

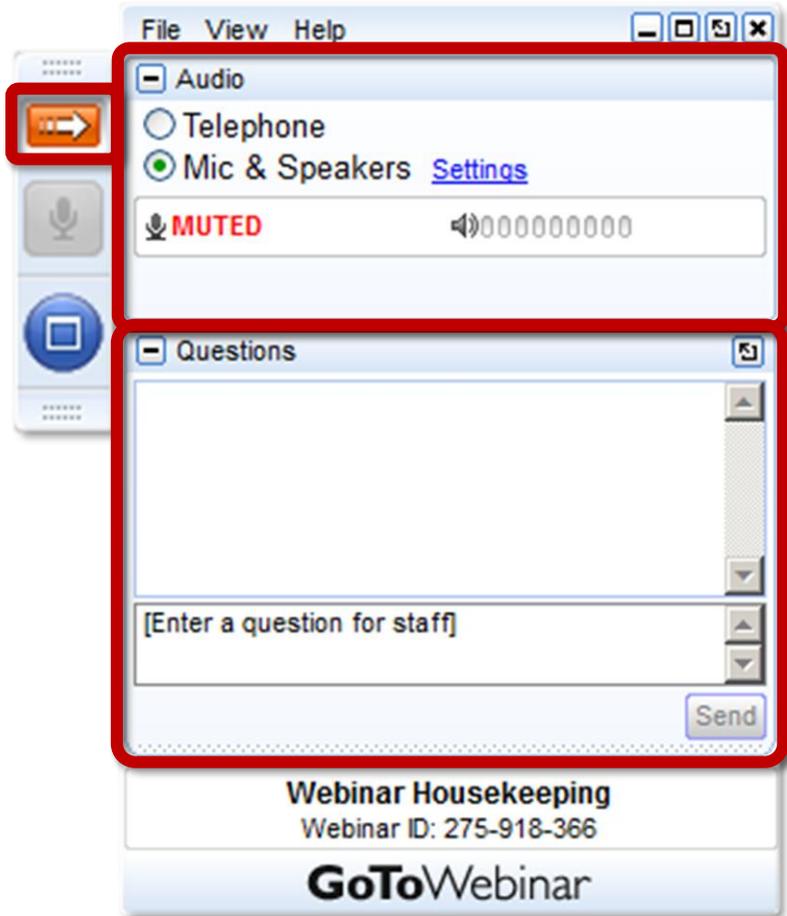
2020 AWARDS

State Leadership in Clean Energy

State Leadership in Clean Energy: SMUD's Energy StorageShares and Smart Energy Optimizer Programs

August 20, 2020

Housekeeping



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Webinar Speakers



Warren Leon

Executive Director, Clean
Energy States Alliance



Todd Olinsky-Paul

Senior Project Director,
Clean Energy States
Alliance (moderator)



James Frasher

Sr. Strategic Business
Planner, ESR&D, SMUD



CleanEnergy States Alliance



The 2020 State Leadership in Clean Energy Award Winners



Learn more about the award winners at:

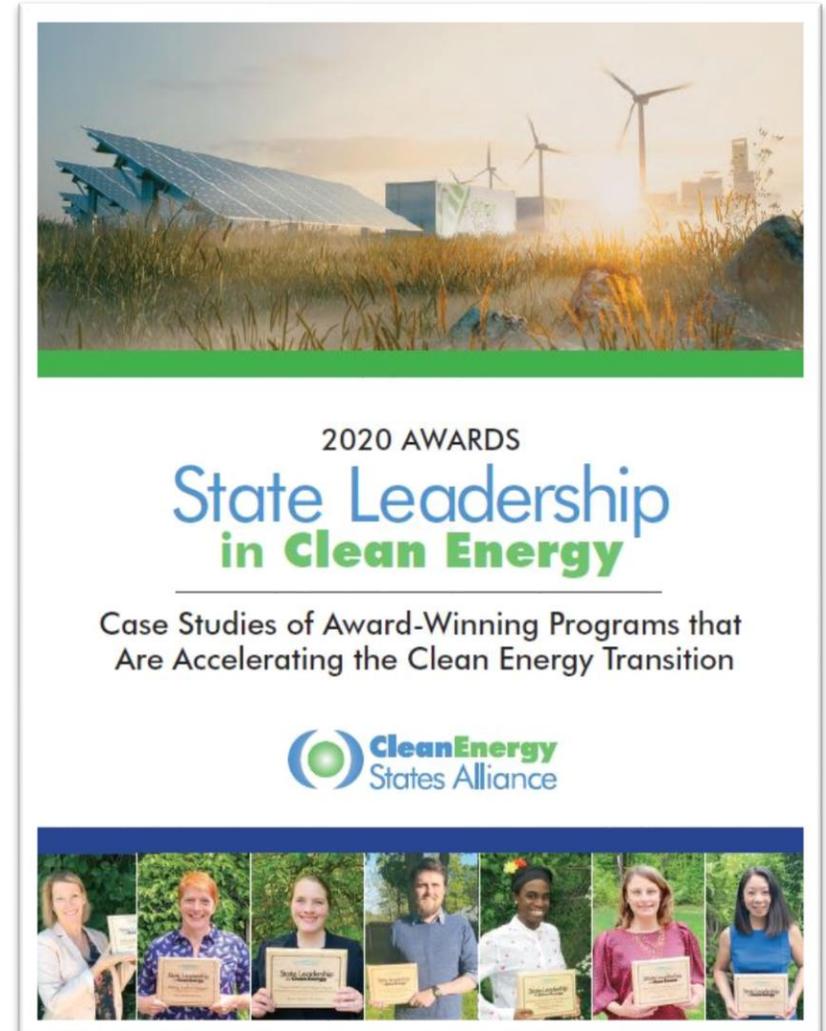
<https://www.cesa.org/projects/state-leadership-in-clean-energy/2020-awards/>

