Introduction to Advanced Energy Storage

Presented by City of Chula Vista's Sustainable Communities Program

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Sustainable Communities Program

- Provides resources to stakeholders of the Chula Vista built environment
  - Purpose: to improve compliance with **energy efficiency** and **green building codes** and to promote construction of **sustainable buildings**.
- Part of the **City of Chula Vista's Local Government Partnership program**
  - Funding: California utility customers and administered by San Diego Gas & Electric® under the auspices of the California Public Utilities Commission.

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Center for Sustainable Energy™

- Independent nonprofit organization
- Our mission: Accelerating the transition to a sustainable world powered by clean energy
  - Program management
  - Training and education
  - Technical assistance

Getting to Zero Net Energy – Workshop Series

- **Overview of Permitting, Ordinances and Incentives in Chula Vista**
  - Tues, April 14
- **Introduction to Solar Water Heating**
  - Tues, April 21
- **Streamlined Permitting for Residential Solar PV**
  - Wed, May 6
- **Introduction to Energy Storage**
  - Tues, May 19
- **Electric Vehicle Charging in Buildings**
  - Wed, June 10

Register at www.energycenter.org/events

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What is “Zero Net Energy”?

A Zero-Net-Energy Code Building is one where the **net amount of energy produced by on-site renewable energy resources** is equal to **the value of the energy consumed annually by the building**, at the level of a single “project” seeking development entitlements and building code permits, measured using the California Energy Commission’s Time Dependent Valuation metric.

-- California Energy Commission, 2013 Integrated Energy Policy Report

California's ZNE Goals

- All **new residential construction** will be ZNE by 2020
- All new and 50 percent of existing **state-owned public buildings** will be ZNE by 2025
- All **new commercial buildings** will be ZNE by 2030
- 50 percent of **existing commercial buildings** will be retrofit to ZNE by 2030

AGENDA

1. Technology Overview
2. Use Cases and Customer Benefits
3. Role of Energy Storage in California
4. Self-Generation Incentive Program
5. Looking Ahead: The Future of AES

Technology Overview

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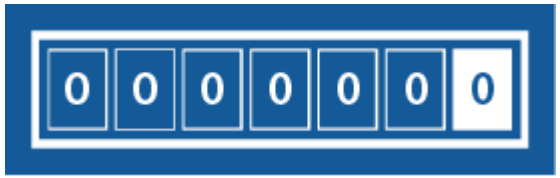
Measuring Electricity

kW (demand) vs. kWh (energy)

- **kW**: unit of *power*
  - Power is the **rate** at which electricity is generated or used

- **kWh:** unit of *energy*
  - Energy is a measure of **how much** electricity over a specific period of time



Measuring Electricity

kW (demand) vs. kWh (energy)

- **For example, an energy storage system that can discharge 10 kWh of energy over a two-hour period is considered a 5 kW system.**

- **10 kWh/ 2 hours = 5 kW**

What is Energy Storage?

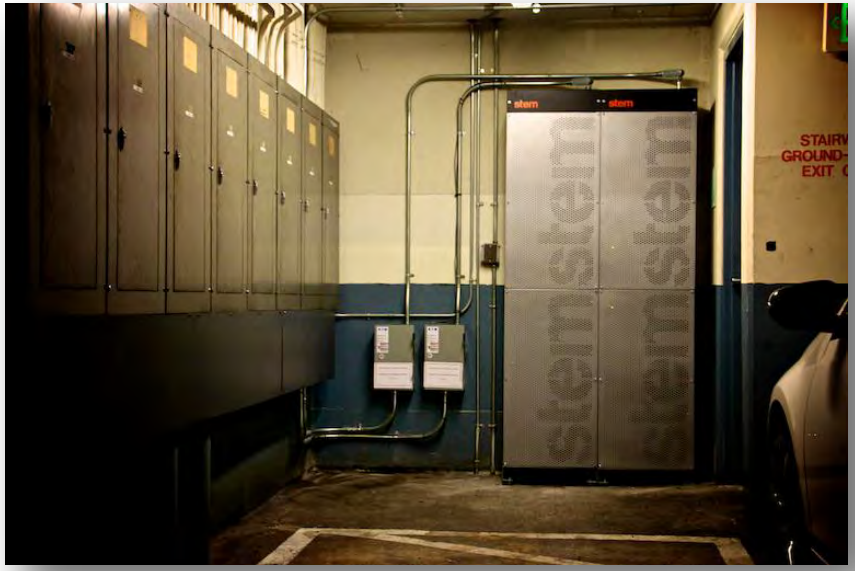
- AES is a technology that is capable of absorbing energy, storing it for a period of time, and discharging the energy at a later time

