

PROPOSED DECISION

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Decision **PROPOSED DECISION OF COMMISSIONER PETERMAN**
(Mailed 11/3/2017)

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to consider
policy and implementation refinements to
the Energy Storage Procurement
Framework and Design Program
(D.13-10-040, D.14-10-045) and related
Action Plan of the California Energy Storage
Roadmap.

Rulemaking 15-03-011

DECISION ON MULTIPLE-USE APPLICATION ISSUES

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DECISION ON MULTIPLE-USE APPLICATION ISSUES

Summary

This decision provides direction to the utilities on how to promote the ability of storage resources to realize their full economic value when they are capable of providing multiple benefits and services to the electricity system. We adopt eleven rules to govern evaluation of these multiple-use energy storage applications, along with definitions of service domains, reliability services, and non-reliability services. We also establish a working group to further develop several issues and direct our Energy Division to report to us in 2018 on the state of the energy storage industry. This proceeding is closed.

1. Background

On March 26, 2015, the California Public Utilities Commission (CPUC) issued an Order Instituting Rulemaking to address enactment and ongoing implementation of Assembly Bill (AB) 2514¹ and to continue to refine policies and program details as required or recommended by Decision (D.) 13-10-040 and D.14-10-045, which established the Energy Storage Procurement Framework and Design Program (Program) and approved the utilities' applications to implement the Program. This proceeding is the successor to Rulemaking (R.) 10-12-007. This Rulemaking also considers recommendations included in the California Energy Storage Roadmap (Storage Roadmap), an interagency guidance document that was jointly developed by the California Independent System Operator (CAISO), the California Energy Commission (CEC), and the CPUC. The Storage Roadmap identified needed actions, set priorities and defined the responsibilities of each organization to address the challenges. Several of the items identified in the Storage Roadmap were considered in this proceeding.

¹ Stats 2010, ch. 469.

In D.13-10-040,² the CPUC adopted a total energy storage procurement target of 1,325 megawatts (MW), allocated to each of the investor-owned utilities³ in four biennial solicitations through 2020 (non-utility load serving entities have targets based on one percent of annual peak load by 2020). That decision provided a basis for cost/benefit analysis in several use cases, adopted caps for procurement of storage in various grid domains (Transmission, Distribution and Customer), and allowed for some flexibility across the transmission and distribution grid domains, but not into and out of the customer grid domain. In addition, the decision allowed each utility to utilize its proprietary protocols for assessing and selecting winning energy storage bids but required the utilities to develop a consistent evaluation protocol (CEP) for reporting/benchmarking and facilitating a consistent comparison across utilities, bids, and use-cases. D.13-10-040 also directed that a comprehensive evaluation of the Program be conducted no later than 2016 and once every three years thereafter.

In D.14-10-045, the CPUC evaluated and approved the utilities' energy storage procurement plans for the 2014 biennial period, with some modifications. In addition, D.14-10-045 approved eligible energy storage technologies and approved the Power Charge Indifference Adjustment (PCIA) mechanism to allow recovery of potential above-market costs associated with departing load for bundled energy storage projects but denied a request for an extension of the PCIA mechanism for bundled energy storage contracts beyond 10 years. Finally, the CPUC approved the proposed utility CEPs, with modifications, and directed that these evaluation protocols be used in the December 2014 solicitation requirements and bid materials.

² This accounting of D.13-10-040, D.14-10-045, D.16-01-032, and D.17-04-039 is meant to be illustrative and not exhaustive. Please see each respective decision for a complete list of policies and programs adopted.

³ Reference to "utility" or "utilities" throughout the decision means investor-owned utilities, unless otherwise specified. The utilities are Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), and San Diego Gas & Electric Company (SDG&E).

Following the Prehearing Conference held on May 20, 2015, the assigned Commissioner and Administrative Law Judges (ALJ) issued a Scoping Memo and Ruling on June 6, 2015 (First Scoping Memo and Ruling). The First Scoping Memo and Ruling determined that the proceeding would be divided into two tracks.

Track 1 was narrowly scoped to consider issues that required resolution prior to the commencement of the utilities' 2016 energy procurement solicitations and were resolved in D.16-01-032. Among other issues, D.16-01-032 approved the utilities' request for additional flexibility of energy storage targets between grid domains, allowing the utilities to satisfy some of their transmission and distribution domain targets through customer-connected projects, up to a "ceiling" of 200 percent of the existing customer domain targets; clarified that direct current (DC)-based storage used as part of a DC microgrid is an eligible storage product for purposes of meeting the storage targets but found that hydrogen-based power-to-gas option, when injected into the natural gas pipeline system, is ineligible to meet the storage targets established in D.13-10-040 and the requirements of AB 2514; and established that credit for Self-Generation Incentive Program (SGIP) funded energy storage projects should be split evenly between an unbundled customer's utility and the community choice aggregator (CCA)/energy service provider (ESP) for purposes of meeting the storage targets.

On January 5, 2016, the assigned Commissioner and ALJ issued a Scoping Memo and Ruling (Second Scoping Memo and Ruling) that sought comments on Track 2 issues. Track 2 was scoped to consider additional issues for the continued development and refinement of the Program which could not be sufficiently addressed prior to the commencement of the 2016 procurement solicitations. The Track 2 Decision, D.17-04-039, determined that no additional increase to the existing 1,325 MW storage target was warranted at this time; declined to modify the list of eligible storage technologies; adopted station power rules for electric storage devices; implemented an "automatic limiter" that ensures that the obligation of an ESP or CCA to procure storage never exceeds that of its associated investor-owned utility, based on a percentage of total

load; directed the creation of a working group to develop specific recommendations to enable a specific use case for “community storage”; and set forth requirements and a process for implementing AB 2868 (Gatto, 2016).

This decision addresses the remaining issue of Multiple-Use Applications.

2. Scoping Memo Issues

The Second Scoping Memo and Ruling reiterated that this Rulemaking continues to adhere to the following guiding principles, set forth in D.14-10-045:

1. Optimization of the grid, including peak reduction, contribution to reliability needs, or deferment of transmission and distribution upgrade investments;
2. Integration of renewable energy; and
3. Reduction of greenhouse gas emissions to 80% below 1990 levels by 2050.

The Scoping Memo and Ruling solicited comments on a number of issues, but the only one that remains unresolved in this proceeding is Multiple-Use Applications, and two remaining issues on station power.

Multiple-use applications are defined in the Storage Roadmap as those that provide multiple services to different entities or jurisdictions.⁴ The CAISO is currently engaged with stakeholders to enable wholesale market participation of energy storage assets interconnected to the distribution and transmission grids, primarily through the Energy Storage and Distributed Energy Resources (ESDER) stakeholder initiative.⁵ The CAISO has included issues associated with Multiple-Use Applications in ESDER Phase 3, consistent with its jurisdiction.

On May 3, 2016 staff of the CPUC and CAISO held a workshop on multiple-use applications for energy storage resources. Opening comments were filed on May 13,

⁴ Storage Roadmap at 14.

⁵ <http://www.caiso.com/informed/Pages/StakeholderProcesses/EnergyStorageAggregatedDistributedEnergyResources.aspx>.

2016 and reply comments were filed on May 20, 2016. In coordination with efforts underway at CAISO, the CPUC sought input on the following questions:

- a. What are the energy storage configurations or use-cases that currently exist, or may exist in the future, that provide multiple services at the transmission and/or distribution level (e.g., provide both retail or distribution services and participate in the CAISO wholesale market)? Which of these configurations/use-cases are most likely to occur and should be considered first? Please identify specific regulatory issues under the CPUC's jurisdiction that need to be resolved to enable these multiple-use applications. Explain the "procedural home" where the regulatory issues identified should be resolved.
- b. What cost-recovery issues arise from the identified multiple-use applications? How should the Commission address these? Are there any double-counting issues, such as double payments, overlapping value streams, or redundant compensation, and wholesale/retail energy charges that arise with multiple-use applications and that should be addressed by the Commission?
- c. Are existing interconnection requirements adequate to enable configurations/use cases involving behind-the-meter or in-front-of-the-meter energy storage to both provide retail and/or distribution services and participate in the CAISO wholesale market? If not, what is the applicable interconnection process that needs to be modified (i.e., Rule 21 or the Wholesale Distribution Access Tariff), and what specific modifications are needed to interconnect and enable multiple uses?
- d. What jurisdictional metering and sub-metering requirements are relevant to behind-the-meter and in-front-of-the-meter multi-use configurations? Are existing metering and sub-metering requirements adequate to enable configurations/use cases involving behind-the-meter energy storage to both provide retail and distribution services and participate in the CAISO wholesale market? If not, what specific modifications are needed to metering and sub-metering requirements to enable multiple-use applications?
- e. How should dispatch coordination and prioritization work for resources that have agreed to provide services to more than one entity (e.g., a contract to provide distribution asset deferral

and resource adequacy capacity)? How should settlement be handled?

3. Background of the Report and Revised Report

On May 18, 2017, the assigned ALJ solicited comments on a Joint Workshop Report and Framework – Multiple-Use Applications for Energy Storage (Report) prepared by CPUC’s Energy Division and CAISO. The Report proposed a multiple-use application framework, based on input received at the 2016 workshop, and subsequent comments and reply comments. The Report defined clear rules for which combinations of revenue streams storage providers may access, and to identify and propose ways to address regulatory and market barriers to applications of storage connected in each of the three grid domains – customer, distribution and transmission.⁶ The Report designated services as either “reliability services” or “non-reliability services,” based on comments primarily from utilities, and staff’s own analysis, that certain services are more important to the reliability functioning of the system than others.

On June 2, 2017, staff from the CPUC’s Energy Division and CAISO held a workshop on the Report. Advanced Microgrid Solutions, Inc. (AMS), California Energy Storage Alliance (CESA), California Hydrogen Business Council, Calpine Corporation (Calpine), Center for Sustainable Energy, Cities of Anaheim, Azusa, Banning, Colton, Pasadena, and Riverside, California, Clean Coalition, Green Power Institute (GPI), Independent Energy Producers Association, ITC Grid Development LLC, NRG Energy, Inc., PG&E, SDG&E, SCE, Stem, Inc. (Stem), Sunrun, Inc. (SunRun), Sunverge Energy, Inc., and Tesla, Inc. (Tesla) filed comments on June 16, 2017 and CESA, Calpine, GPI,

⁶ The Report uses the term “grid domain” to denote the three levels of the electric system at which a storage device may be interconnected – behind the customer meter, on the utility distribution system, or on the transmission system. The term “service domain” indicates the level of the electric system in which the device may provide services, which includes wholesale market and resource adequacy in addition to the three grid domains. Later sections of the Report explain these terms in detail.