2020 State Leadership in Clean Energy Awards

- The California Energy Commission (CEC)'s **Renewable Energy for Agriculture Program (REAP)**
- Energy Trust of Oregon's **Inclusive Innovation Project**
- Massachusetts Clean Energy Center and Massachusetts Department of Energy Resources' **Mass Solar Loan Program**
- Michigan Department of Environment, Great Lakes, and Energy's **Michigan Solar Communities – Low- to Moderate-Income Access Program**
- New York State Energy Research and Development Authority's (NYSERDA) **Offshore Wind Program**
- Sacramento Municipal Utility District's (SMUD) **Energy StorageShares**

Read case studies on the 2020 award winners at:

<https://www.cesa.org/resource-library/resource/2020-slice-report/>



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CESA SLICE Webinar: SMUD Energy Storage Shares Program

James Frasher

August 20, 2020

Powering forward. Together.



Agenda

- About SMUD
- Energy Storage Vision
- Program Overview
 - StorageShares
 - Smart Energy Optimizer (SEO)

About SMUD Today

We're Community-Owned and Not-For-Profit



1.5
million

in our service area

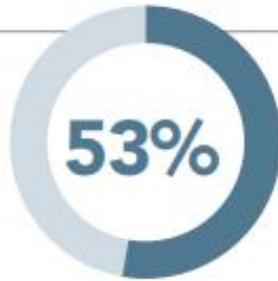
900
sq. miles
service area

Customers
residential + business:

628,952
(as of Dec. 31, 2017)



Number of SMUD
employees:
2,293



Carbon free
resources in power mix

What Guides SMUD

Strategic direction is set by a community elected 7-member Board

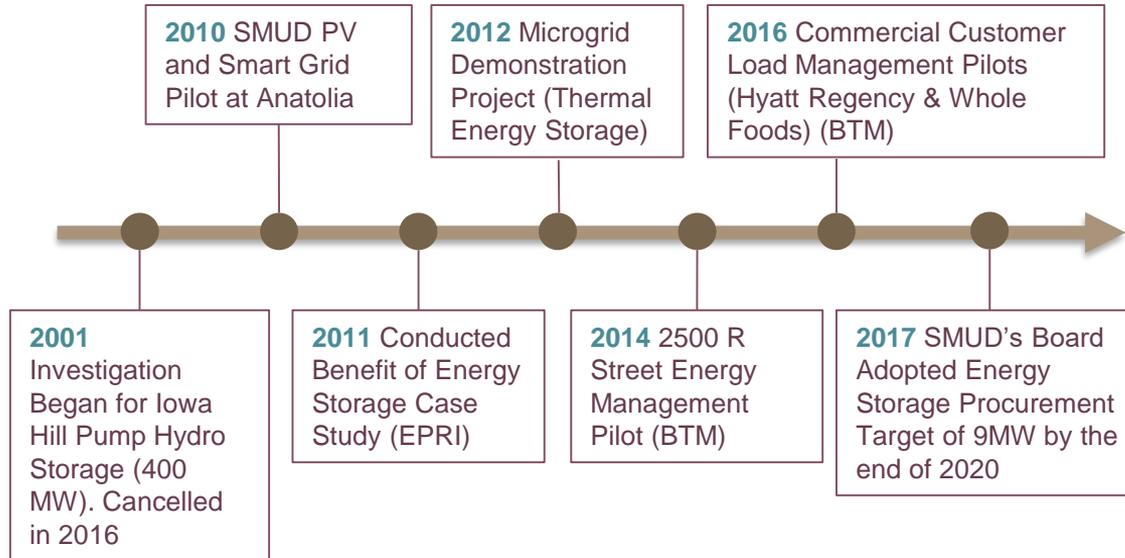
In 2018 SMUD's Board adopted a net-zero-carbon target by 2040.



