STORAGE OIR BRAINSTORMING SESSION

April 12, 2012

CPUC (Energy Division, Policy Planning Division)
CESA
SCE
PG&E
SDG&E

GOALS

- Introductions
- Brainstorm re Staff Proposal => Phase 2 work
    - How to do CE methodology/analysis
    - How to address barriers (here, elsewhere)
        - fair competition,
        - full compensation
    - How to consider/evaluate policy options to "encourage" storage adoption

TAXONOMY

- "End use"
- "Type" of storage
- "Scenario"
- "CE template"
- "Use case"

- 20+ End uses = applications = SCE "operational uses"
    - Each 'end use' with associated benefit(s) stream(s) of value [market revenue, cost savings, environmental]
    - 'End uses' divided into two types:
        - grid reliability services (rate base recovery) or
        - generator services (market recovery)

- 3 "types" of Storage (in terms of "operational profile" = "duration of use")
    - Short duration storage ~ recurring charge/discharge over seconds / minutes
    - Long duration storage ~ recurring charge/discharge cycles over multi-hours
    - Intermittent storage ~ non-recurring charge/discharge cycles at random times/intervals (contingency)

Storage System	**A/S (flywheel)**	**PLS**	**Voltage Support**	**"Peaker"**
SDS (short-duration)	SDS		SDS	SDS
LDS (long-duration)		LDS		LDS
IMS (intermittent)				IMS

- Storage system = "logical" aggregation of up to three types of storage units
- Capacity allocation to the three types can change in actual operation

- 5 storage deployment (generalized) "scenarios" (in terms of grid location = "point of connection")
    1. Transmission
    2. Distribution (primary, secondary)
    3. Behind-the-Meter
    4. Variable Energy Resource-sited (~ co-located with generator)
    5. Transportable

	Scenario 1 AS	Scenario 2 DES	Scenario 3 DSM	Scenario 4 Renewables Support	Scenario 5 Transportable
POC **>** **DOU** \/	**Transmission**	**Distribution** (primary, secondary)	**Behind the Meter**	**VER*-Sited**	**Transportable**
SDS (short-duration)	← **19. T operations / reliability**	*1. Frequency reg* *2. Ramping* 3. Real time energy balancing **4. D operations / voltage support**	13. Power quality • Smoothing/ firming of DG • *Ancillary services*	*16. VER integration / smoothing* *17. Supply firming*	
LDS (long-duration)	← **20. T upgrade deferral**	5. Resource Adequacy 6. Peak shaving ~ peaker substitution 7. Energy price arbitrage 8. Congestion relief **9. D upgrade deferral**	14. TOU energy management / PLS	*18. VER integration/ time-shifting, voltage sag*	
IMS (inter-mittent)	←	*10. Spin / non-spin/ replacement reserves* *11. Blackstart* **12. Outage mitigation**	• Peak shaving (DR events) 18. UPS / back-up power		

*VER = variable energy resource

Bold = Grid reliability end uses (rate base cost recovery)
Italics = Ancillary services (market cost recovery)
Normal = Other market cost recovery
Normal/Underline = Customer savings or benefits
Italics/Underline = Generator benefits (derived from avoided utility/ISO costs or generator enhancement)

Notes:

- some end-uses are compatible, some mutually exclusive
- not all compatible end uses within a scenario may be operationally feasible (e.g. technology limitation)

TBD: Cost-Effectiveness??

- Many “Use cases”: a specific scenario (subset)

One option:

	Scenario 1 AS	Scenario 2 DES	Scenario 3 DSM	Scenario 4 Renewables Support	Scenario 5 Transportable
POC > **DOU** \/	**Transmission**	**Distribution** (primary, secondary)	**Behind the Meter**	**VER*-Sited**	**Transportable**
SDS (short-duration)	UC1	UC4	UC7	UC10	UC12
LDS (long-duration)	UC2	UC5	UC8	UC11	
IMS (inter-mittent)	UC3	UC6	UC9	N/A?	

Another option: SCE’s 12 “applications”

Alternative approach:

- Up to 5 Cost-Effectiveness (CE) “templates”:
  - Identifies all potential benefits streams and costs applicable to the general scenario
  - Apply “TRC” approach
  - In actuality, probably need only 3 CE templates:
    - VER-sited, Distribution, DSM (IOU/Third Party perspective)
  - TBD: how to estimate benefits
    - Most seem straightforward
    - “Difficult” end uses (in terms of valuation):
      - VER-sited end-uses: #16, 17, 18
      - Operational reliability end uses (3 out of 5): #4, #12, #19
      - Peak shaving (peaker substitute): #6
  - Template exercised with specifics associated with a use case

	Scenario 1 AS		Scenario 2 DES		Scenario 3 DSM			Scenario 4 Renewables Support	Scenario 5 Transportable
POC > **DOU \/**	**Transmission**		**Distribution** (primary, secondary)		**Behind the Meter**			**VER*-Sited**	**Transportable**
SDS (short-duration)	**G**en benefits	Defer	G	R	G	R	EU	G	Defer
LDS (long-duration)		**R**eliabilit y benefits							
IMS (inter-mittent)									

- Many "Use cases": a specific scenario (subset)
    1. location,
    2. specific end use (= application) bundle,
    3. specific operational profile allocation (flexible),
    4. ownership model (single, shared?)
    5. technology

Examples:

Peaker ~	G	R
CES ~	G	R
Distrib Deferral/ Reliabiltiy	R	

VER-sited (solar RPS or WDG)
A/S (T-level)
DSM (utility or third party owned)

=>TBD: address CE and barriers in 6 use cases.

