

Energy Storage

An Essential Resource for California's Smart Grid

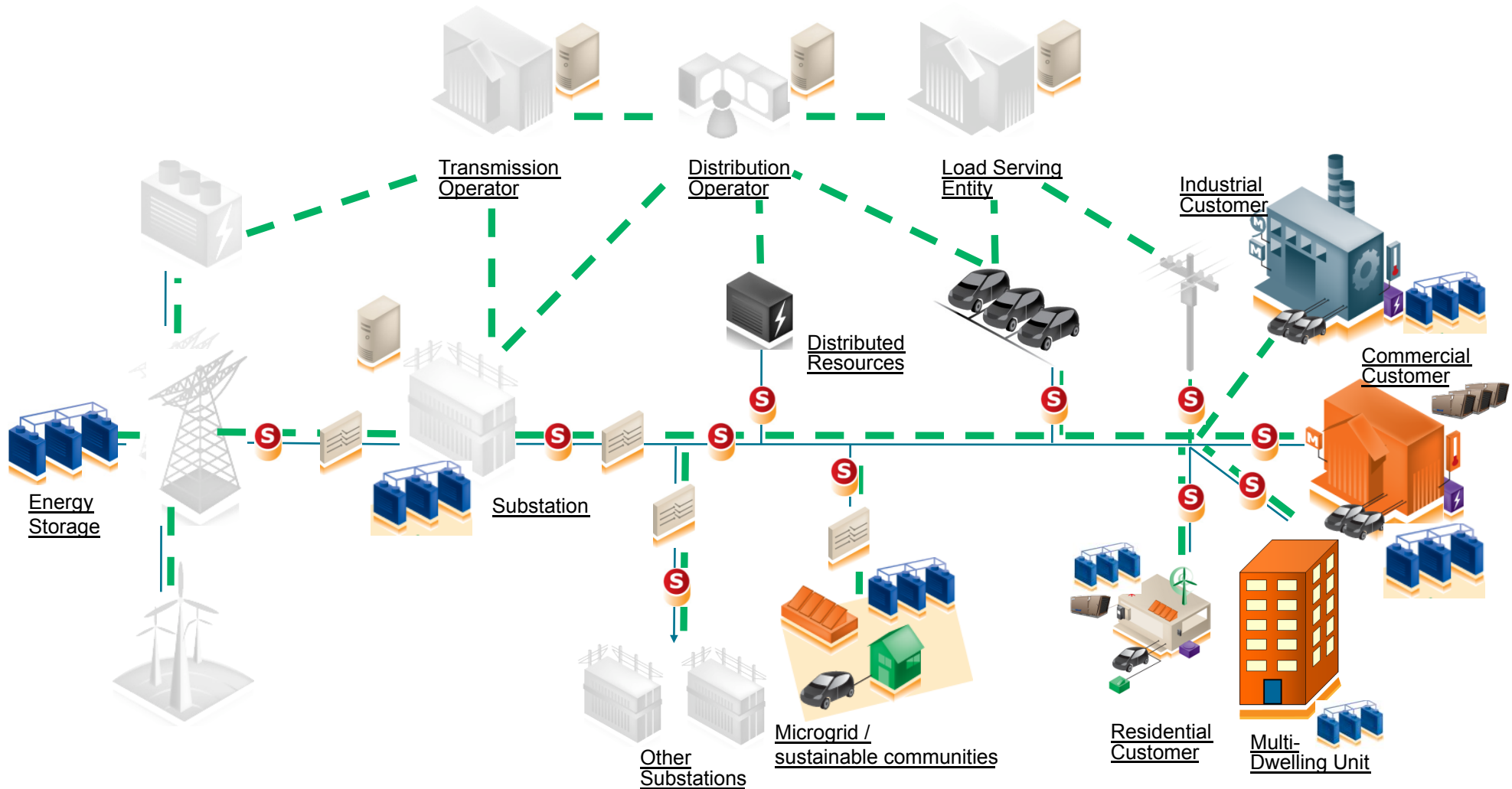
The California Energy Storage Alliance (CESA)

