COMPONENTS OF VALUE

- DEFINE IT
- MEASURE IT
- HAVE A WILLING BUYER

MATURING REGULATORY FRAMEWORK

Law/Regulation	Impact	Opportunity Created
FERC ORDER 784	Broader market access to sell various ancillary services	More accurate pricing
FERC ORDER 755	Frequency regulation services payment account for speed and accuracy	More accurate pricing
CA AB 2514	Market creation with 1325 MW procurement target	Creates demand through utility requirement
CAL CPUC-SCE Ruling	Required storage in regional procurement plan	Created demand through utility requirement
CAL SGIP	Rebate for projects up to 3 MW ($5 million)	Direct financing
PJM Capacity Market		Operating market with a working price mechanism

Clean Coalition

Making Clean Local Energy Accessible Now

Solar + Storage hybrid systems

Policy Development and Opportunity

Kenneth Sahm White
Director of Policy &
Economic Analysis
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18 Dec 2014

Clean Coalition Mission and Advisors

Clean Coalition

Mission

To accelerate the transition to renewable energy and a modern grid through technical, policy, and project development expertise.

Board of Advisors

Jeff Anderson
Co-founder and Former ED, Clean Economy Network

Josh Becker
General Partner and Co-founder, New Cycle Capital

Pat Burt
CEO, Palo Alto Tech Group; Councilman & Former Mayor, City of Palo Alto

Jeff Brothers
CEO, Sol Orchard

Jeffrey Byron
Vice Chairman National Board of Directors, Cleantech Open; Former Commissioner, CEC

Rick DeGolia
Senior Business Advisor, InVisM, Inc.

John Geesman
Former Commissioner, CEC

Eric Gimon
Independent Energy Expert

Patricia Glaza
Principal, Arsenal Venture Partners

Mark Z. Jacobson
Director of the Atmosphere/Energy Program & Professor of Civil and Environmental Engineering, Stanford University

Dan Kammen
Director of the Renewable and Appropriate Energy Laboratory at UC Berkeley; Former Chief Technical Specialist for RE & EE, World Bank

Fred Keeley
Treasurer, Santa Cruz County, and Former Speaker pro Tempore of the California State Assembly

Felix Kramer
Founder, California Cars Initiative

Amory B. Lovins
Chairman and Chief Scientist, Rocky Mountain Institute

L. Hunter Lovins
President, Natural Capitalism Solutions

Ramamoorthy Ramesh
Founding Director, DOE SunShot Initiative

Governor Bill Ritter
Director, Colorado State University's Center for the New Energy Economy, and Former Colorado Governor

Terry Tamminen
Former Secretary of the California EPA and Special Advisor to CA Governor Arnold Schwarzenegger

Jim Weldon
Technology Executive

R. James Woolsey
Chairman, Foundation for the Defense of Democracies; Former Director of Central Intelligence (1993-1995)

Kurt Yeager
Vice Chairman, Galvin Electricity Initiative; Former CEO, Electric Power Research Institute

A Modern Power System: Smarter, More Distributed

Clean Coalition

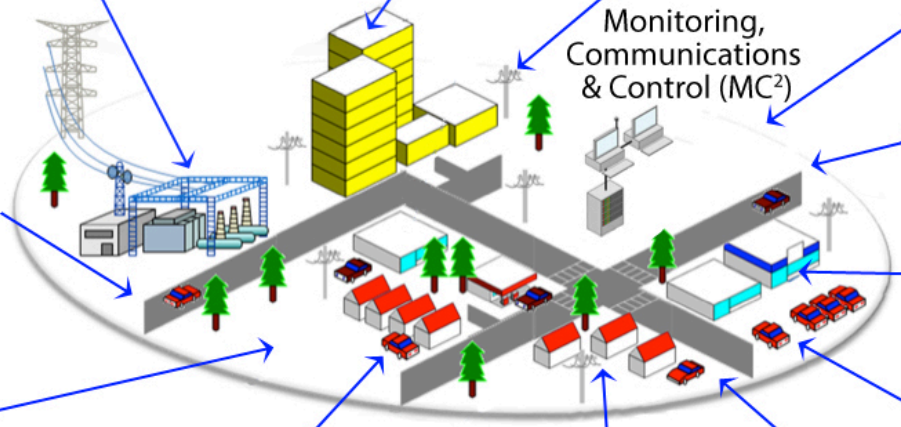
Grid Energy Storage

Distributed Generation

Switches & Power Electronics

Distributed Generation

Biopower Generation



Monitoring, Communications & Control (MC^2)

Energy Storage

Microturbine

Distributed Generation

Electric Vehicles (EV)

Home Energy System

Fuel Cells

Distributed Generation

Storage Use Cases

ISO/ Market

1. Frequency regulation
2. Spin
3. Ramp
4. Black start
5. Real-time energy balancing
6. Energy arbitrage
7. Resource Adequacy

Generation

8. Intermittent resource integration: wind (ramp/ voltage support)
9. VER/ PV shifting, Voltage sag, rapid demand support
10. Supply firming

Transmission / Distribution

11. Peak shaving: load shift
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)
16. Distribution operation (volt/VAR support)

Customer

17. Outage mitigation
18. Time-of-use (TOU) energy cost management
19. Power quality
20. Back-up Power

California Energy Storage Roadmap

Clean Coalition

California ISO
Shaping a Renewed Future

California Public Utilities Commission

Utilities recognizing:

- Valuable role of storage in planning and operations at all levels
- Many barriers to realizing that value
- Inter-Agency policy planning and coordination required

CA Storage Roadmap (CASIO, CPUC & CEC)

