# Joint Workshop on Multiple-Use Applications and Station Power for Energy Storage

## CPUC Rulemaking 15-03-011 and CAISO ESDER 2 Stakeholder Initiative

## Issue Paper

May 2-3, 2016

April 14, 2016

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# Joint Workshop on Multiple-Use Applications and Station Power for Energy Storage

## Issue Paper

# 1 Introduction

On May 2, 2016 and May 3, 2016 the California Public Utilities Commission (Commission or CPUC) and the California Independent System Operator (CAISO) will jointly hold a workshop on the topics of station power and multiple-use applications of energy storage systems. The workshop is part of both CPUC Rulemaking (R.) 15-03-011 Track 2 and the CAISO's Energy Storage and Distributed Energy Resources Phase 2 (ESDER 2) stakeholder initiative.

## 1.1 BACKGROUND

### *1.1.1 CPUC's Rulemaking (R.) 15-03-011*

On March 26, 2015, the CPUC opened Rulemaking (R.) 15-03-011 to address the enactment and ongoing implementation of Assembly Bill 2514 (Skinner, Stats. 2010 – ch. 469) and to continue to refine policies and program details to implement the 1.325 GW Storage Procurement target. In addition to storage procurement and design program issues, this rulemaking also considers a limited set of action items from the California Energy Storage Roadmap (Storage Roadmap) that relate to planning, market participation, or procurement areas.[1]

The Storage Roadmap was a collaborative effort between the CPUC, the CAISO and the California Energy Commission (CEC) to identify a broad array of challenges and barriers confronting energy storage and aggregated distributed

[1] https://www.caiso.com/Documents/Advancing-MaximizingValueofEnergyStorageTechnology_CaliforniaRoadmap.pdf

energy resources. During the development of the Storage Roadmap, energy storage developers articulated that one of the biggest challenges to realizing the full value of energy storage is the ability for a single installation to provide multiple services to several entities with compensation provided through different revenue streams. Stakeholders provided several examples of multiple-use applications of interest for energy storage.[2] The Commission decided on defining and developing models and rules for multiple-use applications that cross jurisdictions as an issue for further discussion and resolution in Track 2 of the current rulemaking.

On January 5, 2016, the Commission issued a Scoping Memo in Track 2 of R.15-03-011 asking parties to address specific questions regarding multiple-use energy storage applications and Station Power. Parties filed Comments and Reply Comments on February 5 and February 19, 2016, respectively. The scoping memo also noted CAISO's ongoing Energy Storage and Distributed Energy Resources (ESDER) stakeholder initiative to enable wholesale market-level participation of energy storage systems interconnected to the distribution grid.

Besides multi-use application of storage, the workshop will also discuss Station Power in relation to an energy storage system.

### *1.1.2 CAISO's ESDER Initiative*

The CAISO launched the first phase of the ESDER initiative (ESDER 1) in June 2015. Similar to the CPUC's storage rulemaking, the ESDER initiative began with the general intent to address high-priority action items from the Storage Roadmap that call for clarifying existing CAISO requirements, rules, and market products for energy storage and aggregated distributed energy resources, and specifying enhancements to these existing rules. The ESDER initiative's central focus is to lower barriers and enhance the ability of transmission grid-connected energy storage and the many examples of distribution-connected resources to participate in the CAISO market.

[2] Energy Storage Roadmap, Page 14

The scope of ESDER 1 is comprised of three topics areas: (1) enhancements to the CAISO non-generator resources (NGR) model; (2) enhancements to demand response performance measures and statistical sampling for the CAISO proxy demand resource (PDR) and reliability demand response resource (RDRR) market participation models; and, (3) clarifications to rules for non-resource adequacy multiple-use applications. Proposals to enhance the NGR model and demand response performance measures trigger the need for changes to the CAISO tariff, which require approval from the CAISO Board of Governors. The CAISO Board of Governors at its February 3-4, 2016 meeting approved these proposals. The CAISO stakeholder process to develop tariff amendments to implement these proposals is underway.