NET-ZERO-CARBON
ELECTRICITY BY
2040

History of Energy Storage at SMUD

Over the past decade, SMUD has developed a diverse portfolio of energy storage pilots.



Energy Storage Road Map

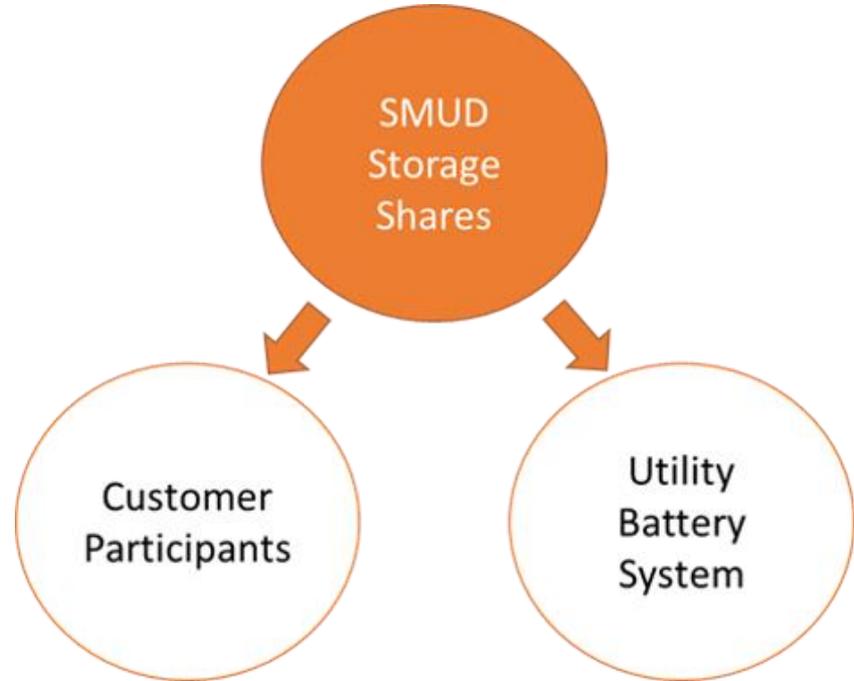


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SMUD Energy StorageShares

StorageShares

StorageShares is a battery program that allows commercial customers to invest in an energy storage system that does more than just reduce their cost of electricity. StorageShares enables retail savings and optimizes the grid benefits of energy storage.



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Customer Participants

StorageShares – Customer Participants

- Customer buys shares at an upfront cost and receives a benefit over 10 years (1 share = 1kW of demand charge reduction)

Customer Rate Class	2020 Share Price (\$/Share)
General Service Demand (GSS_T)	\$520
Small General Service (GS-TOU3)	\$485
Medium General Service (GS-TOU2)	\$480
Large General Service (GS-TOU1)	\$475

- Customer benefit is provided by SMUD on the customer's bill (120 total bill credits).

StorageShares – Target Customers

- Commercial customers with a low load factor and high peak demand.
- Customers in locations with low grid needs.
- Not for customers seeking back-up power.



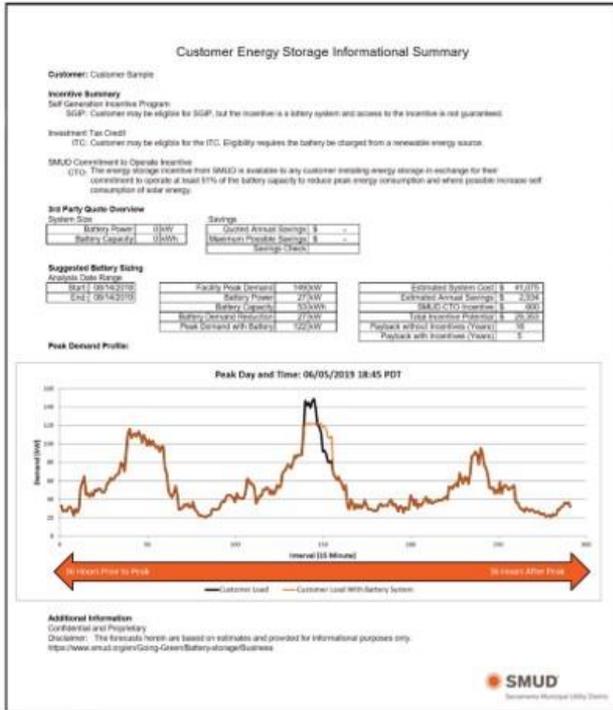
StorageShares Benefits and Limitations

- No interconnection, maintenance or operating costs.
 - Guaranteed performance.
 - If your business relocates, StorageShares can move with you (within SMUD service territory).
 - No disruption to normal business operations.
 - Continue to receive only one bill from SMUD.
-
- Number of shares offered is limited to the potential benefit an actual battery could provide.
 - Participant agrees to not install a battery for demand charge reduction (no double dipping).
 - Only customers on rates with demand charges are eligible.

