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An Application-Specific Approach to Energy Storage

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Overview

"Application-specific approach" = an effective framework for identifying and addressing energy storage issues to the benefit of all stakeholders

What is the application-specific approach? → **How might it apply to this OIR forum?** → **Examples and conclusions**

What is an application-specific approach?

SCE's Four-Step Methodology for Evaluating Energy Storage:

Step 1:	Step 2:	Step 3:	Step 4:
Identify operational uses	Develop practical applications	Match applications with technologies	Evaluate application-technology pairs

SCE approaches energy storage by developing and evaluating applications based on practical challenges in the electric system.

Operational uses

Grid location	Minimum duration of output energy (continuous)		
	Short (< 2 min)	Medium (2 min – 1 hour)	Long (1 hour +)
Generation		1 Provide spin / non-spin 2 Provide ramping	4 Provide capacity 5 "Firm" renewable output 6 Shift energy 7 Avoid dump energy and/or minimum load issues 8 Provide black start 9 Provide in-basin generation
	← 3 Provide frequency regulation services →		
	← 10 Smooth intermittent resource output →		
Transmission	11 Improve short-duration performance 12 Provide system inertia	← 15 Improve system reliability →	13 Avoid congestion fees 14 Defer system upgrades
Distribution	16 Improve power quality	← 18 Mitigate outages →	17 Defer system upgrades
		← 19 Integrate intermittent distributed generation →	
End user	21 Maintain power quality	← 22 Provide uninterruptible power supply →	20 Optimize retail rates

Energy storage is a broad and heterogeneous space made up of numerous potential operational uses across the electric value chain.

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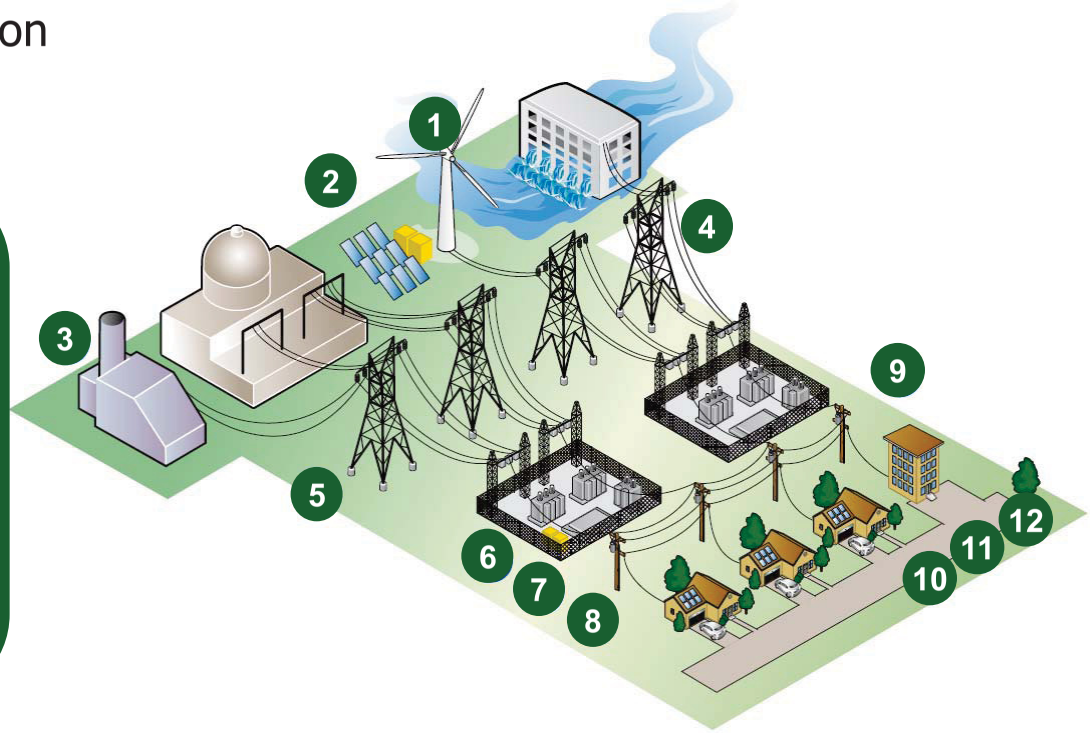
Application development