The CAISO launched ESDER 2 on March 22, 2016, with the issuance of an issue paper. In the issue paper, the CAISO is proposing that the scope of ESDER 2 comprise the following topic areas:

1. Consider two areas of NGR enhancement: (a) represent use limitations in the NGR model; and (b) represent multiple configurations in the NGR model.
2. Consider two areas of demand response enhancement: (a) ability for PDR to be dispatched to both curtail and increase load and provide regulation service; and (b) alternative baselines to evaluate PDR performance. The CAISO is recommending that proposals on both topics be developed through stakeholder-led working groups.
3. Multiple-use applications. To avoid redundant efforts on this topic, the CAISO is initially proposing to work with stakeholders through its participation in the CPUC's R.15-03-011 Track 2 rather than initially in ESDER 2.
4. Resolve the distinction between wholesale charging energy and station power. Although this is a topic in the CPUC's R.15-03-011 Track 2, station power is specifically addressed in the CAISO tariff and the CAISO will address this issue in ESDER 2. However, because coordination on this topic is important, the CAISO intends to also contribute to this topic in R.15-03-011 Track 2.
5. Review the allocation of transmission access charge to load served by DER. This topic was initially raised in the ISO's transmission access

charge options stakeholder initiative. The ISO has determined this topic is more appropriately addressed in the ESDER 2 initiative.

### *1.1.3 Energy Storage Targets*

Commission Decision (D.) 13-10-040 set procurement targets (Table 1) for California's investor owned utilities (IOUs) across three categories -- transmission, distribution, and customer-facing storage deployments. These targets were designed to meet grid and energy management needs.

Table 1. Storage Grid Domain Point of Interconnection

| Storage Grid Domain Point of Interconnection | Total IOU ES Target to be contracted by 2020 |
|---|---|
| Transmission | 700 |
| Distribution | 425 |
| Customer | 200 |
| **Total Targets** | **1,325** |

### *1.1.4 Energy Storage Procurement and Progress*

#### 1.1.4.1 Utility Procurement

The following table illustrates each IOUs target, the status of energy storage procurements as of March 31, 2016 and the remaining targets for 2016 and beyond.

Table 2 – Storage Procurement Summary (in MWs)

| San Diego Gas & Electric | Trans. | Dist. | Customer-connected | Total |
|---|---|---|---|---|
| Established target | 80 | 55 | 30 | **165** |
| Existing projects as authorized[3] | 40 | 6.15 | 4.66 | **50.81** |
| 2014 RFO Procurement (Pending Commission review and approval) | 20 | 0 | 8.29 | **28.29** |
| Targets for 2016 and beyond | 20 | 48.85 | 17.05 | **85.9** |

| Southern California Edison | Trans. | Dist. | Customer | Total |
|---|---|---|---|---|
| Established Target | 310 | 185 | 85 | **580** |
| Existing projects as authorized[4] | 100 | 32.33 | 171.46 | **303.79** |
| 2014 RFO Procurement (Pending Approval) | 0 | 16.3 | 0 | **16.3** |
| Targets for 2016 and beyond | 210 | 136.37 | -86.46[5] | **259.91** |

| Pacific Gas & Electric | Trans. | Dist. | Customer | Total |
|---|---|---|---|---|
| Established Target | 310 | 185 | 85 | **580** |
| Existing projects as authorized[6] | 0 | 6 | 3.5 | **9.5** |
| 2014 RFO Procurement (Pending Approval) | 60 | 15 | 6.5 | **81.5** |
| Targets for 2016 and beyond | 250 | 164 | 75 | **489** |

[3] Attachment A – Summary of Existing Storage Deployment, D.14-10-045.

[4] SCE's existing projects as authorized are from the D14-10-045 and their recent LCR procurement.

[5] The new flexibility rules adopted in the D.16-01-003 allow Southern California Edison (SCE) to apply up to 85 MW of customer-connected storage toward meeting the targets in the transmission and distribution domains.

[6] Attachment A – Summary of Existing Storage Deployment, D.14-10-045.

#### 1.1.4.2 Behind-the-Meter Storage Installations

Besides utility-scale procurement, the Self-Generation Incentive Program (SGIP) is a major driving force for adopting behind-the-meter energy-storage technologies. Under SGIP, Californians have installed 23.78 megawatts (MW) of energy storage systems since storage became eligible in 2008. An additional 87.33 MW in capacity is currently pending in applications under review.

Table 2. SGIP Advanced Energy Storage Systems – Project and Capacity as of April 7, 2016 (Installed and Reserved for pending installations)[7]

| Years 2009-2015 | Projects | Installed Capacity (MW) | Incentive Paid | Reserved Capacity (MW) | Incentives Reserved |
|---|---|---|---|---|---|
| Total | 1,136 | 23.78 | $42,621,155 | 87.33 | $140,432,527 |

# 2 Station Power Issues and Joint Workshop Objectives

Station power is a form of retail electric service provided by load-serving entities (LSEs) to electric generating facilities providing wholesale services.