Customer Engagement

- All customer engagement begins with education.
 - Identify customer's motivation for battery storage.
 - Educate customers on the benefits and costs of battery storage.
 - Assess how SMUD's available programs align with the customer's needs.
- SMUD conducts analysis with a battery sizing tool for interested customers.
 - Determines if the customer load shape is ideal for a battery.
 - Determines the number of shares a customer may be eligible for.
- SMUD provides a summary report to help customers understand how a battery can affect their peak load.

Example Summary Report



- Shows peak kW demand reduction a battery system could deliver.
- Provides the number of shares the customer is eligible for.
- Offers estimated cost information for comparing 3rd party battery project proposals.
- Lists possible incentives and tax credits available for battery system installation.

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Utility Battery System

Utility Benefit

- SMUD deploys and manages a battery based on locational grid needs.
- Battery operation is independent of StorageShares on-bill customer benefit.
- Battery procurement benefits from economies of scale.
- Utility control creates a supply side resource instead of demand side load shaping.

Impact of Utility Deployment

Example Scenarios

Scenario 1: Individual Optimization

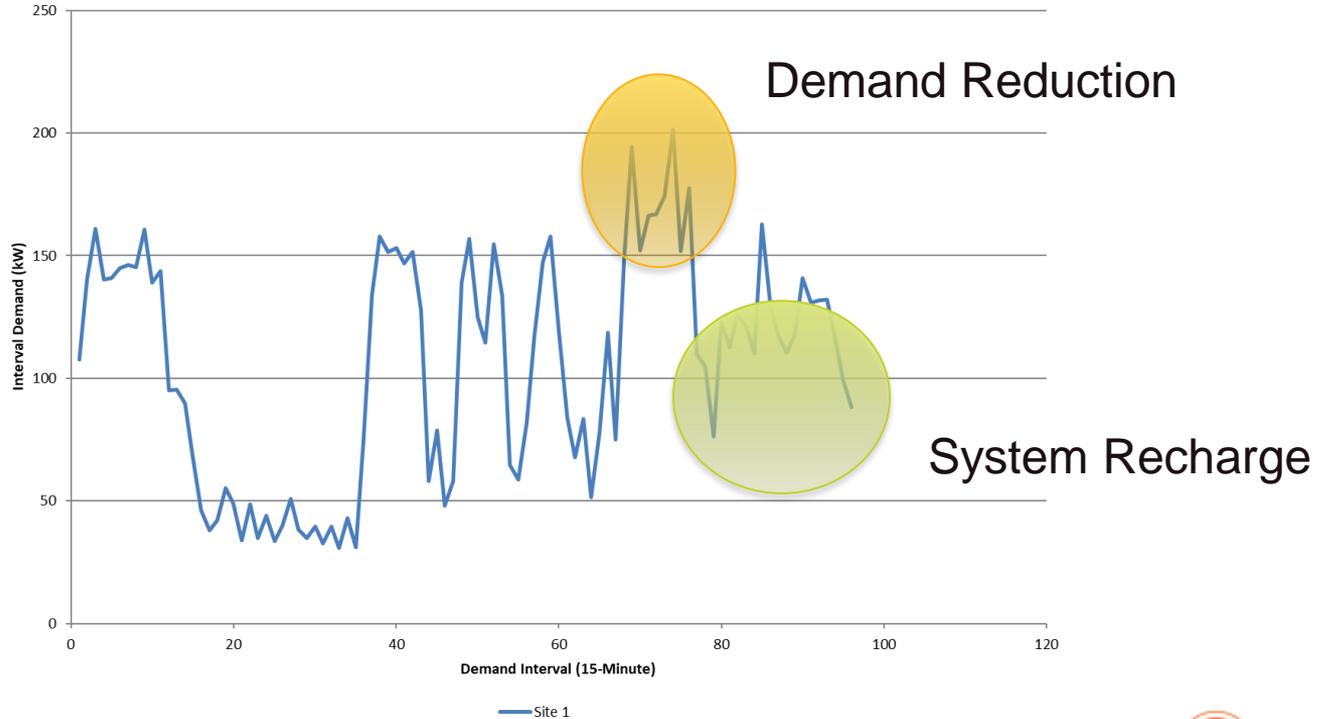
- 9 Systems Installed - Each sized at 60kW // 120kWh
- Total Batteries installed – 540kW // 1080kWh

