Energy Storage Phase 2 Workshop
August 20, 2012

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Meeting Goal and Agenda

Goal: To open discussion of Phase 2 issues, present a plan of analysis, and to consider a proposed schedule which can be presented to the ALJ during the September 4 PHC.

Action Item		Time Alotted	Clock
Introductions		15 minutes	9:30 am – 9:45 am
Review Proceeding		15 minutes	9:45 am – 10:00 am
Phase 2 Considerations		60 minutes	10:00 am – 11:00 am
Matrix and Use Case Templates		75 minutes	11:00 am – 12:15 pm
Lunch		75 minutes	12:15 pm – 1:30 pm
Scoping Issues		75 minutes	1:30 pm – 2:45 pm
Scheduling		45 minutes	2:45 pm – 3:30 pm
Wrap-Up		15 minutes	3:30 pm – 3:45 pm

CPUC OIR R10-12-007

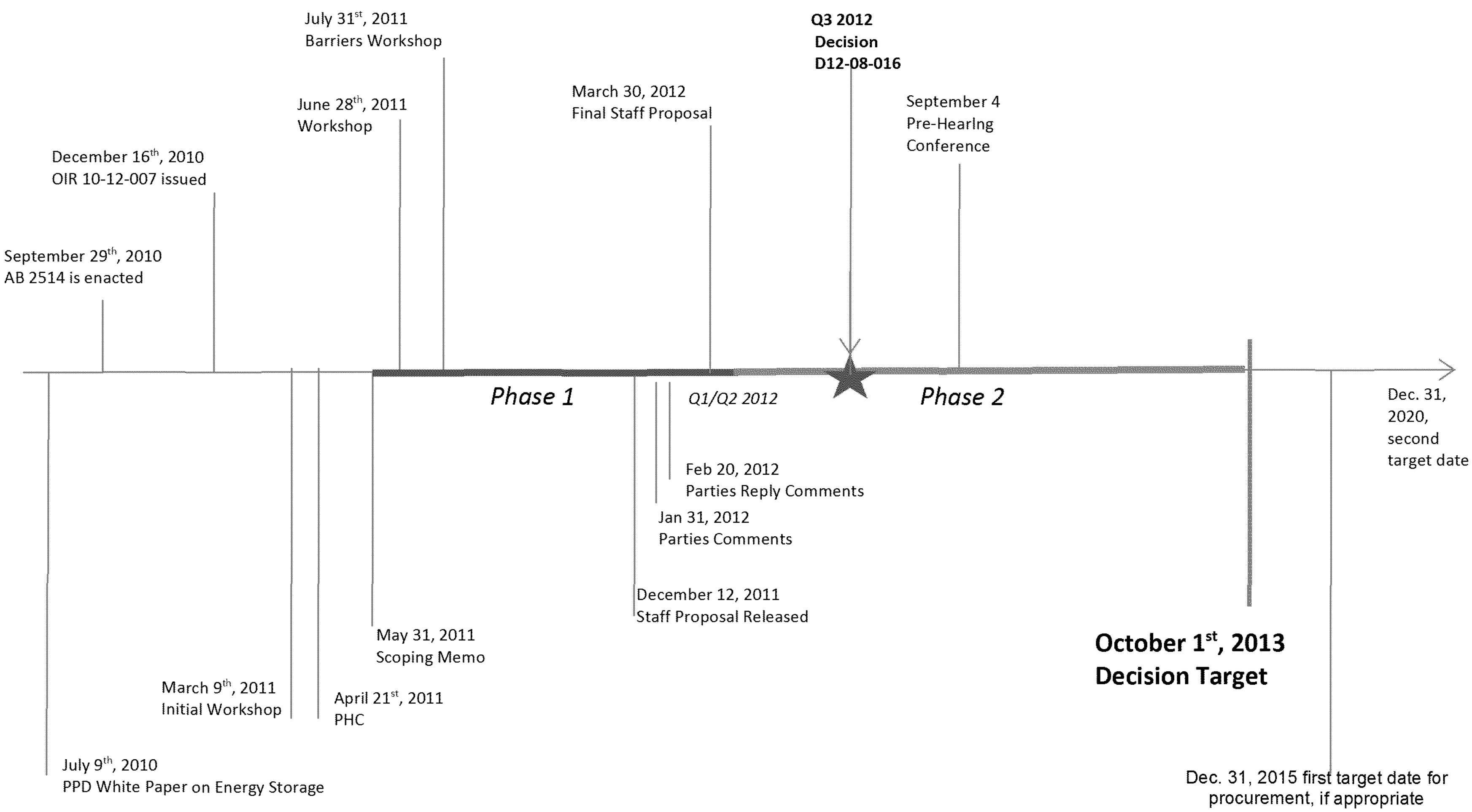
Responsive to AB 2514, which requires the CPUC:

1. To open a proceeding to determine appropriate targets, if any, for each load-serving entity to procure viable and cost-effective energy storage systems.