The principal issue for energy storage is distinguishing between wholesale charging energy that will be resold and "station power," which is energy consumed to operate a generator. This issue is equally relevant to distribution- or transmission-connected storage participating in the wholesale market. The Scoping Memo in R.15-03-011 noted that the treatment of station power in the context of energy storage might not be as straightforward as it is for conventional generating assets. The Commission asked parties to comment on existing or

[7] https://energycenter.org/programs/self-generation-incentive-program/program-statistics

potential rules or guidelines needed to distinguish station power from wholesale charging energy taken in by distribution connected storage assets participating in wholesale markets. The Commission also asked what rate implications there could be for station power in the context of energy storage. The CAISO also is examining this issue in ESDER 2 from the wholesale/transmission perspective.

**Station Power Joint Workshop Objectives**

The CPUC and CAISO have set the following objectives for the workshop:

1. Develop common understanding and background on how station power has been defined for conventional generating resources.
2. Consider similarities and differences for energy storage in comparison to station power for conventional resources.
3. Identify specific energy uses of storage facilities and hear alternative views on whether to classify them as components of station power.
4. Identify measurement issues associated with the components of station power.

## 2.1 Present Rules and Guidelines for Station Power

### *2.1.1 CAISO Rules*

The CAISO tariff defines station power as "energy for operating electric equipment, or portions thereof, located on the Generating Unit site owned by the same entity that owns the Generating Unit, which electrical equipment is used exclusively for the production of Energy and any useful thermal energy associated with the production of Energy by the Generating Unit; and for the incidental heating, lighting, air conditioning and office equipment needs of buildings, or portions thereof, that are owned by the same entity that owns the Generating Unit; located on the Generating Unit site; and used exclusively in connection with the production of Energy and any useful thermal energy associated with the production of Energy by the Generating Unit."[8] The CAISO tariff explicitly states that station power includes, for example, the energy

[8] Appendix A to the CAISO tariff.

associated with motoring a hydroelectric generating unit to keep the unit synchronized at zero real power output to provide regulation or spinning reserve.[9] Importantly, because the CAISO tariff allows for netting of consumption against output within a five-minute interval, station power under the CAISO tariff is only measured as the amount of consumption that exceeds output within a five-minute interval.[10]

### *2.1.2 CPUC Rules*

Per CPUC rules, generators are assessed retail charges towards their station power in accordance with the Otherwise Applicable Tariffs (OATs). The three IOUs have Station Power Self-Supply Schedules with applicable rules.

Prior to the CAISO's current rules on station power, customers who were on a utility's Station Power Self-Supply Schedule (Schedule SPSS) or a similar schedule were under the OATs. The OATs were tariffs previously approved by the Commission as final rates. Station power load subject to the OATs was measured and determined in15-minute metering intervals.

2.1.2.1 Equipment and loads presently considered station power

Per IOU Schedules[11], station power is energy for operating electric equipment or portions thereof, located on the Generating Unit site owned by the same entity that owns the Generating Unit, in which case -

- Electrical equipment is used exclusively for –

[9] Station power does not include any energy used to power synchronous condensers; used for pumping at a pumped storage facility; provided during a black start procedure; or to serve loads outside the CAISO BAA.

[10] See Sections 10.1.3, 10.2.9.2, and 10.3.2.2 of the CAISO tariff.

[11] The above text is from PGE – Schedule S – Standby Service. SCE and SDG&E have a similar Schedule SPSS - Schedule Station Power Self Supply Schedule

- The production of Energy and any useful thermal energy associated with the production of energy by the Generating Unit;
- The incidental heating, lighting, air conditioning and office equipment needs of buildings, or portions thereof, that are owned by the same entity that owns the Generating Unit; located on the Generating Unit site; and

- Station Power Station includes the energy associated with motoring a hydroelectric unit to keep the unit synchronized at zero power output to provide Regulation or Spinning Reserve.
- Station Power does not include any energy used to power synchronous condensers; used for pumping at a pumped storage facility; or provided during a Black Start procedure. Station Power does not include energy to serve loads outside the CAISO Control Area.