Scenario 2: Aggregated Optimization

- 1 System Installed – 200kW // 400kWh

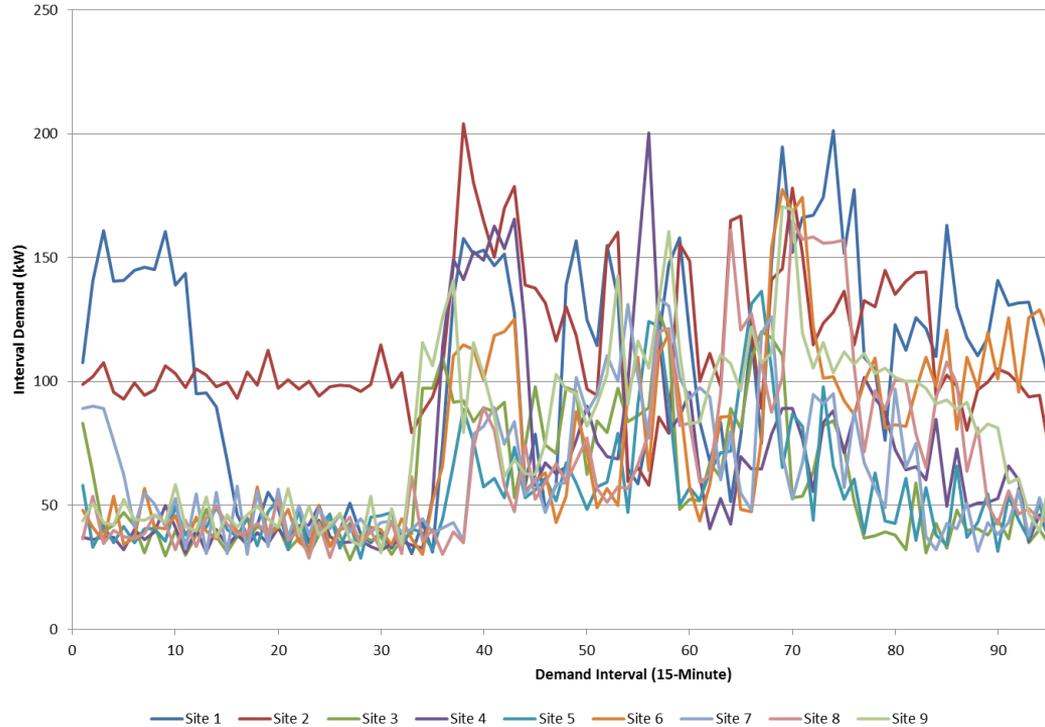
Individual Customer Load

This graph shows an individual commercial customer load profile for 1 day. The curve contains 96 data points taken at 15-minute intervals. Recording data at 15-minute intervals is standard for commercial customers.