2. By October 1, 2013, to adopt an energy storage procurement target, if determined to be appropriate, to be achieved by each LSE by December 31, 2015, and a 2nd target to be achieved by December 31, 2020.

3. "[T]he commission may consider a variety of possible policies to encourage the cost-effective deployment of energy storage systems, including refinement of existing procurement methods to properly value energy storage systems."

Status of Energy Storage OIR



Energy Storage Analysis Approach

Roadmap	
Regulatory Framework	
Cost Effectiveness	
Procurement Objectives	

• Draft list of policy gaps/issues that need to be addressed
policies (e.g. RPS) develop high-level Roadmap criteria,
Analyze benefit streams across energy storage 'end uses'
urement objectives
• Draft key strategic themes based on criteria
Identify high priority energy storage applications where and when policy
siderations from procurement perspective
enablers and dependencies
gaps can be addressed

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Barriers to Energy Storage

The barriers to Energy Storage deployment have been summarized into the following key areas:

1. Lack of definitive operational needs
2. Lack of cohesive regulatory framework
3. Evolving markets and market product definition
4. Resource Adequacy accounting
5. Lack of cost-effectiveness evaluation methods
6. Lack of cost recovery policy
7. Lack of cost transparency and price signals (wholesale and retail)
8. Lack of commercial operating experience
9. Lack of well-defined interconnection process

Storage "End Use" Framework

Category	Storage "End Use"
ISO/Market	• Ancillary services: frequency regulation • Ancillary services: spin/non-spin/replacement reserves • Ancillary services: ramp • Black start • Real time energy balancing • Energy price arbitrage • Resource adequacy
Generation	• Intermittent resource integration: wind (ramp/voltage support) • Intermittent resource integration: photovoltaic (time shift, voltage sag, rapid demand support) • Supply firming
Transmission/ Distribution	• Peak shaving: off-to-on peak energy shifting (operational) • Transmission peak capacity support (upgrade deferral) • Transmission operation (short duration performance, inertia, system reliability) • Transmission congestion relief • Distribution peak capacity support (upgrade deferral) • Distribution operation (Voltage Support/VAR Support) • Outage mitigation: micro-grid
Customer	• Time-of-use (TOU) energy cost management • Power quality • Back-up power

Phase 2 Scoping Issues For Consideration

- Cost-Effectiveness
- Market Needs Analysis
- Barriers Analysis
- Impacts of Ownership Models
- Coordination with Other Proceedings – LTPP and RA
- Procurement Targets or Other Policies
- Defining Long-Term Roadmap

Key Terms

- **Energy Storage System** – As defined in AB 2514 and D. 12-08-016: "[C]ommercially available technology that is capable of absorbing energy, storing it for a period of time, and thereafter dispatching the energy…"

- **Benefit** – A single value or revenue stream captured by a resource.

- **End Use** – Specific targeted operational use of a resource in the field.

- **Application** – A combination of end uses (and benefits that a storage system may capture when sited and managed in a particular way.

- **Use Case** – A document that describes a problem being solved by a particular storage system.

- **Priority Scenarios** – A broad set of possible applications that respond to a public policy determination or priority.

What is a Use Case?

- A Use Case is a document that illustrates the context of where and how storage can be used on the electric grid, thus promoting clearer analysis and decision-making.

- The purpose of describing Use Cases is NOT to fully specify the precise details of the storage project and their relevant technologies (i.e., specifications, project design, financing).

- Use Cases define goals and purpose: the problems we are trying to solve. Establishing these goals lays the foundation for the scope of analysis that will follow.

Elements of Energy Storage Use Cases

- 1. Overview Section
- 2. Use Case Description
- 3. Cost/Benefit Analysis
- 4. Barriers Analysis & Policy Options
- 5. Real World Example
- 6. Conclusion and Recommendations