Janice Lin | CESA Director and Managing Partner of StrateGen Consulting

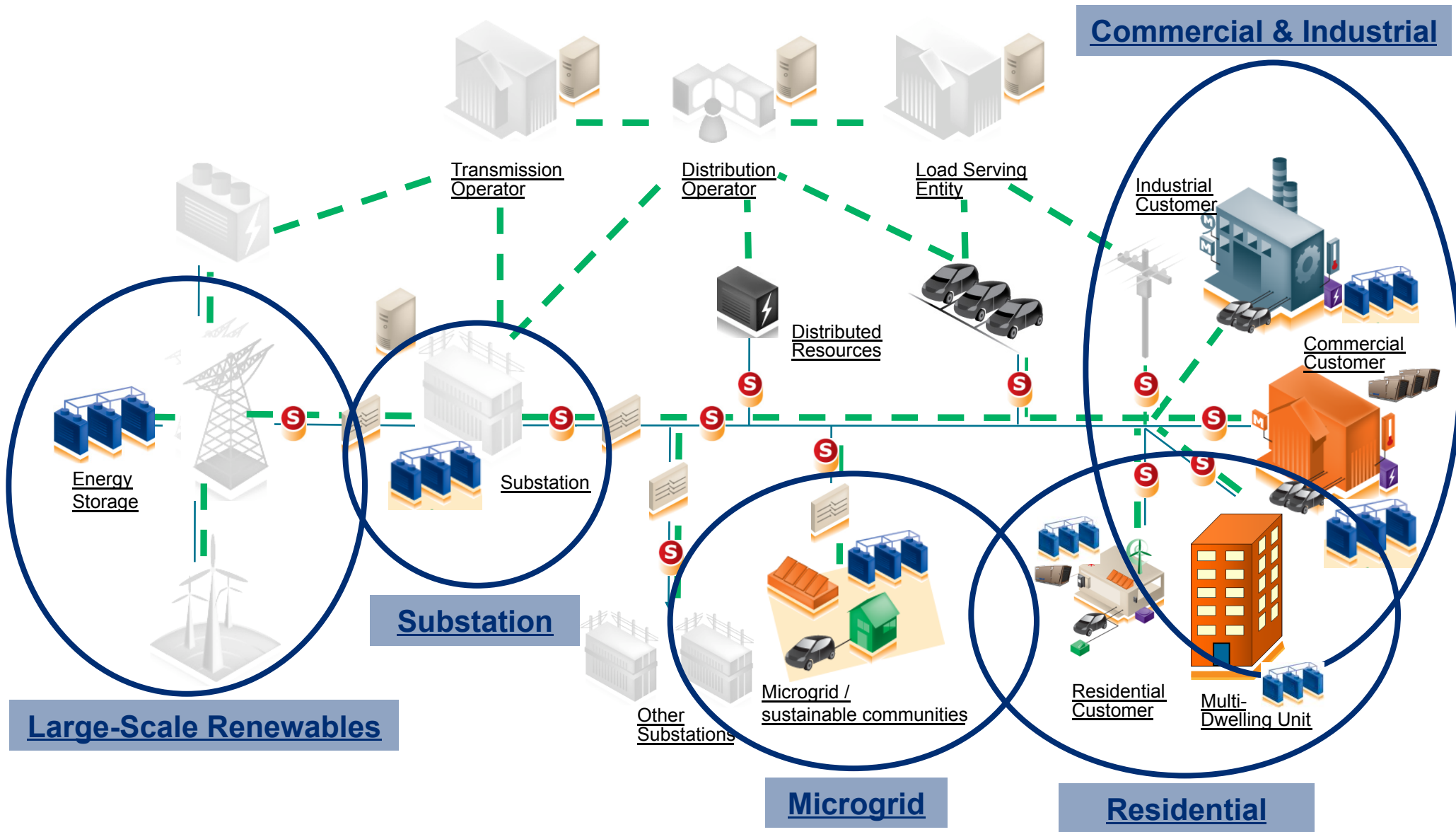
CPUC Smart Grid Workshop: Transmission and Storage