Application Examples

1. Off-to-on peak intermittent energy shifting & firming
2. On-peak intermittent energy smoothing & shaping
3. Ancillary service provision
8. Peak load shifting downstream of the distribution system
10. End user retail rate optimization

Application Defined:

All of the operational uses (or value streams) a storage device may provide when sited at a specific place & managed in a particular way.



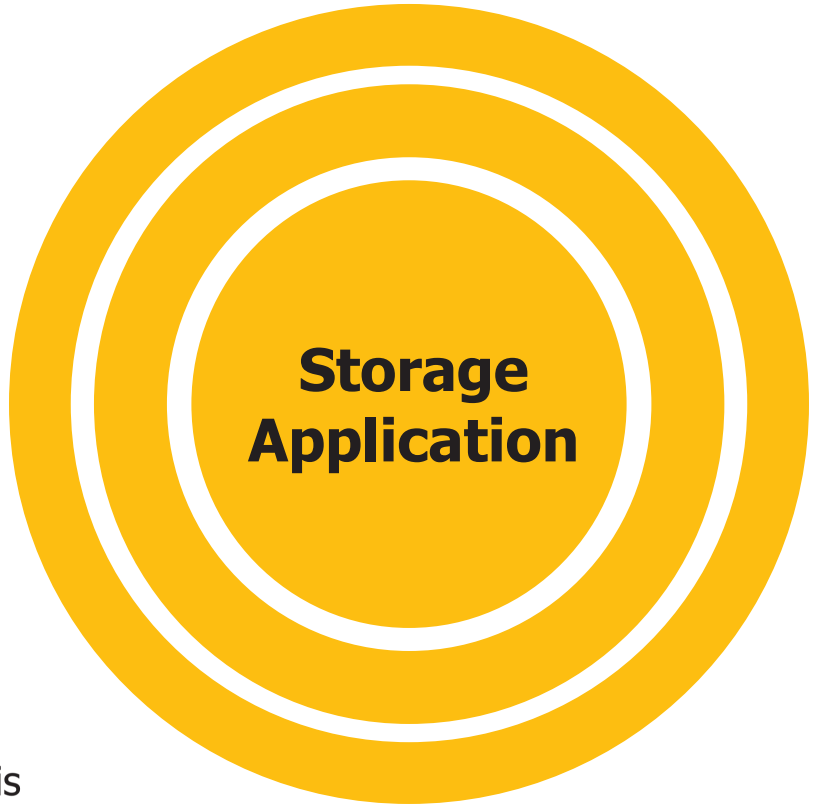
Why application-specific?

Technology Development

- What are storage's specifications and requirements?
- Where and how can a technology by used?
- How much should a technology cost?

Ownership & Business Model

- Who should own a storage device?
- What business model is most appropriate?



Regulatory Uncertainty

- Where are regulations unclear or absent concerning storage?
- At which forums should issues be considered?
- Should we encourage storage?

Benefit Realization

- What benefits can storage target / accrue?
- What is the value of these benefits?

Defining a storage application (what does a device do and where is it located?) is the central and common first step for addressing questions.

How might an application approach align with this proceeding?

Phase 1: Policies and Guidelines

- 1 **Define applications** and associated uses / value streams
- 2 **Identify issues** (regulatory or market impediments) by each application
- 3 **Categorize issues** by jurisdiction (CPUC, FERC, CAISO)
- 4 **Assess & prioritize** whether / how the CPUC can help resolve the issues

Phase 2: Benefits, Costs and Allocation

Following the above four steps in the first phase will ensure that impediments to storage deployments are identified and addressed.