LS Power, Office of Ratepayer Advocates, PG&E, SCE, SDG&E, Tesla and The Utility Reform Network filed reply comments on June 30, 2017.

The storage industry, in general, argued for a system of penalties and incentives attached to each service such that a storage provider could elect to provide services. Industry generally argues against contract or program rules that specifically prohibit or restrict certain services. Some storage companies, such as AMS and SunRun, argue that existing rules and penalties for services should be sufficient. The inherent problem with this approach is that existing rules only anticipate a very limited set of use cases – such as resource adequacy capacity providing wholesale market services – and do not anticipate that a resource may render itself entirely unavailable if it is committed to provide more than one competing service at one time. Rather, most tariffs, contract provisions, and rules assume that a resource will only provide one service. Multiple-Use Applications present a completely different paradigm. The storage industry also argues that the Multiple-Use Application framework is discriminatory to storage compared to other resources; however, it is the ability for storage to provide multiple services, and the active role that storage has been playing in this space, that makes storage unique and necessitates new rules. If and when other resources begin to actively participate in the provision of multiple services, we anticipate that we would consider a similar set of rules.

The Report also focused on combinations of services to occur simultaneously, using the same capacity; and dictated that resources could not contract for two reliability services at the same time, regardless of the time commitment to provide those services; and, that resource adequacy services could not be combined with most services. The rules, thus, limited combinations of services to a significant extent in some cases.

Following the June 2, 2017 workshop, the CPUC's Energy Division and CAISO prepared a Revised Report which reflects their current recommendations. The Revised Report is attached as Appendix B. The Revised Report contains clarifications and major revisions based on written party comments.

First, the Revised Report clarifies terms to respond to the concern that it did not clearly distinguish the terms device, resource and capacity, potentially creating confusion and implementation hurdles for aggregated small storage systems and some types of Multiple-Use Application. Second, the Revised Report adopts three categories of Multiple-Use Applications, based on the comments of such parties as PG&E, SCE and Tesla. These are: 1) time differentiated Multiple-Use Application, 2) capacity differentiated Multiple-Use Application, and 3) simultaneous Multiple-Use Application. This change modifies the structure significantly, as the first type would allow for a single resource to provide multiple reliability services that occur in different time intervals, using the same capacity, thus maintaining reliability. Third, the Revised Report adds several services suggested by parties and reclassifies all services other than imbalance energy in the wholesale market domain and all services in the customer domain, as reliability services.

4. Discussion

Our work on Multiple-Use Applications is designed to address the fact that current market rules (i.e., utility standard contracts and program tariffs) do not support the ability of an energy resource to access, or “stack,” more than one service, including any incremental values to the wholesale market, distribution grid, transmission system, resource adequacy requirements and customers. As a result, energy storage cannot realize its full economic value to the electricity system even though it may be capable of providing multiple benefits and services to the electricity system. Our objectives in developing rules and guidance addressing Multiple-Use Applications are to enable energy storage systems to stack incremental value and revenue streams by delivering multiple services to the wholesale market, distribution grid, transmission system, resource adequacy requirements, and customers in whatever procurement venue it participates. Achieving this vision increases the value of storage, and potentially other forms of energy device/resources, and enhances its economic viability and cost-effectiveness.

The Revised Report proposes that the CPUC adopt certain definitions for domains and services and further divides services into reliability and non-reliability services in Table 1. For purposes of clarity, we define all five domains as service domains, as services may occur in any domain. We define the customer, distribution and transmission domains as grid domains as they represent physical points of interconnection.

Table 1. Domains: Reliability Services and Non-Reliability Services

Domain	Reliability Services	Non-Reliability Services
Customer	None	TOU bill management; Demand charge management; Increased self-consumption of on-site generation; Back-up power; Supporting customer participation in DR programs
Distribution ⁷	Distribution capacity deferral; Reliability (back-tie) services; Voltage support; Resiliency/microgrid/islanding	None
Transmission	Transmission deferral; Inertia*; Primary frequency response*; Voltage support*; Black start	None
Wholesale Market	Frequency regulation; Spinning reserves; Non-spinning reserves; Flexible ramping product	Energy
Resource Adequacy	Local capacity; Flexible capacity; System capacity	None
*Voltage support, inertia, and primary frequency response have traditionally been obtained as inherent characteristics of conventional generators, and are not today procured as distinct services. We include them here as placeholders for services that could be defined and procured in the future by the CAISO.		

The Revised Report also proposes the following rules for Multiple-Use Applications:

⁷ For distribution-level services, the rules, procurement procedures and the services themselves are currently in development in a separate Commission R.14-10-003, the Integrated Distributed Energy Resources (IDER). Ordering Paragraph 2 of D.16-12-036 in R.14-10-003 defines these four product types. Should the product types be modified in R.14-10-003 or a subsequent proceeding, the product types on the distribution system available to storage device/resources will automatically update.

Rule 1. Resources interconnected in the customer domain may provide services in any domain.

Rule 2. Resources interconnected in the distribution domain may provide services in all domains except the customer domain, with the possible exception of community storage resources, per Ordering Paragraph 11 of D.17-04-039.

Rule 3. Resources interconnected in the transmission domain may provide services in all domains except the customer or distribution domains.

Rule 4. Resources interconnected in any grid domain may provide resource adequacy, transmission and wholesale market services.

Rule 5. If one of the services provided by a storage resource is a reliability service, then that service must have priority.

Rule 6. Priority means that a single storage resource may not contract for two or more different reliability services from the same capacity in a single, or multiple, domains, over the same or overlapping time interval for which the resource is committed to perform or be available. The storage provider must not enter into multiple reliability service obligations such that the performance of one obligation renders the resource from being unable to perform the other obligation. An exception for resource adequacy services is noted in Rule 7, below.

Rule 7. The exception to Rule 6 is for resource adequacy services. A single storage resource may contract for resource adequacy capacity and provide wholesale market reliability services using the same capacity, and over the same time interval. For example, if a storage resource is providing local resource adequacy capacity, it may meet its resource adequacy must offer obligation by providing any service in the wholesale service domain using its resource adequacy capacity.

Rule 8. If using different portions of capacity to perform services, storage providers must clearly demonstrate when contracting for services both the total capacity of the resource, with a guarantee that a certain, distinct capacity be dedicated and available to the reliability service, whether or not the individual devices within an aggregated resource will always be used to provide it.

Rule 9. For each service, the program rules, contract or tariff relevant to the domain in which the service is provided, must specify enforcement of these rules, including any penalties for non-performance.

Rule 10. In response to a utility request for offer, the storage provider is required to list any additional services it currently serves, or intends to serve, outside of the solicitation, and take the revenue from these services into consideration when pricing offers to the utilities' solicitation. In its evaluation of bids, the utilities must take these services into account in evaluating and ranking bid prices. The intent of this Rule is to avoid windfall profits for any storage provider.

Rule 11. If the reliability service is procured to avoid or defer a transmission or distribution asset upgrade, the resource must comply with availability and performance requirements specified in its contract with the relevant authority.

Rule 12. In paying for performance of services, compensation and credit may only be permitted for those services which are incremental or distinct. Services provided must be measurable, and the same service only counted and compensated once to avoid double compensation. This is an interim rule, which may be further refined through the working group process.

With the exception of clarifications to Rules 6, 8, 10, 11, and 12 and deletion of Rule 7, we adopt the Rules for the services that may be stacked and compensated. The adopted Rules are described in Appendix A. We adopt the Revised Report's recommendation for a working group to resolve additional issues that are not addressed here. Below we describe our rationale and thinking about how these definitions and rules, as modified, accomplish our vision of increasing the value of storage, and potentially other forms of energy device/resources, and enhancing its economic viability and cost-effectiveness.

4.1. How Do the Proposed Definitions of Domains and Services and Proposed Rules Support our Vision for Multiple-Use Applications?

The structure of domains and services is generally based on the Rocky Mountain Institute's report *The Economics of Battery Storage*,⁸ issued in December 2015. CPUC and CAISO staff adapted the structure of domains and services to be specific to the California market structure. The organization of services into domains is designed to follow jurisdictional and physical (points of interconnection) lines. Services are specific to each domain. As noted in the Report, services may be added and domains may change over time as policies evolve in either CPUC proceedings or CAISO stakeholder initiatives, or both. In comments on the staff proposal, parties generally⁹ agreed with the structure of domains and services proposed by CPUC and CAISO staff, with a few recommendations for additional services.

Much of the focus and discussion prior to the issuance of the Report focused on enabling a set of specific use cases. Based on the breadth of issues raised in comments and replies to the first Multiple-Use Application workshop in 2016, CPUC and CAISO staff opted to develop a structure of rules that would apply to any storage use case, or combinations of services, that a storage provider or utility chooses to pursue. Thus, the framework is not limited to a specific set of use cases but, rather, is meant to articulate the rules for the combinations of any available services. The benefits of this approach are two-fold: first, market actors are empowered to select the most optimal and cost-effective use cases, and second, regulators have a clear template of rules and holistic view into barriers of existing rules. While several parties, such as SCE and CESA, support review and approval of specific use cases on a case-by-case basis, we do not

⁸ <https://www.rmi.org/insights/reports/economics-battery-energy-storage/>.

⁹ Clean Coalition notes in comments on the Proposed Decision that it opposed limiting the ability of distribution connected resources to meet customer domain services.

believe such a structure is preferable as it would be both administratively burdensome and expose regulators to the risk of inconsistent decision-making.

All of the adopted Rules are considered first steps with an expectation that refinements may be considered following experience with the Rules.