June 26, 2009

Storage is a necessary component of the smart grid

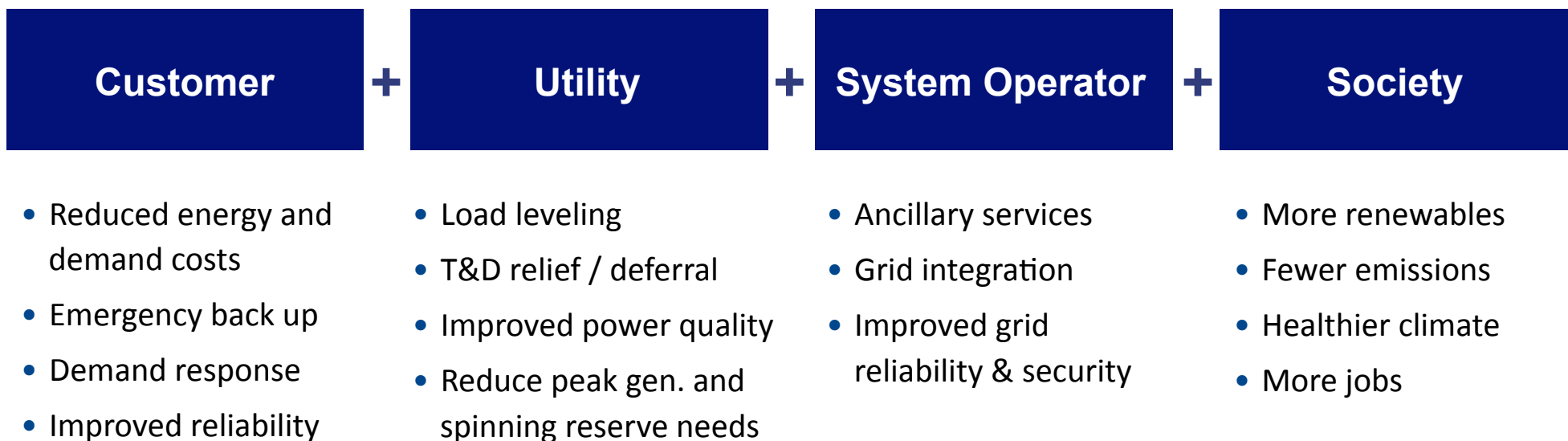


Storage is a necessary component of the smart grid



Storage enables capture of multiple value streams

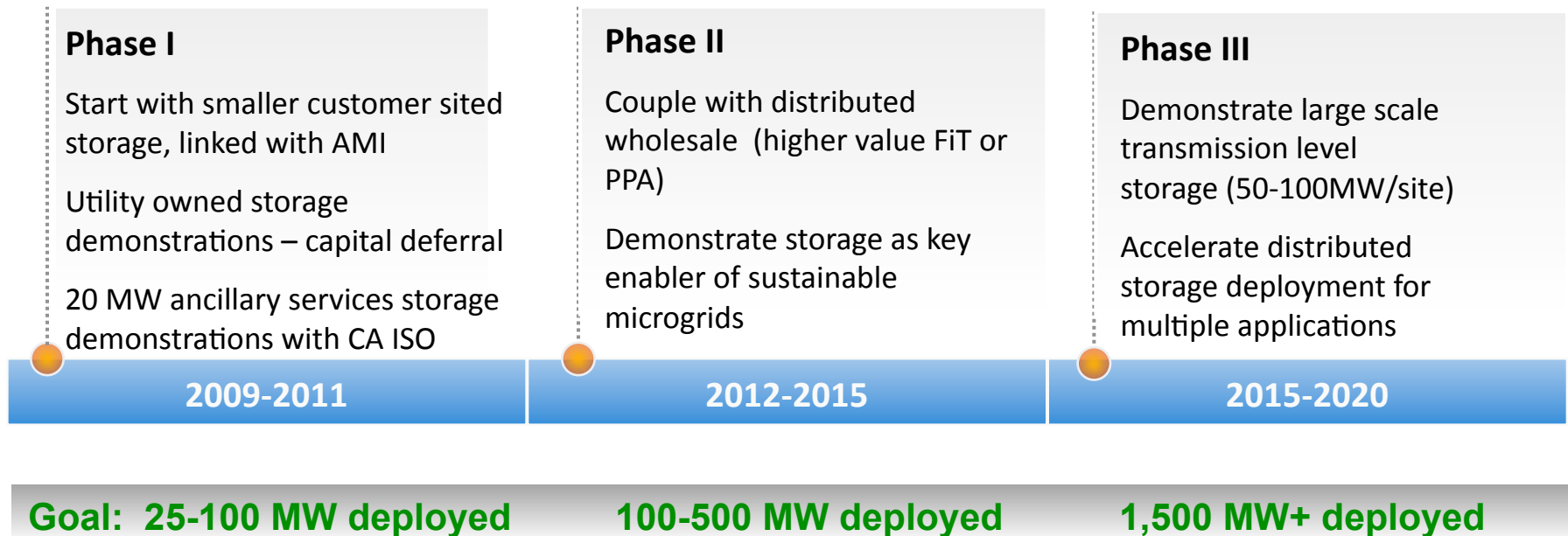
Storage will facilitate many energy policy initiatives:
Demand Response, RPS, Smart Grid, Resource Adequacy



Furthermore...