## 2.2 New equipment and loads introduced by storage

**Questions**

1. What loads related to energy storage must be considered that are not clearly addressed in existing station power provisions? Considering these, what principles should apply to determine whether they should be categorized as station power versus wholesale consumption for resale?
2. Should battery temperature regulation be considered part of charging (similar to efficiency loss) and subject to a wholesale rate, or should it be considered consumption/station power subject to a retail rate (where consumption exceeds output in an interval)? If the latter, how should temperature regulation be accounted for or metered?
3. Do station power rules apply to BTM storage and do they differ from IFOM storage?

## 2.3 Single-use versus multiple-use applications

1. Does the consideration of station power differ depending on whether the storage facility is in a single-use application (i.e., only participating in the

wholesale market) or in a multiple-use application (i.e., MUA use cases 1, 3, 4, 5).

2. Is the difference simply a metering consideration?

# 3 Joint Workshop on Multiple Use Applications Scope and Objectives

**Vision:**

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

**Problem Statement:**

Due to regulatory and/or market barriers, current market rules do not support the stack[12] of incremental values that distributed energy storage systems can provide to the wholesale market, distribution grid, and end users. 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.

**Objectives of the Multiple Use Application Workshop:**

The CPUC and CAISO have set the following objectives for the workshop:

1. Identify and define multiple-use applications, services and associated "use cases" that can be implemented in the near future.

[12] DOE/ EPRI study defines stacked services as – "the flexibility of storage can be leveraged to provide multiple or stacked services, or use cases, with a single storage system that captures several revenue streams and becomes economically viable." http://www.sandia.gov/ess/publications/SAND2013-5131.pdf

2. Identify relevant regulatory and market barriers and rules, and their limitations and possible modifications that would enable a distributed energy storage system to deliver and receive compensation for multiple services.
3. For issues out of scope of this Rulemaking or current CAISO initiatives, the workshop will document these issues for consideration and possible future resolution in the appropriate CPUC proceeding and CAISO initiative.

## 3.1 Use Cases Defined in R.10-12-007

In the energy storage proceeding R.10-12-007, Energy Division Staff worked to develop seven (7) use cases, which illustrated likely storage deployment on the utility grid and described operational requirements and potential benefits associated with each use case. The use cases fall into three general categories based on the location of the storage: transmission, distribution and customer-connected. [13]

This use case approach addressed market needs by: a) defining the utility system services and functions applicable to each of the specific storage applications for the use case; b) describing the objectives for energy storage under that use case; c) setting operational and technical requirements for storage to provide the stated service or function per the use case; d) assessing the appropriate storage technologies in likely configurations that can provide the technical requirements of the stated service or function; and e) listing alternative non-storage technologies that could potentially meet the same service or function.

[13] The Staff Interim Report and use-case documents are available here: http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M042/K157/42157799.PDF

Table 3: Use Cases Identified in Interim Staff Report (R.10-12-007)

| **STORAGE GRID DOMAINS** (Grid Interconnection Point) | **REGULATORY FUNCTION** | **USE-CASE EXAMPLES** |
|---|---|---|
| **Transmission-Connected** | Generation/Market | **(Co-Located Energy Storage)**<br>Concentrated Solar Power,<br>Wind + Energy Storage,<br>Gas Fired Generation + Thermal Energy Storage |
| | | **(Stand-Alone Energy Storage)**<br>Ancillary Services,<br>Peaker,<br>Load Following |
| | Transmission Reliability (FERC) | Voltage Support |
| **Distribution-Connected** | Distribution Reliability | Substation Energy Storage (Deferral) |
| | Generation/Market | Distributed Generation +<br>Energy Storage |
| | Dual-Use<br>(Reliability & Market) | Distributed Peaker |
| **Behind-the-Meter** | Customer-Sited Storage | Bill Mgt/Permanent Load Shifting,<br>Power Quality,<br>Electric Vehicle Charging |

The Staff Interim Report and use-case documents were entered into the record on January 18, 2013.

This information has been foundational for our work; however, we cannot proceed to resolve the current market needs with use cases defined in the report. For the purposes of this workshop we define a limited set of definitive use cases that are more likely to be implemented in the near future.