- This can be accomplished via chemical, thermal, or mechanical processes

Energy Storage Examples

- Mechanical
  - Compressed Air
  - Pumped Hydro
  - Flywheels
- Electrical
  - Capacitors
  - Superconducting Magnets
- Electrochemical
  - Batteries
- Thermal
  - Ceramic Bricks
  - Chilled Water or Ice
  - Molten Salt

Electrochemical Energy Storage (Batteries)



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Customer-Sited Use Cases and Benefits

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Customer-Sited Use Cases and Benefits

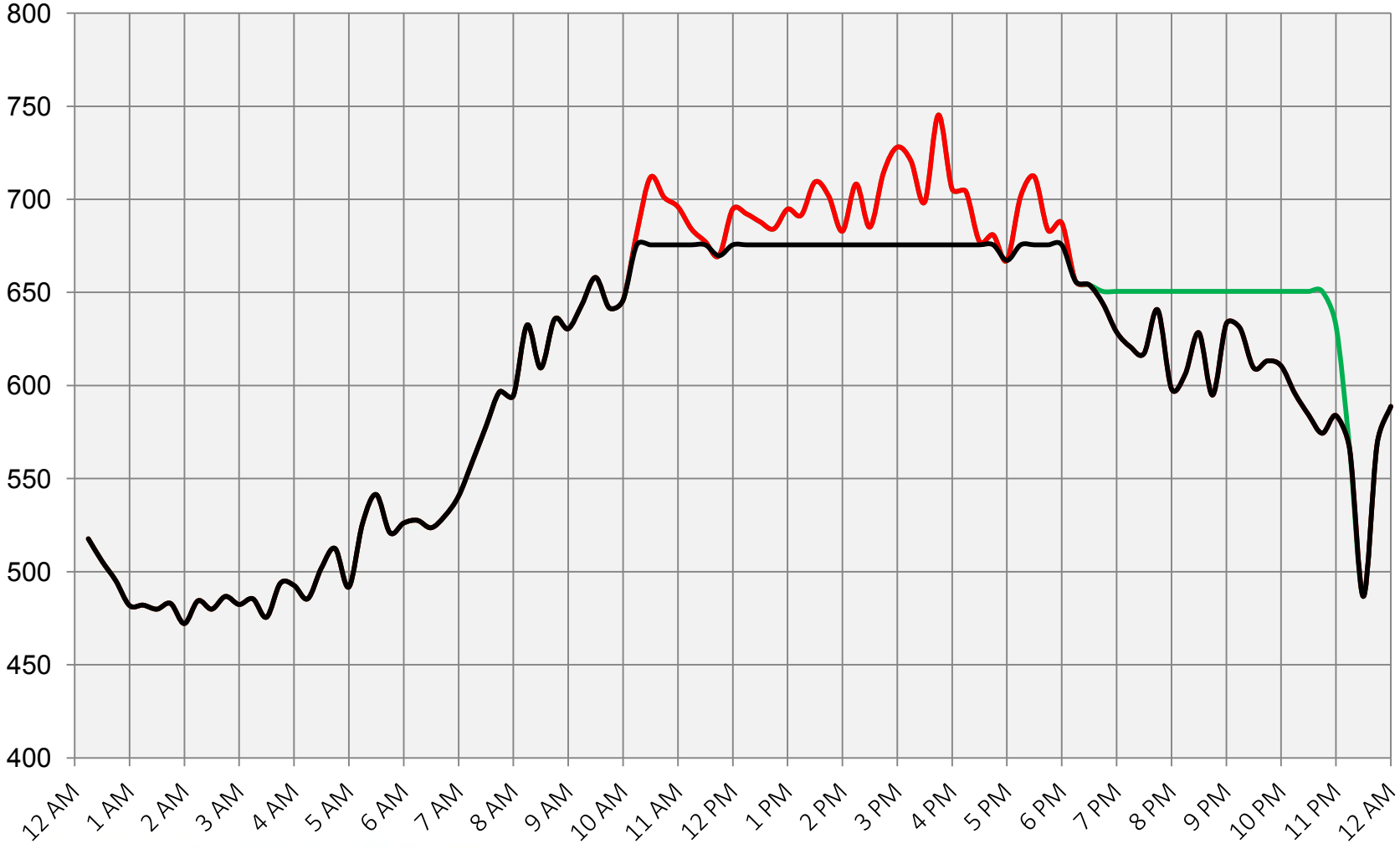
- Facilitates renewable energy integration
  - Time shifting generation
  - Firming variable generation
- Provides reliable power to critical systems
  - Includes power quality and backup power
- Provides load shifting and peak shaving
  - Translates to demand charge savings