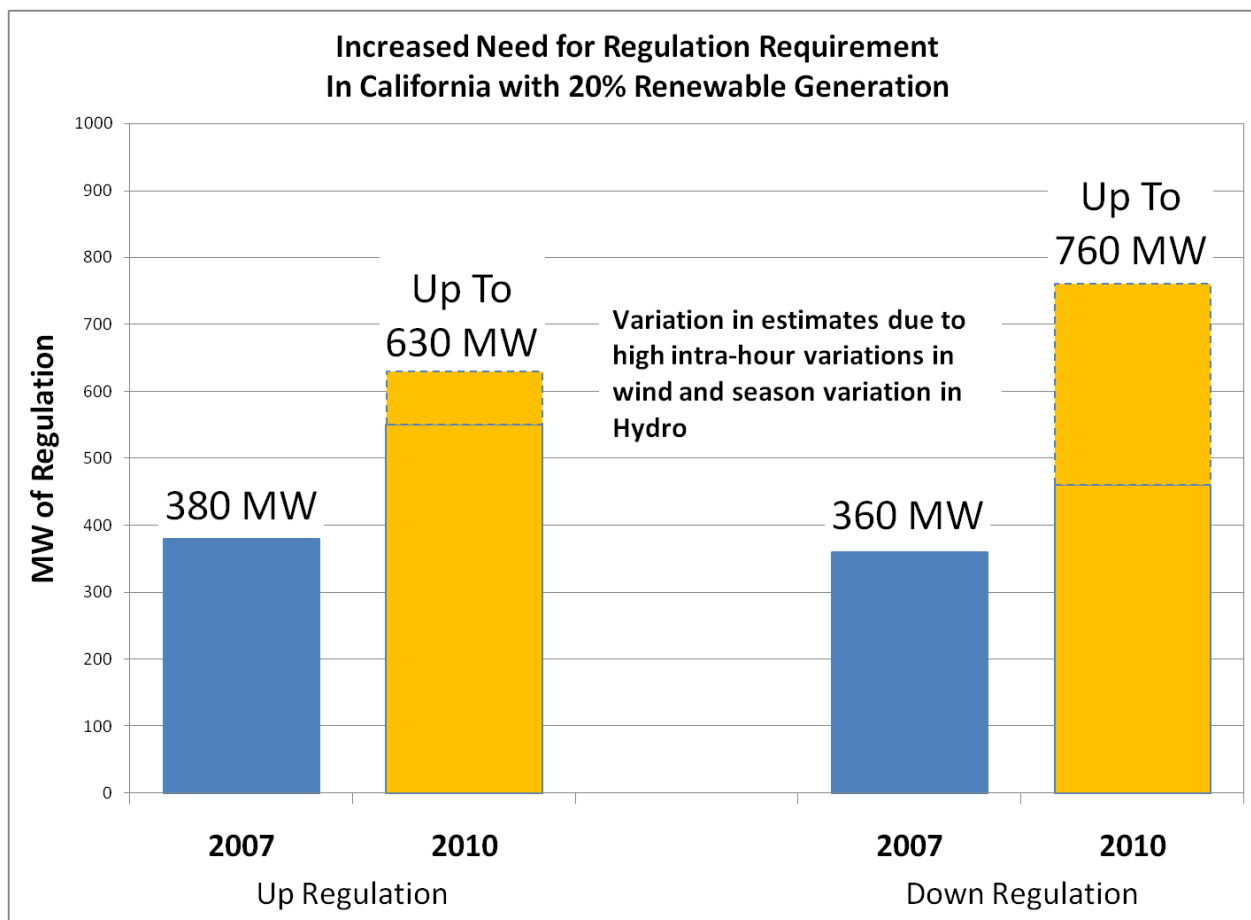
- » Storage can be deployed under many business models (utility owned, customer owned, third party owned)
- » 'Dispatchable renewables' can be realized with energy storage
- » Storage is a key requirement for high penetration of renewables, especially on microgrids

