

ENERGY

WELCOME

California Energy Storage Roadmap Workshop

California ISO, Folsom, September 4, 2014

Guest Wireless

Username: Stakeholder1

Password: Welcome1



The energy storage roadmap is on schedule to be delivered by the end of 2014.

Date	Roadmap Milestone
September 18	Stakeholder comments due
October 2	Publish draft Roadmap
October 13	Stakeholder workshop #2
October 30	Stakeholder comments due
December	Publish final Roadmap

Workshop Agenda

Time	Topic	Presenter
10:20 – 10:40	Summary of Outreach Results	Rick Fioravanti
10:40 – 10:50	Introduction of Stakeholder Key Themes	Heather Sanders
10:50 – 11:45	Financial and Ancillary Services Barriers	Olof Bystrom Heather Sanders
11:45 – 12:15	Interconnection Barriers	Beth Reid Tom Flynn
12:15 – 12:45	Market Rules and Regulatory Barriers	Rick Fioravanti Lorenzo Kristov
12:45 - 1:30	Lunch	

Workshop Agenda – continued

Time	Topic	Presenter
1:30 - 2:00	Metering and Telemetry	Robert Anderson Peter Klauer
2:00 - 2:30	Modeling	Olof Bystrom Tom Flynn
2:30 - 3:00	Standards	Rick Fioravanti Peter Klauer
3:00 - 3:15	Break	
3:15 - 4:00	Additional Barriers	Heather Sanders
4:30	Adjourn	

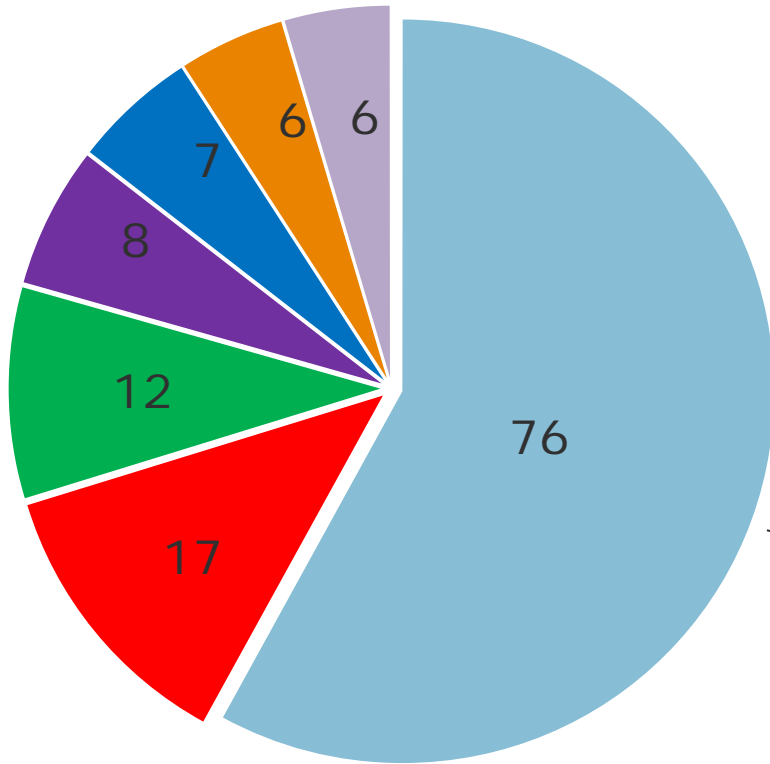
Summary of Outreach Results

Rick Fioravanti, DNV GL

The Initial Public Outreach was very successful in gathering input from a variety of perspectives.

