

SMUD Energy Storage Roadmap

Technical Working Group
Presentation
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Provide information and background on SMUD's past energy storage efforts and future roadmap including established procurement targets.



So that we can utilize past experience, data and results to identify inputs to the Value of Solar and Value of Solar Plus Storage Study.

Energy Storage Research & Development Past Portfolio



Over the past decade, SMUD has developed a diverse portfolio of energy storage pilots including behind the meter (BTM).

2010 SMUD PV and Smart Grid Pilot at Anatolia (Both)

2012 Microgrid Demonstration Project (Thermal Energy Storage)

2016 Commercial Customer Load Management Pilots (Hyatt Regency & Whole Foods) (BTM)

2001 Investigation Began for Iowa Hill Pump Hydro Storage (400 MW). Cancelled in 2016

2011 Conducted Benefit of Energy Storage Case Study with Electric Power Research Institute (EPRI)

2014 2500 R Street Energy Management Pilot (BTM)

2017 SMUD's Board Adopted Energy Storage Procurement Target of 9MW by the end of 2020 (75MW by 2026) (Both)

Examples of Value of Storage Benefits From Past Studies



- Reduced Transformation Losses and Energy Savings
- Emissions Reductions
- Ancillary Services and Voltage Support
- Retail Benefit (Customer)
- Wholesale Market benefit (Utility)
- Local Grid Support
 - Momentary outages
 - Grid Restoration
 - Infrastructure Congestion
 - Coincident Load Management
- Deferred or Avoided Investment
 - Transmission
 - Generation
 - Distribution

Board Adopted Energy Storage Targets & Research Goals



2017 – 2020: Strategic Readiness

- How do customers respond to various business models?
- Can we quantify technology reliability to provide distribution and grid services?
- What are the requirements to control and aggregate assets to access desired services?

9 MW

Target
Check
Point

2021 – 2023: Business and Integration Optimization

- Which business models do we intend to move forward with?
- What new cyber security and operating challenges arise when we think about relying on Storage?
- Are back office systems ready to capture the full value chain and realize the benefits of grid services?

28 MW

Target
Check
Point

2024 – 2026: Financial Viability

- Will the technology and program designs scale with broad natural adoption?
- Are the value streams modeled in previous phases the same as volume increases?
- What are the long term drivers for customer energy storage adoption?

75 MW

Beyond 2026: Standard Business Operations

- Storage operationalized. Questions become programmatic rather than research-oriented.
- How can we continue to enhance the value of energy storage for SMUD and our customers?
- What is the right amount of energy storage for SMUD given the mature market conditions?

Potential
246 MW
Need by
2030
Identified
by SMUD's
IRP

Phased
Research
Demos &
Scaled
Customer
Pilots

Transition
to
Standard
Business
Operations

Primary Research Intent (2017 – 2023)



Awareness, Processes & Procedures

- Customer Value
- Establish Interconnection Processes
- Permitting Collaboration with Local Government Agencies
- Launch of Initial Customer Programs

Data Integration & Visibility

- Understand Communication Reliability
- Device Accuracy and Communication Latency
- Integration with Device Aggregators
- Integration with SMUD's Distributed Energy Resource Management System (DERMS)

Energy Dispatch

- Response Reliability
- Cyber Security
- Contracted Performance
- Metering Requirements
- Market Potential
- Location Based Benefits



Residential

Commitment to Operate (CTO)

Incentive: \$300 - \$600 (one time).

Intent: Encourage utilization of interconnection process. Optimization renewable self consumption and time of day pricing.

Next Steps: Launch data integration and dispatch pilot.

Commercial

Commitment to Operate (CTO)

Incentive: \$600 - \$5,000 (one time).

Intent: PV/TOD Optimization. Utilization of interconnection process.

Next Steps: Launch data integration and dispatch pilot.

Sector	Battery Storage Installed		Battery Storage Procured (not installed)	
	Total Customers	KW	Total Customers	KW
Residential	114	724.87	75	495.35
Commercial	2	290	0	0



- SMUD believes energy storage will be a critical component of the future grid.
- Past research, current work and future planning all consider the potential opportunities that this technology will bring.
- Current efforts focus on understanding the benefits and barriers for energy storage to ensure successful long term grid integration.
 - Locational benefits...
 - Cyber security...
 - Contracted capacity...
 - Infrastructure reliance...
 - Optimized for customers and the community...

FYI / Appendix Items

Sacramento Municipal Utility District

PV and Smart Grid Pilot at Anatolia



- SMUD demonstrated advanced lithium ion storage at customer and distribution transformer locations in the Anatolia III Solar Smart Homes Community located in the southeast portion of SMUD's service territory in the city of Rancho Cordova, CA.
- Pilot Focus
 - Firm intermittency of PV generation
 - Mitigate reliability impacts
 - Reduce utility system peak load
- Pilot Technology
 - (3) Transformer Sited Batteries
 - (15) Residential Storage Systems



Benefit Analysis of Energy Storage: Case Study



The objectives of this project was to apply earlier developed and generic energy storage dispatch models and evaluation methods to several cases and locations in the SMUD service territory.

- Evaluation of Residential Energy Storage Systems.
- Evaluation of neighborhood located storage systems on the SMUD side of the meter.
- Evaluation of Substation and Transportable Storage systems for Grid support and to provide a comparison for SMUD of all three use cases.

Study performed by:



2500 R Street Integrated Energy Management Use Case Report



The first Net Zero Energy community in Sacramento's midtown district.

- 34 homes with PV panels rated at 2.25 kW output, 4.5 kW inverter, and the battery storage of 11.7 kWh per home.