Demand Reduction

- Large, medium and some small commercial customers have demand charges

- Utility costs are shifting away from generation related charges
  - Demand more accurately reflects the distribution infrastructure costs to ratepayers

Daily Demand Reduction



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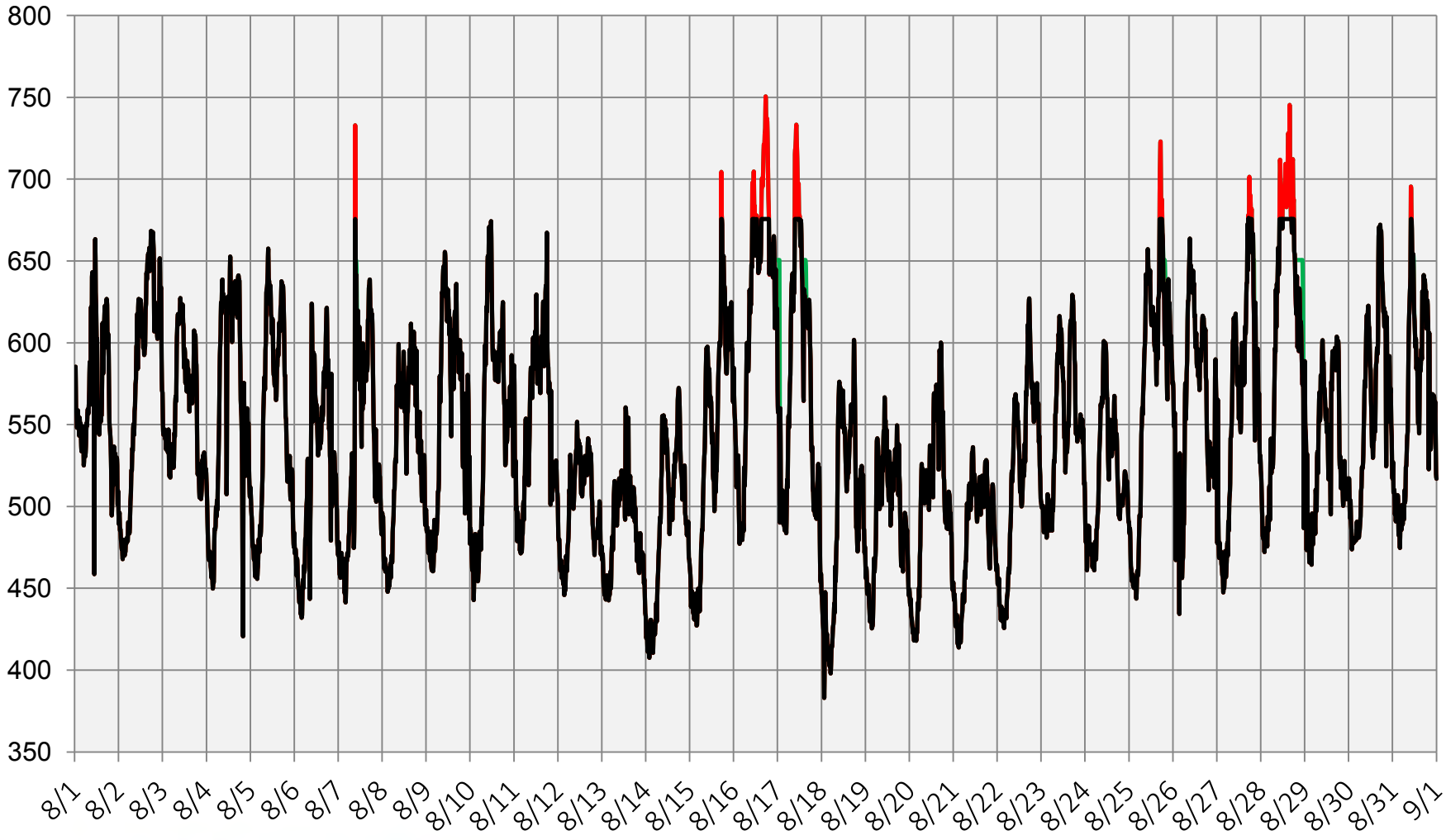
Monthly Demand Reduction