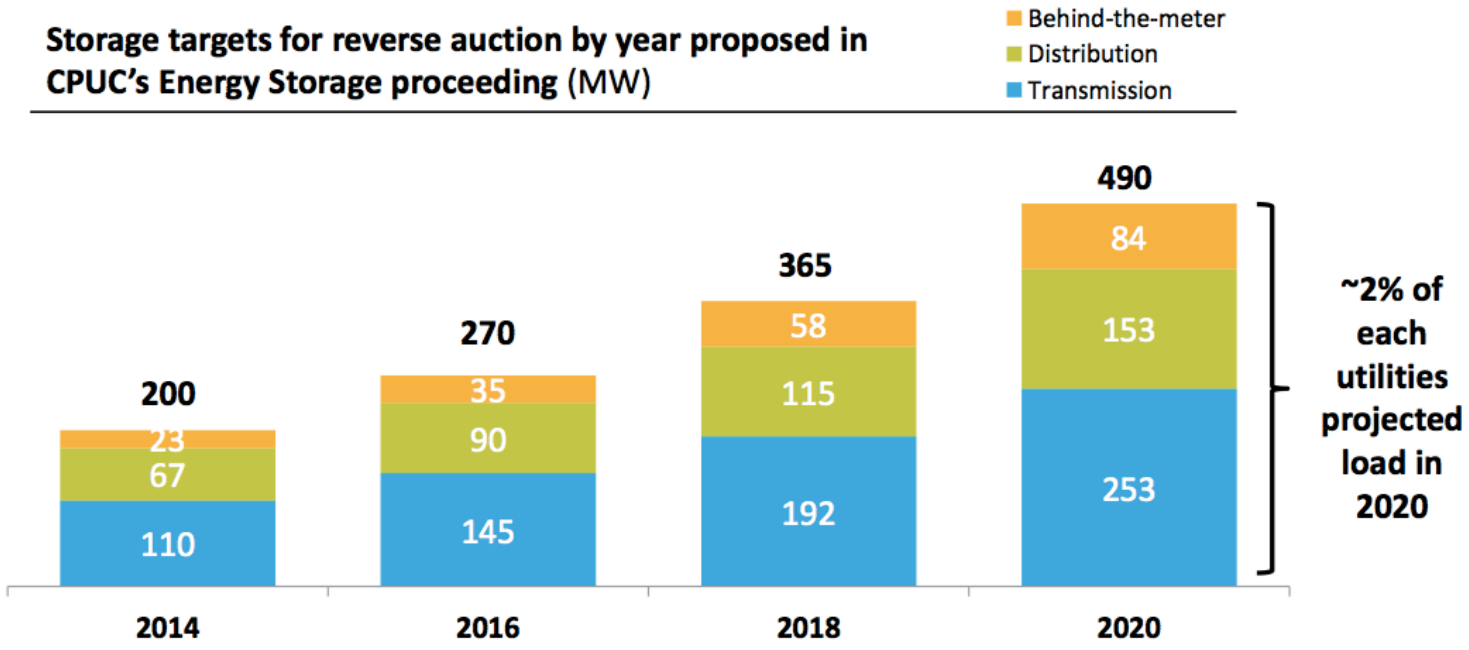
- The Roadmap identifies and prioritizes the barriers to development and utilization of energy storage in California, and identifies the policy, technical, and regulatory actions needed, and venues where each will be addressed.

- Final Storage Roadmap to be published by end of December

California Utility Energy Storage Procurement

Clean Coalition

California's 1,325 MW mandate sends a very strong market signal for energy storage



Creates a $2.5 Billion market in California alone through 2020
Procurement is ahead of schedule
Storage is successfully competing against other solutions

For PV + Storage, C&I is Optimal

Clean Coalition

In practice, for hybrid solar with storage, C&I sites offer:

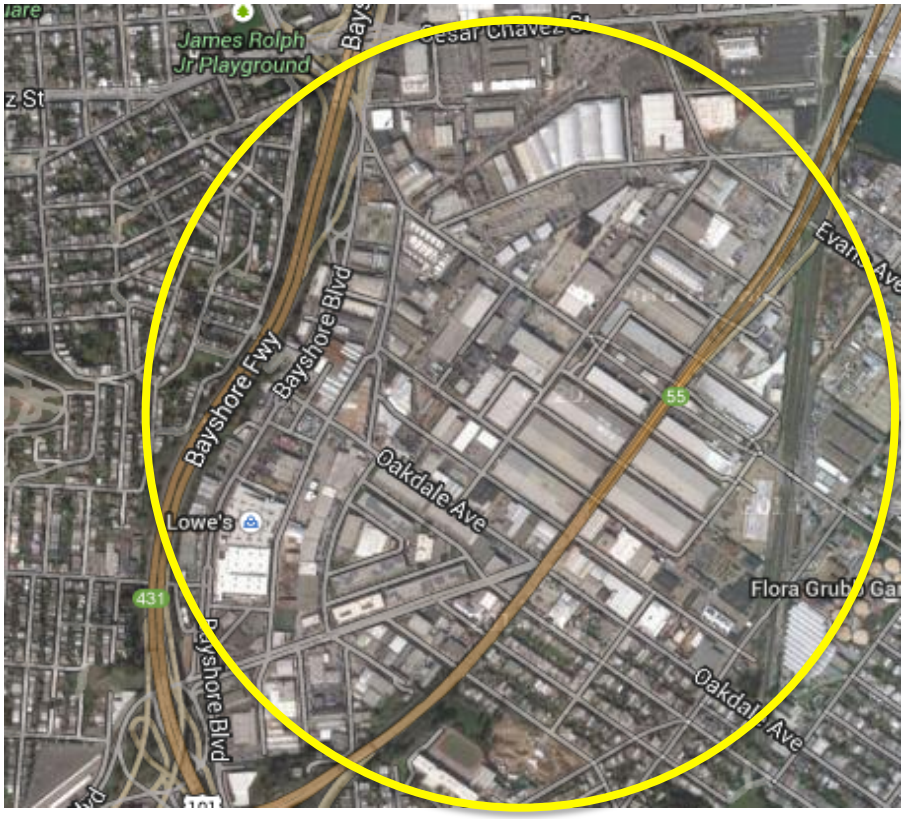
1. **Most Generation**
   Larger rooftop spaces generate more energy

2. **Lowest System Costs**
   Larger systems reduce overall costs

3. **Best Grid Locations**
   Large loads served by robust feeder segments

4. **Matching Load Profiles**
   Larger daytime loads match solar generation

5. **Greater Financially Motivation**
   Larger bills w/demand charges, TOU load shifting and DR market opportunities, DSO services (reactive power, CVR…) plus rooftop leasing



DER Hybrid Optimization & Utility Planning

Clean Coalition

Utility Data
- Customer & transformer loads
- Network model & circuit map
- Equipment list & upgrade plans
- O&M schedule

Other data
- Solar insolation
- Weather forecasting
- Assumptions for DR/ EE/EV charging, etc.
- Performance specs, e.g. storage

4. Higher Capacity
- **Increase storage & local reserves (e.g. CHP) to flatten peaks and island essential services. Include system deferrals.**
- **Optimize via locations, sizes, types & costs**

3. Medium Capacity
- **Add lower-cost DER: DR, EE, & storage for key peak reduction, & EV charging. Include system deferrals.**
- **Optimize via locations, sizes, types & costs**

2. Baseline Capacity
- **Vary locations & sizes of DG to define existing substation(s) capacity w/no upgrades. Include system deferrals.**
- **Use load tap changers, advanced inverters, etc. to manage voltage issues**

1. Baseline Powerflow
- **Acquire all data sets, validate data accuracy**
- **Model existing powerflow, including existing DG**

