Appendix A

Storage Workshop Materials - August 20, 2012

The following application use case priorities and definitions are based on informal input/discussion between CPUC Staff, CESA, SCE, PGE, SDGE on April 12, 2012 and refined May 11, 2012. They are for discussion purposes only; the numbering is not in order of priority.

Basis for Prioritization

1. Magnitude of direct benefits to utilities, end users
2. Magnitude of societal benefits, including emissions reductions, market development, system flexibility etc.
3. Renewables integration (key California policy priority)
4. Fit with CPUC jurisdictional control
5. Availability of commercially ready energy storage technologies
6. Ability to be deployed quickly and achieve 'quick wins'

Key Definitions to Standardize:

1. Benefit = a single value or revenue stream captured by a resource. A stream of benefits comes from solving the identified problem and providing additional end-uses that result in providing value or capturing revenue. The cost-benefits for different solutions should be evaluated separately and the net benefits should be compared.
2. End Use = 'operational use (SCE)' = specific targeted operational use for a resource in the field, may result in capture of one or more

benefits.

3. Application = combination of end uses (and benefits) that an energy storage system may capture when sited at a specific place and managed in a particular way (consistent with SCE and CESA's definition)
4. Use-Cases = A document that describes an application (problem being solved) by a particular storage system in a particular location with a clear operating regime, funding structure, governance, etc.
5. Scenario = as used in Staff's Final Proposal, represents a group of closely related use cases for a generalized application.

New Terms that Need Definitions

1. Bulk Storage – large-scale energy storage that is interconnected to the grid at transmission-level voltage, and is used primarily for electric supply capacity. Can be generator co-located (storage onsite with generator) or stand alone (CAES, pumped hydro, battery) or aggregated (large-scale aggregated battery storage interconnected at transmission level).
2. Generation-Sited Storage – category of energy storage solutions that are co-located with large-scale generation (vs. distributed generation). Includes molten salt (co-located with concentrated solar thermal) and thermal energy storage co-located with natural gas combustion turbines.
3. Operational Considerations – Description of how a storage project is used; i.e., on a defined basis, what application is it being employed for; what resource solution is it providing, who is deciding, etc..
4. Multi-Function Analysis – A storage project may at different times operate as a Generation, Transmission, Distribution or Load resource. This functionality determines the jurisdictional authority that governs its markets or terms of use; i.e., FERC/transmission, CPUC/distribution.

#	Application (use case)	Description/ Problem Solving	Potential Compensation or	Likely Siting	Primary End Uses	Conventional Solutions or Alternatives	Energy Storage Case Study

DRAFT
Storage Use Case – Matrix

			Ownership				Example
1	Community Energy Storage[1]	Improve local service reliability. Integration of distributed variable energy resources Voltage control	• Utility Ratebased • Third Party under contract	• Adjacent to loads, on utility 'easement' >25 kW x 2 hr	• Service Reliability* • D Deferral* • T Congestion* • Electric Supply* • Ancillary Services* • Transportability	• Capacitor • Transformer	• AEP CES • Detroit Edison CES • SMUD Solar Smart RES/CES Project • SDG&E secondary storage projects

Operational considerations: Will operate on a scheduled basis (load shift) **OR** on an automated basis (power quality / operational reliability) depending on the nature of the problem to be solved [**OR** Bid into ISO markets; operate according to awards and ISO dispatch signal]

[1] Includes resource adequacy in the form of supply capacity and reserves.
* Responds to utility and/or ISO signals.

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Storage Use Case – Matrix

#	Application (use case)	Description/ Problem Solving	Potential Compensation or Ownership	Likely Siting & Scale (C x hr)	Storage Solution	Conventional Solutions or Alternatives	Energy Storage Case Study Example
2	Distribution Storage	Defers distribution upgrades. (For Example: overloaded wire, transformers , capacitor – not a load modifier!) Use energy storage in lieu of sub transmission capacity (for 1-4 years)	• Utility Ratebased • Third party • End User	• At or down-stream from overloaded equipment • Substation • Circuit ➢ 1 MW x 4 hrs	• Upgrade Deferral* • Replacement Deferral* • Equipment life extension • Service reliability • T&D congestion • Transportability	• Upgrade wires or transformers.	• SDG&E primary distribution storage (batteries)

Operational considerations: Will operate on a scheduled basis (load modifier) **OR** maintains a prescribed level of charge and responds automatically to improve operational reliability (voltage support, etc).

#	Application (use case)	Description/ Problem Solving	Likely Compensation or Ownership	Likely Siting	Primary End Uses	Conventional Solutions or Alternatives	Energy Storage Case Study Example

* Responds to utility and/or ISO signals.