## 3.2 Multiple Services Provided by Storage Systems

As noted in a Department of Energy (DOE) workshop report on the Analytical Challenges of Valuing Energy Storage, published in November 2011, the economics of a storage system depend on the compatibility of multiple applications for shared storage capacity, both in terms of revenue recovery through markets and regulatory structures (less transaction costs), and in terms of technical and operational feasibility.[14]

In an attempt to identify and resolve issues for near-term multiple-use applications and its associated use cases, the first logical step is to categorize services provided by these energy storage systems. The CAISO and the CPUC reviewed "The Economics of Battery Energy Storage" paper published by the Rocky Mountain Institute, which identifies a suite of thirteen general services to the electricity system.[15] Tailoring it to the California need, we recognize several of these services under the three areas as:

A. Retail Customer Services – This may include time-of-use bill management, demand charge reduction, back-up power, and increased solar self-consumption. As explained by PG&E in comments on the Track 2 Scoping Memo, "the storage device is located behind the retail meter (BTM), and charged from grid-supplied or self-supplied energy to serve on-site load. Stored energy may be discharged to shift end-use load, thereby reducing retail charges, to enhance reliability, or for other purposes. This end use includes storage of NEM-eligible generation."[16]

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[14] www.energy.gov/eere/analysis/downloads/analytic-challenges-valuing-energy-storage-workshop-report

[15] The Economics Of Battery Energy Storage - HOW MULTI-USE, CUSTOMER-SITED BATTERIES DELIVER THE MOST SERVICES AND VALUE TO CUSTOMERS AND THE GRID, Published October 2015, Page 5

[16] PG&E Opening Comments in Track 2 of R.15-03-011, Page 12

B. Distribution Grid Services – Storage systems providing distribution grid services can be both in-front-of-the-meter (IFOM) and BTM installations. These storage systems can provide distribution asset deferral, reactive supply and voltage control, regulation and frequency response, among others. The storage device is charged and discharged as directed by the utility distribution company to provide for the reliable operation of the distribution system.[17] As highlighted by SDG&E in comments on the Track 2 Scoping Memo, the distribution level grid services can be: "utility owned storage devices that defer conventional distribution system infrastructure investments designed to address peak loading conditions, such as a circuit upgrade or transformer bank, may be needed for a only a limited number of hours and days each year to accomplish their deferral objectives. Additional benefit streams from market participation are an obvious fit."[18]

C. Wholesale Market Services – Both IFOM and BTM storage installations can participate in the CAISO market and could include provision of energy and ancillary services. The RMI paper suggests that a storage installation on the customer-side could provide services to all three entities: the end-use customer, distribution grid, and wholesale market services. In comments on the Track 2 Scoping Memo, Ice Energy provides three use cases: "first, an energy storage system can provide permanent load reduction to distribution utility and/or end use customer, for which it receives resource adequacy (RA) credit as a load modifying resource, and bids any dispatchable load increase capacity into CAISO market in the day-ahead or real-time energy market. In the second use case, the resource provides permanent load reduction to the utility as above. However, the load reduction is bid into the CAISO market as a proxy demand response (PDR)/Reliability Demand Response Resource (RDRR) in the day-ahead market. The dispatchable load increase is bid into the day ahead or real time energy market as above. Lastly, the resource provides permanent load reduction to distribution utility, for which it

[17] PG&E Opening Comments in Track 2 of R.15-03-011, Page 12.

[18] SDG&E Opening Comments in Track 2 of R.15-03-011, Page 4.

receives RA credit as load modifying reduction, and/or end use customer. No capacity is bid into CAISO markets. In addition, the distribution utility can dispatch resource to increase load to mitigate over-generation events." [19]

Table 4: Grid Domain and services

| **Grid Domain** | **Service Provided** |
|---|---|
| Retail Customer Service | Time-of-use bill management<br>Demand charge reduction<br>Back-up power<br>Increased solar self-consumption |
| Distribution Level Services | Distribution infrastructure deferral<br>Reactive supply and voltage control<br>Regulation<br>Frequency response |
| Wholesale markets | Energy<br>Regulation<br>Contingency reserves<br>Resource adequacy capacity<br>Flexible capacity |

[19] Comments of Ice Energy in Track 2 of R.15-03-011, page 3

# 4 Multiple-Use Applications Use Cases and Questions

Multiple-use applications (MUA) are those where a single energy resource or facility, or a virtual resource formed as an aggregation of individual sub-resources, provides multiple services to several entities with compensation provided through different revenue streams.[20]

Distributed energy resources (DER),[21] including distribution connected energy storage, could potentially provide and be compensated for many services targeted at three areas—customers, the distribution system, and the wholesale markets—as new markets and services evolve across the energy supply chain. This includes DER on either the utility side (i.e., in-front-of-meter or "IFOM") or the customer side of the end-use customer meter (i.e., behind-the-meter or "BTM"). MUA use cases reflect various combinations of these.