Analysis of Energy Storage Use Cases

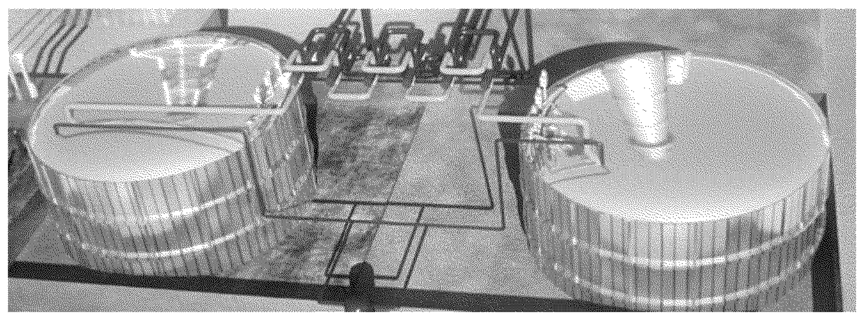
- Commercial readiness
- Operational viability
- Benefit streams
  - Benefits monetize through existing markets/mechanisms
  - If not, how should they be valued?
- Cost-effectiveness
- Most important barriers preventing /slowing deployment of ES
- Policy options to address identified barriers
- Consider procurement target or other policies to encourage ES

Prioritized Scenarios/Use Cases

Scenario/Use Case	Primary End Use
• **Generator-sited Storage**	
– Co-located with VER	Renewables integration
– Co-located with Conventional Gen	Peaking capacity
– Co-located with Wholesale DG	Renewables integration
• **Bulk "Generation"**	
– Storage as "Peaker"	Ancillary Services/Capacity/Energy
– Ancillary Services	Ancillary Services
• **Distributed Storage**	
– Distributed Peaker	Energy cycling to meet peak
– Distribution Storage	Defer upgrades
– Community Energy Storage	Local service reliability
• **Demand-Side Management**	End-use bill management
– Permanent load shift	
– On-site renewables with storage	

Variable Energy Resource -- Generation Sited

Purpose	On-site firming or shaping variable energy; ramping; voltage support
Location	With or near renewable energy generation, or elsewhere
Technology	Centralized Solar Power w/molten salt or other; generation sited thermal storage; batteries: >25 MW, >5 hours
Example	AES Laurel Mountain Li-ion battery: 32 MW (to back up 98 MW wind farm) BrightSource CSP with molten salt, 3 units, 200 MW, 6 hours



http://www.brightsourceenergy.com/energy-storage

VER Generation Sited

	Application (use case)	Description/ Problem Solving	Potential Compensation or Ownership	Likely Siting	Primary End Uses	Conventional Solutions or Alternatives	Energy Storage Case Study Example
4	VER-sited (renewables)	On-site firming or shaping of intermittent generation	• Expensed by LSE (if third party owns and sells higher value power to LSE) • Ratebased (If IOU owns and pairs with generation)	• At or near RE Generation • Subtransmission • Substation • Distribution 35 MW – 250 MW	• Variable RE Generation Integration • energy time-shift • capacity-firming • ramping • Volt/VAR support	• Additional Sub -T or D Infrastructure • Static VAR Compensator • Switched Capacitor Banks • Generation storage technologies	• Xtreme Power - various • Solar Thermal with molten salt or other • TAS Generation Storage™ • Laurel Mtn AES

Bulk Generation

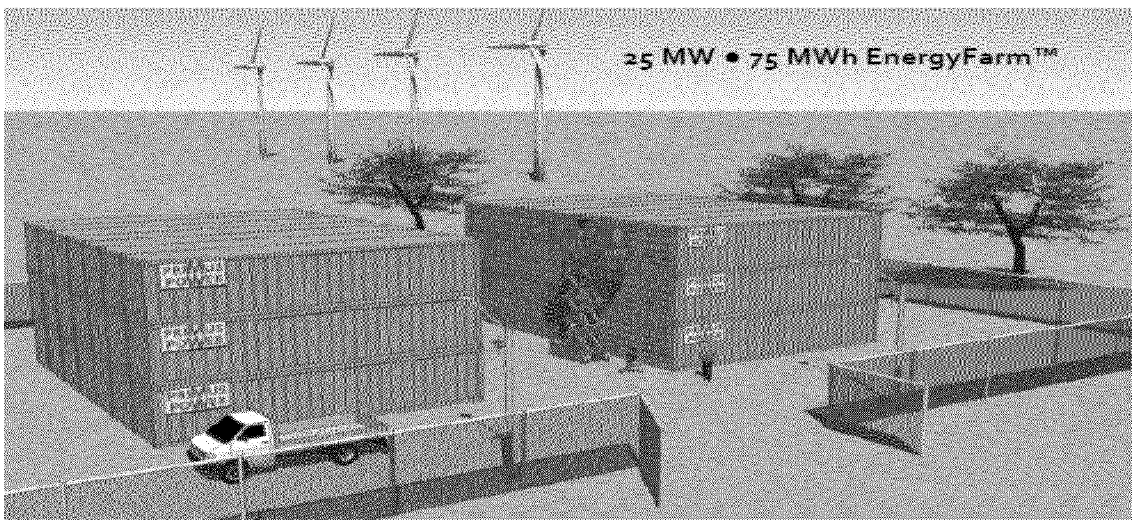
Purpose	Capacity, energy and ancillary services
Location	at generator site or on transmission grid
Technology	Hydro pumped storage, CAES, generation-sited thermal storage: >50 MW, 6 hours
Example	TAS Energy turbine inlet cooling with storage 45 MW incremental capacity on a 300 MW CCGT