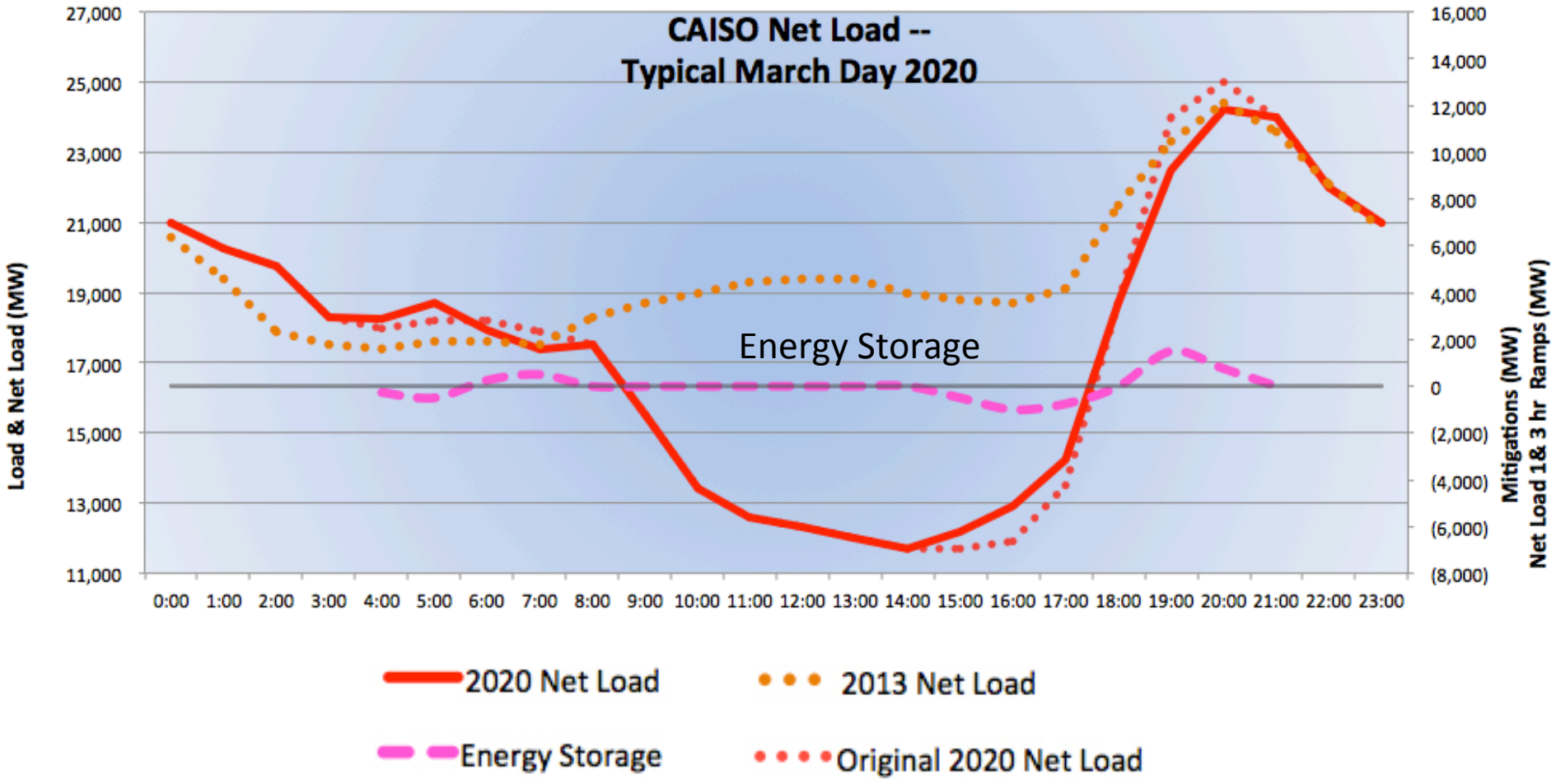
- **Validate with utility & technology vendors**
- **Maintain or improve grid reliability & power quality**

Max DG + DER capability & services

Add DER for Increased DG capacity

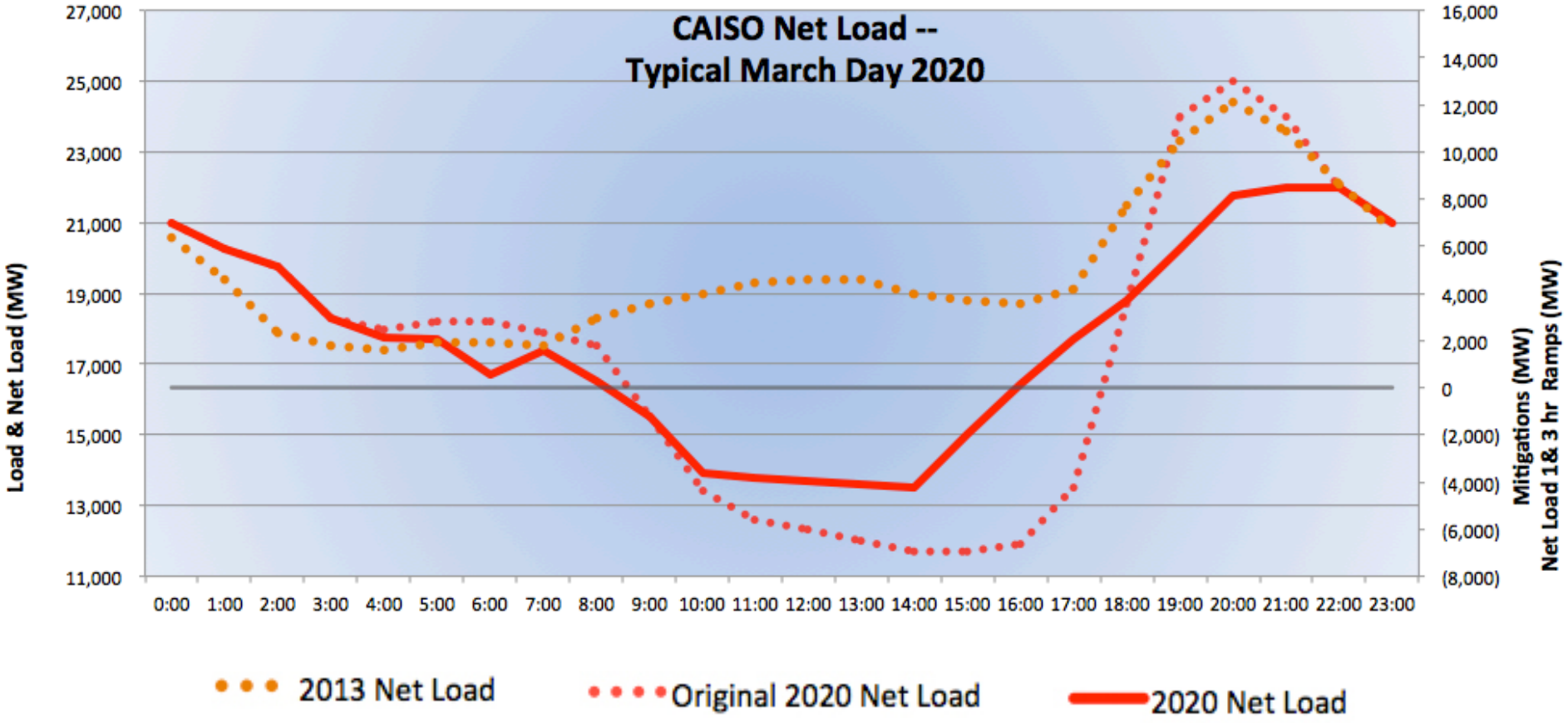
Limited Low Cost DG capacity

Flattening the Duck – System Level Storage Value



California set a target of 1.325 GW of new cost-effective storage by 2020

Flattening the Duck – Aggregated Solutions



The reflected aggregated solutions include imports/exports, demand response, energy storage and solar curtailment

