRA-funded stimulus programs.[19] As such, the CPUC will also ensure that the Smart Grid Deployment Plans[20] currently under review adequately incorporate energy storage.

2.10. Lack of well-defined interconnection process

2.10.1 Summary of Party Comments

Parties have identified the lack of well-defined interconnection processes as a barrier to energy storage deployment.[21] This challenge arises both as the result of overlapping tariffs (CPUC Rule 21 and FERC WDAT) and evolving technical standards.

2.10.2 Proposed Next Steps

The storage rulemaking should defer the consideration of distribution-level energy storage interconnection issues to R.11-09-011 (which includes the Rule 21 Working Group). For transmission level interconnection issues, the CPUC remains an active participant in the CAISO's Generation Interconnection Procedures initiative.

2.11. Energy Storage Adoption Barriers Summary

CPUC Staff summarized parties' comments into nine underlying barriers to energy storage adoption. Several of the identified barriers are the subject to either existing CPUC proceedings or soon-to-start CPUC proceedings, such as RA, LTPP and others. Additionally, others rely on work from entities other

[19] For example, SCE is testing a 4 MW/16MWH battery located at a substation to firm wind production from the Tehachapi. PG&E also received funding to begin testing the feasibility of a Compressed Air Energy Storage project at a location to be determined in the Central Valley.

[20] Applications by utilities pursuant to SB17: A.11-06-006; A.11-06-029; A.11-07-001

[21] Placeholder

than the CPUC, such as the CAISO, or are cross-jurisdictional in nature and will require ongoing collaboration across the agencies to address. As the first step to help advancement of energy storage, CPUC Staff has developed a matrix (see Figure 1: Storage Barriers Regulatory Matrix) to outline how the barriers are to be addressed in different proceedings and by different agencies. Going forward, this matrix will need to be refined and updated to reflect additional information and new developments.

While addressing barriers within the existing frameworks will be a significant step towards supporting energy storage, there are considerations that still need to be addressed within this proceeding. Mainly, there is a need for clarity around cost-effectiveness evaluation methods and for determination of next steps pertaining to an energy storage procurement target suggested in AB 2514. Subsequent sections will further outline the CPUC Staff proposal for Phase 2 of this proceeding.

BARRIERS TO ENERGY STORAGE DEPLOYMENT

BARRIER	CPUC RULEMAKING PROCESSES						INTERAGENCY COORDINATION		
	Energy Storage Sec. 2835, 9620 R.10-12-007	LTPP Sec. 454.5 R.12-03-014	RPS Sec. 399.11-399.20	RA Sec. 380 R.11-10-023	SGIP, CSI Sec. 2851-2, 379.6	DSM Sec. 379.6, 454.5(c), 743.1, etc	FERC	CAISO	CEC
[1] Lack of definitive system need	Considers setting a storage "need" or procurement target per AB 2514	Determine long-term grid operational need for flexible resources with CAISO analysis	RPS procurement targets could influence energy storage needs	RA requirements could influence energy storage needs	SGIP and CSI could influence energy storage needs	DSM program targets could influence energy storage needs		Use renewable integration study to help determine storage needs	IEPR considers long term needs
[2] Lack of cohesive regulatory framework	Identify regulatory barriers; encourage collaboration across proceedings						NOI,Orders 890 & 719 on regulation compensation for performance and reserve capacity	Collaboration on initiatives for RIMPR, "pay for performance"	Collaboration on integrated Energy Policy Report
[3] Evolving markets and market product definitions	Identify proceedings affecting storage market participation							Encourage technology-neutral policies and market design (RIMPR, pay for performance)	
[4] Resource Adequacy (RA) accounting	Determine uses where storage can be eligible for RA and collaborate with RA proceeding		RA value for storage sited at RPS generation should be determined by RA proceeding	Determine RA methods and establish rules for storage eligibility for RA value	Programs have impact on RA need and value	Programs have impact on RA need and value		May develop flexible attributes that impact RA methods	
[5] Lack of cost-effectiveness (C/E) evaluation method	Determin a cost-effectiveness framework for energy storage			RA value for storage may provide input to C/E framework	Existing program specific C/E methodologies may be releavent for some storage uses	SPM for evaluating demand-side programs may inform development of energy storage C/E framework		Establish methodology for calculating integration costs	
[6] Lack of cost recovery policy (cost- vs. market-based)	Consider how storage uses can inform CPUC cost recovery policies and consider revisions to allow multi-use storage	Consider cost-recovery policies for storage uses associated with utility power transactions	Consider incorporating avoided integration costs into offer valuation			Consider cost-recovery policies for storage uses associated with DSM	Clarify classification and cost-recovery rules for multi-use storage	Clarify renewables integration costs, cost causation allocation	
[7] Lack of cost transparency and price signals	Identify regulatory forums for improving cost & price signals, including within rate design	Improve cost-transparency within utility procurement planning and contract evaluation process	Allow incorporating avoided integration costs into offer valuation					Evaluate who should bear cost of intermittency through RIMPR	
[8] Lack of commercial operating experience	Considers targeted RD&D; coordinate with R.11-03-012 and R.11-10-003				Advance commercialization of emerging storage technologies	Utility program to encourage customer-owned PLS storage (A.11-03-001)			Storage 2020 study reviews status of storage technology development
[9] Lack of well-defined interconnection processes	Interconnection of distribution-level energy storage is currently being addressed in the OIR proceeding related to modifying to Rule 21 (R.11-09-011)						Set FERC-juridictional interconnection rules	Reform generation interconnection process	