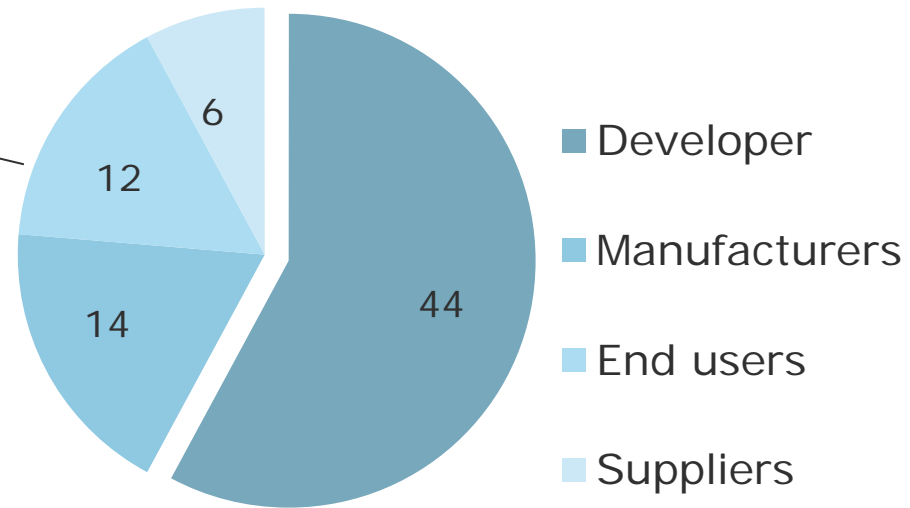
- DNV GL and Olivine, on behalf of the Agencies, conducted a public outreach campaign in late July and the first half of August using a combination of email surveys and an online survey.
- The objective was to gather input from stakeholders to identify barriers, and actions needed to advance energy storage in California.
- Survey results and stakeholder documents are available on the California ISO energy storage roadmap website:
<http://www.caiso.com/informed/Pages/CleanGrid/EnergyStorageRoadmap.aspx>

We received 132 responses across a wide variety of stakeholders.



- Industry
- Utility / IPP
- Association / Non-profit
- Academia
- Government
- Consultant
- Other

Industry Category Breakdown



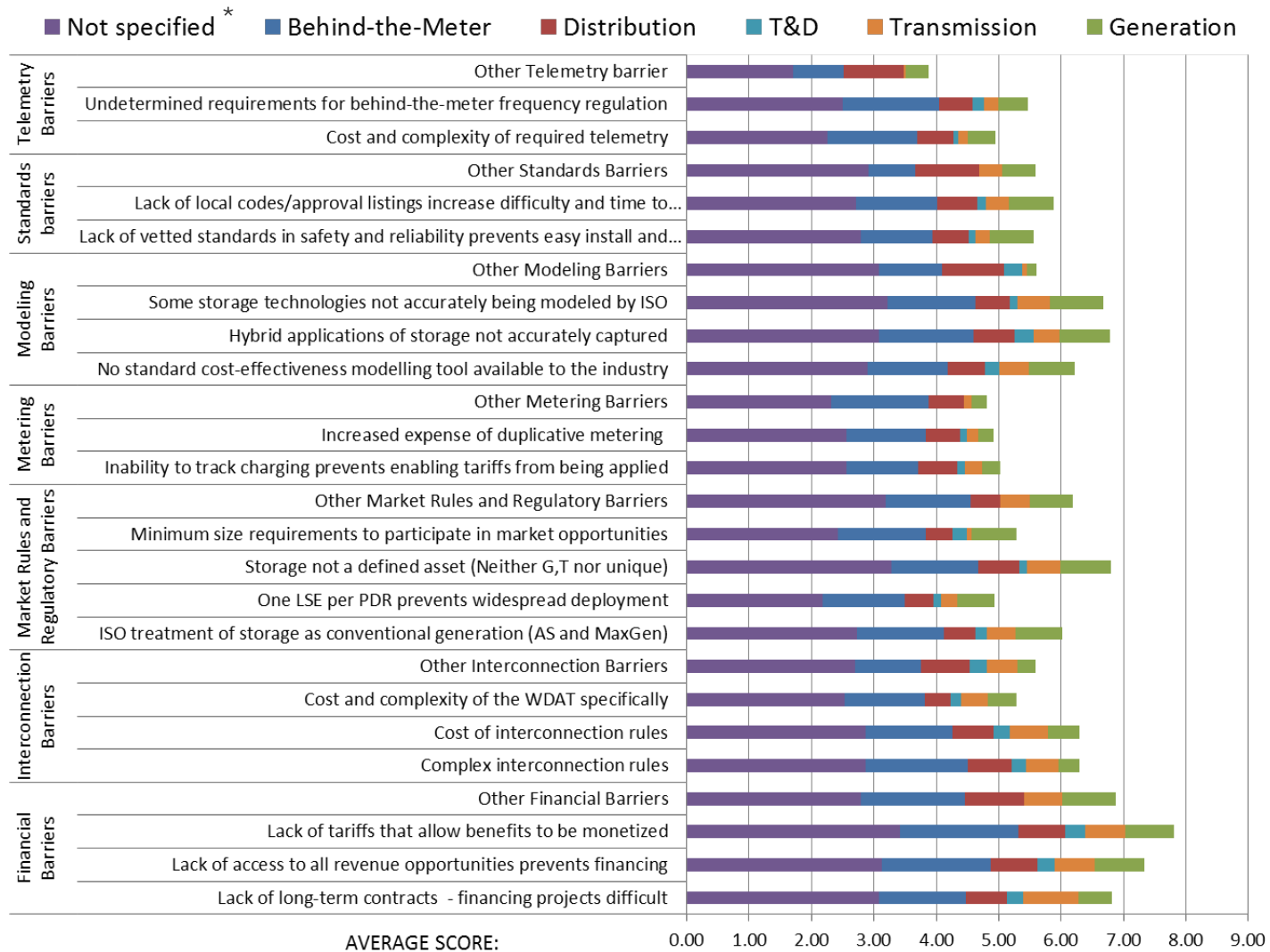
- Developer
- Manufacturers
- End users
- Suppliers

