Community Energy Storage

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1. Overview Section

Utilities have long strived to match electrical supply to electrical demand. While they have very successfully proven their ability to do this it has been done by building the entire grid infrastructure to accommodate peak demand periods which occur a small percentage of the time. Most utilities see their electrical demand peak between 4 – 7pm. As California moves towards full implementation of its 33% Renewable Portfolio Standard (RPS) utilities will be further challenged to match electrical supply and demand for the utility customer. Wind and solar renewable energy resources are both inherently intermittent and the times of day when these resources are most productive do not align with the demand curves for utilities.

2. Use Case Description

This use case describes an energy storage asset (10kW with two hours of storage capacity) located downstream or behind an end customers electric meter. The asset can be controlled in real time via a secure internet connection. Real time monitoring and data collection is also provided. The energy storage device can be integrated with solar PV production or exist on a standalone basis. There are several potential ownership models for Behind The Meter (BTM) energy storage. The utility ownership model is discussed in this use case.

2.1 Objectives

Utility owned and controlled Behind-The-Meter (BTM) energy storage can be utilized to dispatch energy to coincide with periods of peak electrical demand. Releasing energy coincident with the **utility's** peak demand allows for the maximum impact on reducing costly distribution plant upgrades (to address ever increasing peak electrical demand), providing voltage support, and increasing reliability. In addition, the utility can use aggregated BTM energy storage as an additional asset to participate in the ancillary services market. When coupled with distributed solar production, BTM energy storage can provide can help firm intermittent electric production and allow self-consumption in high penetration PV areas.

Electric customers benefit by utilizing the BTM energy storage device to provide emergency power to critical circuits during a grid outage. This protects key equipment and/or processes from the effects of weather related electricity interruptions and outages, rolling blackouts, brownouts, and generation and / or transmission system failures upstream of the customer sited energy storage resource.

2.2 Actors

Name	*Role description*

Commercial Electrical Customer	Building owner on commercial tariffs
Residential Electric Customer	Building owner on residential tariffs
Utility	Investor Owned Electric Utility, Municipal Electric Utility, Electric Cooperative Utility

2.3 Proceedings and Rules that Govern Procurement Policies and Markets for This Use

Agency	*Description*	*Applies to*
CPUC	Self-Generation Incentive Program	
Federal Tax	FITC	
Utility Tariffs	Utility TOU Tariffs	
CPUC	AB 2514	
CEC	Definition of Renewable Technology	Ability to interconnect storage on NEM or VNM meters with renewable generation on site

2.4 Location

The energy storage resource is located behind the customer's electric meter. Solar energy may or may not be co-located.

2.5 Operational Requirements

The energy storage asset should be able to be controlled in real time by the utility, preferably by secure internet communications. The equipment should be self-contained, maintenance free, safe, and comply with UL 1741 standards for utility interconnection. Power output and duration could vary dependent on utility and application.

Upstream aggregation software would be necessary to ease control and data collection of multiple units.

2.6 Applicable Storage Technologies

The energy storage devices would use commercially available, UL listed batteries in this application. The most applicable battery technologies today are Absorbent Glass Mat Sealed Value Regulated Lead Acid (AGM VRLA) and Lithium Ion.

Storage Type	*Storage capacity*	*Discharge Characteristics*
Li-ion Battery	2 hours at rated output (this is a variable)	
AGM VRLA	2 hours at rated output (this is a variable)	

2.7 Non-Storage Alternatives for Addressing this Objective

Programs historically used by utilities to reduce peak electrical demand include:

- Air Conditioning Cycling – Utility owns local communications and switching equipment on customer site to cycle on and off an air conditioner compressor. Typically achieves about 1 kW in electrical reduction per residence. Results in higher indoor temperature.
- Demand Response Programs – Utility driven events which incentivize commercial electric customers to decrease electrical consumption during peak demand periods.