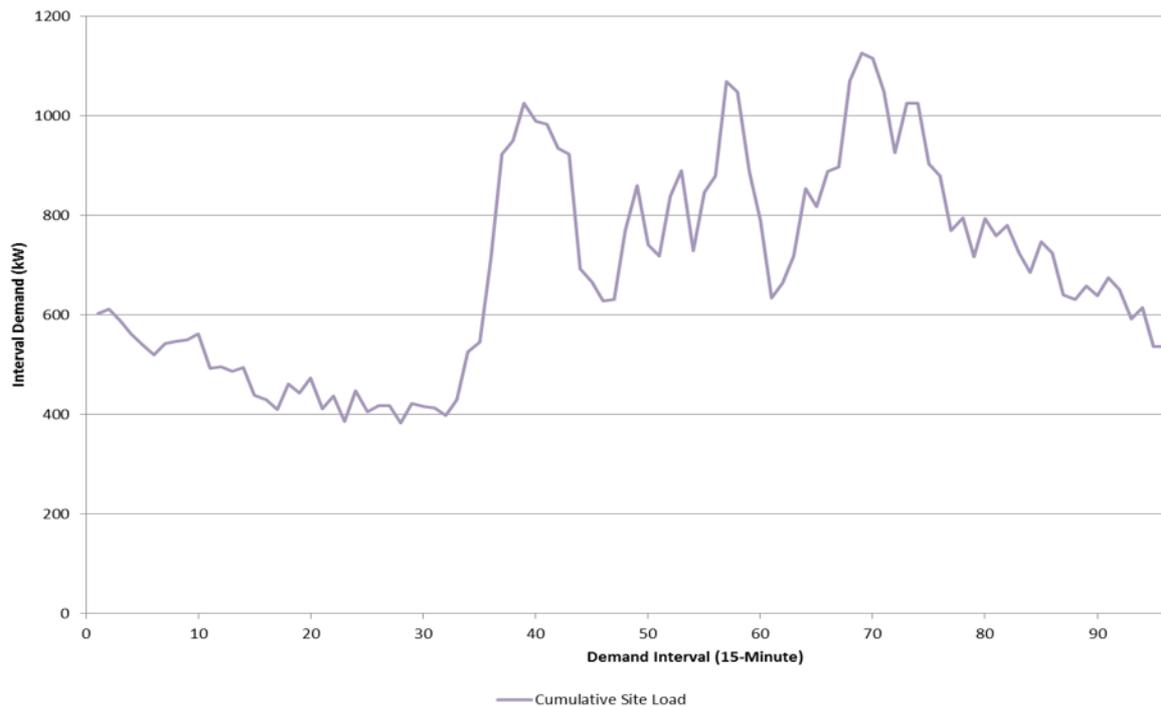
Individual Customer Loads

This graph is an overlay of data from 9 similar commercial customer loads for a 24 hour day. Each line shows the utility meter readings for an individual customer.



Aggregated Customer Loads

Adding the individual customer loads together shows the load that SMUD serves for these 9 customers. Lowest consumption occurs overnight with increased consumption during the daytime.



Scenario Details

The impact of battery control was evaluated under 2 scenarios. Scenario 1 assumes installation of batteries by individual customers and operation based on individual demand charge reduction. Scenario 2 considers the installation of a smaller battery system to reduce peak demand of the aggregated load.