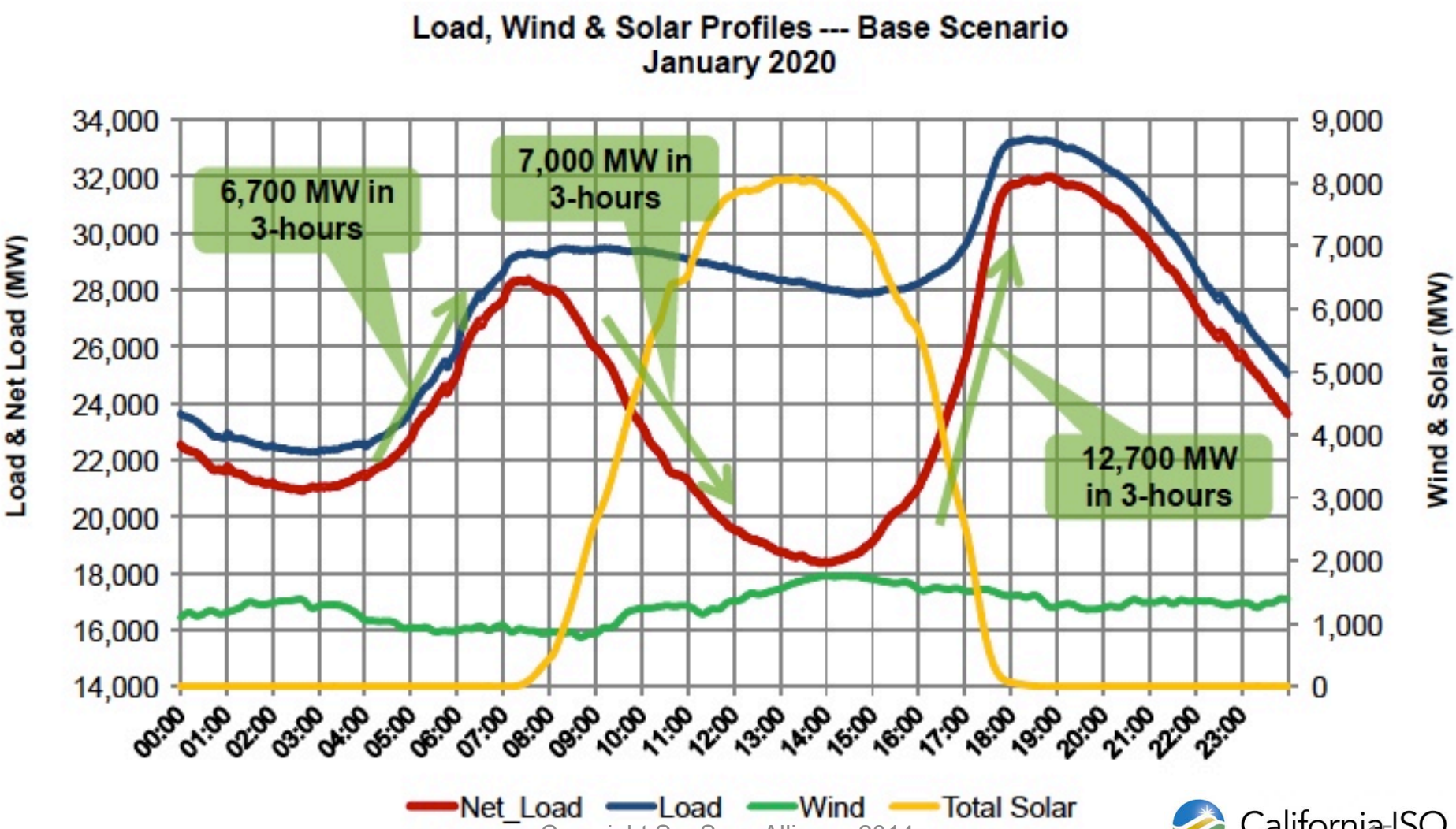
SPG Solar-Storage Webinar

Sunspec Alliance
TJ Keating, Dec. 18, 2014

Grid Capacity For Dumb Energy Is Near

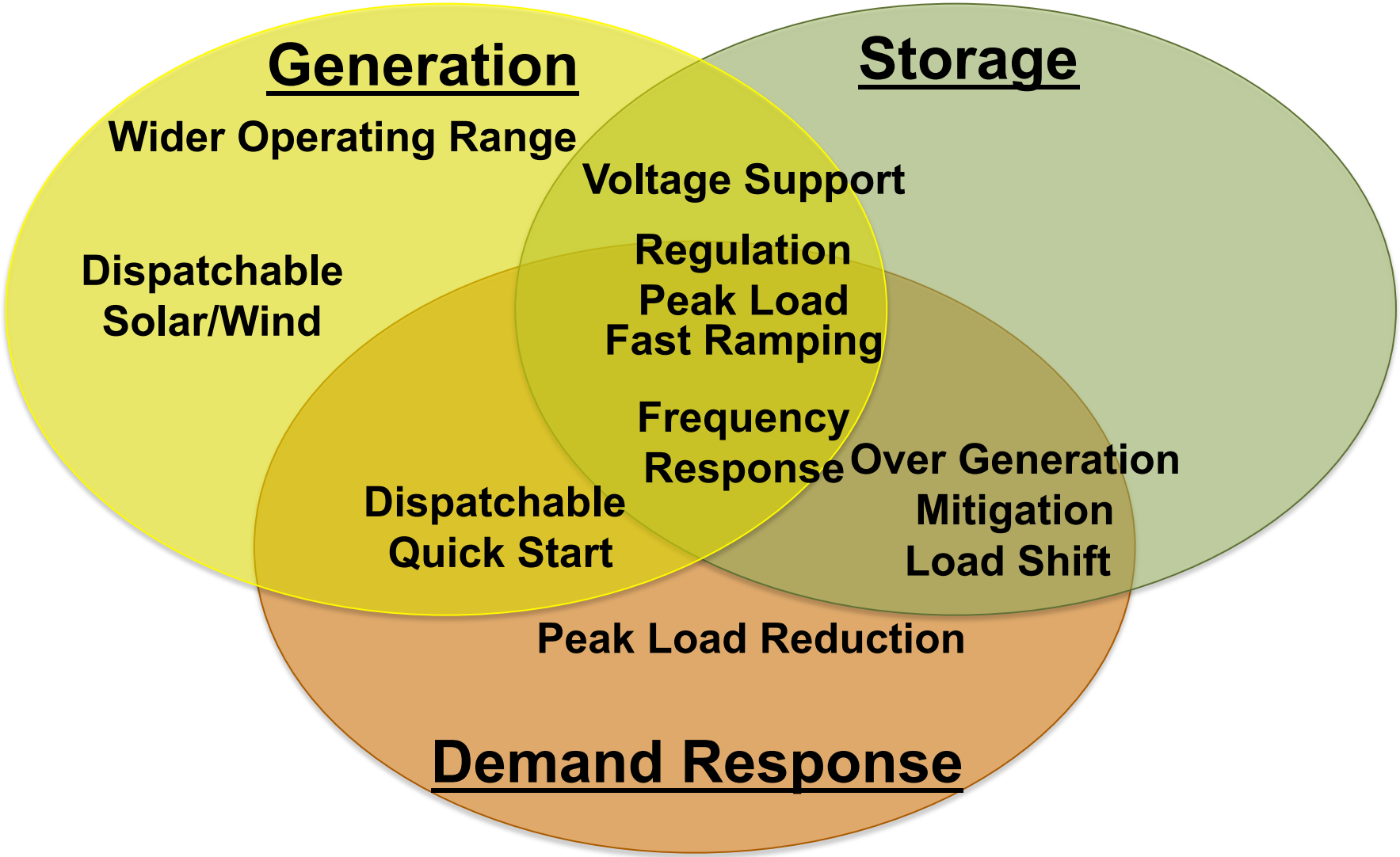
- European dream turning into a nightmare
  - Unintentional islanding in Spain
  - 50.2 Hz auto trip behavior in Germany
  - Major move toward “re-powering” across continent
- Hawaii market grinding down
  - 50% smaller market than one year ago
- California “tapping the brakes”
  - “Solar needs to clean up the grid mess it has made”