Bulk Generation

#	Application (use case)	Description/ Problem Solving	Potential Compensation or Ownership	Likely Siting	Primary End Uses	Conventional Solutions or Alternatives	Energy Storage Case Study Example
5	Bulk Generation/ Storage	Electric Supply Capacity/ provides resource adequacy, ancillary services, and energy	• Market • Utility Ratebasing • Third Party	• Transmission • Generator co-located >100 MW x 6 hr	• Resource adequacy • Ancillary services • Energy	• Conventional Generation (CT, CC) • PPA • DR	• Utility-owned Pumped Hydro-electric • Alabama CAES • TAS Energy Generation Storage™

Distributed Peaker

Purpose	Energy cycling to meet peak load requirements and ancillary services
Location	Sub-transmission level or at substation
Technology	Large batteries, compressed air, or turbine inlet cooling/thermal storage: >25 MW, >3 hours
Example	Modesto Irrigation District/Primus Power Flow battery: 25 MW/75 MWh



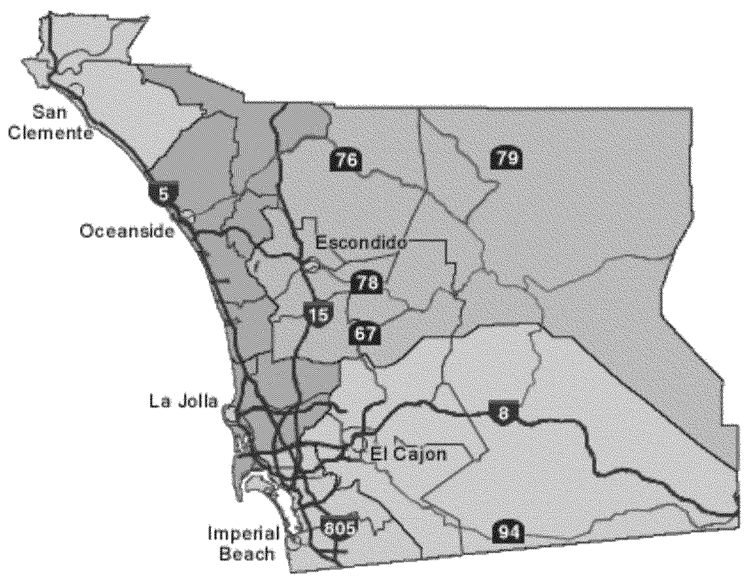
http://www.smartgrid.gov/sites/default/files/primus-power-oe0000228-final.pdf

Distributed Peaker

#	Application (use case)	Description/ Problem Solving	Likely Compensation or Ownership	Likely Siting	Primary End Uses	Conventional Solutions or Alternatives	Energy Storage Case Study Example
3	Distributed Peaker (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 ownershipPPA	• Subtransmission • Substation >25 MW x 4 hr	• Electric Supply • Ancillary Services • T Congestion • Service Reliability • Dist Deferral • Transportability	• Conventional Generation (CT, CC) • PPA • DR • Critical Peak Pricing (CPP) • TES	• Modesto Irrigation District • Raleigh, NC (TAS Energy) District Energy

Distribution Storage

Purpose	Defers distribution upgrades for 1 to 4 years
Location	Substation or downstream from overloaded equipment
Technology	Batteries: >1 MW, 4 hours discharge
Example	SDG&E Borrego Springs substation-level Li-ion battery: 500 kW/1,500 kWh