Figure 1: Storage Barriers Regulatory Matrix

(Note: Grey cells indicate primary proceeding to address barrier. White cells indicate other proceedings that may influence resolution of barrier.

[1]RIMPR = Renewable Integration Market & Product Review. [2]OIR to Address Utility Cost and Revenue Issues Associated with GHG Emissions.

[3]OIR on CPUC motion to determine the impact on public benefits associated with the expiration of ratepayer charges pursuant to PU Code Section 399.8*)*

3. Energy Storage Analysis Framework

The purpose of the Energy Storage Analysis Framework is to set a foundation for how to approach energy storage. In its basic form, the framework is a decomposition of energy storage into manageable components that can be used in a variety of ways to assist with analysis. This section describes of how this framework was developed and how it will be used going forward.

3.1. Framework Introduction

Electric energy storage is a highly complex area and many analysts in the industry have come to the conclusion that a framework that decomposes storage into more manageable and discrete areas is needed to support analysis in this space. An example of such a framework was submitted by Southern California Edison (SCE) in comments on August 29, 2011. SCE proposes an application and operational usage approach, which decomposes energy storage by looking at physical location and operating profile across the value chain. The approach taken by SCE acknowledges that actual energy storage implementations may have several operational uses and, therefore, groups operational uses into 12 applications to facilitate a better understanding of benefits.[22] There are also several other similar frameworks, including one outlined by Electric Power Research Institute (EPRI) in the Electricity Energy Storage Technology Options whitepaper.[23] Leveraging work done by SCE and EPRI, among others, CPUC Staff has developed a similar framework that decomposes energy storage into 20 'end uses' across the energy value chain. This list (Figure 2: Energy Storage 'End Uses') is intended to be used as a foundation for further framework development and subsequent analysis of energy storage related issues.

[22] Southern California Edison, *Moving Energy Storage from Concept to Reality*
[23] Electric Power Research Institute, *Electricity Energy Storage Technology Options*, December 2010

Category		Storage 'End Use'
Describes at what point in the value chain storage is being used		Describes what storage is being used for i.e. its application.
ISO/Market	1	Ancillary services: frequency regulation
	2	Ancillary services: spin/ non-spin/ replacement reserves
	3	Ancillary services: ramp
	4	Black start
	5	Real time energy balancing
	6	Energy price arbitrage
	7	Resource Adequacy
Generation	8	Intermittent resource integration: wind (ramp/voltage support)
	9	Intermittent resource integration: photovoltaic (time shift, voltage sag, rapid demand support)
	10	Supply firming
Transmission/ Distribution	11	Peak shaving
	12	Transmission peak capacity support (upgrade deferral)
	13	Transmission operation (short duration performance, inertia, system reliability)
	14	Transmission congestion relief
	15	Distribution peak capacity support (upgrade deferral)
	16	Distribution operation (voltage / VAR support)
Customer	17	Outage mitigation: micro-grid
	18	Time-of-use (TOU) energy cost management
	19	Power quality
	20	Back-up power

Figure 2: Energy Storage 'End Uses'

The 'end uses' identified above are intended to be a comprehensive set of ways in which energy storage can be used and, therefore, provide value. As the understanding of the ways that energy storage can be used evolves, the above list can be adjusted to reflect new developments.