California ISO: Status Quo Does Not Work

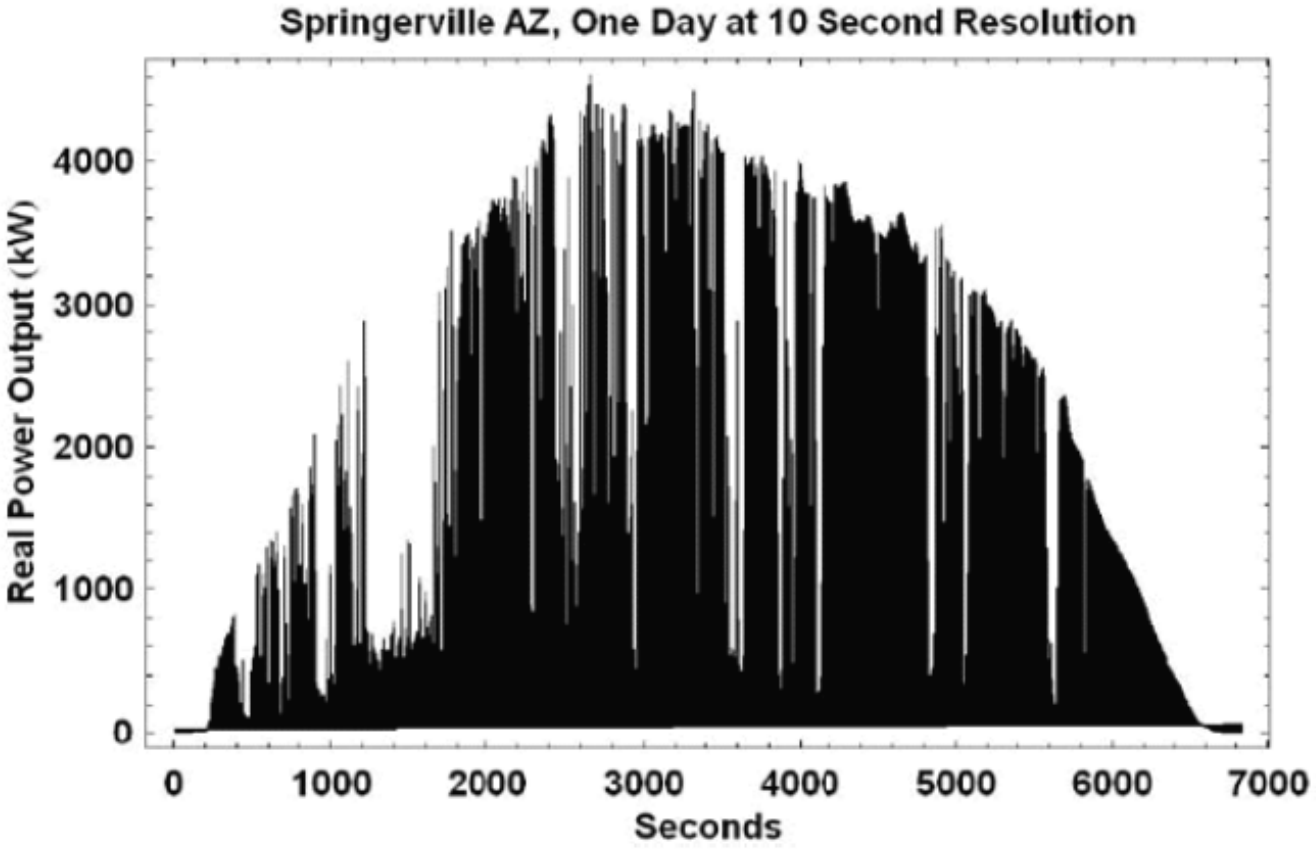


California ISO
Your Link to Power

Integrated Storage Use Cases



Storage Benefits: Intermittent Solar



Source: Carnegie Mellon Electricity Industry Center (CEIC)