Storage systems are commercially ready and can be deployed quickly



CA's RPS implementation will increase the need for regulation and ramping

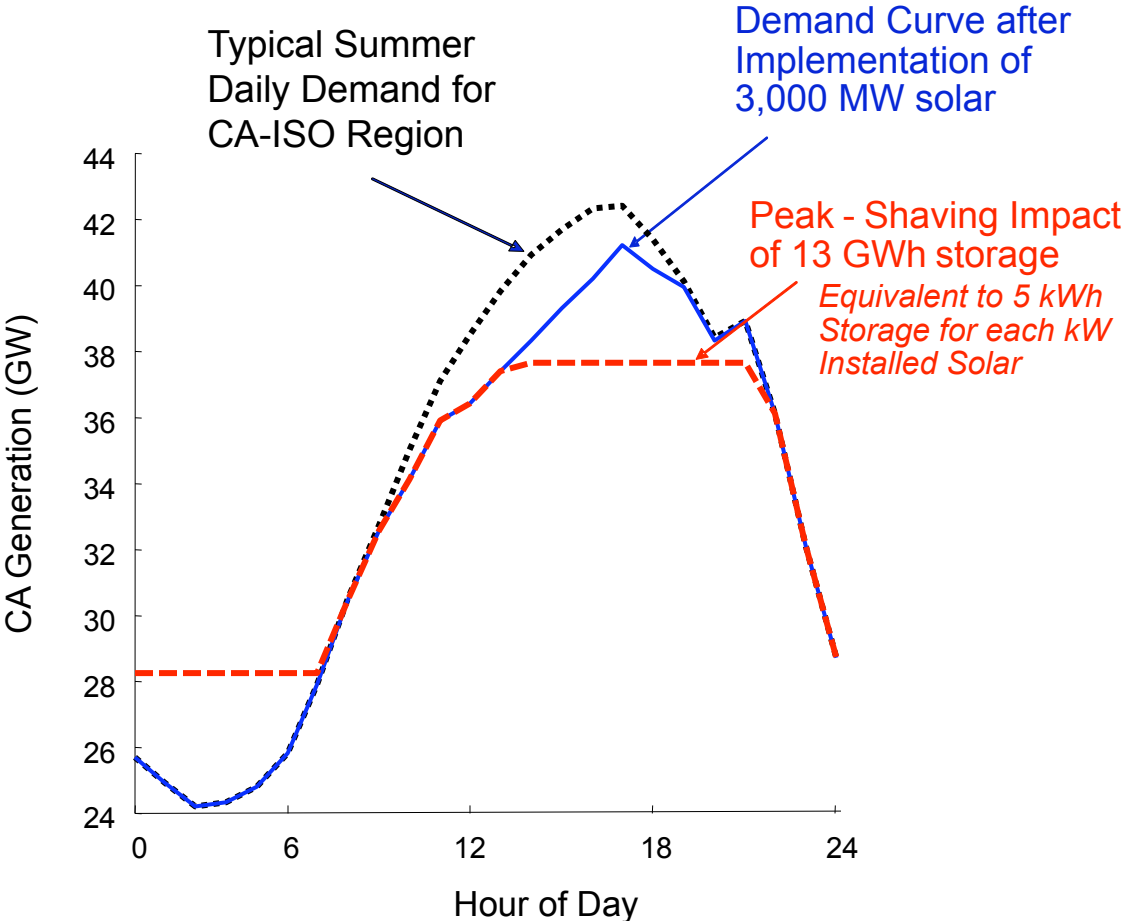
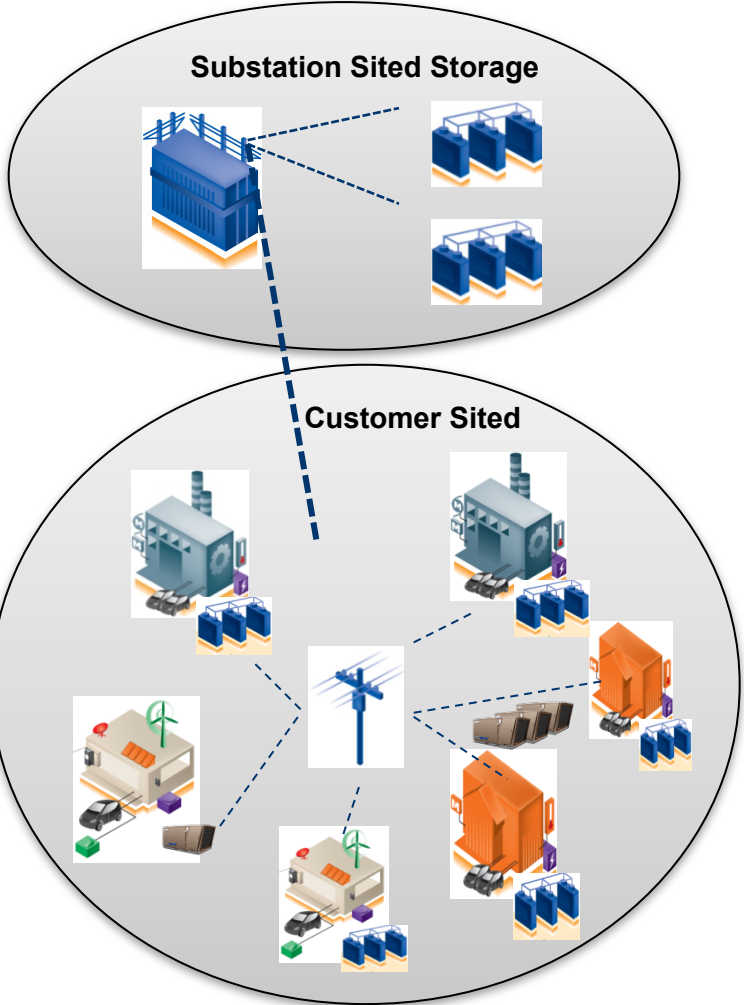
- Increased wind penetration creates need for greater regulation capacity and faster regulation ramping capability
- Nov '07 CAISO report identifies significant additional regulation requirements with 20% renewables (about 10% wind penetration)