3.2. Potential Framework Applications

There are many ways in which the energy storage 'end use' framework can be utilized. The decomposition of energy storage subject matter into more manageable areas can be useful across many areas of analysis. For example, the energy storage 'end use' framework can serve as the basis for:

- RA value: The recently opened RA proceeding should consider creating an RA value for storage. Parties in that proceeding should make use of the identified 'end uses' of storage and be able to calculate the RA value, where appropriate, of those identified 'end uses.' Parties and CPUC Staff should work with the RA proceeding to facilitate a discussion around the creation of an RA model and value for storage that can be used in a timely manner.
- Further barriers analysis: Barriers can be aligned to specific 'end uses'. This way, the more challenging applications of energy storage can be better understood. Additionally, barriers can be better prioritized and managed if considered in relationship to particular 'end uses' and consequently goals and benefits.
- Technology analysis: Aligning energy storage solutions to 'end uses' is a critical step in understanding both the functional requirements and maturity of technology required to enable 'end use' functionality.
- Value proposition: 'End uses' have corresponding benefit streams. In some cases, it will make sense to combine 'end uses' into applications in order to capture not just stand-alone benefits, but also synergies. 'End uses' and applications will have corresponding costs and through understanding both benefit and cost drivers value proposition for storage can begin to emerge.
- Roadmap development: The workshops and comments provided by the parties demonstrate that there are too many considerations, barriers, issues and uncertainties to be dealt with at the same time. Therefore, CPUC Staff proposes developing an energy storage roadmap that captures a vision for energy storage adoption based on policy goals, priorities and constraints. This roadmap can then serve as a tool to prioritize issues pertaining to energy storage and lay a foundation for developing a plan to address them.

It is also important to note that the proposed framework is not intended to eliminate analysis of energy storage from a unified perspective. Rather, by focusing on the specific 'end uses' it will become apparent which aspects of energy storage are unique to specific applications and which aspects of storage are common across all uses.

4. Continued Analysis and Next Steps

4.1. Analysis Process

The end goal of this proceeding is to determine what procurement targets, if any, should be established for energy storage. Also to be considered in this proceeding are the policies to encourage cost effective energy storage. Through the work conducted so far, CPUC Staff has identified several key themes:

- The best practice for analyzing energy storage is to use a framework based on 'application' and/or 'operational use' of storage. Such frameworks have been developed by several entities in the market, including SCE and EPRI, for the analysis of the energy storage market.
- The variety of possible applications and operational uses of energy storage makes cost/benefit analysis particularly challenging.
- There are many different points of view regarding whether procurement targets, or including energy storage in the IOU loading order, would be beneficial.
- Different types of energy storage add another layer of complexity, as maturity varies drastically depending on the technology. Additionally, not only do different types of storage enable different applications and operational uses, but where energy storage is located on the grid also increases the complexity of defining benefits and uses.

Since energy storage is a very large and complex subject, the preferred approach for achieving progress is to incrementally manage the policy analysis. Therefore, it is proposed that the analysis approach going forward focuses on incremental steps and that the approach and framework be revised as issues become more precise. Also, CPUC Staff proposes that the energy storage issues are prioritized based on system needs and technology maturity to ensure that solutions with most potential are identified and supported.

The proposed analysis approach consists of four major categories: regulatory framework, cost effectiveness, procurement objectives and energy storage roadmap (Figure 3: Energy Storage Analysis Approach).