Standards And Scale Drive Adoption

CES

- 25 kWh Li-ion battery
- ~$100k

One-off Projects

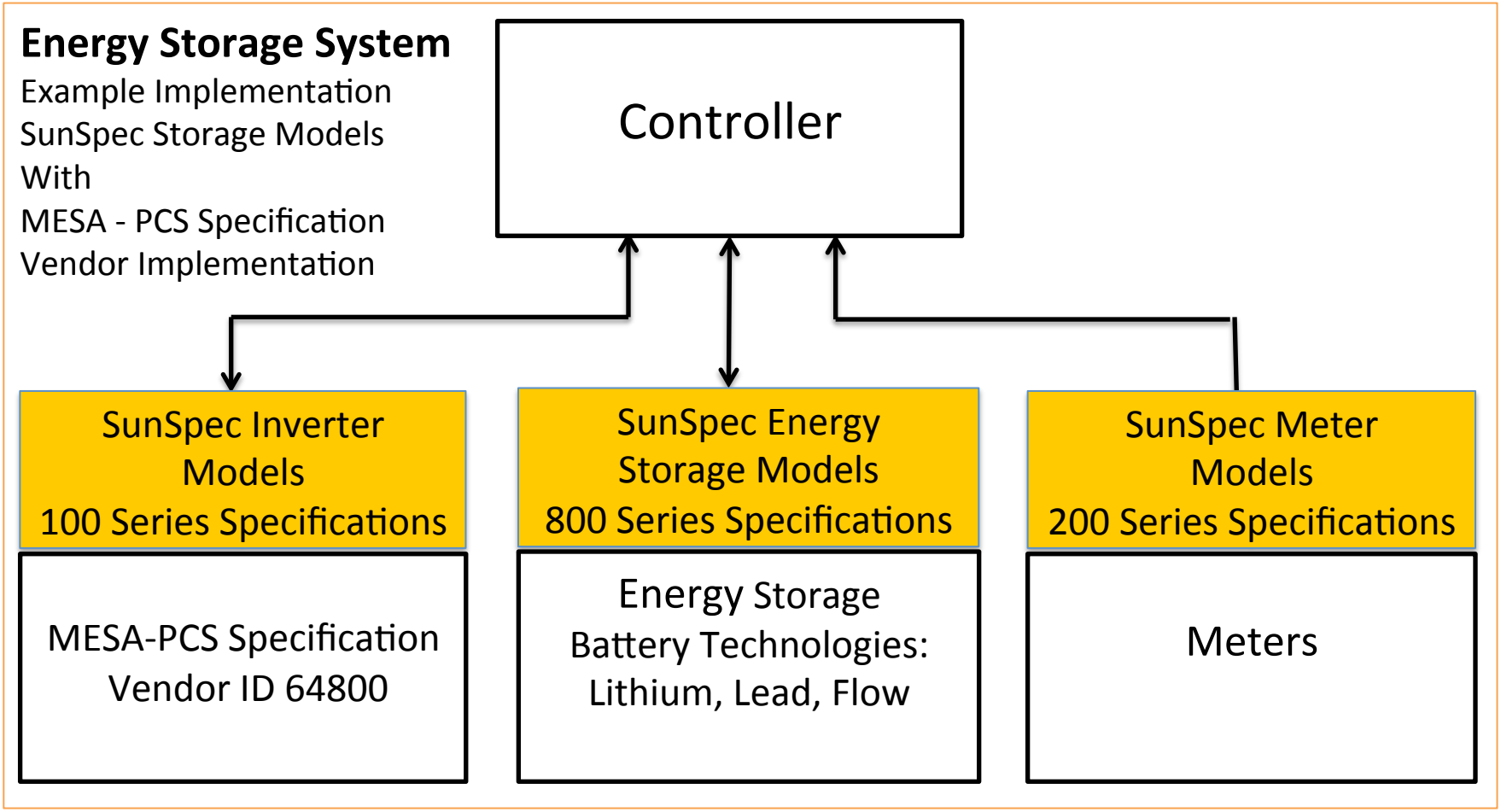
Nissan Leaf

- 24 kWh Li-ion battery
- $35k
- Plus a car

Engineered for Scale

* Credit David Kaplan 1Energy Systems

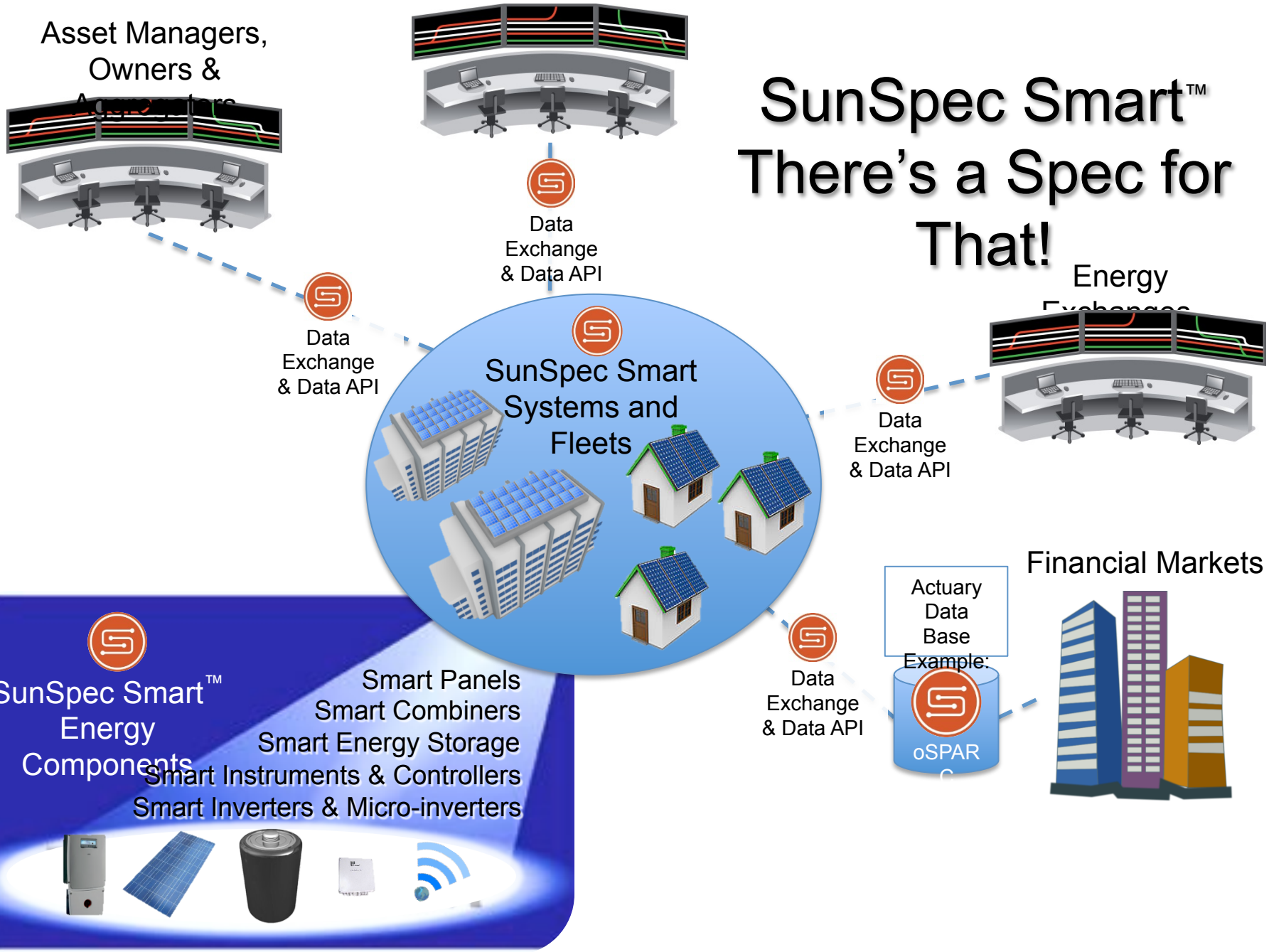
SunSpec Energy Storage Specification



SunSpec Energy Storage Spec

- Developed in collaboration with members and the MESA Alliance
- Spec focused on small set of models to start
  - Battery Storage Model- Common attributes of battery storage systems
  - Lithium Ion Battery Model Done First
- Enable standard use cases
  - Energy shifting
  - Peak shaving
  - Voltage & frequency support
  - Power smoothing
- Expand to other storage technologies in future
- SunSpec Energy Storage Models specification status
  - Available now at www.SunSpec.org

SunSpec Smart™ There's a Spec for That!



Thank You!

Accelerating Distributed Energy

Contact TJ Keating for more information - tjkeating@sunspec.org

The Cost Effectiveness Found in Solar + Storage Integration

Mark Higgins
Strategen Consulting, LLC
510.665.7811 x 106

CESA Members

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Brookfield
CALMAC
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Coda Energy
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Toshiba International Corporation
Trimark Associates, Inc.
Tri-Technic
Wellhead Electric

CESA
CALIFORNIA ENERGY STORAGE ALLIANCE

Strategen Overview

We combine strategic thinking with deep industry expertise to create sustainable value

Strategen Core Team

- Deep industry knowledge in clean energy; core focus on solar & storage
- Analytical and financial capabilities
- Strategic management expertise
- Product development & project construction experience
- Project leadership and management
- Industry-leading regulatory strategies

Partners

- Technology Specialists
- Structured Finance
- Controls & Smart Grid
- Project Developers
- Tariff and Rate Specialists

Clean Tech Manufacturers / Service Providers

- What is the value proposition of our product / service?
- How can we develop a new product to differentiate our company and generate additional profits?
- Where are our profitable opportunities for growth?
- How can we alter regulations/policies in our favor?