4.1.1. Rules 1 through 4

Rules 1 through 3 state that storage resources may only provide services within the domain in which they are interconnected, or a higher level grid domain but not in reverse. These rules are based on current law and practice, and no party opposed these rules. A distribution interconnected storage resource can provide services to the transmission grid domain. Transmission projects can and are regularly deferred due to deployment of distributed energy resources interconnected to the distribution system. We are not aware of the reverse being true, wherein a transmission interconnected resource would defer the need for a distribution level resource, or provide services to an individual customer or group of specific customers. We allow for one possible exception within the modification of Rule 2, which contemplates possibly exempting community storage resources. Ordering Paragraph 11 in D.17-04-039 directed SCE to hold workshops on a specific community storage case – a storage resource interconnected at the distribution level in front of the meter serving end use customer load – and submit a report to the Energy Division by October 15, 2017.¹⁰ The original Report's Rule 2 would have forbidden this use case, as it specifically disallowed provision of customer level services by a resource in the distribution grid domain. The Revised Report allows for the possibility of an exception for community storage if the workshops' recommendations to the Energy Division are acted upon and this use case is actualized.

Rule 4 states that any storage resource in any grid domain may provide any service in the wholesale market or resource adequacy service domains which are not

¹⁰ SCE has complied with this requirement.

limited by the physical location of a resource. These rules also state that a storage resource located in any grid domain may provide services in the transmission grid domain, as it is the highest grid domain.

4.1.2. Rules 5 through 8

Rule 5 assigns priority to “reliability services” over “non-reliability services,” based on the premise that certain services are more important to the reliability functioning of the system than others. Rule 6 defines priority between reliability services as meaning that no storage resource may contract for more than one reliability service over the same time interval and using the same capacity. Rules 5 and 6 are designed to ensure that reliability services always take precedent. As noted above, in place of adopting specific rules prioritizing reliability services the storage industry generally supports a system of penalties and incentives, or else argue that existing rules and penalties for reliability services are sufficient. We generally support moving towards rules that enable storage resources to provide the broadest suite of reliability services possible. However, because we are just beginning to understand the different types of services that storage can provide, as well as the real-time economic decisions and tradeoffs that come from providing multiple services, we find it prudent to be more restrictive at this time to ensure that safety and reliability are not compromised. For reliability services, there are reliability impacts to the system if the resource does not follow instructions from the CAISO or utility, such that simply relying on market prices or penalizing a resource financially for not being available for its contractual obligation may be an insufficient incentive.

For example, in the case that a storage resource is providing transmission or distribution service, and the provision of that service means that the CAISO or utility have foregone transmission and distribution upgrades, it is critical, for the reliability and safety of the grid, that the storage resource perform as needed. Provision of such services in real time should not be left entirely to the resource operator's financial optimization. We are not comfortable that a sufficient set of penalties can be created in the short term

to address this concern, and current rules, must-offer obligations, contracts and penalties were not designed with the provision of more than one reliability service by the same capacity in mind. This decision and these rules represent a new paradigm, and the storage industry is not primarily tasked with ensuring the reliable operation of the grid. Thus, it is insufficient to simply rely upon existing penalties and rules to ensure real time reliability performance.

That said, we are cognizant that these rules will need to evolve over time as market prices, penalties, and services continue to evolve, and that allowing some flexibility for storage resources to provide multiple reliability services in the near term may provide important learning opportunities to inform future policymaking. Further, the opportunity to evaluate the potential implications from overlapping reliability services can be further evaluated if and when specific multiple-use applications are brought before the Commission for consideration. With this in mind, we note that Rule 6 has been refined from the original Report, which stated that no storage resource could provide more than one reliability service, regardless of whether or not the obligation to perform the services occurred over the same time interval. As the Revised Report mentions, this modification allows for more flexibility, and greater diversity of use cases, while still ensuring that reliability services take precedent. In response to comments on the Proposed Decision, we have made edits to Rule 6 to further support this approach. As edited, the new Rule 6 says:

Rule 6. Priority means that a single storage resource must not enter into two or more reliability service obligation(s) such that the performance of one obligation renders the resource from being unable to perform the other obligation(s). New agreements for such obligations, including contracts and tariffs, must specify terms to ensure resource availability, which may include, but should not be limited to, financial penalties.

Today, as Rule 7 highlights, resource adequacy capacity may provide any wholesale market service to fulfill its must offer obligation. To restrict this ability, and only for storage, would be unnecessarily restrictive and discriminatory. With the edit to

Rule 6, the exception that allowed for resource adequacy contracts concurrent with other reliability obligations, is subsumed into Rule 6 and thus Rule 7 is redundant and can be deleted.¹¹

Rule 8 provides further refinement to Rules 5 and 6, by requiring storage providers to demonstrate adherence to these rules for reliability services. Specifically, Rule 8 requires storage providers to show, when contracting for reliability services, that there will be capacity dedicated to that reliability service. In response to comments on the Proposed Decision, we have made minor edits to Rule 8 to further support this approach. As edited, the new Rule 8 says:

Rule 8. If using different portions of capacity to perform services, storage providers must clearly demonstrate, when contracting for services, the total capacity of the resource, with a guarantee that a certain, distinct capacity be dedicated and available to the capacity-differentiated reliability services

4.1.3. Rules 9 and 11

Rule 9 provides that enforcement and penalties must be known upfront so that storage providers fully understand, and quantify, any risk in providing services. Rule 11 provided that storage providers must meet all requirements if they are contracting to avoid a transmission or distribution upgrade. In the Proposed Decision, these services were singled out because of their importance to reliability; however, we indicated that this rule should not be interpreted to mean that complying with performance requirements for resource adequacy services (all of which are deemed reliability services in the Revised Report) or wholesale market services, are simply optional or that any penalty would or should be waived. We have now modified Rule 11 to conform to this intent. The modified Rule 11 now reads:

¹¹ For ease of reference, we will retain the numbering for Rules 8 through 12 in the discussion section of this decision, although we now adopt only 11 rules. Appendix A reflects the adopted renumbered rules.

Rule 11. For all services, the storage resource must comply with availability and performance requirements specified in its contract with the relevant authority

4.1.4. Rule 10

Rule 10 is intended to promote transparency and ensure the most competitive price for ratepayers. This rule requires storage providers to make known to the utility any service it is currently providing or intends to provide, and consider these when pricing services offered to the utility in order to impose some discipline on ratepayer cost. When all providers are providing a single service, cost discipline is typically achieved through competition via the Request for Offers (RFO) process for that service. The Revised Report does not propose or require any CPUC oversight of the earnings of storage developers, nor do we assign that authority to the utilities.

Based on our review of the Revised Report, we believe some minor changes are needed to Rule 10. In the Revised Report, the first sentence of Rule 10 used the word “serves.” We have modified this to “provides” which appears more consistent with our goal of disclosure and transparency. The first sentence has also been broken into two, the first dealing with services already provided, and the second establishing an ongoing obligation to report additional services added to the entities that contract with the resource. These minor edits do not substantially modify the meaning of Rule 10. In addition, we clarify that the purpose of this rule is transparency rather than addressing revenue for storage providers.

After review of comments on the Proposed Decision, we have removed language directed utilities take the price of those additional services into account in evaluation and make clear how they will approach valuation of multiple services. This change ensures that the focus of this rule is on disclosure and transparency. Thus, the Rule 10 we adopt is as modified below:

Rule 10. In response to a utility request for offer, the storage provider is required to list any additional services it currently provides outside of the solicitation. In the event that a storage resource is enlisted to provide

additional services at a later date, the storage provider is required to provide an updated list of all services provided by that resource to the entities that receive service from that resource. The intent of this Rule is to provide transparency in the energy storage market.

4.1.5. Rule 12

Rule 12 is an interim rule intended to avoid double compensation. This rule reflects the input of many parties that compensation and credit should only be allowed for services that are incremental, measurable and distinct. This is an interim rule, which may be further refined through the working group process.

4.2. Should the CPUC Defer Certain Issues to a Working Group?

The Revised Report recommends that a number of issues require further discussion before developing final rules, and recommends that the CPUC Energy Division staff, in coordination with the CAISO, establish a working group to develop clear, actionable recommendations on the following issues, and submit their recommendations to the CPUC. The proposed categories of issues to be discussed by a working group(s) are as follows:

- Compensation for CPUC jurisdictional services;
- Appropriate metering, measurement, and accounting for Multiple-Use Applications beginning with time-differentiated Multiple-Use Application first, then capacity-differentiated and, finally, simultaneous Multiple-Use Application;
- CPUC-jurisdictional enforcement of Multiple-Use Application rules, beyond that which is stated in this proposal. Such enforcement includes, but is not limited to, contract provisions;
- Incrementality – any refinements to the preliminary rule set forth in this proposal;
- Any modifications to CPUC-jurisdictional rules or tariffs in order to actualize the rules and principles set forth in this proposal;
- Enabling a subset of a distributed energy resource aggregation to provide distribution-level services; and

- Any other issues within the CPUC's jurisdiction that the working group identifies.

We defer most of these issues to a working group process so that further discussion and development can occur. We adopted several preliminary rules to support the 2018 storage procurement solicitations, but for each of the deferred topics we determine that more time should be taken on these topics so that robust rules can be adopted, should rules be necessary. While the Revised Report included Compensation for CPUC Jurisdictional Services as a specific topic, we will leave it to the working group to determine whether this issue requires additional development beyond the discussion of incrementality. We briefly discuss each topic that the working group must address below.

4.2.1. Appropriate Metering, Measurement, and Accounting Methodologies for Multiple-Use Applications

This topic ties closely to the topics of compensation, incrementality and enforcement. In order to accurately track, record, and compensate resources providing multiple services, additional measurement and/or metering protocols may be necessary. Staff recommends the working group organize this work by focusing first on time-differentiated Multiple-Use Application, then capacity-differentiated and, finally, simultaneous Multiple-Use Application, based on an assumed declining order of difficulty.

Parties also offered substantial comment on rules for measurement and metering of services for resources located behind-the-meter, particularly as it relates to participation of BTM resources in the wholesale market. Currently, there are two ways for BTM resources to participate in the wholesale market: The first is indirectly, such as where the storage device acts as Proxy Demand Resource (PDR). No additional metering is required for this type of participation, and BTM storage providers are already participating as a PDR today. The second type is direct participation in the wholesale market as a non-generator resource (NGR). Many parties, including but not limited to

PG&E, SDG&E, and Stem, recommended further discussion for behind-the-meter resources to participate as a NGR, and specifically the accounting methodologies necessary to determine incrementality and to determine the split between wholesale and retail on an on-going operational basis. As noted in the outline in Section 4.2, the Working Group is tasked with further discussing and developing appropriate metering and measurement methodologies. We expect the working group to also tackle the topic of appropriate measurement and metering for behind-the-meter storage systems participating in NGR.