The average score for each barrier category did not signal clear priorities.

Barriers Category	Average Barrier Score
Ancillary Services	6.2
Financial	7.2
Interconnection	6.0
Market Rules and Regulation	5.7
Metering and Telemetry	5.1
Modeling	6.3
Standards	5.5

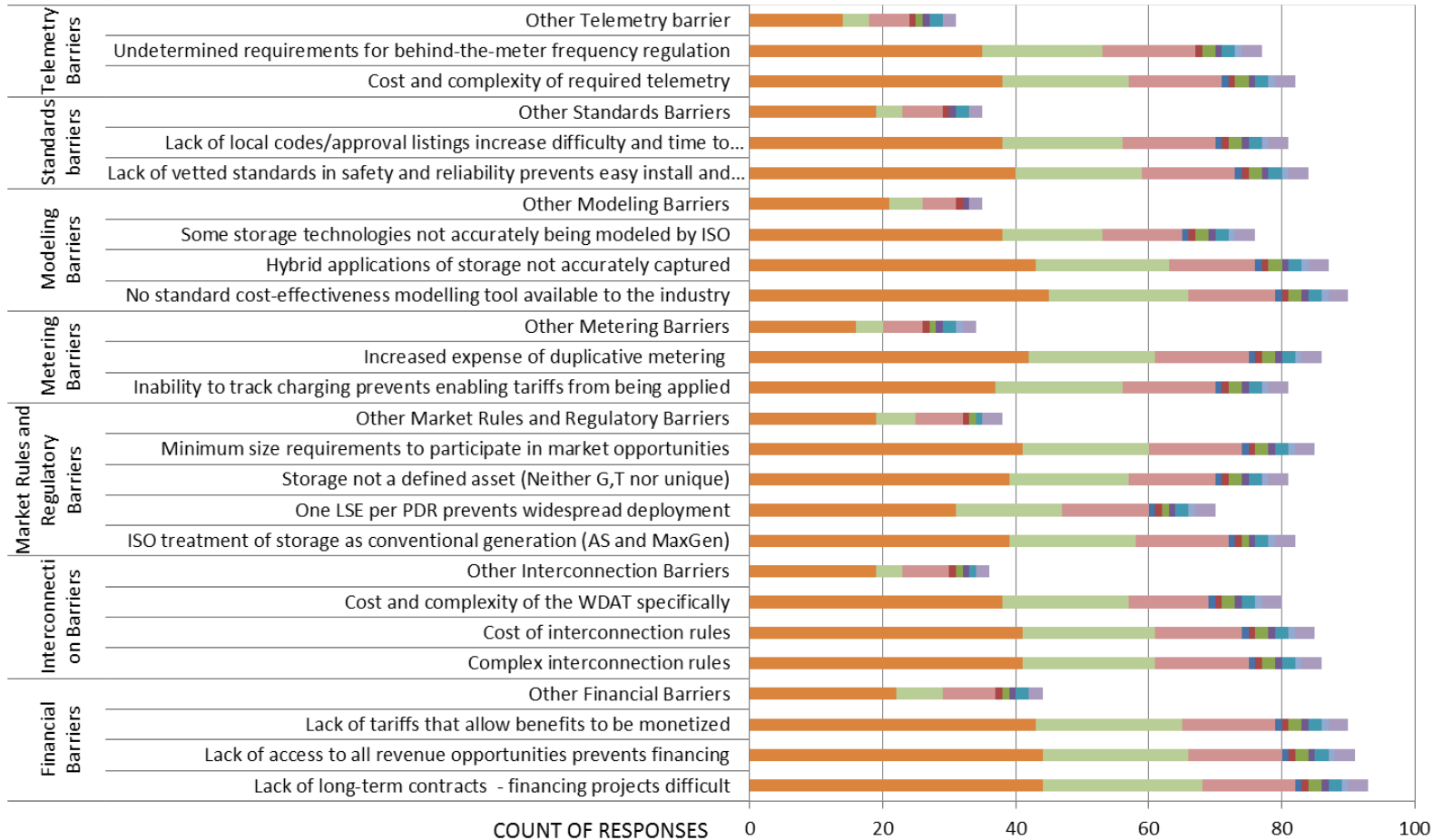
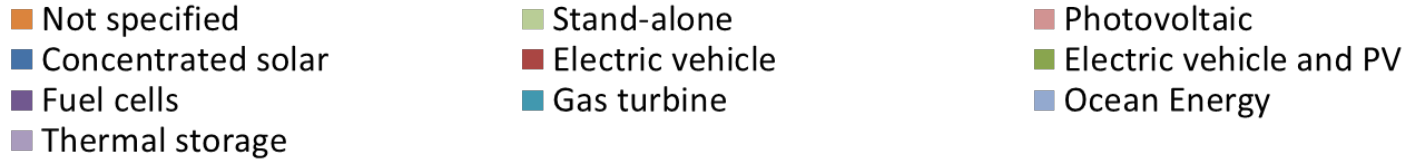
Key: 0= Not a barrier, 10= High barrier

Barriers by Point of Interconnection –Average Score



* Respondent did not state interconnection point (mainly non-developers)

Barriers by leading configurations – Count of responses



Introduction of Stakeholder Key Themes

Heather Sanders, California ISO

Barriers emerge based on objectives to maximize revenue, minimize cost, and manage time.

Products and services



Revenue

- Financial barriers
- Ancillary Service barriers

Rules and requirements



Costs

- Market and Regulatory barriers
- Standards barriers
- Metering barriers
- Telemetry barriers

Complexity and uncertainty



Time

- Interconnection barriers
- Modeling Barriers

Financial and Ancillary Services Barriers

Olof Bystrom, DNV GL

Heather Sanders, California ISO

Survey Results – Financial and Ancillary Services Barriers

Specific Barriers	Average Score	Response Rate (%)
Lack of electricity tariffs that allow all storage benefits to be monetized	7.7	69%
Lack of access to all revenue opportunities for storage preventing financing packages being established	7.3	69%
Lack of long-term contracts for energy storage make financing projects difficult	6.9	71%
Not all benefits of storage can be monetized due to lack of product availability	7.0	69%
Lack of ability to access products from behind-the-meter points of connection	5.6	71%
No enablers that allow operators to leverage unique characteristics of storage (Reg, Black Start, Spin)	6.1	67%