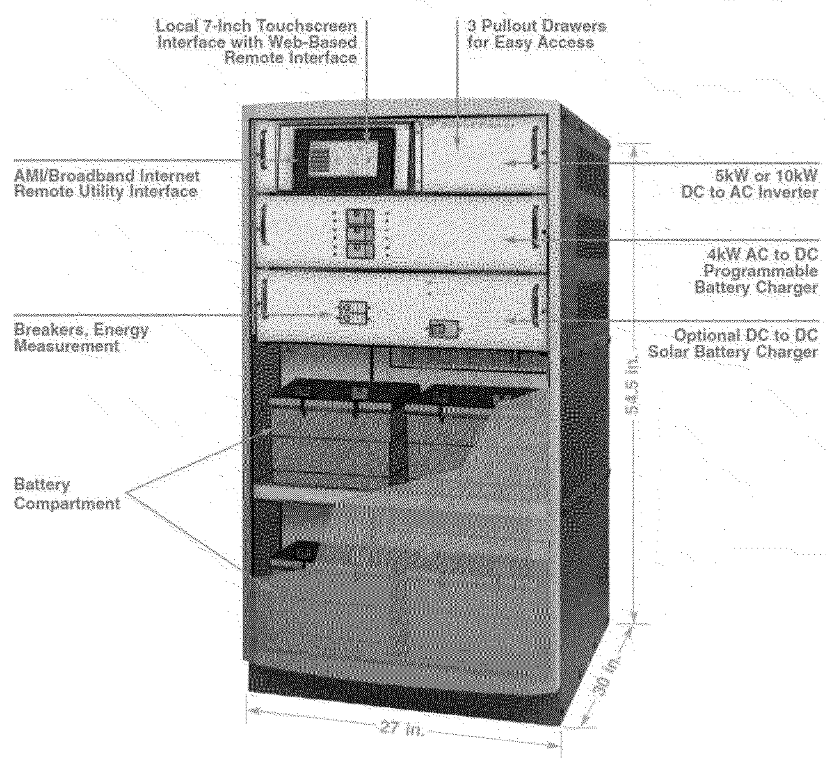
http://events.energetics.com/SmartGridPeerReview2010/pdfs/presentations/day2/am/12_SDG_E_Borrego_Springs_Microgrid_NEW.pdf

Distribution Storage

#	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
1	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 • Transportabilit y	• Upgrade wires or transformers.	• SDG&E primary distribution storage (batteries)

Community Energy Storage

Purpose	Improve local reliability; integrate distributed renewable generation; provide voltage control
Location	Adjacent to load, on utility or customer property
Technology	Batteries: >25 kW, 2 hours
Example	SMUD "Smart Solar" in Anatolia neighborhood. Li-ion batteries: 15 units, 8.7 kW/8.8 kWh (residential) 3 units, 30 kW/kWh (pad-mount transformers, distribution feeders)



Residential Energy Storage
http://www.advancedenergy.org

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Community Energy Storage

#	Application (use case)	Description/ Problem Solving	Potential Compensation or Ownership	Likely Siting	Primary End Uses	Conventional Solutions or Alternatives	Energy Storage Case Study Example
2	Community Energy Storage	Improve local service reliability. Integration of distributed VREs 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

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Demand-Side Management

Purpose	Peak shaving/load shifting; customer bill management; reliability
Location	customer site or district energy facility
Technology	batteries, thermal energy storage
Example	Santa Rita Jail microgrid Li-ion battery: 2 MW/4 MWh backup for wind, fuel cell generation Tesla-Solar City. Li-Ion battery to support rooftop PVs Ice Energy, thermal energy storage cooling

http://www.ice-energy.com

http://www.solarcity.com

Demand-Side Management

#	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	• 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 *	• 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?

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Proposed Schedule 2012

• August 20	Workshop, CPUC Auditorium.
• September 4	PHC Phase 2.
• September 7	Joint Storage/LTPP workshop on flexibility characteristics.
• September 24	Workshop on cost-effectiveness tools.
• September ??	Scoping memo for Phase 2.
• October 8-9	Workshops on Use Case development.
• Oct.-Nov.	Working Groups to develop Use Cases.
• December 20	Staff Report on Use Cases.

Proposed Schedule 2013

- January 25 Parties comment on Staff Report, propose specific Storage Applications that should be considered for utility portfolios. Identify how Barriers relate or may be addressed in this or other Proceedings.
- February 5 Reply comments.
- March-April Evidentiary Hearings or Workshops on Procurement Targets, Policy Options and Roadmap Issues.
- May 1 Staff recommendations to ALJ.
- August ALJ PD on Phase 2 issues; determination if Procurement will be ordered and how it should be conducted or other alternative Policy approaches.
- September Commission consideration of PD.
- **Dec. 31 Report to Legislature on outcome of Proceeding.**

Next Steps

- Identify Work Groups to Develop Use Cases
- Upcoming Workshops:
  - Sept. 4, Pre-hearing Conference
  - Sept. 7, Joint workshop with LTPP on flexibility and procurement options
  - Sept. 24 Workshop on Cost-Effectiveness Models
  - Oct. 8-9 Workshops on Use Case development

Thank you!

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