3. Cost/Benefit Analysis

3.1 Direct Benefits

End Use	***Primary/ Secondary***	***Benefits/Comments***
1. Frequency regulation	**S**	
2. Spin		
3. Ramp		
4. Black start		
5. Real-time energy balancing		

6. Energy arbitrage		
7. Resource Adequacy		
8. VER[1] / wind ramp/volt support,		
9. VER/ PV shifting, Voltage sag, rapid demand support		
10. Supply firming	P	If combined with onsite solar or wind.
11. Peak shaving: load shift	P	
12. Transmission peak capacity support (deferral)		
13. Transmission operation (short duration performance, inertia, system reliability)		
14. Transmission congestion relief		
15. Distribution peak capacity support (deferral)	S	
16. Distribution operation (volt/VAR support)	S	
17. Outage mitigation: microgrid	S	
18. TOU energy mgt	P	Helps reduce peak demand charges
19. Power quality	S	
20. Back-up power	S	Can provide backup power to critical circuits

3.2 Other Beneficial Attributes

Benefit Stream	*Y/N*	*Assumptions*
Flexibility (Dynamic Operations)	Y	

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[1] VER = Variable Energy Resource

Reduced Fossil Fuel Use	Y	
Reduced emissions	Y	
Increase T&D Utilization	Y	
Reduced T&D Investment	Y	
Power Factor Correction	Y	Dependent on equipment capabilities
Voltage Support	Y	
Maximize self-consumption of renewable generation	Y	When paired with on-site renewable generation.
Backup Emergency Power	Y	Including continued solar production during blackout

3.3 Costs

Cost Type	*Description*
Installation	
O&M	

3.4 Cost-effectiveness Considerations

Utilities have the ability to drive large volumes and creating a very cost competitive market for this type of distributed energy storage equipment. Large format, cost effective lithium ion battery technology is being driven by the electric vehicle industry. The batteries comprise the largest cost component of the distributed storage solution. Battery costs are linear in respect grid scale (large centralized energy storage systems) and distributed BTM energy storage systems.

The real savings of BTM energy storage systems comes from the reduction in non-equipment costs. These costs include planning, installation, site acquisition costs, etc. Because the units located at an electric customer's site the utility avoids many site planning and construction issues. The customers who opt into the program provide many of these services in exchange for the emergency backup features of energy storage during a grid outage.

4. Barriers Analysis & Policy Options

4.1 Barrier Resolution

Barriers Identified	*Y/N*	Policy Options / Comments
System Need		
Cohesive Regulatory Framework		
Evolving Markets		
Resource Adequacy Value		
Cost Effectiveness Analysis		
Cost Recovery Policies		
Cost Transparency & Price Signals		
Commercial Operating Experience		
Interconnection Processes		

4.2 Other Considerations

5. Real World Example

5.1 Project Description

Silent Power has installed 15 behind the meter OnDemand Energy Appliances in Rancho Cordova, California. Each OnDemand system is installed in a solar PV homes within a solar community. SMUD's $5.9 million pilot project will evaluate how the integration of energy storage enhances the value of distributed PV resources for the community, the utility and the grid by reducing peak loads, firming intermittent renewable capacity and maximizing overall system efficiency. The pilot project will allow monitoring of PV systems, along with energy storage, to give SMUD a better assessment of the value of distributed energy resources from a utility standpoint. SMUD will be able to determine how well the storage systems can support its super-peak consumption times, when output from the PV systems drops significantly. Based on these outcomes, the utility may replicate the technology throughout its service territory should it prove feasible.

Location	*Sacramento Municipal Utility District*
Operational Status	Operational
Ownership	Utility owned and controlled, installed in residential solar homes
Primary Benefit Streams	Solar shifting, solar firming
Secondary Benefits	Peak demand reduction, T&D utilization
Available Cost Information	

5.2 Outstanding Issues

Description	*Source*

5.3 Contact/Reference Materials

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6. Conclusion and Recommendations

Is ES commercially ready to meet this use?

Yes

Is ES operationally viable for this use?

Yes

What are the non-conventional benefits of storage in this use?

Combines numerous utility/ISO benefits with emergency backup power for electric customer

Can these benefits be monetized through existing mechanisms?

Yes

If not, how should they be valued?

Is ES cost-effective for this use?

Yes

What are the most important barriers preventing or slowing deployment of ES in this use?

Utility ownership of customer sited assets

What policy options should be pursued to address the identified barriers?

Allow utility owned BTM energy storage

Should procurement target or other policies to encourage ES deployment be considered for this use?

Yes