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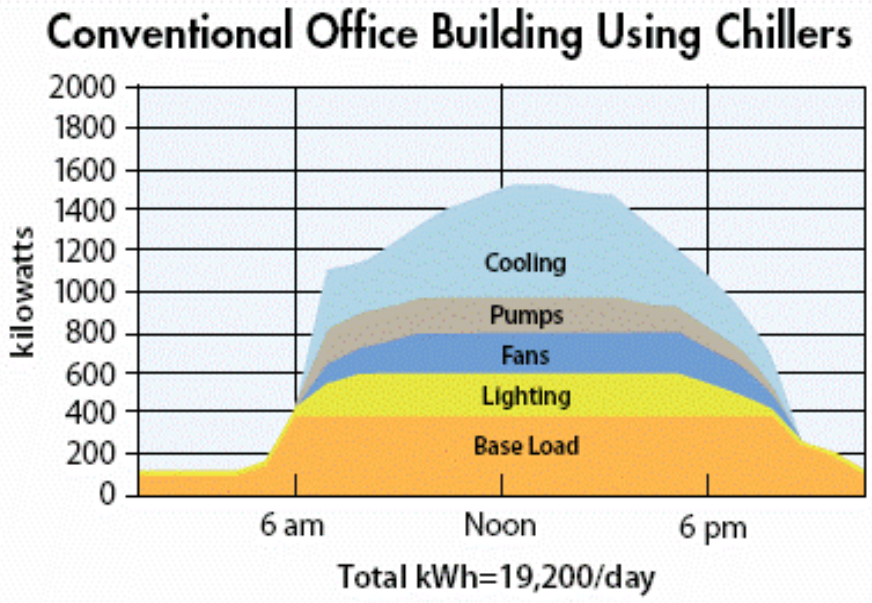
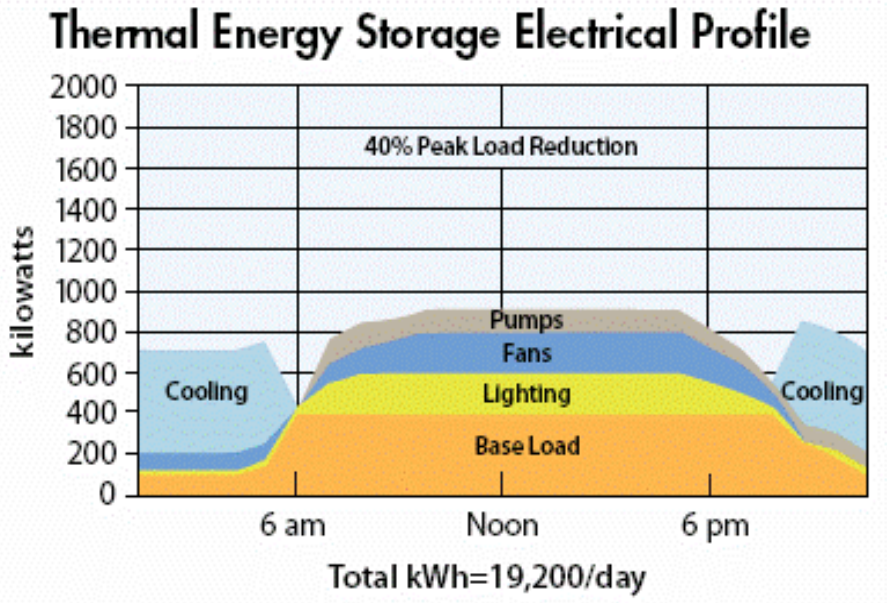
Thermal Energy Storage Example

- Uses electricity at night to ‘charge’ (create ice)
- Ice melts and cools air, providing cool air for buildings
- Compressor on HVAC unit turns off, saves energy





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Residential Energy Storage

- Unlike commercial entities, residential customers do not have demand charges and most are not on time-dependent pricing (TOU).
- Back-up Power (10kWh)
- TOU energy arbitrage & EV charging (7kWh)
- Residential automated Demand Response participation is a future market

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The Role of Energy Storage in California

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The Need for Energy Storage Resources

- CA is aggressively transitioning from fossil fuels to renewable energy sources, improving energy efficiency in homes and businesses, and maintaining a flexible transmission and distribution infrastructure

- AES helps achieve various California policies and mandates already in place, including:

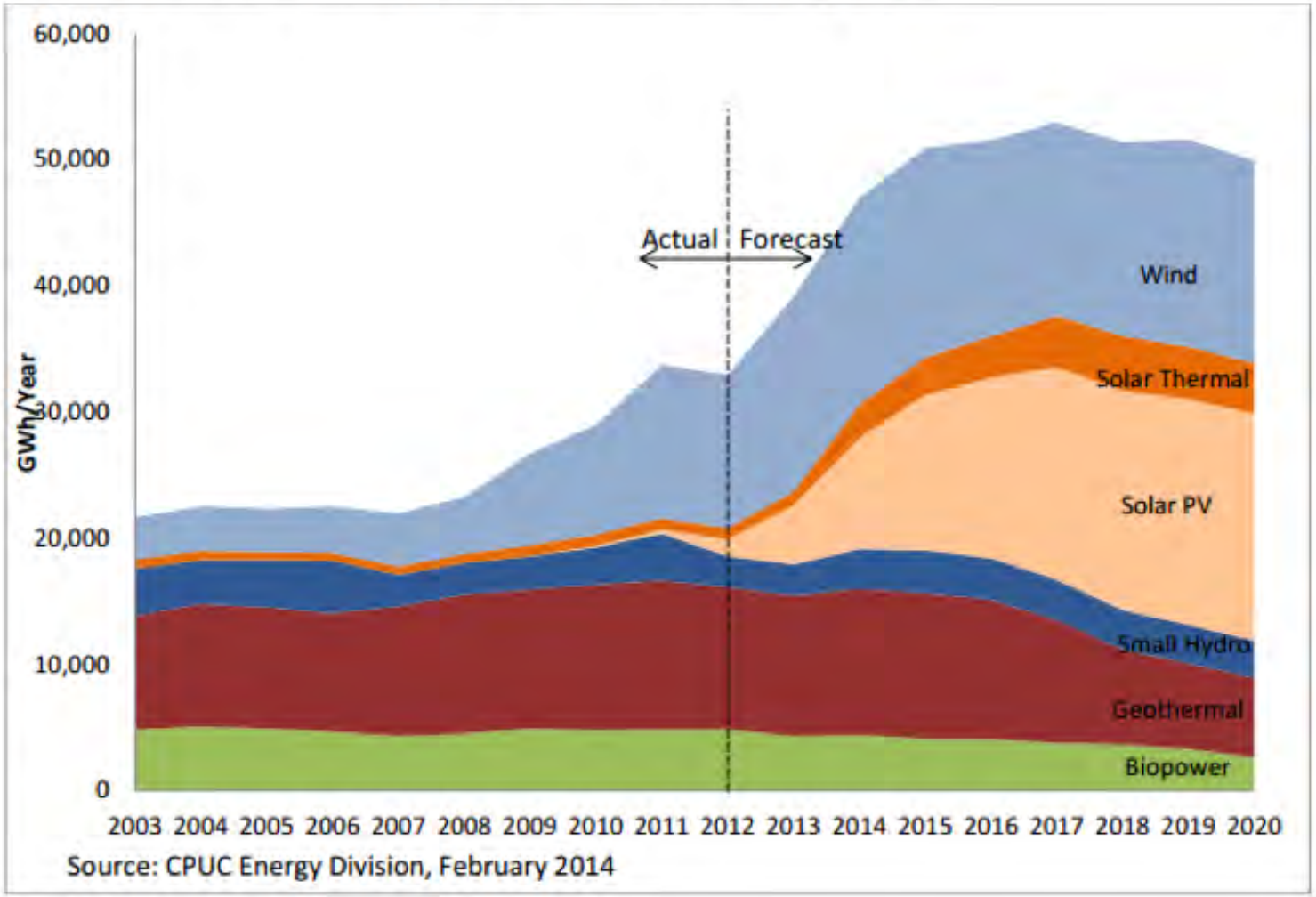
ZNE Goals

Executive Order for 1.5 million electric vehicles by 2025

RPS: 33% renewable procurement by 2020

California's Renewable Resource Mix

Figure 3: Renewable Resource Mix, Actual and Forecasted by Year[11,12]