Corporations Exploring Clean Energy Opportunities

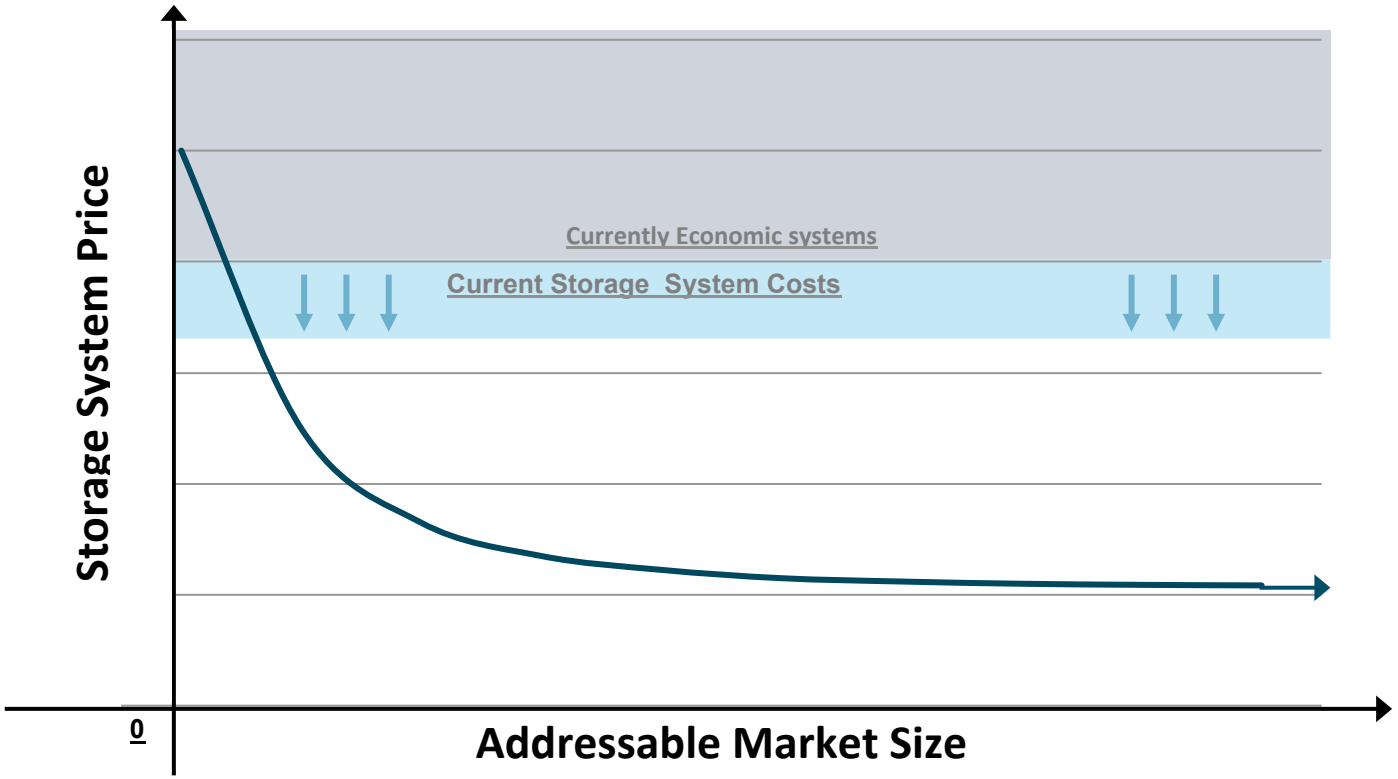
- How can we use our competitive strengths to take advantage of opportunities in clean energy?
- How can we minimize risk to our firm and customers?
- How should we plan for future market evolution?
- With whom should we partner; under what terms?

Private Equity / VC Firms Investing in Clean Tech

- What are the most valuable sectors of clean tech?
- What are likely impacts of future regulatory changes?
- What value does a company's products and services generate for its customers and for itself?
- Is this company well positioned for long-term success?

Conceptual View of the Storage Market

» Storage is economic today in locations and applications with high value



» As costs go down, the number of applicable applications and markets grows

» The process accelerates if we give the learning curve a gentle push

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Southern California Edison Procuring 260+ MW of Storage

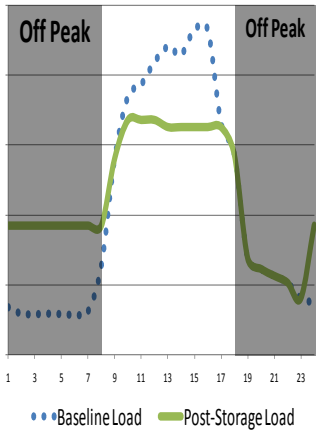
- In an all-source solicitation to meet the local capacity requirements of the Los Angeles area, Southern California Edison selected 261.1 MW of energy storage resources
- SCE's target in the solicitation for energy storage was set at only 50 MW – but they procured more than 5x the original target.
- Sends a strong signal that Southern California Edison found energy storage to be extremely cost effective versus all other forms of generation – including conventional resources

Seller	Resource Type	MWs	Number of Contracts
Ice Energy Holdings, Inc.	Behind-the-Meter Thermal Energy Storage	25.6	16
Advanced Microgrid Solutions	Behind-the-Meter Battery Energy Storage	50	4
Stem	Behind-the-Meter Battery Energy Storage	85	2
AES	In-Front-of-Meter Battery Energy Storage	100	1
NRG Energy, Inc.	In-Front-of-Meter Battery Energy Storage	0.5	1
TOTAL:		261.1	24

New Opportunities: Energy Storage & Commercial Facilities

Commercial Bill Management

- Before storage, commercial facilities in California pay
  - High Demand Charges ($/kW)
  - High Energy Costs ($/kWh)
- After storage, load shifted from high cost peak to low cost off-peak
- Savings from peak demand reduction



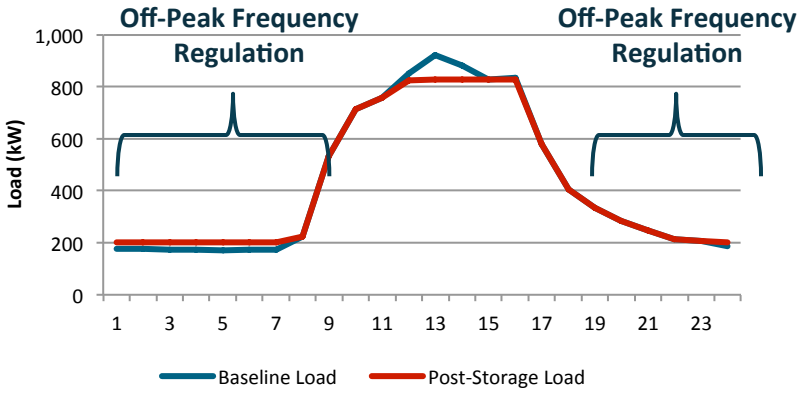
CAISO Wholesale Market Participation

- Ancillary Services participation on the customer side of the meter is now possible in CAISO territory
- Participating systems would be able to capture additional value from Pay-for-Performance, which pays more for faster and more accurate regulation providers
- Resources must be >500 kW of capacity (aggregated)

Storage-Specific CA Incentives: SGIP

- Self Generation Incentive Program (SGIP)
- 2014 Incentive Level: $1.62/W
- 2014 Statewide Program Budget: $83M (PG&E: $36M)
- Program recently re-authorized through 2019 for $83M/year
- First Come, First Served program. Reservations are expected increase dramatically going forward.
- Program to be revised in 2015 – greater emphasis to be placed on GHG performance vis-à-vis project funding and program evaluation.