4.2.2. Enforcement of Multiple-Use Application Rules

There was little discussion in the Report or comments of enforcement of Multiple-Use Application rules. The Revised Report incorporates several rules that apply to solicitations, storage provider bids and utility offerings and contracting, to enable application to the 2018 storage RFO. Additional enforcement may or may not be necessary. Stakeholders in the Working Group should address whether any other program rules and utility tariffs may need to change to enable the Multiple-Use Application structure staff describes in the Revised Report.

4.2.3. Incrementality

We received very specific recommendations on incrementality from PG&E, but few comments from others. We are adopting an interim rule for purposes of upcoming procurement activities. We also note that incrementality rules are either in place or in process for other programs including, but not limited to, the IDER process. The working group should discuss and develop any rules specific to Multiple-Use Applications, in consideration of existing rules for other programs, which may require modification.

4.2.4. Modifications to CPUC-jurisdictional Rules or Tariffs

Stakeholders in the Working Group should address whether any other CPUC-jurisdictional rules and tariffs may need to be modified to actualize Multiple-Use Application configurations. Such modifications were not the focus of the Report or

comments, and such modifications may be outside the CPUC's jurisdiction or the scope of this proceeding, so we defer to a working group to develop actionable recommendations. In particular, we seek input from the Working Group on whether modifications to Rules 6 are necessary to support moving towards rules that enable storage resources to provide the broadest suite of reliability services possible while still ensuring reliability.

4.2.5. Enabling Distribution-Level Services

This topic was not discussed in either the Report or Revised Report and, thus, was not explicitly discussed in comments. CPUC and CAISO staff recommend exploring this issue in the working group, based on their assessment that this use case is likely in the very near term. The working group should draw from experience in the IDER pilot and related experience.

4.2.6. Working Group Process and Deliverables

The working group shall be convened by the Energy Division, in coordination with CAISO staff, and Energy Division will establish any necessary processes or ground rules for its operation. All interested parties are welcome to participate. The first meeting shall be held no later than 45 days from the effective date of this decision. Energy Division may direct the utilities to provide administrative support of the working group process. The working group is required to produce a Compliance Report with clear recommendations for any new rules or modifications to existing rules, or further Commission action, on the above-referenced issues. The working group may also provide recommendations for further refinements to any of the other rules and services adopted in this decision, as necessary. Energy Division has final approval of working group deliverables including content and format. The working group shall file this Compliance Report in this proceeding, or its successor, no later than six months from the date of the first working group meeting.

5. Station Power Related Issues Deferred from D.17-04-039

D.17-04-039 deferred two station power related issues to this decision on Multiple-Use Applications: (1) appropriate metering arrangements for in-front-of-the-meter systems; and (2) station power treatment for storage resources located behind the utility meter and participating in the wholesale market as a demand response resource. Based on party comments and subsequent filings, we determine that two meters are not required at this time, and that Load Serving Entities and storage providers must determine and establish up-front their desired metering configuration. Even though we deferred this issue, the utilities proposed several options for recording station power consumption for storage resources in their station power tariff filings, one of which is direct metering. We found those tariffs and agreements to be reasonable, and have approved them¹² and therefore see no need for further decision-making on this topic.

Regarding the station power treatment for behind-the-meter resources participating in the wholesale market as a demand response resource, we are convinced by party comments, as well as the discussion at the June 2, 2017 workshop, that for the time being all charging energy used entirely for on-site purposes, whether or not that use is to support a demand response program dispatch in the wholesale market, should be treated as retail. We decline to adopt a methodology for separating the treatment of wholesale and retail activity behind the retail meter for two reasons: First, it is clear that implementation is complex and still requires significant work. While the detailed measurements needed to separate station power (and, similarly, measure incrementality) could feasibly be accomplished through direct metering of the storage resource, the larger and more complex issue is the accounting methodology and protocols necessary to

determine the split between wholesale and retail on an on-going operational basis. CESA and SCE, in particular, discussed this issue at length in comments and reply comments, and we appreciate their focus and creative thinking on this topic; however, we agree with several of the parties that this issue requires more in-depth discussion and analysis, particularly in regards to potential gaming concerns.

Second, storage companies that develop behind-the-meter projects – Stem, AMS and Tesla – all stated in comments on the Report that permitting a non-exporting storage device to charge at wholesale is either not desirable or not a priority issue at this time. GPI also took this position in comments. Given both, we decline to further pursue this matter, but may do so in the future, as and if appropriate; because this issue overlaps with the metering and accounting rules necessary to determine incrementality of compensation, the working group may want to simultaneously address this issue as part of the discussion in Section 4.2.1.

6. Application of Adopted Rules to 2018 Request for Offers

We require these rules and principles to apply to the 2018 storage RFO, and be reflected in contracts, whether or not a specific wholesale service procured by the utility is offered to the utility or to the market. Although this decision sets forth some remaining issues for the Working Group to address, as needed, there are still a number of different combinations of multi-use storage applications able to occur today using the rules adopted in this decision. Utilities may continue to request certain wholesale market services, in addition to distribution level or resource adequacy services. In addition, the utilities shall not unreasonably restrict a storage provider's ability to provide multiple services so long as those services do not conflict with the framework adopted today or the

¹² The CPUC Energy Division Director approved SDG&E Advice Letter 3084-E and PG&E Advice Letter 5076-E by disposition letter on July 17, 2017. SCE AL 3609-E was approved by the Commission with Resolution E-4876 on August 24, 2017.

specific contractual terms of the utility's solicitation. For storage projects that are either owned or controlled entirely by the utility, we encourage the utility to maximize value to ratepayers by providing multiple services, consistent with the rules we adopt here.

To the extent that utilities procure distribution level services in their 2018 storage RFOs, we direct that the services reflect those listed below consistent with D.16-12-036:

- Distribution Capacity services are load-modifying or supply services that distributed energy device/resources provide via the dispatch of power output for generators or reduction in load that is capable of reliably and consistently reducing net loading on desired distribution infrastructure;
- Voltage Support services are substation and/or feeder-level dynamic voltage management services provided by an individual device/resource and/or aggregated device/resources capable of dynamically correcting excursions outside voltage limits as well as supporting conservation voltage reduction strategies in coordination with utility voltage/reactive power control systems;
- Reliability (Back-Tie) services are load-modifying or supply services capable of improving local distribution reliability and/or resiliency. Specifically, this service provides a fast reconnection and availability of excess reserves to reduce demand when restoring customers during abnormal configurations; and
- Resiliency (microgrid) services are load-modifying or supply services capable of improving local distribution reliability and/or resiliency. This service provides a fast reconnection and availability of excess reserves to reduce demand when restoring customers during abnormal configurations.

7. Outstanding Procedural Matters and Next Steps

The CPUC affirms all rulings made by the assigned Commissioner and assigned ALJ. All motions not previously ruled on are deemed denied.

This rulemaking was opened to consider refinements to energy storage policies in light of initial implementation experience. The utilities continue to make steady progress towards meeting their energy storage procurement goals and integrating energy storage into all source procurement solicitations. Many contracted energy storage resources are

just coming online or will come online over the next few years. Therefore, we see no need to leave this proceeding open, nor will we open a new energy storage rulemaking at this time. Rather, we direct Energy Division staff to prepare and present a report to the CPUC no later than 90 days following the Compliance Report filing in Ordering Paragraph 4 on the state of utility energy storage procurement, a survey of the market, a recommendation on whether additional refinements to the energy storage procurement framework or policies are required, and procedural options for accomplishing any needed refinements or recommendations by the working group. This approach will allow the CPUC to integrate any necessary work into its annual work plan process based on the best information available at the time to help inform whether a new storage rulemaking should be instituted.

8. Categorization and Need for Hearing

The January 5, 2016 Scoping Memo and Ruling of the Assigned Commissioner and Administrative Law Judge affirmed the categorization of this proceeding as quasi-legislative and determined that no hearings would be necessary for Track 2 of R.15-03-011.

9. Comments on Proposed Decision

The proposed decision of Commissioner Peterman 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 November 28, 2017 by PG&E, SCE, SDG&E, TURN, AMS, CESA, Clean Coalition, GPI, Stem, SunRun, and Tesla, and reply comments were filed on December 4, 2017 by PG&E, SCE, CAISO, CESA, Stem, and Tesla. Minor modifications have been made throughout the decision to improve clarity.

10. Assignment of Proceeding

Carla J. Peterman is the assigned Commissioner and Michelle Cooke is the assigned ALJ in this proceeding.

Findings of Fact

1. Current market rules (i.e., utility standard contracts and program tariffs) do not support the ability of an energy storage resource to access, or “stack,” more than one service, including any incremental values to the wholesale market, distribution grid, transmission system, resource adequacy requirements and customers.
2. Definitions for service domains, and further division of services into reliability and non-reliability services, facilitate provision of multiple services by energy storage resources.
3. For energy storage resources to provide multiple services, a clear priority must be established for which services are most critical in order to assure reliability.
4. The issues described in Section 4.2 would benefit from additional development through a working group process.
5. Until additional information is available from current implementation experience, there are no remaining issues that require resolution in this rulemaking.

Conclusions of Law

1. We should adopt the definitions of service domains, reliability services, and non-reliability services set forth in Table 1.
2. The eleven rules set forth in Appendix A empower market actors to select the most optimal and cost-effective use cases for their specific energy storage resource.
3. The eleven rules set forth in Appendix A establish priority for providing reliability services when multiple services can be delivered by the same energy storage resource.
4. The eleven rules set forth in Appendix A should be adopted.
5. Future energy storage procurements should reflect the definitions and rules adopted in this decision, which may be modified in the future.
6. A working group process will facilitate development of clear recommendations for new rules or modifications to existing rules, or further CPUC action, on the issues set forth in Section 4.2, with the exception of Compensation for CPUC Jurisdictional Services.