Scenario 1: Individual Optimization

9 Individual Systems Installed: Each sized at 60kW // 120kWh

Total Batteries installed: 540kW // 1080kWh

Estimated Total Battery Cost: \$600,000 to \$1,000,000

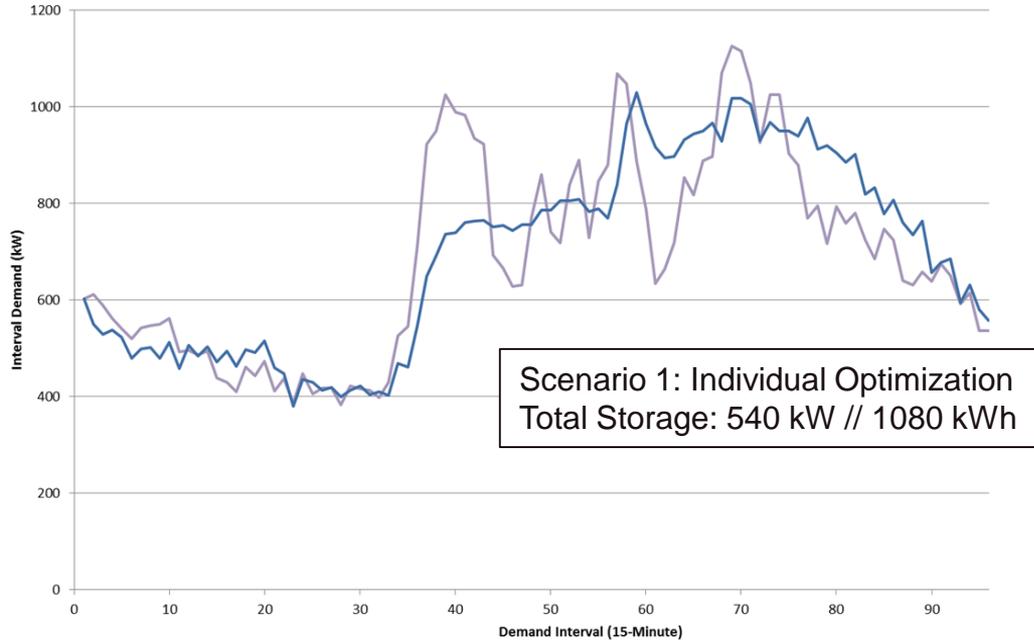
Scenario 2: Aggregated Optimization

1 System Installed: 200kW // 400kWh

Estimated Total Battery Cost: \$200,000 to \$400,000

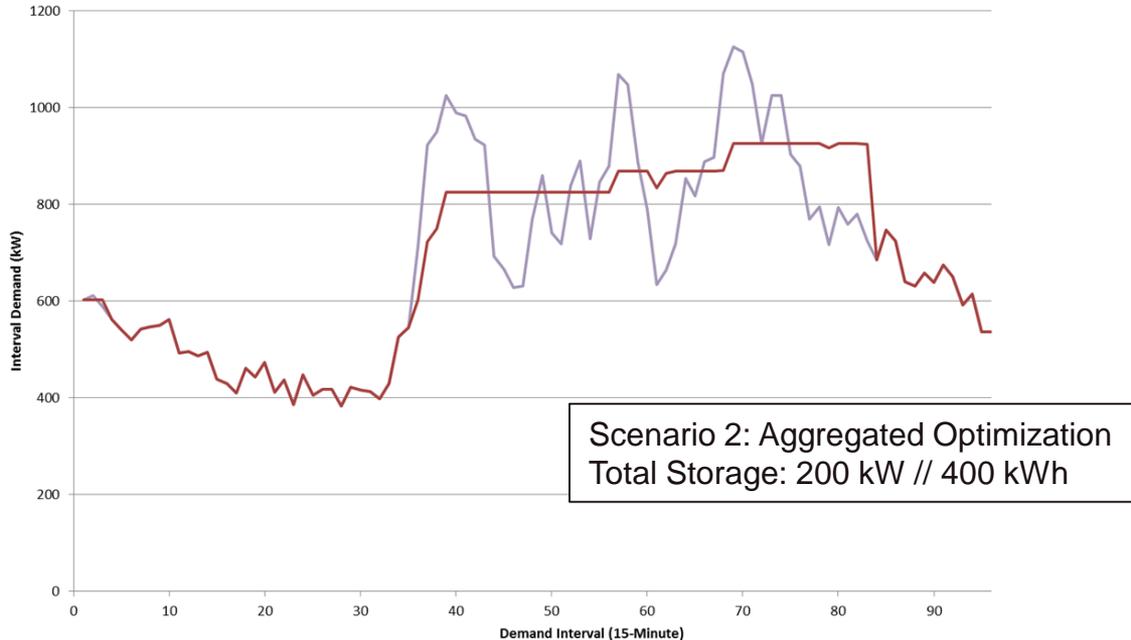
Impact of Demand Charge Reduction

Under scenario 1, individual operation of the battery systems decreases the peak of the aggregated load. Peak reduction varies over the 24 hour period because individual customer loads do not always peak at the same time.



Impact of Utility Control

Under scenario 2, aggregated operation of the battery systems also decreases the peak of the aggregated load. Peak reduction is more stable over the 24 hour period because the battery is not responding to changes at the individual customer level, but rather changes in the aggregated load.



Scenario Impact Summary

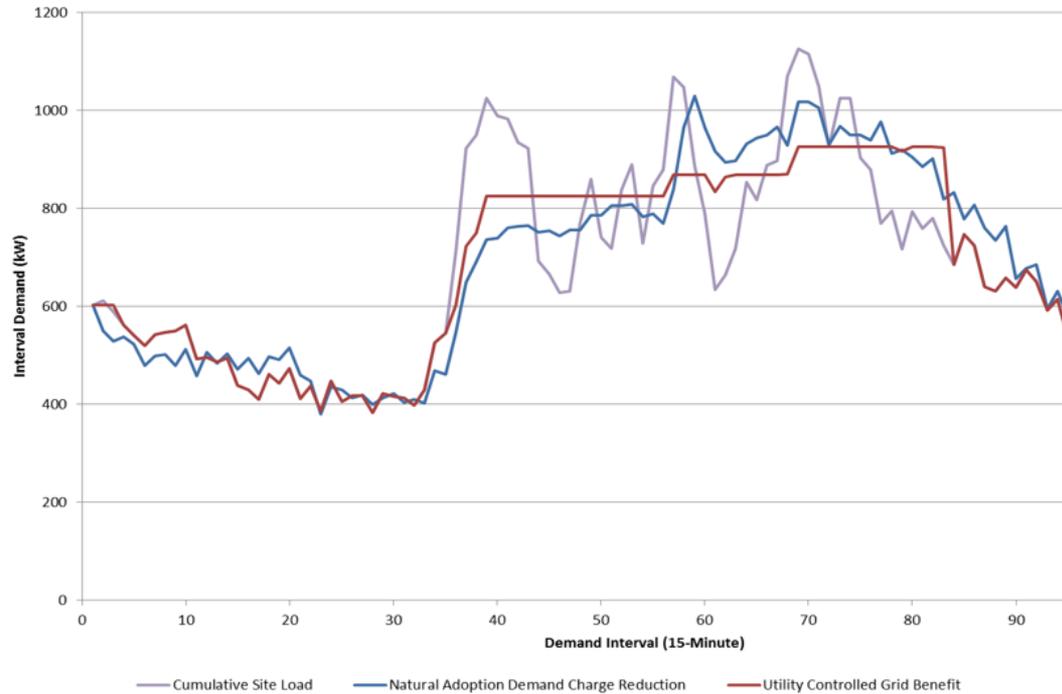
Scenario 1 Impact:

- Individually customers reduce a total of 441kW of retail demand charges.
- Poor alignment of 15 minute interval loads means often times customer batteries are charging and discharging at the same time.
- The coincident demand reduction on the feeder is only 95kW.

Scenario 2 Impact:

- The utility controlled battery is less than half the size of the customer natural adoption batteries in scenario 1.
- The utility controlled system is able to reduce the peak demand by 198kW.
- Utility control creates a more predictable load with the ability to dispatch energy based on bulk or feeder demand events.