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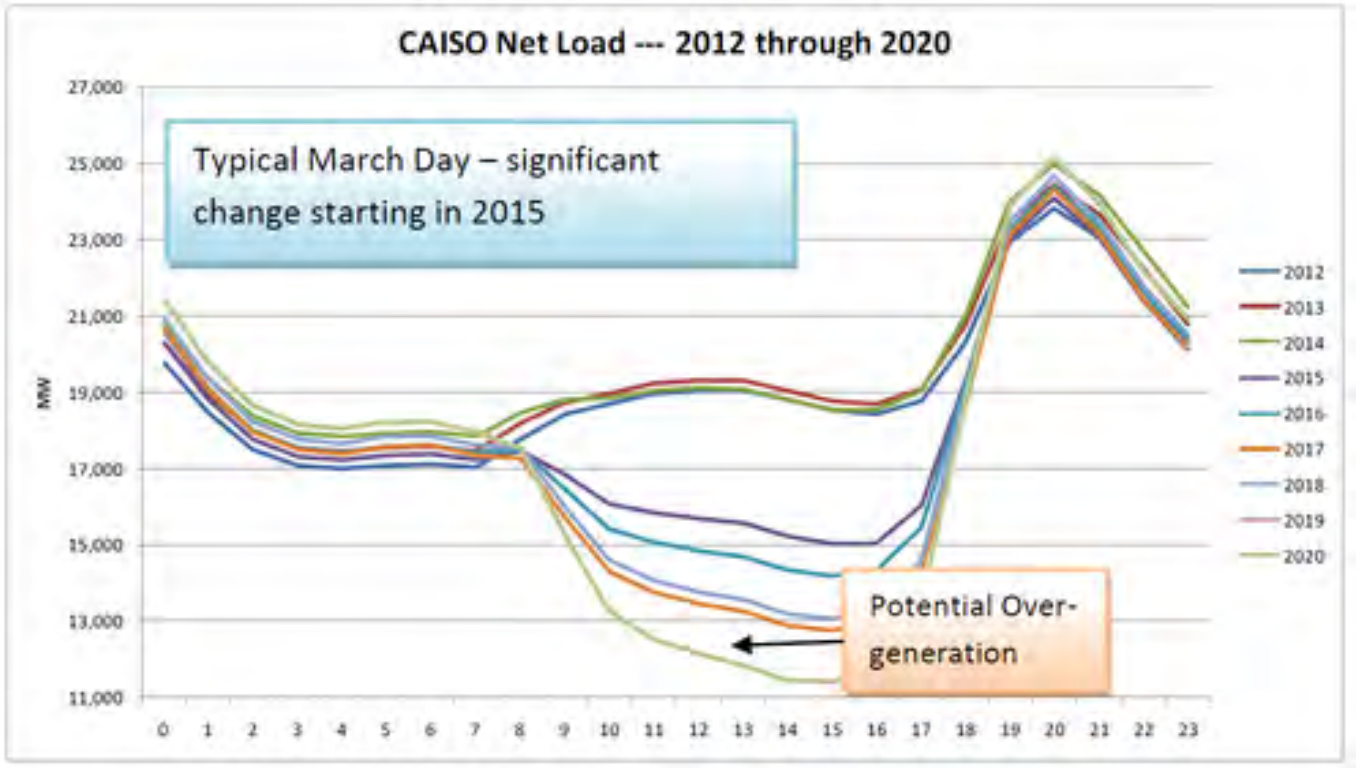
Duck Curve

AES is a *flexible capacity* resource that will help integrate renewables and meet the current and future needs of an evolving grid.



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Storage Procurement Targets for California's IOUs

Table 1 – Initial Proposed Energy Storage Procurement Targets (in MW)

Use case category, by utility	2014	2016	2018	2020	Total
Southern California Edison					
Transmission	50	65	85	110	310
Distribution	30	40	50	65	185
Customer	10	15	25	35	85
Subtotal SCE	90	120	160	210	580
Pacific Gas and Electric					
Transmission	50	65	85	110	310
Distribution	30	40	50	65	185
Customer	10	15	25	35	85
Subtotal PG&E	90	120	160	210	580
San Diego Gas & Electric					
Transmission	10	15	22	33	80
Distribution	7	10	15	23	55
Customer	3	5	8	14	30
Subtotal SDG&E	20	30	45	70	165
Total – all 3 utilities	200	270	365	490	1,325

Note: Of the 1.325 GW, **200 MW** is allocated for customer-sited systems

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Self-Generation Incentive Program

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Self-Generation Incentive Program (SGIP)

- Provides incentives to promote the installation of clean and efficient distributed generation and storage technologies installed on the customer's side of the utility meter
- Ratepayer funded and overseen by the CPUC
- Available to utility customers of SDG&E, SCE, PG&E, SoCal Gas
- SGIP plays a key role in realizing the customer-sited goals of AB 2514
- Recently reauthorized with administration through 2020

SGIP Goals

GHG

reduction

RELIABILITY

improved transmission and distribution

DEMAND

reduction

MARKET

transformation

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Current Eligible Technologies and Incentive Levels

QUALIFYING EQUIPMENT & INCENTIVES	
Qualifying Technologies	Incentive ($/watt)*
Renewable and Waste Energy Recovery	
Wind Turbine	$1.07
Waste Heat to Power	$1.07
Pressure Reduction Turbine	$1.07
Nonrenewable Conventional Combined Heat & Power	
Internal Combustion Engine	$ 0.44
Microturbine	$ 0.44
Gas Turbine	$ 0.44
Steam Turbine	$ 0.44
Emerging Technologies	
Advanced Energy Storage	$1.46
Biogas Adder	$1.46
Fuel Cell – CHP or Electric-Only	$1.65

*2015 Rates – Incentives decline annually.