7. Rather than open a new rulemaking now, Energy Division should prepare and present a report to the CPUC on the state of utility energy storage procurement, a survey of the market, a recommendation whether additional refinements to the energy storage procurement framework or policies are required, and procedural options for accomplishing any needed refinements or recommendations by the working group.

O R D E R

IT IS ORDERED that:

1. The definitions of service domains, reliability services, and non-reliability services set forth in Table 1 are adopted.

2. Pacific Gas and Electric Company, Southern California Edison Company, and San Diego Gas & Electric Company must reflect all eleven rules set forth in Appendix A, in their 2018 storage procurement applications, standard contracts, and evaluation protocols, which are to be filed no later than March 1, 2018. Nothing in the eleven rules is intended to limit a utility's ability to designate the specific services it is seeking in its 2018 storage procurement.

3. Pacific Gas and Electric Company, Southern California Edison Company and San Diego Gas & Electric Company must reflect all eleven rules set forth in Appendix A, in all procurement processes in which storage is procured including, but not limited to, local capacity procurement, the Integrated Distributed Energy Resources procurements for distribution grid services, and procurement resulting from the Integrated Resource Plan. Nothing in the eleven rules is intended to limit a utility's ability to designate the specific services it is seeking in its 2018 storage procurement.

4. The Energy Division, in coordination with California Independent System Operator, shall convene a working group no later than 45 days from the effective date of this decision to produce a Compliance Report with clear recommendations for new rules or modifications to existing rules, or further Commission action, on the issues set forth in Section 4.2 of this decision, with the exception of Compensation for California Public

Utilities Commission Jurisdictional Services. Energy Division may direct the utilities to provide administrative support of the working group process. Pacific Gas and Electric Company, Southern California Edison Company and San Diego Gas & Electric Company shall file the Compliance Report, on behalf of the working group, in this proceeding, or its successor, no later than six months from the date of the first working group meeting.

5. Energy Division must prepare and present a report to the California Public Utilities Commission no later than 90 days following the Compliance Report filing in Ordering Paragraph 4 on the state of utility energy storage procurement, a survey of the market, a recommendation on whether additional refinements to the energy storage procurement framework or policies are required, and procedural options for accomplishing any needed refinements or recommendations by the working group.

6. Rulemaking 15-03-011 is closed.

This order is effective today.

Dated _____, at San Francisco, California.

GLOSSARY

AB	Assembly Bill
ALJ	Administrative Law Judge
AMS	Advanced Microgrid Solutions, Inc.
CAISO	California Independent System Operator
Calpine	Calpine Corporation
CCA	Community Choice Aggregation
CEC	California Energy Commission
CEP	consistent evaluation protocol
CESA	California Energy Storage Alliance
CPUC	California Public Utilities Commission
D.	Decision
DC	direct current
ESDER	Energy Storage and Distributed Energy Resources stakeholder initiative
ESP	Energy Service Provider
First Scoping Memo and Ruling	June 6, 2015 Scoping Memo and Ruling
GPI	Green Power Institute
IDER	Integrated Distributed Energy Resources
MW	Megawatt
PCIA	Power Charge Indifference Adjustment
PG&E	Pacific Gas and Electric Company
PHC	Prehearing Conference
Program	Energy Storage Procurement Framework and Design Program
R.	Rulemaking
Report	Joint Workshop Report and Framework - Multiple-Use-Applications for Energy Storage
Revised Report	Joint Workshop Report and Framework - Multiple-Use-Applications for Energy Storage REVISED
RFO	Request for Offers
SCE	Southern California Edison Company
SDG&E	San Diego Gas & Electric Company

Second Scoping Memo and Ruling	January 5, 2016 Scoping Memo and Ruling
SGIP	Self-Generation Incentive Program
Stem	Stem, Inc.
Storage Roadmap	California Energy Storage Roadmap
SunRun	SunRun, Inc.
Tesla	Tesla, Inc.

APPENDIX A
ADOPTED RULES

These are interim rules, which may be further refined through the working group process.

Rule 1. Resources interconnected in the customer domain may provide services in any domain.

Rule 2. Resources interconnected in the distribution domain may provide services in all domains except the customer domain, with the possible exception of community storage resources, per Ordering Paragraph 11 of D.17-04-039.

Rule 3. Resources interconnected in the transmission domain may provide services in all domains except the customer or distribution domains.

Rule 4. Resources interconnected in any grid domain may provide resource adequacy, transmission and wholesale market services.

Rule 5. If one of the services provided by a storage resource is a reliability service, then that service must have priority.

Rule 6. Priority means that a single storage resource must not enter into two or more reliability service obligation(s) such that the performance of one obligation renders the resource from being unable to perform the other obligation(s). New agreements for such obligations, including contracts and tariffs, must specify terms to ensure resource availability, which may include, but should not be limited to, financial penalties.

Rule 7. If using different portions of capacity to perform services, storage providers must clearly demonstrate, when contracting for services, the total capacity of the resource, with a guarantee that a certain, distinct capacity be dedicated and available to the capacity-differentiated reliability services.

Rule 8. For each service, the program rules, contract or tariff relevant to the domain in which the service is provided, must specify enforcement of these rules, including any penalties for non-performance.

Rule 9. In response to a utility request for offer, the storage provider is required to list any additional services it currently provides outside of the solicitation. In the event that a storage resource is enlisted to provide

additional services at a later date, the storage provider is required to provide an updated list of all services provided by that resource to the entities that receive service from that resource. The intent of this Rule is to provide transparency in the energy storage market.

Rule 10. For all services, the storage resource must comply with availability and performance requirements specified in its contract with the relevant authority.

Rule 11. In paying for performance of services, compensation and credit may only be permitted for those services which are incremental or distinct. Services provided must be measurable, and the same service only counted and compensated once to avoid double compensation.

(End of Appendix A)

APPENDIX B

REVISED

**Joint Framework
Multiple-Use Applications for Energy Storage
CPUC Rulemaking 15-03-011 and
CAISO ESDER 2 Stakeholder Initiative**

August 7, 2017

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Introduction

On May 3, 2016 the California Public Utilities Commission (CPUC or Commission) and the California Independent System Operator (CAISO) (hereafter “we”) held their first joint workshop on the topic of multiple-use applications (MUA) for energy storage systems. The workshop was part of both CPUC Energy Storage Rulemaking (R.) 15-03-011 Track 2 and the CAISO’s Energy Storage and Distributed Energy Resources Phase 2 (ESDER 2) stakeholder initiative. Parties to Rulemaking (R.) 15-03-011 filed post-workshop comments and reply comments on multiple-use applications on May 13th and 20th, respectively. At the workshop, both a vision and problem statement were presented, to guide this effort. We modify these vision and problem statements slightly, only to reflect the breadth of applications addressed in this paper, and reiterate them here:

Problem statement: Current market rules do not support stacking of incremental values that energy storage systems can provide to the wholesale market, distribution grid, transmission system, and customers. As a result, energy storage cannot yet provide the full scope of multiple benefits and services it is capable of and realize its full economic value to the electricity system.

Vision: To enable energy storage systems to stack incremental value and revenue streams by delivering multiple services to the wholesale market, distribution grid, transmission system and customers. Achieving this vision increases the value of storage, and potentially other forms of energy resources, and enhances its economic viability and cost-effectiveness.

On May 15, 2017, the CPUC released a joint CPUC-CAISO staff proposal in R.15-03-011 that proposed to define clear rules for which combinations of revenue streams storage providers may access, and to identify and propose ways to address regulatory and market barriers to applications of storage connected in each of the three grid domains – customer, distribution and transmission.¹ The CAISO and CPUC staff held a workshop to discuss the proposal on June 2, 2017. Parties filed comments on June 16, 2017 and reply comments on June 30, 2017. This paper is revised to reflect input received by parties, to the overall framework, rules and structure. Issues within the CAISO’s jurisdiction will be resolved, if necessary, within the appropriate stakeholder process.

This paper describes a framework, with rules and principles, for the services that may be stacked and compensated. This paper includes a proposal for a working group to resolve additional issues that are not addressed here.

¹ This report uses the term “grid domain” to denote the three levels of the electric system at which a storage device may be interconnected – behind the customer meter, on the utility distribution system, or on the transmission system. The term “service domain” indicates the level of the electric system in which the device may provide services, which includes wholesale market and resource adequacy in addition to the three grid domains. Later sections of this report explain these terms in detail.

Clarifications & Major Revisions

Following are responses to several requests for clarification in party comment, as well as major revisions resulting from comments. The revisions and clarifications are also reflected throughout the body of the framework.

Device vs. Resource vs. Capacity

Many parties raise concerns that the paper does not clearly distinguish the terms device, resource and capacity, thus potentially creating confusion and implementation hurdles for aggregated small storage systems and some types of MUA. We clarify here that the term “device” means a single functional piece of storage equipment at a single point of interconnection in one of the three grid domains. A storage “resource” that provides services in any of the service domains can be comprised of either a single device or an aggregation of devices at multiple points of interconnection. The term “capacity” refers to (a) a measure of a resource’s total physical capability to provide any given service, or (b) a portion of a resource’s total physical capability that may be dedicated to a particular service. Usage (b) explicitly recognizes the possibility that a resource – a single device or an aggregation of devices – may dedicate different portions of its physical capability to different services.

Distinct Types of MUAs

In comments, PG&E recommends that three categories of MUA be created – 1) time differentiated MUA, 2) capacity differentiated MUA, and 3) simultaneous MUA. Many other parties also support such a categorization. We concur with this structure in general, and discuss the application of these three MUA types later in this paper.

Modifications to List of Services

Parties recommended the following modifications to the list of 20 services contained within the original staff proposal. Within the customer domain, parties requested that “Demand Response Program” participation be added and “Increased PV self-consumption” be modified to “Increased self-consumption of on-site generation”. Within the wholesale market domain, parties request that the Flexible Ramping Product be added. Parties also recommend that system capacity be moved from the list of non-reliability services to the list of reliability services in the resource adequacy service domain, and that all distribution level services be classified as reliability. We make these changes here.