3	Distributed Peaker[2] (Load Modifier -- primarily in lieu of added electric supply capacity)	Energy cycling to address peaking needs (part year operated by utility, part year operated by CAISO)	• Utility Ratebased • Third Party ownership, PPA	• Subtransmission • Substation >25 MW x 4 hr	• Electric Supply* • Ancillary Services* • T Congestion* • Service Reliability* • D Deferral* • Transportability	• Conventional Generation (CT, CC) • PPA • DR • Critical Peak Pricing (CPP) • EE TES	• Modesto Irrigation District • Raleigh, NC (TAS Energy)

Operational considerations: Bid into ISO markets; operate according to awards and ISO dispatch signal **OR** Operate on a scheduled basis (load shift) **OR** on an automated basis (power quality / operational reliability).

The unit is operated as a traditional generation resource bidding into the market during part of the year; thus the unit is *not* operated to meet local reliability needs during that period. The "potential additional" benefits are the cost savings resulting from proximity to load, thus avoided some congestion charges and line losses.

	Application (scenario)	**Description/ Problem Solving**	**Potential Compensation or Ownership**	**Likely Siting**	**Primary End Uses**	**Conventional Solutions or Alternatives**	**Energy Storage Case Study Example**
4	Generator-sited[3]	On-site firming or shaping of intermittent generation	• Expensed by LSE (if third party owns and sells higher	• At or near Generation ✓ Subtransmission ✓ Substation ✓ Distribution	• Variable RE Generation Integration ✓ energy time-shift	• Additional Sub-T or D Infrastructure • Static VAR Compensator	• Xtreme Power - various • Solar Thermal with molten salt or other

*[2] Includes resource adequacy in the form of supply capacity and reserves.
* Responds to utility and/or ISO signals.
[3] Formerly referred to as Renewables Support/Dispatchability scenario in Staff's Final Proposal; renamed for the matrix.

			value power to LSE) • Ratebased (If IOU owns and pairs with generation)	35 MW – 250 MW	✓ capacity-firming ✓ ramping ✓ Volt/VAR support	Switched Capacitor Banks • Generation storage technologies	TAS Generation Storage™ • Laurel Mtn AES

Operational Considerations: Dispatch coordinated to smooth VER output to avoid future integration charges. **OR** Bid into ISO markets; operate according to awards and ISO dispatch signal.

This application is distinct from the Bulk Generation application scenario only when the storage device is integrated in to the generator itself (either variable energy resource or gas-fired turbine), such as solar coupled with thermal storage. Otherwise, there is no need for the storage device to be co-located with the generator as opposed to at a transmission substation. There could *potentially* be additional value if the storage device was able to reduce or avoid an investment to increase the transmission capacity necessary to accommodate a variable energy resource, but this would be a FERC-jurisdictional benefit.

#	Application (scenario)	Description/ Problem Solving	Potential Compensation or Ownership	Likely Siting	Primary End Uses	Conventional Solutions	Energy Storage Case Study Example
5	Bulk Generation/ Storage [4]	Electric Supply Capacity/ provides resource	• Market • Utility Ratebasing	• Transmission • Generator co-located	• Resource adequacy • Ancillary services	• Conventional Generation (CT, CC) • PPA	• Utility-owned Pumped Hydro-electric • Alabama CAES

[4] Formally referred to as "Ancillary Service" scenario in Staff's Final Proposal; renamed for the matrix.

		adequacy, ancillary services, and energy	• Third Party	25 – 250 MW x 4-6 hr	Energy	DR • Hydro	

Operational considerations: While this application is conceived as large scale storage, the C/E template would be the same for a much smaller device so long as that device is interconnected at the transmission level and intended to earn revenues through markets exclusively.

#	Application (use case)	Description/ Problem Solving	Likely Compensation or Ownership	Likely Siting	Primary End Uses	Conventional Solutions or Alternatives	Energy Storage Case Study Example
6	Demand Side Manage-ment	End-use Customer Bill Management System load modification Service Reliability/ Quality PV Integration	• Customer • Market (for ancillary services) • End-user • Third-party • Utility Ownership?	• Customer-side of Meter	• TOU Energy Cost Management • Demand Charge Management • Reliability (back-up power) • Power Quality • Ancillary Services [5]	• *Energy Efficiency* • *Combined Heat and Power (CHP)* • *Combined Cooling Heat and Power (CCHP)*	• Alameda County Santa Rita Jail • Various SGIP funded projects • TES • Tesla/Solar City?

Operational considerations: Operated to minimize customer energy and demand charges, potentially responding to price signals sent by utility; potentially providing backup power in an outages if outage occurs when battery happens to be charged

[5] Responds to utility and/or ISO signals

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