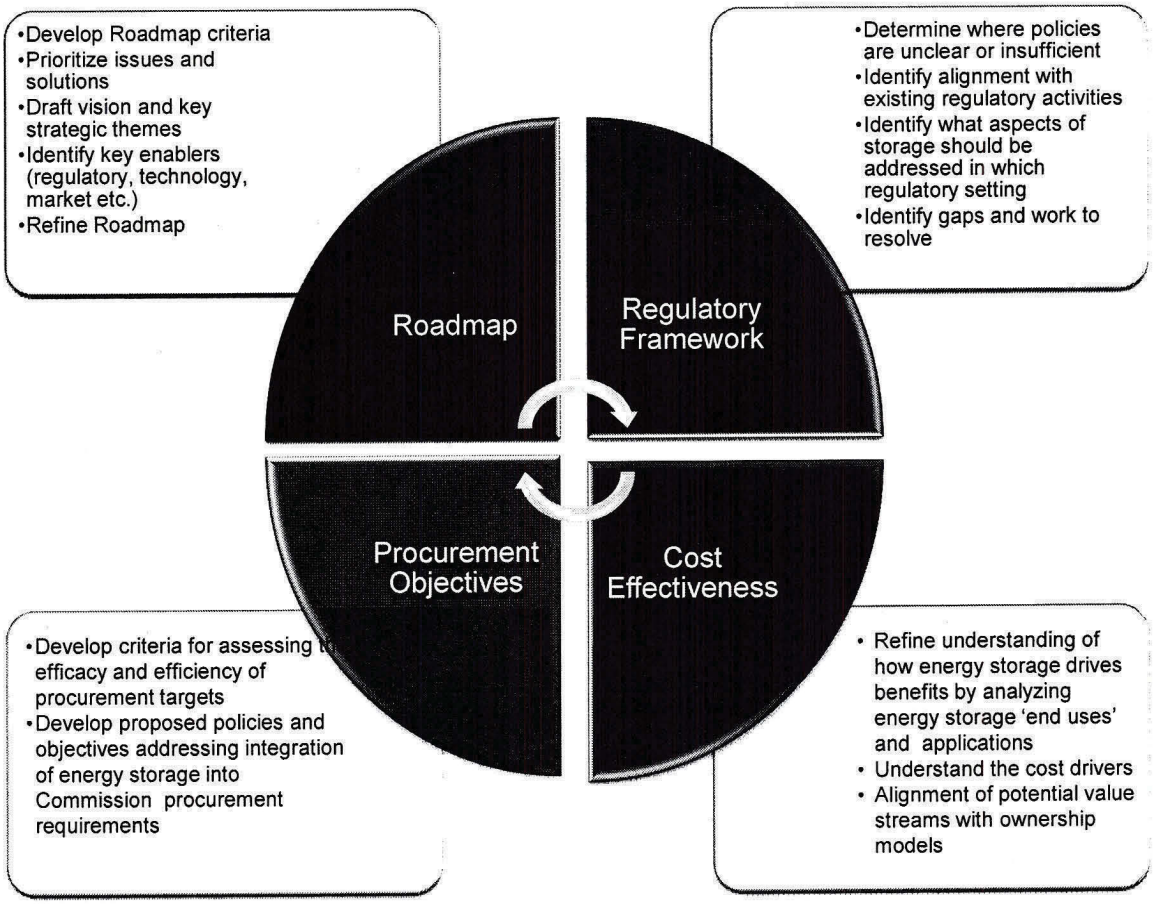

Figure 3: Energy Storage Analysis Approach

Notably, there are issues that fall outside of these four main categories. As our analysis progresses, these issues will either be addressed as part of these four focus areas or the framework will be adjusted to accommodate them. For example, assessing engineering and operations implications of introducing a significant amount of energy storage to the distribution network currently do not fall into any of the categories, as it remains to be seen to what extent this question needs to be addressed in this proceeding.

The analysis framework proposed would address the four analysis categories in an iterative manner. In other words, a draft roadmap and regulatory framework would be developed and then refined as value proposition and procurement objectives become better defined. The end result is that the four elements would come together synergistically to help frame energy storage policy direction.

4.2. Key Next Steps

Parties' comments have been utilized to finalize several work products, including an updated storage barriers regulatory matrix, cost-effectiveness methodology proposal and energy storage adoption roadmap. The outcomes of the analysis outlined above will be used to evaluate whether or not to adopt a procurement target or if other policy options are better suited to meet the objectives of AB 2514.

4.2.1 Prioritization of End Uses

As a next step, feedback from parties suggests that further analysis in the Storage OIR be pursued across the four categories discussed above by focusing on a few end uses considered high priority[24]. To achieve this, CPUC Staff recommends identifying priorities based on existing State and CPUC policy objectives, particularly increasing the penetration of renewable and distributed generation, GHG reduction, limiting peak growth and grid modernization. Rather than examining each end use individually, CPUC Staff proposes to prioritize four basic "scenarios" for deploying energy storage systems involving different combinations of multiple end uses (Figure 4: Energy Storage Deployment Scenarios).

The proposed scenarios will be a starting point for CPUC Staff in Phase 2 and will be further refined. In Phase 2, CPUC Staff recommends that there is an opportunity for the parties to recommend adjustments to the scenarios and priorities. The proposal below should be considered a point of departure and not a fixed direction.

[24] CESA January 31, 2012 comments at p.12.