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6/28 Workshop Questions

	How are or will energy storage systems be used?	Barriers and impediments to further widespread use
Alignment With Proposed Phase 1 Approach	1 Define applications and associated uses / value streams	2 Identify issues (regulatory or market impediments) 3 Categorize issues by jurisdiction 4 Assess / prioritize whether & how the PUC can help resolve issues
Key Principles	• Benefits are a function of each application's physical location and operating profile • It is difficult to evaluate technologies independent of their matching applications	• Each application has unique issues based on its location and operational uses • Issues should be considered in the appropriate forums • **Resolving regulatory uncertainties will clarify the value proposition for affected storage applications**

Clear and appropriate rules will help unlock potential value streams for some storage applications

EXAMPLE 1:

Off-to-on peak intermittent energy shifting & firming at or near generation

Description

Charge at the site of off-peak renewable and / or intermittent energy sources (storage device should be sized to absorb several hours of energy); discharge "firmed" energy to grid during on-peak periods.

Define application	Regulatory impediments to further adoption		
1 Primary Operational Uses	2 Policy Barriers [1]	3 Jurisdiction	4 CPUC Role in Resolving Issue
Resource Adequacy / dependable operating capacity	No rules exist for determining RA for a storage device	CPUC – Annual RA proceeding	Coordinate proceedings
Energy shifting (arbitrage)	Tariff clarifications & revisions (*and related software upgrades*)	CAISO (FERC approval)	Identify issues and recommend to proper forum for resolution
Renewable output firming	Integration costs and markets not yet developed or fully understood	FERC (CAISO to implement) – Integration of VER proceeding	Identify issues and recommend to proper forum for resolution
Intermittent energy smoothing			

1. *Non policy-related barriers are identified in italics. Cost-effectiveness is a potential barrier that applies to each application.*

EXAMPLE 2:

Peak load shifting downstream of distribution system

Description

Charge device during off-peak downstream of the distribution system (located below the secondary transformer); discharge during the 2-4 hour peak period daily.

Define application	Regulatory impediments to further adoption		
1 Primary Operational Uses	2 Policy Barriers [1]	3 Jurisdiction	4 CPUC Role in Resolving Issue
Energy shifting (avoided wholesale cost)	None	N/A	N/A
Resource Adequacy / dependable operating capacity	Unclear / restrictive rules for determining the RA qualification of a storage device on the load side	CPUC – Annual RA proceeding	Coordinate proceedings
Distribution infrastructure upgrade deferral	None	CPUC – GRC process or separate application	Assess the merits of any future request

1. *Non policy-related barriers are identified in italics. Cost-effectiveness is a potential barrier that applies to each application.*

EXAMPLE 3:

End user TOU rate optimization

Description

Charge device when retail TOU prices are low, discharge when high (or during DR curtailment periods). The device must be sited on the customer side of the meter in order to optimize retail TOU rates in this context.

Define application	Regulatory impediments to further adoption		
1 Primary Operational Uses	2 Policy Barriers [1]	3 Jurisdiction	4 CPUC Role in Resolving Issue
Customer rate optimization/ demand response	TOU rates not mandatory for many customers	CPUC	Ruling on customer TOU rate adoption
	TOU rate schedules may not fully reflect system costs	CPUC	Rulings on TOU rate design
	Smart meter deployment	CPUC	N/A

1. *Non policy-related barriers are identified in italics. Cost-effectiveness is a potential barrier that applies to each application.*

Conclusions

- ✓ Clear and appropriate rules will help unlock potential value streams for some storage applications
- ✓ Regulatory issues can only be meaningfully identified by application
- ✓ Depending on the issue, different regulatory forums will need to be consulted (e.g., FERC, CAISO, CPUC)
- ✓ There are outstanding questions on whether / how to prioritize issues once they are identified
- ✓ Identifying and resolving / referring issues is in the best interests of all stakeholders (e.g., buyers, suppliers, regulators, customers)