Parties request that the jurisdiction for each service be listed. Simply put, all services in the customer, resource adequacy (RA) capacity procurement and distribution domain are jurisdictional to the CPUC. All services in the transmission and wholesale market domains are jurisdictional to the CAISO. In the resource adequacy service domain, the must offer obligations associated with each type of RA capacity are jurisdictional to the CAISO.

We concur with parties that in many cases a storage resource may only provide services that are determined to be needed prior to the resource contracting for or offering the service. However, this principle is not universally relevant. We adopt it for services in the distribution, transmission, and resource adequacy domains. We do not adopt this principle for the customer and wholesale market domains.

Issues Deferred to Working Group

We agree with many parties that a number of issues require further discussion and development. Thus, to that end, we recommend that the CPUC Energy Division staff, in coordination with the CAISO, establish a working group or series of working groups to develop clear, actionable recommendations on the following issues, and submit their recommendations to the Commission. All interested parties may participate in the working group(s). In addition we anticipate that the CAISO will open its own initiative in the near future to address issues that are within its scope of responsibilities and jurisdiction. The categories of issues to be included in the CPUC Energy Division-led working group(s) are as follows:

- ◆ Compensation for CPUC jurisdictional services.
- ◆ Appropriate metering and measurement for MUAs.
 - CPUC staff recommends the discussion begin with time-differentiated MUA first, then capacity-differentiated and, finally, simultaneous MUA as the more complicated].
- ◆ CPUC-jurisdictional enforcement of MUA rules, beyond that which is stated in this proposal. Such enforcement includes, but is not limited to, contract provisions.
- ◆ Incrementality – any refinements to the preliminary rule set forth in this proposal.
- ◆ Any modifications to CPUC-jurisdictional rules or tariffs in order to actualize the rules and principles set forth in this proposal.
- ◆ Enabling a subset of a DERA to provide distribution-level services.
- ◆ And any other issues within the CPUC's jurisdiction that the working group identifies.

The CAISO will inform stakeholders via a market notice in the near future regarding the scope of issues to be considered in a CAISO stakeholder initiative.

Principles: Domain, Service and Time

The following basic terms and parameters guide our multiple use application framework. This discussion is organized into three key areas – domain, service, and time.

Domain

Domain generally refers to the categorization of both the physical point of interconnection, or location on the grid, of a storage resource, as well as the categorization of uses, or services, that are possible. We define two types of domain – grid domains and service domains – below:

- *Grid Domain:* Grid domain refers to the physical point of interconnection of the storage asset. Grid domains are the same three domains defined in Decision (D.) 13-10-040, and around which the California storage mandate is designed. Those three grid domains are: customer (i.e., behind the end use customer meter), distribution, and transmission. These domains have been defined previously in this proceeding, and we do not reiterate that definition here.
- *Service Domain:* Service Domain refers to the five (5) distinct areas in which a resource may provide services. In consideration of comments, and the specifics and complexities of California's unique electricity market design, we propose redefining the domains that have been used to date. As shown in Table 1, the definition we propose here includes the three grid domains, transmission, distribution and customer, as defined by Decision (D.) 13-10-040, and adds the wholesale market and resource adequacy as two separate additional service domains.

Service

The term service, as we use it here, is synonymous with “use”. Thus, the term *multiple use applications* is synonymous with *multiple service applications*. Within each domain there are several possible services, or uses, that a storage resource may provide. For example, in the end-use customer domain the resource may provide time-of-use load shifting and demand-charge management; in the wholesale domain a resource may provide energy, contingency reserves, and regulation. We propose twenty-two (22) services across these five domains.

Table 1. Service Domains & Services

Service Domain	Service
Customer	TOU bill management
	Demand charge management
	Increased self-consumption of on-site generation
	Back-up power
	DR program participation
Distribution²	Distribution capacity/deferral
	Reliability (back-tie) services
	Voltage support
	Resiliency/microgrid/islanding
Transmission	Transmission deferral
	Black start*
	Voltage Support*
	Inertia*
	Primary frequency response*
Wholesale Market	Frequency regulation
	Imbalance energy
	Spinning Reserves
	Non-spinning reserves
	Flexible ramping product (Flexi-Ramp)
Resource Adequacy	System RA capacity
	Local RA capacity
	Flexible RA capacity
<i>*Black start, voltage support, inertia, and primary frequency response have traditionally been obtained as inherent characteristics of conventional generators, and are not today procured as distinct services. We include them here as placeholders for services that could be defined and procured in the future by the CAISO.</i>	

This list is not final, however, and may evolve as more services are identified, created, or more clearly defined, through the appropriate CAISO stakeholder process or CPUC proceeding.

Each one of these services is generally distinct from the other, and there is not cross-over of services between grid domains. For example, a storage resource cannot provide distribution deferral to both the distribution and wholesale domains at the same time, because distribution deferral is specific to the distribution grid domain. However, as discussed further below, a storage resource providing distribution deferral may also provide other services.

² For distribution-level services, the rules, procurement procedures and the services themselves are currently in development in a separate Commission Rulemaking (R.) 14-10-003, the Integrated Distributed Energy Resources (IDER). Ordering Paragraph 2 of Decision (D.) 16-12-036 in R.14-10-003 defines these four product types. Should the product types be modified in R.14-10-003 or a subsequent proceeding, the product types on the distribution system available to storage resources will automatically update.

Note that a resource physically interconnected in one grid domain may provide services in another domain, provided that the other domain is at a higher hierarchical level than the resource's grid domain, with one possible exception, as noted, below. Customer-sited resources may provide services in any of the service domains. Distribution-connected resources may provide distribution and transmission-level services, but not customer services, with the one possible exception of "community storage", the structure and barriers for which are under deliberation by a working group, per Ordering Paragraph 11 of Decision (D.) 17-04-039. Services in the wholesale market and resource adequacy service domains may be provided by resources located in any grid domain.

While rules and principles addressing MUAs with distribution level services are included in this paper, we defer to the Integrated Distributed Energy Resource (IDER) and Distribution Resources Plan (DRP) proceedings for any final procurement or other CPUC rules that may conflict with this framework.

Reliability, Non-Reliability and Resource Adequacy Services

In our review of services, as well as party input, it is clear that it is useful to designate certain services as crucial to the reliable operation of the electricity system. To this end, in this section, we discuss special rules for reliability services and resource adequacy services, in multiple use applications. In establishing the following rules and principles, we clarify that the prioritization of reliability services and resource adequacy services in no way permits LSEs/UDCs to "fence off" non-reliability services.

Reliability and Non-Reliability Services

First, we designate certain services as "reliability services" and others as "non-reliability services" in Table 2, below. Reliability services are generally defined as services that are essential to grid reliability and must be available and perform as required when called. Based on party comment, we re-classify "system capacity" as a reliability service, in the resource adequacy domain and also re-classify all distribution level services as reliability services.

Table 2. Reliability Services and Non-Reliability Services

Domain	Reliability Services	Non-Reliability Services
<i>Customer</i>	None	TOU bill management; Demand charge management; Increased self-consumption of on-site generation; Back-up power; DR program participation
<i>Distribution</i>	Distribution capacity deferral; Reliability (back-tie) services; Voltage support; Resiliency/microgrid/islanding ³	None
<i>Transmission</i>	Transmission deferral; Inertia*; Primary frequency response*; Voltage support*; Black start*	None
<i>Wholesale Market</i>	Frequency regulation; Spinning reserves; Non-spinning reserves; Flexible ramping product	Imbalance energy
<i>Resource Adequacy</i>	Local capacity; Flexible capacity; System capacity	None
*Black start, voltage support, inertia, and primary frequency response have traditionally been obtained as inherent characteristics of conventional generators, and are not today procured as distinct services. We include them here as placeholders for services that could be defined and procured in the future by the CAISO.		

Reliability Services

For reliability services, there can be reliability impacts to the system if the resource does not follow instructions from the ISO or utility distribution company (UDC), so much so that simply relying on market prices or penalizing a resource financially for not being available for its contractual obligation may be an insufficient incentive. For example, in the case that a storage resource is providing transmission or distribution service, and the provision of that service means that the ISO or UDC have foregone transmission and distribution upgrades, it is very important for the reliability and safety of the grid that the resource actually be available and perform as needed. Provision of such services in real time should not be left entirely to the resource operator's financial optimization.

However, as stated in our original proposal, we are cognizant of the reality that resource owners will likely develop storage projects in a capacity greater than is required to fulfill any one obligation, to maximize their ability to provide multiple services while minimizing exposure to penalties for non-performance or for some other reason. Further, we also believe that it is reasonable to allow resource owners to contract for more than one reliability service using the

³ These distribution level services were identified in the Integrated Distributed Energy Resources (IDER) proceeding, R.14-10-003. We note that the definition of these services may change as the IDER proceeding evolves.

same capacity as long as the obligation to provide the services do not overlap and the resource has the physical ability (managing both charging and battery integrity) to meet both obligations. There is no good reason to prevent a storage provider from increasing its service options and managing its risk in this manner as long as the provision of reliability services is guaranteed. To that end, we adopt distinct MUA “types”, as discussed below.

Three Distinct MUA Types

Time Differentiated MUA

In the original joint proposal, we introduced the time consideration to explore two issues: first, the potential for a resource to receive conflicting instructions for how to perform at a given time; and second, the potential for a resource to be double-compensated inappropriately for providing the same service.

We concur that storage providers would ideally be allowed to provide more than one reliability service if the services have different, non-overlapping temporal obligations. We note that the obligation is not the same as the actual performance. Parties comment that what truly matters is the physical ability for a resource to perform subject to an actual dispatch or call, however, availability rules for many services are not designed in this way, and this forum is not appropriate for modifying these rules. The most significant example may be must offer obligations (MOOs) for resource adequacy resources in the wholesale market, which are set in the CAISO tariff.

This paper includes a new rule that, in so far as a storage resource is serving more than one reliability service or need, it may do so as long as the temporal obligations for each service to do not conflict and the storage resource has ample time to recharge sufficient to fully serve each need. The final list of rules and principles, later in this paper, incorporate this concept.

Simultaneous MUA

Simultaneous MUA refers to the provision of services using the same capacity over the same time interval. Indeed, the original proposal focused on a simultaneous MUA structure.