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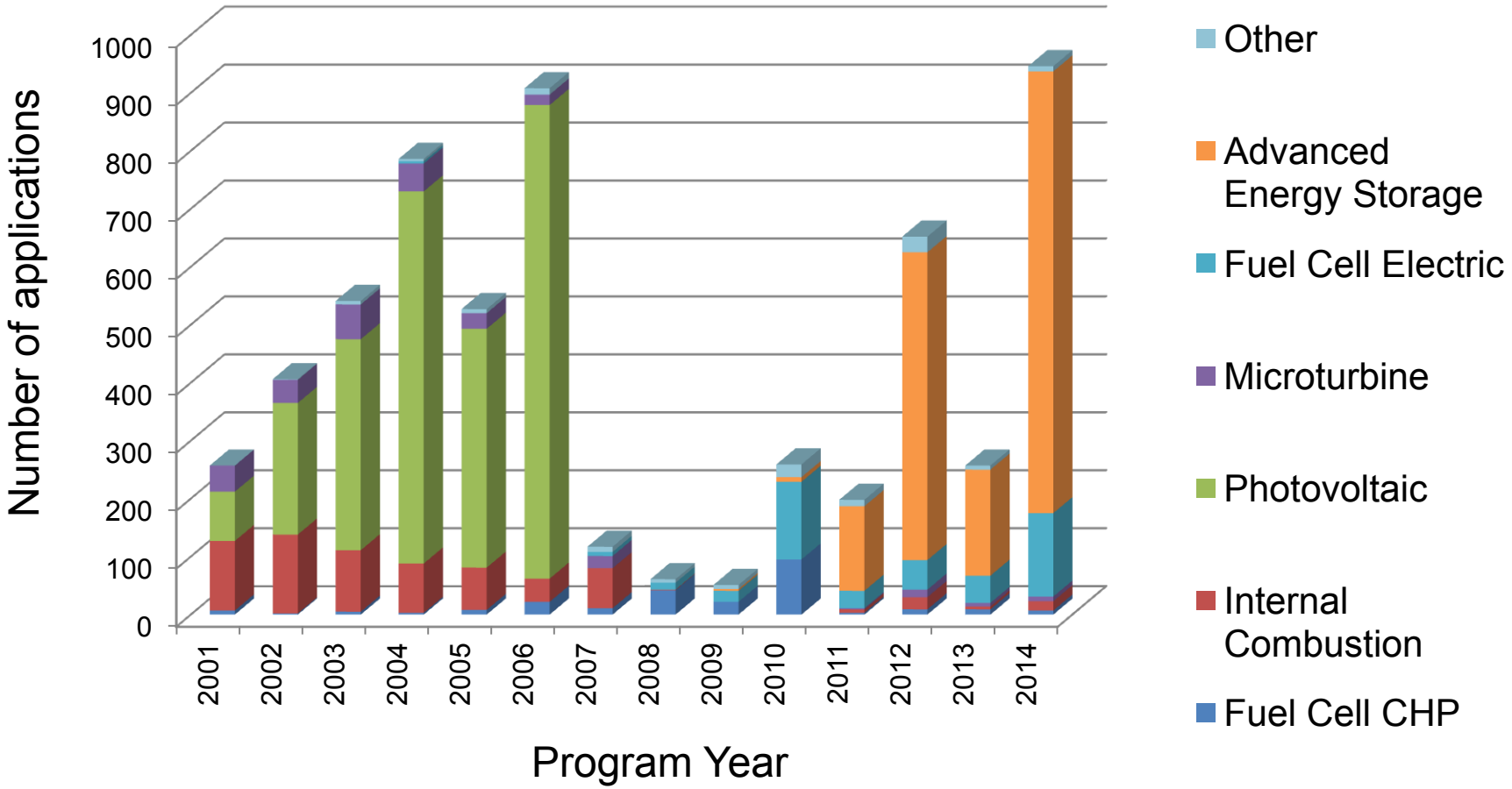
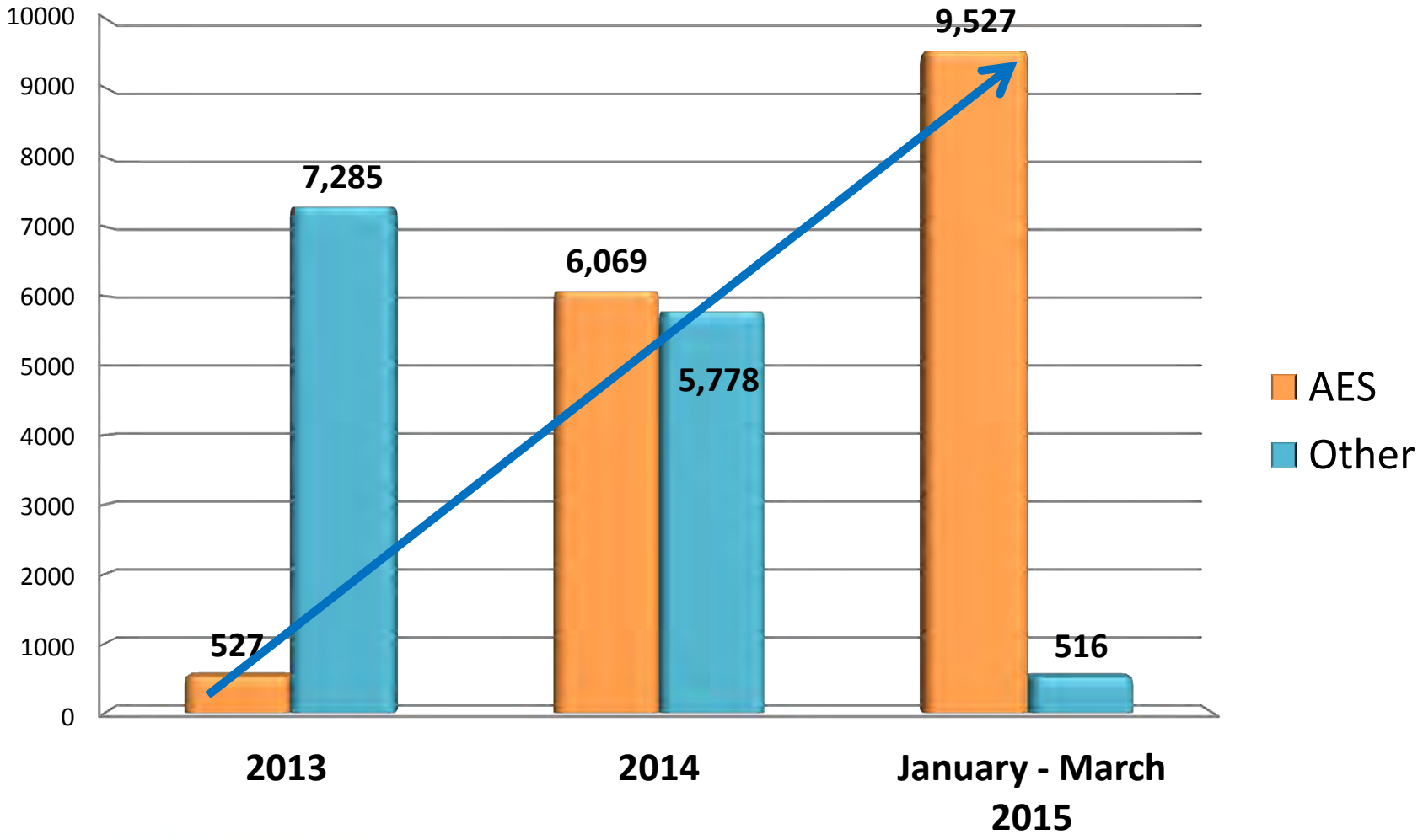
Influx of Storage Applications in SGIP



Source: Self Generation Incentive Program Quarterly Statewide Report Last Updated: December 31, 2014

CSE Storage Capacity Received (kW)



Source: Self Generation Incentive Program Statewide Report Last Updated: March 30, 2015

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AES Customers in SDG&E

- Multifamily housing
- Convenience stores
- Banks
- Department stores
- Supermarkets
- Hotels
- High schools/ universities

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Looking Ahead:
The Future of Advanced Energy Storage

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Looking Ahead

- Technological capabilities of storage are still outpacing storage policy & continued regulatory developments are necessary.
  - Time of Use Rates
  - Demand Response
  - Aggregation of Resources

- SGIP “2.0” Redesign

Key Takeaways

- Energy storage is a flexible resource that includes a variety of technologies and processes
- Customer-sited storage benefits include demand charge reduction, backup power, TOU arbitrage, and renewable integration
- CA has progressive policies in place to promote energy storage on both the transmission and distribution level
- Continued regulatory developments will be necessary for California to realize all the benefits storage has to offer.

Questions?

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