Utility Control Matters



Benefits Extend Beyond Load Shape

Location Is Critical



Customer
Battery Need



Value Spread
Across Territory



Utility Battery
Need



Highly
Locational Value



*Conceptual Representation. Not based on actual location needs.

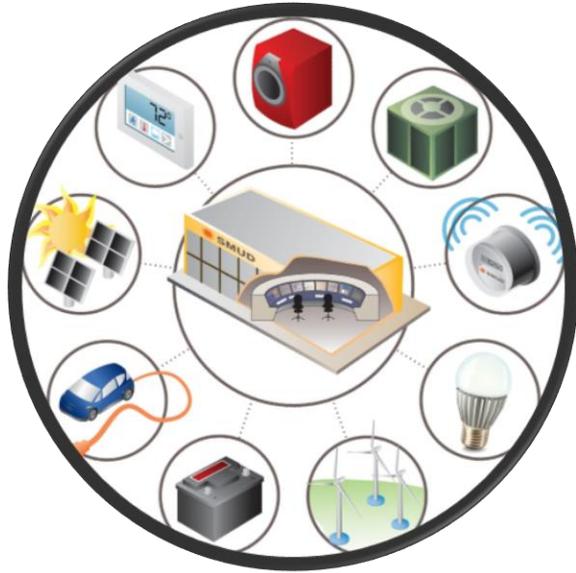
Utility Battery Storage Installation

- Nov. 2019: Issued Utility Battery RFP for a 4MW Battery
 - 4MW creates 4,000 shares for the pilot offering
 - Contract announcement coming soon!
- Location selected based on the potential need to reconductor and upgrade a distribution line in the next 5 years.
- Battery will provide a diverse set of benefits
 - Infrastructure support
 - Grid services
 - DERMS integration
 - Market Participation (CAISO, EIM)
 - Job Training and Education

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SMUD Smart Energy Optimizer (SEO)

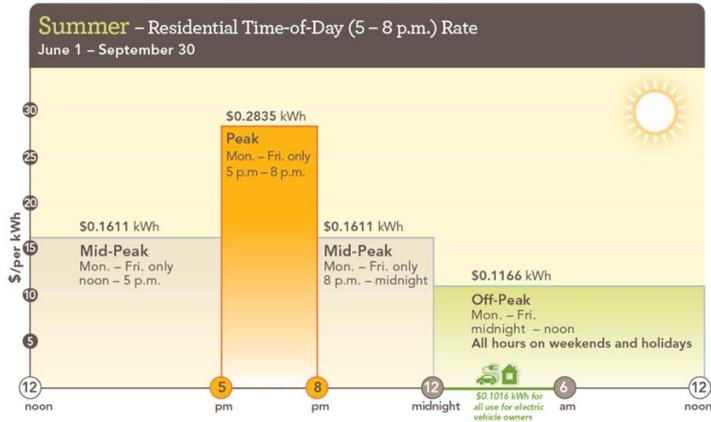
Smart Energy Optimizer (SEO)



Smart Energy Optimizer is a step towards a DER enabled virtual power plant comprised of residential energy storage systems.

- Utilizes customer owned behind the meter battery systems.
- Provides day ahead price signals to align retail benefits with grid needs.
- Allows customers to reserve 49% of the batteries stored energy for backup power.

Smart Energy Optimizer (SEO)



Retail rates are based on typical prices, but often times may not perfectly match grid needs.

The responsiveness and ability to communicate inherent to the current generation of residential energy storage enables these batteries to provide benefits beyond TOD arbitrage.



SEO allows customers to maximize the value of their energy storage system by allowing SMUD to manage the dispatch of the battery for up to 120 events per year.

Smart Energy Optimizer (SEO)



Smart Energy Optimizer (SEO): Incentivizes customers to let SMUD manage 51% of their battery using day ahead pricing to inform operation.

<https://www.smud.org/en/Going-Green/Battery-storage/Homeowner>

The battery incentives are based upon the storage unit's kW rating:

Storage	One-time incentive	Monthly bill credit
1kW - 10kW, not enrolled in CTO	\$500	\$10 per month
10.1 kW and above, not enrolled in CTO	\$1,000	\$20 per month

Thank you!

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SMUD | Powering forward. Together.

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Thank you for attending our webinar

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Upcoming Webinars

The Massachusetts Clean Peak Standard – How it will affect renewable and storage value streams, projects, and markets

Wednesday, September 2, 1-2pm ET

The Role of Hydropower in State Clean Energy Policy

Tuesday, September 8, 2-3pm ET

Power After Carbon: Findings and Insights for State Policymakers

Wednesday, September 9, 3-4pm ET

Innovative Pathways to Developing Solar+Storage in Low-Income Communities: Norfolk Solar's Qualified Opportunity Zone Fund

Thursday, September 10, 1-2pm ET

Read more and register at: www.cesa.org/webinars