Ancillary services can be provided today at 20 MW scale, and from systems as small as 1 MW on the customer side of the meter

Distributed Applications Are Utility-Scale

Small distributed systems can have a grid-scale impact



Government intervention is needed to overcome current barriers

Current Barriers

» Cost / Economics

- Many storage technologies have not achieved scale economies
- Analyzing impact of storage, especially coupled with renewables, is very challenging

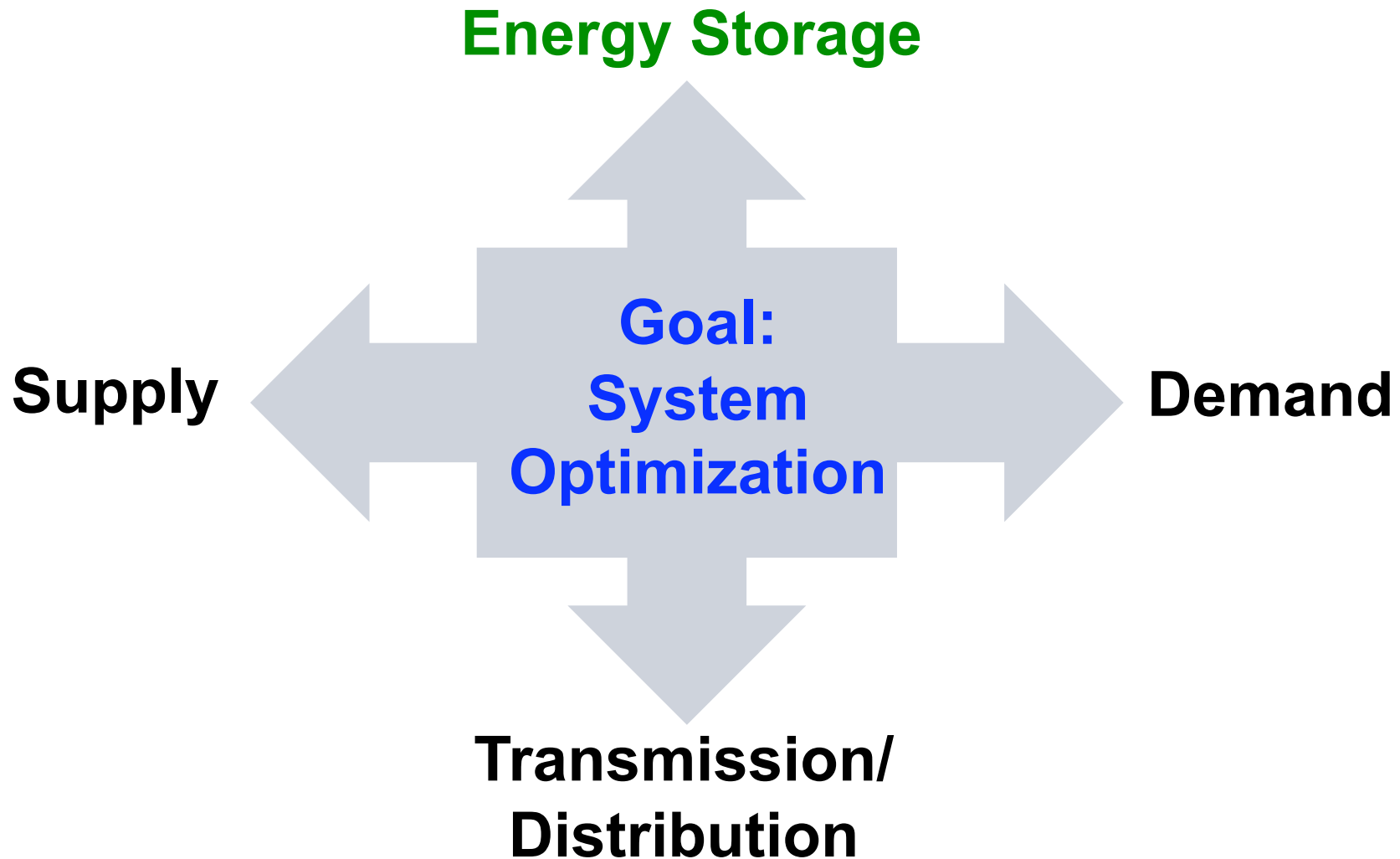
» Technology

- Many solutions, all with tradeoffs
- First demonstrations of new applications are difficult to implement

» Regulatory / Policy

- Difficult to aggregate complete value streams provided by storage
- Perception that storage is just a 'utility solution'
- Tariff design that does not reflect true cost of producing and delivering power on peak
- Incomplete CA ISO implementation of FERC Order 890/719 energy storage tariff for regulation
- Unclear net metering rules for storage + renewables projects
- Integration of storage into all aspects of policy making

Energy storage is deserving of its own asset class category and immediate energy policy focus



Enabling storage will enable the smart grid!

Additional incentives & RD&D are needed:

» **Incentives**

- ‘Fully implement’ SGIP (need incentives for standalone and solar apps)
- Allow an increased rate of return for utility owned storage, similar to renewables treatment
- State supported alternative energy financing for storage