RANGE of POLICY OPTIONS (not exhaustive)

Basket of Market Neutrality (Pull) Policy Options [No Endorsement]

For Generator domain:

1. Implement resource-neutral, level-field market design.
2. Establish full and accurate compensation of value supplied to markets.
3. Identify applicable system needs
4. Assign RA value.
5. Identify integration costs
6. *Develop CE framework for multi-use storage asset to facilitate LC (Least Cost) analysis.
7. *Enable co-existence of market & ratebase end-uses (if issues exist in practice).
8. Update procurement evaluation matrix for BF (Best Fit) analysis to account for novel storage attributes.
9. Set up a process for securing long term contracts for generator (A/S) products

For T&D domain:

9. Identify value of reliability end-use value
10. Enable long-term storage-based service contracts to supply grid reliability services.

10. Capitalize the cost of storage-based service contracts.

Basket of Proactive (Push) Policy Options [NO Endorsement]

For Generator domain:

1. Global procurement target:

   Establish global procurement standard, gradually increasing over time, expressed as percent of system peak.

2. Application-specific procurement target:

   Establish procurement standards, gradually increasing over time, for meeting a percentage of A/S requirements via resources that add zero emissions or reduce emissions relative to thermal resources (such as SDS/IMS, DR).

3. Loading order:

   When evaluating planning/procurement options to support growth in peak demand and resource adequacy requirements, storage resources (such as LDS) should be considered by the utilities ahead of new peak generation or T&D, *when cost-effective and reliable*.

   When evaluating options to support applicable grid reliability requirements, utilities should consider any of the storage types (SDS, IMS, LDS) as an alternative to building capacity margins, generation reserves, or other infrastructure additions *when cost-effective and reliable*.

4. Incentives (higher ROI, tax credit, accelerated depreciation, other options)

5. Rebates

6. Pilot funding

How to set-up / inform discussion of above options?

APPENDIX: Acronyms Dictionary

DOU Duration of Use
SDS Short Duration Storage (recurring, on seconds to many minutes time scale, up to an hour)
LDS Long Duration Storage (recurring on multi-hour time scale)
IMS Intermittent Storage (non-recurring, at random / irregular intervals)

POC Point of Connection (at Transmission, Distribution, or Behind the Meter)
BTM Behind the Meter

G Generator
T Transmission
D Distribution

EU End User
TP Third Party

CE Cost-Effectiveness
RA Resource Adequacy

RPS Renewable Portfolio Standard
CSI California Solar Inititative
DR Demand Response
DSM Demand-Side Management

Storage Accounting Rules

If a storage asset is being operated with variable mix of applications, some type of "storage accounting rules" may be needed, particularly for cost-allocation purpose to avoid "double counting", and could be based on following principles:

1. A capacity (or energy) unit [of storage] can only be used for a *single* application at *any particular instant*.
2. The same capacity (energy) unit [of storage] can be used for *different* applications at *different* times.
3. Two different capacity (energy) units of [storage] can be *concurrently* used in two *different* applications (at the *same* instant).

Definition of Energy Storage Systems

Assembly Bill (AB) 2514 (Stats. 2010, ch. 469) provides guidance on the definition:

> (1) "Energy storage system" means commercially available technology that is capable of absorbing energy, storing it for a period of time, and thereafter dispatching the energy. An "energy storage system":
>
> may have any of the characteristics in paragraph (2),
> shall accomplish one of the purposes in paragraph (3), and
> shall meet at least one of the characteristics in paragraph (4).
>
> (2) An "energy storage system" may have any of the following characteristics:
>
> (A) Be either centralized or distributed.
> (B) Be either owned by
> a load-serving entity or local publicly owned electric utility,
> a customer of a load-serving entity or local publicly owned electric utility, or
> a third party,
> or
> is jointly owned by two or more of the above.
>
> (3) An "energy storage system" shall be cost effective and either
>
> reduce emissions of greenhouse gases,
> reduce demand for peak electrical generation,
> defer or substitute for an investment in generation, transmission, or distribution assets, or
> improve the reliable operation of the electrical transmission or distribution grid.
>
> (4) An "energy storage system" shall do one or more of the following:
>
> (A) Use mechanical, chemical, or thermal processes to store energy that was generated at one time for use at a later time.
> (B) Store thermal energy for direct use for heating or cooling at a later time in a manner that avoids the need to use electricity at that later time.
> (C) Use mechanical, chemical, or thermal processes to store energy generated from renewable resources for use at a later time.
> (D) Use mechanical, chemical, or thermal processes to store energy generated from mechanical processes that would otherwise be wasted for delivery at a later time.