For non-reliability services, the Commission and the ISO agree with designing effective market price signals, financial incentives and possibly penalties associated with each use in a multi-use application in order to drive prioritization of those services, rather than establishing a strict priority of service to which the resource must be dedicated all of the time, regardless of whether the storage provider is utilizing the same or different capacity. Market price signals, financial incentives and penalties may include rates and tariffs applicable to a service, imbalance energy settlement in the wholesale market, as well as specific penalties for non-performance.

Capacity Differentiated MUA

As clarified at the June 2nd workshop, and as stated in Appendix C to the original proposal, if a storage provider elects to provide more than one service using entirely different capacity, these MUA rules do not apply. Thus, there is no need to create a “capacity differentiated MUA” at this time. This framework of principles and rules is focused on instances where double counting or compensation, or competing commitments, may occur. Such issues should not occur with services providing using different capacity. To further clarify this point, see Table 3, below:

Table 3 – Capacity differentiated

	Resource 1	Resource 2	Resource 3
Total capacity	10 MWs	5 MWs	5 MWs
Capacity devoted to reliability services	5 MWs + 5 MWs	5 MWs	5 MWs
Reliability services & associated capacity	Distribution deferral (5 MWs) Transmission deferral (5 MWs)	Reliability (back-tie) services (5 MWs)	Distribution deferral (5 MWs) Primary Frequency Response (5 MWs)
MUA rules apply?	No – resource is free and clear. MUA rules only come into play if the resource adds services to either 5 MW block.	Yes, if resource adds any services to any portion of its capacity.	Yes. MUA not allowed unless services can be effectively differentiated by time.

However, while we do not see a need to create a distinct capacity-differentiated MUA, we do see merit in requiring that storage owners/providers clearly demonstrate when contracting for services both the total capacity of the resource, with a guarantee that a certain, distinct capacity be dedicated and available to the reliability service, whether or not the individual devices within an aggregated resource will always be used to provide it. Further, the working group recommended in this report is tasked with developing any specific measurement or metering protocols for such configurations.

Distribution and Transmission Grid Services

The prior version of this paper included several rules that refer to potential specific requirements for services in the transmission and distribution grid domains. We remove these as rules in this proposal, and also decline to adopt them as “principles”, but mention them here as considerations. First, resources providing transmission deferral or distribution level services may have specific performance or direct control requirements depending on the specific location and nature of the transmission facility being deferred. For reliability services in the

transmission and distribution domains, the ISO and UDC, respectively, may require the resource to respond to a direct operating instruction or a control signal rather than a normal market dispatch. We do not adopt any such requirements here, but note that they may be created in the future if deemed necessary in either this, or a companion, Rulemaking such as IDER. Further, and in response to comments, we advise that the operating characteristics of the storage resource be taken into consideration when using any sort of direct control or requiring the resource to perform outside of its normal schedule. Finally, if a resource is deferring a transmission upgrade it may be required to retain available unloaded capacity that cannot be used for any other service in any domain in order to be able to respond to a contingency event when needed. The precise requirements will typically depend on the location and the specific transmission upgrade being deferred.

Resource Adequacy Capacity

Resource adequacy capacity is classified as system, local, or flexible. The counting rules for system and local RA define the qualifying capacity (QC) of a storage resource to be the maximum discharge rate the resource can sustain for four hours. Thus a storage resource that can store 4 MWh of energy would typically be able to sustain a 1 MW discharge rate for 4 hours and would therefore qualify to provide 1 MW of system or local RA capacity.⁴

If a storage resource receives a capacity payment, and is counted toward an investor owned utility's resource adequacy obligation, then it must participate in the wholesale market and be subject to a must-offer obligation. A must-offer obligation (MOO) is a requirement to bid or schedule the capacity into the ISO's day-ahead and real-time markets in accordance with specific ISO tariff provisions, and to be able to perform to fulfill its ISO schedule or dispatch instructions. This is important to this discussion of multiple use applications, because the MOO requires the resource to participate in the market during specific time periods and with specific rules. The section below describes those rules.

An important feature of the RA MOO is that they apply only to bid submission by the RA resource to the ISO day-ahead and real-time markets. The MOO as structured today does not address real-time performance by the resource. This means that once a resource has received an ISO day-ahead schedule for energy or ancillary services or a real-time dispatch, the ISO makes no distinction between RA and non-RA resources when it comes to real-time performance. Any resource that deviates from its ISO schedule or dispatch instruction in real time is subject to the uninstructed imbalance energy (UIE) settlement at the real-time locational price, but there is no penalty for such deviation. This treatment is the same for RA and non-RA resources. One question to be considered with regard to MUA is whether there should be a stronger financial incentive or some other mechanism to ensure that a storage

⁴ The counting rule for flexible capacity is somewhat more complicated because a storage resource's charging cycle can also provide flexibility value, so the flexible RA capacity of the same 1 MW / 4 MWh storage resource could be somewhat greater than 1 MW. For purposes of this report we focus on system and local capacity.

resource that is paid to provide RA capacity actually delivers the capacity value through its real-time performance.

Even though a storage resource's qualifying capacity (QC) for system or local RA is defined by its 4-hour sustainable discharge rate, many storage resources can operate at a much higher discharge rate. Suppose a storage resource that has 4 MWh storage capacity (thus having QC = 1 MW for RA by the counting rules) can actually discharge at a rate of 16 MW, which would use up its full charge in 15 minutes. Assuming the resource is authorized to operate at this level,⁵ it is possible that the ISO market could use the resource in this manner if needed, in which case the resource would not be available for the full 4 hours. However, because this usage was instructed through the ISO market the resource would have met its MOO. Alternatively, if the resource used up its energy in some other activity outside the ISO market and was not available to the ISO as a result, it would fail to meet its MOO. As noted above, however, if the resource receives an ISO dispatch instruction and fails to comply, today it would be subject only to the UIE settlement. In a future with higher volumes of distributed energy storage able to participate in MUA, the UIE settlement may not be sufficient to ensure that RA resources deliver their full RA value.

As stated in our original proposal, we are cognizant of the reality that resource owners will likely develop storage projects in a capacity greater than is required to fulfill their resource adequacy obligation, to maximize their ability to provide multiple services while minimizing exposure to penalties for non-performance or for some other reason. Further, we also believe that it is reasonable to allow resource owners to contract for other services in addition to resource adequacy using the same capacity as long as the obligation to provide the services do not overlap and the resource has the physical ability (managing both charging and battery integrity) to meet both obligations. There is no good reason to prevent a storage provider from increasing its service options and managing its risk in this manner as long as the provision of reliability services is guaranteed. As stated earlier in this paper, we do not propose to modify MOO availability requirements here.

All Other Services

For any services that are not reliability services or resource adequacy services we do not assign any priority of uses here. For these services, it is appropriate to leave it to the contracting and interested parties to design incentives, penalties, and priority of service if applicable and appropriate to the specific use case. Our purpose in dictating priority and primacy of resource adequacy and reliability service is to ensure reliability of the grid.

⁵ The highest allowable rate at which a resource can discharge energy is set by the terms of its interconnection agreement. Thus if the resource in this example wanted to be able to operate at the 16 MW operating level it must have requested this operating level in its interconnection request and have satisfied all the requirements identified in the interconnection process.

Compensation Principles

We agree with the principle that storage resources may receive revenue from multiple services that are specific and measurable, if those services serve distinct system or customer needs. We concur with many parties, as stated earlier in this paper, that any services provided in the transmission, distribution, or resource adequacy domains must meet an actual determined need. We decline to adopt this requirement for services in the customer or wholesale market domain.

Incrementality

It is reasonable and desirable to permit storage systems to enjoy revenue from multiple services that are specific and measurable, if those services serve distinct system or customer needs. Services provided must be measurable, and the same service only counted and compensated once to avoid double compensation. As a general rule, a utility, UDC or the ISO should not be required to procure or pay for a service that the entity has already planned and paid for. To do so is the textbook definition of double compensation, which we wish to avoid. A preliminary rule in this regard is within the final list of rules and principles later in this paper. The CPUC-CAISO working group we establish here, shall determine whether, and how, this rule should be modified.

Complete List – Proposed Rules for Multiple Use Applications

- 1) Resources interconnected in the customer domain may provide services in any domain.
- 2) Resources interconnected in the distribution domain may provide services in all domains *except* the customer domain, with the possible exception of community storage resources, per O.P. 11 of D.17-04-039.
- 3) Resources interconnected in the transmission domain may provide services in all domains *except* the customer or distribution domains.
- 4) Resources interconnected in any grid domain may provide resource adequacy, transmission and wholesale market services.
- 5) If one of the services provided by a storage resource is a reliability service, then that service must have priority.
- 6) Priority means that a single storage resource may not contract for two or more different reliability services from the same capacity in a single, or multiple, domains, over the same or overlapping time interval for which the resource is committed to perform or be available. The storage provider must not enter into multiple reliability service obligations such that the performance of one obligation renders the resource from being unable to perform the other obligation. An exception for resource adequacy services is noted in Rule 7, below.
- 7) The exception to Rule 6 is for resource adequacy services. A single storage resource may contract for resource adequacy capacity and provide wholesale market reliability

services using the same capacity, and over the same time interval. For example, if a storage resource is providing local resource adequacy capacity, it may meet its resource adequacy must offer obligation (MOO) by providing any service in the wholesale service domain using its resource adequacy capacity.

- 8) If using different portions of capacity to perform services, storage providers must clearly demonstrate when contracting for services both the total capacity of the resource, with a guarantee that a certain, distinct capacity be dedicated and available to the reliability service, whether or not the individual devices within an aggregated resource will always be used to provide it.
- 9) For each service, the program rules, contract or tariff relevant to the domain in which the service is provided, must specify enforcement of these rules, including any penalties for non-performance.
- 10) In response to a utility request for offer (RFO), the storage provider is required to list any additional services it currently serves, or intends to serve, outside of the solicitation, and take the revenue from these services into consideration when pricing offers to the IOUs' solicitation. In its evaluation of bids, the IOUs must take these services into account in evaluating and ranking bid prices. The intent of this Rule is to avoid windfall profits for any storage provider.
- 11) If the reliability service is procured to avoid or defer a transmission or distribution asset upgrade, the resource must comply with availability and performance requirements specified in its contract with the relevant authority.
- 12) In paying for performance of services, compensation and credit may only be permitted for those services which are incremental or distinct. Services provided must be measurable, and the same service only counted and compensated once to avoid double compensation. This is an interim rule, which may be further refined through the working group process.