Load Shape Impacts (July)



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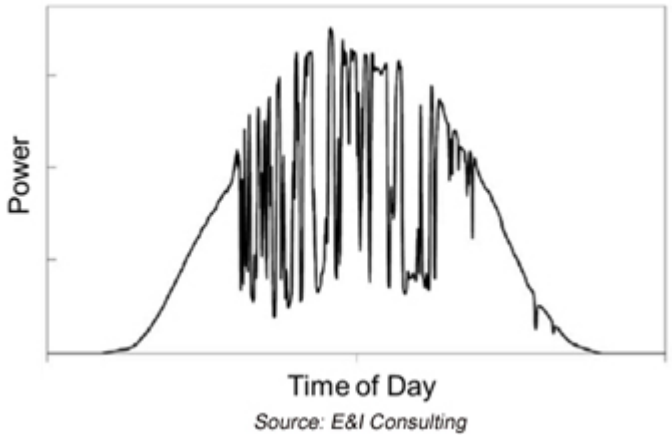
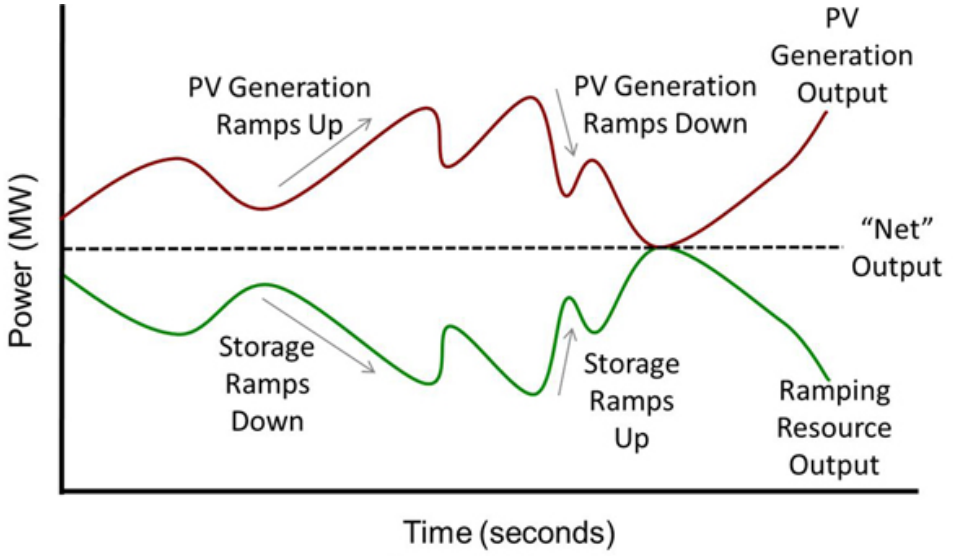
Energy Storage Very Complementary to Distributed PV

- Distributed PV benefits the grid by providing generation close to load, but it can also cause problems that energy storage can solve:
  - Ramping
  - Backfeeding
  - Voltage control



Source: E&I Consulting

- From customer perspective, storage value proposition often strongest when paired with solar – solar reduces energy costs, storage reduces demand charges



Source: E&I Consulting

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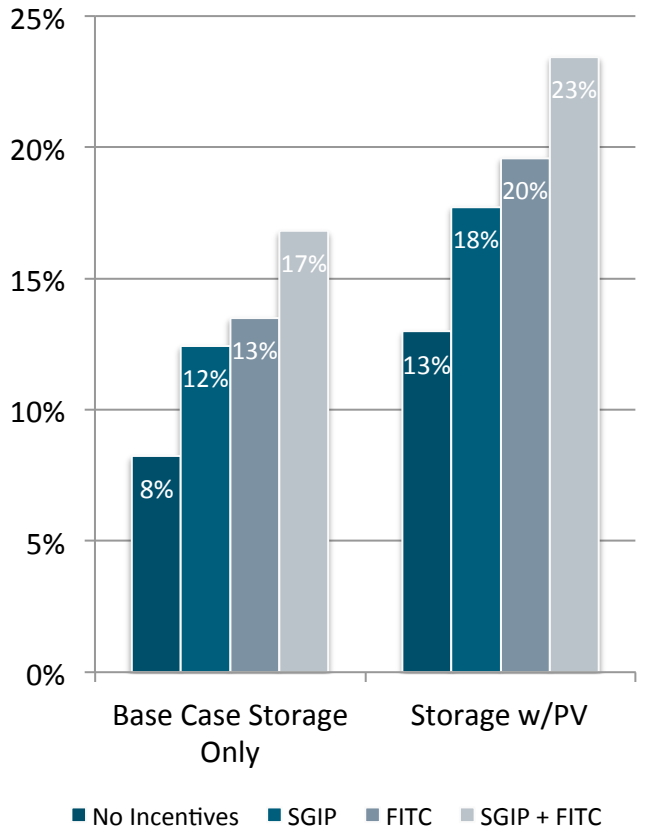
Hundreds of Storage Projects are Underway Behind the Meter

Attractive value propositions due to Small Generator Incentive Program (SGIP)

SGIP General Requirements for Energy Storage

Size Restriction:	» Maximum size: A standalone system can be no larger than the host customer's previous 12-month annual peak demand at the proposed site. A generation-paired system can be no larger than the generation system it is paired with » Must meet onsite load – Max. 25% export to grid
Discharge Capacity Criteria:	» Rated Capacity = average discharge kW over 2 hours » Standalone systems must be able to discharge once per day » Wind-coupled projects must be able to handle "hundreds" of partial discharge cycles per day.
Incentive Payment Method:	» Tech Based, 50% up front, 50% PBI (100% up front if <30kW) » Incentive calculations are separate for companion technologies
Minimum Required Round Trip Efficiency (AC to AC)	67.9%
Capacity Factor	10% (% total yearly capacity the system is in operation)
Cost Cap	» Applicants must pay a minimum of 40% of the eligible project cost » $5 million maximum incentive amount per project
Warranty Requirement	» All SGIP-eligible systems must have a minimum 10 year warranty on all major components of the system

After Tax IRR Impacts*



*Assumes 100kW, 2h storage system, Base Case CAPEX & OPEX, High School Load, Year 1 in 2014, 3.5% escalation rate, SCE TOU-8B Secondary Service, 350kWp PV system

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SOLAR + STORAGE WEBINAR

December 18, 2014

Elliot Hinds (Moderator), Partner, Akin Gump
(ehinds@akingump.com, +1 310-229-1035)

Kenneth Sahm White, Economics & Policy Analysis Director, Clean Coalition

Tim Keating, Development Director, Sunspec Alliance

Mark Higgins, Senior Director, California Energy Storage Alliance