The Scoping Memo in R.15-03-011 asked MUA related questions, such as: what are the energy storage configurations/use-cases that currently exist, or may exist in the future, that provide multiple services, and which configuration/use-cases are most likely to occur and should be considered first?

Based on comments and reply comments filed in the Storage Proceeding and in the ESDER initiative, as well as the RMI paper and the staff interim report this Issue Paper presents **five MUA use cases,** summarized in Table 5. The Issue Paper also presents a set of questions for each use case based on concerns and barriers identified by various stakeholders in the storage proceeding as well as the CAISO initiative. However, to avoid listing the questions after each use case, we present them at the end of MUA # 5.

[20] Energy Storage Roadmap Page 14.

[21] DER are those resources on the distribution or sub-transmission system (i.e., below an CAISO LMP pricing node on non-ISO controlled grid facilities) on either the utility side or the customer side of the end-use customer meter, including rooftop solar, energy storage, plug-in electric vehicle charging facilities, and demand response.

TABLE 5 – MUA Use Cases

| Serving Regulatory Functions for - | MUA Use Cases | | | | |
|---|---|---|---|---|---|
| | In-Front-Of-Meter (IFOM) | Behind-The-Meter (BTM) | | | |
| | #1 | #2 | #3 | #4 | #5 |
| **Retail Customer Services** | | X | X | | X |
| **Distribution Grid Services** | X | X | | X | X |
| **Wholesale Market** | X | | X | X | X |

This issue paper expands on the use cases with examples from comments filed in the proceeding R.15-03-011.

## 4.1 MUA Use Case #1

**Description: In-front-of-meter distributed energy resources providing services to the distribution system and participating in the CAISO market.**

In SDG&E's comments[22] there are two examples that fit the description of MUA use case #1, they are –

(a) In front of the meter storage resource serving a primary RA function and a secondary distribution reliability function; meaning, it has an obligation to bid or schedule into the CAISO's markets on a daily basis under a must offer obligation. SDG&E also identifies potential barriers, such as the obligation to be available to the CAISO each day appears to constrain that resource's ability to consistently

[22] Opening Comments in Track 2 of R.15-03-011

and predictably provide a secondary reliability function to the distribution system. A potential solution suggested by SDG&E in its comments is relaxing CAISO's must-offer requirements for RA resources, distribution or transmission system operators, accepting an engineering solution that is outside their immediate control, or allowing the storage device owner to choose which obligation to honor with the understanding of the consequences that attach to such choice. It further adds that the potential "sharing" of facilities that might be dispatched across multiple functional areas, such as distribution operations and generation marketing, would have to be addressed in a manner that is consistent with any applicable rules governing the separation of various functional areas and operations.

(b) Utility owned storage serving a primary distribution reliability function, and participating in the CAISO's markets as a non-RA resource. An example would be – a utility owned distribution deferral storage project. Through its comments, SDG&E highlights the unresolved (and yet un-scoped) issues around regulatory jurisdiction and cost allocation for this configuration. For example, the costs for a utility owned storage asset designed to defer investment in traditional distribution system infrastructure and allocated to all customers who utilize the distribution system, i.e., both bundled and unbundled customers, through distribution rates. However, there is no Commission approved costs and benefits allocation mechanism that would both track and allocate costs and benefits of that single resource participating in the wholesale markets. Developing a Commission-approved mechanism to allocate costs and benefits from market participation back to bundled and unbundled customers is likely required to enable this multiple-use configuration.