Appendix A: Glossary

This report uses the following framework and definitions for describing multiple-use applications and considering their feasibility, impacts and potential barriers. The preliminary definitions and concepts listed here are developed in more detail in the body of the report.

Automatic Generation Control (AGC). Generation equipment that automatically responds to signals from the CAISO's EMS control in Real-Time to control the Power output of Generating Units within a prescribed area in response to a change in system frequency, tie-line loading, or the relation of these to each other, so as to maintain the target system frequency and the established Interchange with other Balancing Authority Areas within the predetermined limits.⁶

Contingency. A potential Outage that is unplanned, viewed as possible or eventually probable, which is taken into account when considering approval of other requested Outages or while operating the CAISO Balancing Authority Area or EIM Balancing Authority.⁷

Economic Bid. A Bid that includes quantity (MWh or MW) and price (\$) for specified Trading Hours.⁸

Grid Domain. Grid domain refers to the physical point of interconnection of the storage asset. Grid domains are the same three domains defined in Decision (D.) 13-10-040, and around which the California storage mandate is designed. Those three grid domains are: customer (i.e., behind the end use customer meter), distribution, and transmission. These domains have been defined previously in this proceeding, and we do not reiterate that definition here.

Non-generator Resource (NGR). Resources that operate as either Generation or Load and that can be dispatched to any operating level within their entire capacity range but are also constrained by a MWh limit to (1) generate Energy, (2) curtail the consumption of Energy in the case of demand response, or (3) consume Energy.⁹

Non-Reliability Services. Non-reliability services are services on which the electric system, or an end-use customer, does not depend for reliable operation and delivery of electricity. As with reliability services, this distinction does not depend on how the service was procured.

Proxy Demand Response (PDR). A Load or aggregation of Loads that has the characteristics of a Proxy Demand Resource set forth in Section 4.13.5, satisfies all other requirements applicable to a Proxy Demand Resource set forth in the CAISO Tariff, and is capable of measurably and verifiably providing Demand Response Services pursuant to the Demand Response Provider

⁶ ISO Tariff Appendix A. April 1, 2017.

⁷ Ibid.

⁸ Ibid.

⁹ Ibid.

Agreement, including but not limited to Sections 4.1 and 4.2 of the Demand Response Provider Agreement and excluding Section 4.3 of the Demand Response Provider Agreement.¹⁰

Qualifying Capacity. The maximum Resource Adequacy Capacity that a Resource Adequacy Resource may be eligible to provide. The criteria and methodology for calculating the Qualifying Capacity of resources may be established by the CPUC or other applicable Local Regulatory Authority and provided to the CAISO. A resource's eligibility to provide Resource Adequacy Capacity may be reduced below its Qualifying Capacity through the CAISO's assessment of Net Qualifying Capacity.¹¹

Regulation Energy Management. A market feature for resources located within the CAISO Balancing Authority Area that require Energy from the Real-Time Market to offer their full capacity as Regulation.¹²

Reliability Services. Reliability services are services on which the electric system (transmission or distribution) depend for reliable operation. For example, in the transmission domain reliability services include contingency reserves and any services that are specified for a resource that is procured to avoid or defer a transmission infrastructure upgrade. In contrast, wholesale energy would be a wholesale market service. Note that this distinction does not depend on how the service was procured; i.e., contingency reserves are procured through the wholesale market. What matters is whether the service is critical for the reliable operation of the system.

Same vs. Different Capacity. Provisions governing MUA must distinguish between a resource as a whole and a specific unit or portion of that resource's capacity. In some cases where a resource may not provide two services with the same capacity, it may be possible for the resource to partition its capacity to provide the two services from different dedicated portions of its total capacity.

Self Schedule. The Bid component that indicates the quantities in MWhs with no specification of a price that the Scheduling Coordinator is submitting to the CAISO, which indicates that the Scheduling Coordinator is a Price Taker, Regulatory Must-Run Generation or Regulatory Must-Take Generation, which includes ETC and TOR Self-Schedules, Self-Schedules for Converted Rights, and Variable Energy Resource Self-Schedules.¹³

Service. Within each service domain there are several possible services that a storage resource may provide. For example, in the end-use customer domain the resource may provide time-of-use load shifting and demand-charge management; in the transmission/wholesale domain a

¹⁰ Ibid.

¹¹ Ibid.

¹² Ibid.

¹³ Ibid.

resource may provide energy, contingency reserves, and regulation. We have defined 20 services for the California market.

Services:

- *TOU Bill Management* – Storage resource located behind the meter enables a customer to minimize its exposure to high electricity rates. The customer can charge the storage resource when rates are low and discharge the storage resource when rates are high, thereby offsetting high electricity rates for the customer.
- *Demand Charge Management* – Storage resource located behind the meter enables a customer to minimize its exposure to demand charges. The customer can use the discharge of the storage resource to manage the periods of the highest peaks in electricity usage.
- *Increased PV Self-Consumption* – Storage paired with solar PV, behind the meter, allows for a customer to maximize its on-site consumption of solar energy by allowing the customer to store any excess energy on-site to use during hours when the PV system is not generating.
- *Back-up Power* – A storage resource located behind the customer meter may enable a customer to have “back-up” power for a period of time in the event of a black out or brown out.
- *Distribution Capacity/Deferral* – Load-modifying or supply services that distributed energy resources provide via the dispatch of power output for generators or reduction in load that is capable of reliably and consistently reducing net loading on desired distribution infrastructure.
- *Reliability (Back-Tie) Services* – Load-modifying or supply services capable of improving local distribution reliability and/or resiliency. Specifically, this service provides a fast reconnection and availability of excess reserves to reduce demand when restoring customers during abnormal configurations.
- *Voltage Support – Distribution and Transmission* – Substation and/or feeder-level dynamic voltage management services provided by an individual resource and/or aggregated resources capable of dynamically correcting excursions outside voltage limits as well as supporting conservation voltage reduction strategies in coordination with utility voltage/reactive power control systems.
- *Resiliency/Microgrid/Islanding* – Load-modifying or supply services capable of improving local distribution reliability and/or resiliency. This service provides a fast reconnection

and availability of excess reserves to reduce demand when restoring customers during abnormal configurations.”

- *Transmission Deferral* – Not an ISO tariff defined service at this time
- *Black Start* – The procedure by which a Generating Unit self-starts without an external source of electricity thereby restoring a source of power to the CAISO Balancing Authority Area following system or local area blackouts.¹⁴
- *Inertia* – Not an ISO tariff defined service at this time
- *Primary Frequency Response* – Not an ISO tariff defined service at this time
- *Energy* - The electrical energy produced, flowing or supplied by generation, transmission or distribution facilities, being the integral with respect to time of the instantaneous power, measured in units of watt-hours or standard multiples thereof, e.g., 1,000 Wh=1kWh, 1,000 kWh=1MWh, etc.¹⁵
- *Spinning Reserve* – The portion of unloaded synchronized resource capacity that is immediately responsive to system frequency and that is capable of being loaded in ten (10) minutes, and that is capable of running for at least thirty (30) minutes from the time it reaches its award capacity.¹⁶
- *Non-Spinning Reserve* – The portion of resource capacity that is capable of being synchronized and Ramping to a specified load in ten minutes (or that is capable of being interrupted in ten (10) minutes) and that is capable of running (or being interrupted) for at least thirty (30) minutes from the time it reaches its award capacity.¹⁷
- *Regulation* – The service provided either by resources certified by the CAISO as equipped and capable of responding to the CAISO's direct digital control signals, or by System Resources that have been certified by the CAISO as capable of delivering such service to the CAISO Balancing Authority Area, in an upward and downward direction to match, on a Real-Time basis, Demand and resources, consistent with established NERC and WECC reliability standards, and any requirements of the NRC. Regulation is used to control the operating level of a resource within a prescribed area in response to a change in system frequency, tie line loading, or the relation of these to each other so as to maintain the target system frequency and/or the established Interchange with other Balancing Authority Areas within the predetermined Regulation Limits. Regulation includes both an increase in Energy production by a resource or decrease in Energy

¹⁴ Ibid.

¹⁵ Ibid.

¹⁶ Ibid.

¹⁷ Ibid.

consumption by a resource (Regulation Up) and a decrease in Energy production by a resource or increase in Energy consumption by a resource (Regulation Down). Regulation Up and Regulation Down are distinct capacity products, with separately stated requirements and ASMPs in each Settlement Period.¹⁸

- *Resource Adequacy Resource* – A resource that is designated in a Supply Plan to provide Resource Adequacy Capacity. The criteria for determining the types of resources that are eligible to provide Qualifying Capacity may be established by the CPUC or other applicable Local Regulatory Authority and provided to the CAISO.¹⁹
 - *System RA Capacity* – CPUC Decision (D.) 05-10-042 first defined and established System RA for utilities under the jurisdiction of the CPUC.
 - *Local RA Capacity* – CPUC Decision (D.) 06-06-064 first defined and established Local RA for utilities under the jurisdiction of the CPUC.
 - *Flexible RA Resource* – CPUC Decision (D.) 13-06-024 recognized a need for flexible capacity in the RA fleet and defined flexible capacity for utilities under the jurisdiction of the CPUC.

Service Domain. Service Domain refers to the five (5) distinct areas in which a resource may provide services. In consideration of comments, and the specifics and complexities of California’s unique electricity market design, we propose redefining the domains that have been used to date. As shown in Table 1, the definition we propose here includes the three domains, transmission, distribution and customer, as defined by Decision (D.) 13-10-040, and adds the wholesale market and resource adequacy as two separate additional domains.

Settlement Interval. The five-minute time period over which the CAISO settles cost compensation amounts or deviations in Generation and Demand in the RTM.²⁰

Uninstructed Imbalance Energy (UIE). The portion of Imbalance Energy that is not RTD Instructed Imbalance Energy.²¹

(End of Appendix B)

¹⁸ Ibid.

¹⁹ Ibid.

²⁰ Ibid.

²¹ Ibid.