Stakeholder Key Themes – Financial Barriers

- WDAT and CPUC tariffs will require revision (rate treatment and cost recovery for the charging/load function)
- Lack of access to all revenue opportunities for storage prevent financing
- Complexity of products and market rules (many markets)
- Insufficiently defined market products (inertial response, reactive power, local reliability support, flexible RA, compensation for supporting system cost reductions such as Residual Unit Commitment costs)
- The uncertainty and slow implementation of the Permanent Load Shifting (PLS) program , caused TES technology adoption to slow
- Current PPA structure does not support long lead time projects such as pumped storage
- Inability for municipal utilities to take advantage of federal incentives
- Dual use (market+distribution/onsite) needs to be addressed
- High cost of technology
- Bankability challenge caused by immaturity of storage technologies

Stakeholder Key Themes - Ancillary Services

- Lack of product availability and access to products for Ancillary Services, including benefits that cannot yet be monetized:
 - Over generation relief for RPS, local generation requirement, regular/flexible resource adequacy, Voltage control, Reactive power support, Inertia, Black start, Spinning reserve, Transmission upgrade deferral
- Lack of ability to access products from behind-the-meter points of connection and/or in a shared use context
- Lack of ability/clarity in aggregating behind-the-meter resources, especially the potential costs of metering, communication, dispatch and verification
- For building thermal storage, respondents suggested a more wide-spread time-varying pricing and incorporating the value of meeting a utility's resource adequacy
- CAISO procuring ramping in the energy market as spin from providers who do not hit accuracy targets makes it difficult to value Fast Response REM in the post-FERC 755 market

Interconnection Barriers

Beth Reid, Olivine

Tom Flynn, California ISO

Survey Results – Interconnection Barriers

Specific Barriers	Average Score	Response Rate (%)
Complex interconnection rules inhibiting adoption	6.4	66%
Cost to meet interconnection rules inhibiting adoption	6.3	65%
Cost and complexity of the WDAT specifically	5.3	61%

Stakeholder Key Themes - Interconnection Barriers

- Lack of clarity and knowledge regarding the interconnection process among all participants including utilities creates uncertainty, delays, high risk, high costs
- No transition process between Rule 21 and WDAT process
- Rate structures not updated to support storage interconnection and support integration with the wholesale market
- Unknown and exorbitant costs inhibit investment

Market Rules and Regulatory Barriers

Rick Fioravanti, DNV GL

Lorenzo Kristov, California ISO

Survey Results – Market Rules and Regulatory Barriers

Specific Barriers	Average Score	Response Rate (%)
Storage is not defined as an asset, either generation or transmission or unique class	6.7	62%
Minimum size requirements to participate in market opportunities	5.1	65%
ISO treatment of storage assets as conventional generation in regards to ancillary service certification quantities and maximum generation	5.8	63%
One LSE per PDR (and presumably per NGR due to procurement issues) prevents widespread deployment	4.9	53%

Stakeholder Key Themes - Market Rules and Regulatory Barriers

- Unique performance characteristics of storage not being fully valued by market operators – desire to treat as traditional technology undervalues unique capabilities offered by storage
- Rules inhibiting Edge of the Grid Applications participating in Grid Operations and Markets
 - Minimum size requirements discourages small system participation or forces into aggregation agreements
- Hybrid applications, new uses of storage outpacing current rules and applications
 - Contributes to uncertainty in the market
 - Lack of understanding by rule-makers of potential to utilize and apply storage's capabilities
 - PV + Storage
 - Flexibility? Ramping? Not really known how to leverage

Metering and Telemetry Barriers

Robert Anderson, Olivine

Peter Klauer, California ISO

Survey Results – Metering and Telemetry Barriers

Specific Barriers	Average Score	Response Rate (%)
Inability to track where/how storage is being charged preventing enabling tariffs from being applied	5.2	62%
Increased expense of duplicative metering	5.0	66%
Cost and complexity of required telemetry	4.9	63%
Undetermined telemetry requirements for behind-the-meter frequency regulation	5.4	59%