PG&E gives an example of its 4 MW Yerba Buena pilot distribution reliability storage facility that is now being operated so as to participate in the CAISO market. In order of priority PG&E states that it is gaining experience through this pilot; there is less urgency to study this MUA.[23]

[23] PG&E Opening Comments in Track 2 of R.15-03-011, Page 14

## 4.2 MUA Use Case #2

**Description: Behind-the-meter distributed energy resources providing services to end-use customers and the distribution grid.**

PG&E explains this scenario as BTM storage facilities providing distribution reliability. They also provide comments on the complexity of this issue, such as the relative priority of operation to maximize retail value for the end-use customer versus ensuring distribution reliability, the need for additional equipment related to the distribution reliability function, and the need for additional standards applicable to a BTM energy storage facility supplying reliability services.[24]

## 4.3 MUA Use Case #3

**Description: Behind-the-meter distributed energy resources providing services to end-use customers and participating in the CAISO market.**

SDG&E, PG&E, SCE, Ice Energy and others explain this use case with examples that either exist today or will exist in the near future. For example, PG&E shows two scenarios wherein retail storage can participate in wholesale markets, including: (1) aggregated or individual resources providing retail services and participating in the wholesale market through means other than demand response; and, (2) through wholesale demand response enabled by storage. PG&E also comments on key jurisdiction, implementation and cost recovery issues associated with these MUA scenarios.

Similarly, Ice Energy in its comments presents the use case that would provide permanent load reduction to the end use customer. However, the load reduction will then bid into the CAISO market as a Supply Resource. The entire load reduction capacity for the resource is bid into CAISO markets as proxy demand response (PDR)/Reliability Demand Response Resource (RDRR) in the day-ahead market.[25]

[24] Opening Comments of PG&E in Track 2 of R.15-03-011, page 12-14

[25] Opening Comments of Ice Energy in Track 2 of R.15-03-011

SDG&E's comments highlight their concern that the conceptual benefits might prove illusory in practice. SDG&E gives an example: "suppose a typical commercial customer discharges its battery from 2-6 p.m. every single workday to both manage exposure to peak demand charges and leverage the arbitrage opportunity between super on-peak and off peak rates. If the customer was going to discharge its storage system consistently and predictably across the same hours to manage his or her retail bill, is there any incremental benefit to the system if this typical, consistent and predictable discharge behavior is also sold to a load serving entity (LSE) as a demand response product and bid into the wholesale market? If so, what exactly is that incremental benefit? Is this arrangement truly supply-side DR, or is it more akin to permanent (or predictable) load shift? Without additional information as to how these resources actually operate, SDG&E remains concerned that this scenario creates overlapping or redundant revenue streams."[26]

## 4.4 MUA Use Case #4

**Description: Behind-the-meter distributed energy resources providing services to the distribution system and the CAISO Market.**

SCE notes that the next most likely dual-use application that will ultimately need consideration is providing distribution reliability services while also participating in the CAISO market (providing energy and ancillary services), and/or Resource Adequacy ("RA"). SCE has deployed a number of pilots and demonstrations of storage providing distribution reliability services exclusively, and is now exploring the option of adding wholesale market participation to increase the value of the storage (and reduce net customer cost).

## 4.5 MUA Use Case #5

**Description: Behind-the-meter distributed energy resources providing services to end-use customers, the distribution grid and the CAISO market.**

[26] Opening Comments of SDG&E in Track 2 of R.15-03-011, page 6

In PG&E's comments, this use case has the lowest priority. Their comments suggest that this MUA is the most complex, combining three use cases: retail; wholesale; and distribution reliability. However, many, if not all, of the issues associated with this three-use case MUA should be resolved in the context of the two-use case MUAs.[27]

## 4.6 Questions

1. What are the distribution system services and revenue opportunities that currently exist for energy storage?
2. What wholesale, distribution and customer services can storage provide now and in the next 2-3 years?
3. To what extent are multiple-use storage applications permitted under current rules? Identify regulatory and market barriers and rules, their limitations and possible modifications that would enable a use case to deliver and be compensated for multiple services.
4. Are there any concerns of overlap between wholesale, distribution and retail services that must be addressed? Which of these services are currently compensated? Does each service provide incremental value? Are there double payment concerns that must be addressed? How should costs and benefits of the same resource serving across the grid be tracked and allocated?
5. Are there any interconnection concerns that must be addressed?
6. Have metering and sub-metering issues, pertinent to both BTM and IFOM storage, been addressed in the CAISO's Expanding Metering and Telemetry Options and ESDER initiatives? Are there any metering concerns that must be addressed?
7. Are there any dispatch priority concerns that must be addressed? How should conflicting real-time needs be managed?
8. For each regulatory and/or market barrier and/or issue what is the logical CPUC or CAISO regulatory proceeding to address and resolve the issue?

[27] Opening Comments in Track 2 of R.15-03-011, Page 15.