Energy Storage "End Use"		Scenarios			
		A. Renewables Support/ Dispatchability	B. Distributed Storage	C. Demand-side Management	D. Ancillary Services
1	Ancillary services: frequency regulation				X
2	Ancillary services: spin/ non-spin/ replacement reserves			x	X
3	Ancillary services: ramp			x	X
4	Black start				
5	Real time energy balancing				x
6	Energy price arbitrage		x		
7	Resource Adequacy		x		
8	Intermittent resource integration (ramp/voltage support)	X			
9	Intermittent resource integration (time shift, voltage sag, rapid demand support)	X			
10	Supply firming	X			
11	Peak shaving		x		
12	Transmission peak capacity support				
13	Transmission operation				
14	Transmission congestion relief				
15	Distribution peak capacity support (upgrade deferral)		X		
16	Distribution operation (voltage / VAR support)		X		
17	Outage mitigation: micro-grid		x	x	
18	TOU energy cost management			X	
19	Power quality			X	
20	Back-up power			X	

Figure 4: Energy Storage Deployment Scenarios

Scenario A: Renewables Support/Dispatchability

The Renewables Support/Dispatchability scenario will look at how energy storage can be used to support renewable generation, including both transmission-level and distribution-level renewable generation. This scenario involves energy storage systems sited near intermittent/renewable energy resources to "improve" the dispatchability and value of the generator output (smoothing, firming, time-shifting), as well as avoid other system level integration costs.

Scenario B: Distributed Storage.

The Distributed Storage scenario will focus on distribution-level storage, particularly how it can be used to support grid operations. Analysis of this scenario will involve exploration of issues that have already been recognized as relatively unique to energy storage due to its multi-functional and flexible nature, such as to what extent multiple 'end uses' can co-exist together from an operational and performance perspective and how associated benefit streams can be monetized. This scenario will also involve considering storage as a distribution-level generation resource.

Scenario C: Demand-side Management

To the extent behind-the-meter storage systems are owned by customers, this scenario has already been evaluated in the demand response proceeding (A.11.03.001, 002, 003) for permanent load shifting. As part of Storage OIR, CPUC Staff can suggest further refinements of this case involving potential bundling of additional 'end uses' with load shifting and also look at cases involving the energy storage system on customer premise under utility ownership or managed by a third-party aggregator.

Scenario D: Ancillary Services

The Ancillary Services scenario will look into use of energy storage systems at the transmission level to provide generator-like services for ancillary markets. While this is largely a CAISO jurisdictional issue, CPUC Staff recommends including this scenario in evaluation as a basis for collaboration with CAISO and to also explore how distribution-level storage can participate in ancillary services through a utility tariff.

4.2.2 Roadmap

Parties offered several comments on potential goals or milestones for the progression of this proceeding and action on identified barriers to encourage adoption of energy storage resources and those comments have been incorporated into an energy storage roadmap summarized below. At this time, the CPUC Staff proposed roadmap is reflective of CPUC proceedings currently on-going or planned that are expected to address storage-related issues. CPUC Staff will work with parties to continue to monitor regulatory developments and adapt the roadmap as needed.

MILESTONE	VENUE / PROCEEDING	YEAR
Utility standard offer for customer-owned 'permanent' load shifting (PLS) storage	Pending approval in Demand Response applications (A.11.03.001, 002, 003)	2Q12
Requirements for flexible resources established	CAISO RI study phase 2	2012
Storage participates in regulation market	CAISO implements REM	
Dispatchability requirements added to RA methodology	RA OIR phase 1	
Storage cost-effectiveness methodology	Storage OIR phase 2	
RA value assigned to storage	RA OIR, phase 2	
Long term system needs	CAISO modeling of 33% RPS and LTPP	
Storage participates in ramping market	CAISO implements Flexiramp product	2013
Storage procurement objectives or other policies to encourage storage adoption	Storage OIR phase 2	
Storage as a transmission asset	Future FERC action	

Figure 5: Roadmap

5. Conclusion

Energy storage is an evolving area and there are many barriers to adoption, including gaps related to how energy storage should be addressed from a regulatory perspective. To move forward with the analysis, CPUC Staff proposes that an RA value be identified for energy storage systems and that LTPP develop a process for energy storage to participate in utility procurement practices. Additionally, CPUC Staff recommends utilizing an energy storage framework with four prioritized scenarios, which align with State and CPUC policy priorities. In Phase 2 of this proceeding the analysis will continue to focus on the four major categories: roadmap, regulatory framework, cost-effectiveness and procurement objectives. CPUC Staff is supportive of energy storage technologies and will continue to resolve barriers to adoption of viable and cost-effective energy storage.

(END OF ATTACHMENT A)