Stakeholder Key Themes - Metering and Telemetry Barriers

- Metering and telemetry costs disproportionately high relative to capacity
 - Costs should be limited by the value gained by that each type of metering, with alternatives and modeling employed where more cost effective
 - Lack of a low cost, "off the shelf" metering and telemetry solution to enable smaller resource aggregation
- Measurement and Verification (M&V) requirements were excessive and unnecessarily onerous, particularly around metering for Permanent Load Shifting programs
 - Improvements can be made monitoring system kW shifted.
 - Respondent cautioned that data and visibility should not be compromised at the expense of saving metering costs
- Inability to distinguish between charging associated with the provision of wholesale services and the provision of customer-side services

Modeling Barriers

Olof Bystrom, DNV GL

Tom Flynn, California ISO

Survey Results – Modeling Barriers

Specific Barriers	Average Score	Response Rate (%)
Hybrid applications of storage not accurately being modelled or benefits not being fully accounted for	6.7	66%
Some storage technologies not accurately being modeled by ISO	6.5	58%
No standard cost-effectiveness modeling tool available to the industry	6.1	69%

Stakeholder Key Themes - Modeling Barriers

- Some technologies insufficiently modeled (or not at all), in particular large long duration resources
- No public and consistent cost effectiveness valuation methodology
- Market price uncertainty
- Lack of data on degradation characteristics of energy storage devices
- ISO models need to improve modeling of cycle depth dependent degradation of batteries, load/supply balance across state, and transmission level ancillary services (FERC 755 Pay for Performance Ancillary Services)
- GIS as an NGR problematic when only viable transmission modeling option is to select Full Deliverability
- Resource control and fit with self-healing grid
- Estimation of greenhouse gas impacts
- Need for seasonal storage neither recognized nor modeled

Standards Barriers

Rick Fioravanti, DNV GL

Peter Klauer, California ISO

Survey Results – Standards Barriers

Specific Barriers	Average Score	Response Rate (%)
Lack of vetted standards in areas such as safety and reliability preventing storage from being easily installed and deployed	5.4	64%
Lack of local codes / approval listings creating difficulty and time in commissioning projects	5.7	62%

Stakeholder Key Themes - Standards Barriers

- Lack of common Standards in key areas are slowing or adding extra cost to storage installations
 - Safety & Reliability
 - Note this is currently being address via U.S. DOE (Sandia, PNNL) creating a roadmap on safety & reliability, National Electrical Manufacturer Association participation in IEC TC 120 on standards, EPRI Energy Storage Integration Council, and DNV GL “GRIDSTORE Effort.”
- Additional Gaps Noted by Stakeholders → Not covered by Outside Agencies
 - Communications...similar to AMI where no “open” communication guidelines to allow integration of devices, different technologies
 - Fire Codes: No set or vetted common fire suppression guidelines
 - Lack of uniform codes creating difficulties at local level

Additional Barriers

Heather Sanders, California ISO

Next Steps

Heather Sanders, California ISO

The draft roadmap will set out a framework to address barriers and stimulate discussion in the next workshop.

Products and services



Revenue

- Financial barriers
- Ancillary Service barriers

Rules and requirements



Costs

- Market and Regulatory barriers
- Standards barriers
- Metering barriers
- Telemetry barriers

Complexity and uncertainty



Time

- Interconnection barriers
- Modeling Barriers

The draft roadmap will set out a framework to address barriers and stimulate discussion in the next workshop.

Objectives and needs

drive

Products and services

and

Rules and requirements

with clear definition, reduce

Complexity and uncertainty



Revenue



Costs



Time

fulfilled through

Procurement mechanisms

governed by

Policy decisions and tariffs

resulting in

Resources and capabilities

implemented through

Well-defined Processes

realized in

Stakeholder participation continues to be crucial.

- Please provide comments by September 18
- Early submission helps facilitate roadmap drafting
- Please capture comments in the comments template provided on the ISO website

Energy Storage Roadmap Schedule

Date	Roadmap Milestone
September 18	Stakeholder comments due
October 2	Publish draft Roadmap
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Mid-December	Publish final Roadmap

Thank you for your participation!

E-mail us at the energy storage mailbox:
EnergyStorage@caiso.com

Find information at the Energy storage roadmap website:
<http://www.caiso.com/informed/Pages/CleanGrid/EnergyStorageRoadmap.aspx>