- Tax incentives comparable to solar and wind (ITC and MACRS)

» **RD&D funding**

- Accelerate deployment of ‘integrated’ demonstration projects under various business models
- Leverage federal ARRA funding for California storage related activity
- Create CA-based Energy Storage Center of Excellence to provide technical and policy leadership

Enabling storage will enable the smart grid!

CESA policy recommendations:

- » **Goal: leverage storage under multiple ownership models to help enable the Smart Grid, GHG reduction, EE, DR and the RPS**
- Include storage in DG, DR, EE cost benefit methodologies
- Increase FiT cap and price for renewables firmed with storage
- Require storage as part of current LT procurement process
- Require storage eligibility for next Permanent Load Shifting RFP
- Explore retail tariff design that encourages load shifting
- Implement energy storage tariff for regulation (comply with FERC order 890 and 719)
- Implement a 3:1 RPS multiplier for renewable energy firmed with storage to deliver on peak
- Consider a peak reduction standard for state energy purchases
- Clarify net metering rules for renewable energy projects with storage

End of Presentation

The California Energy Storage Alliance (CESA)

Janice Lin | CESA Co-Founder and Managing Partner of StrateGen Consulting

The California Energy Storage Alliance (CESA)

Our Goal: *Expand the role of storage technology to promote the growth of renewable energy and create a more stable, secure electric system*



Human Energy™

FLUIDICENERGY

Xtreme Power



ICE ENERGY®



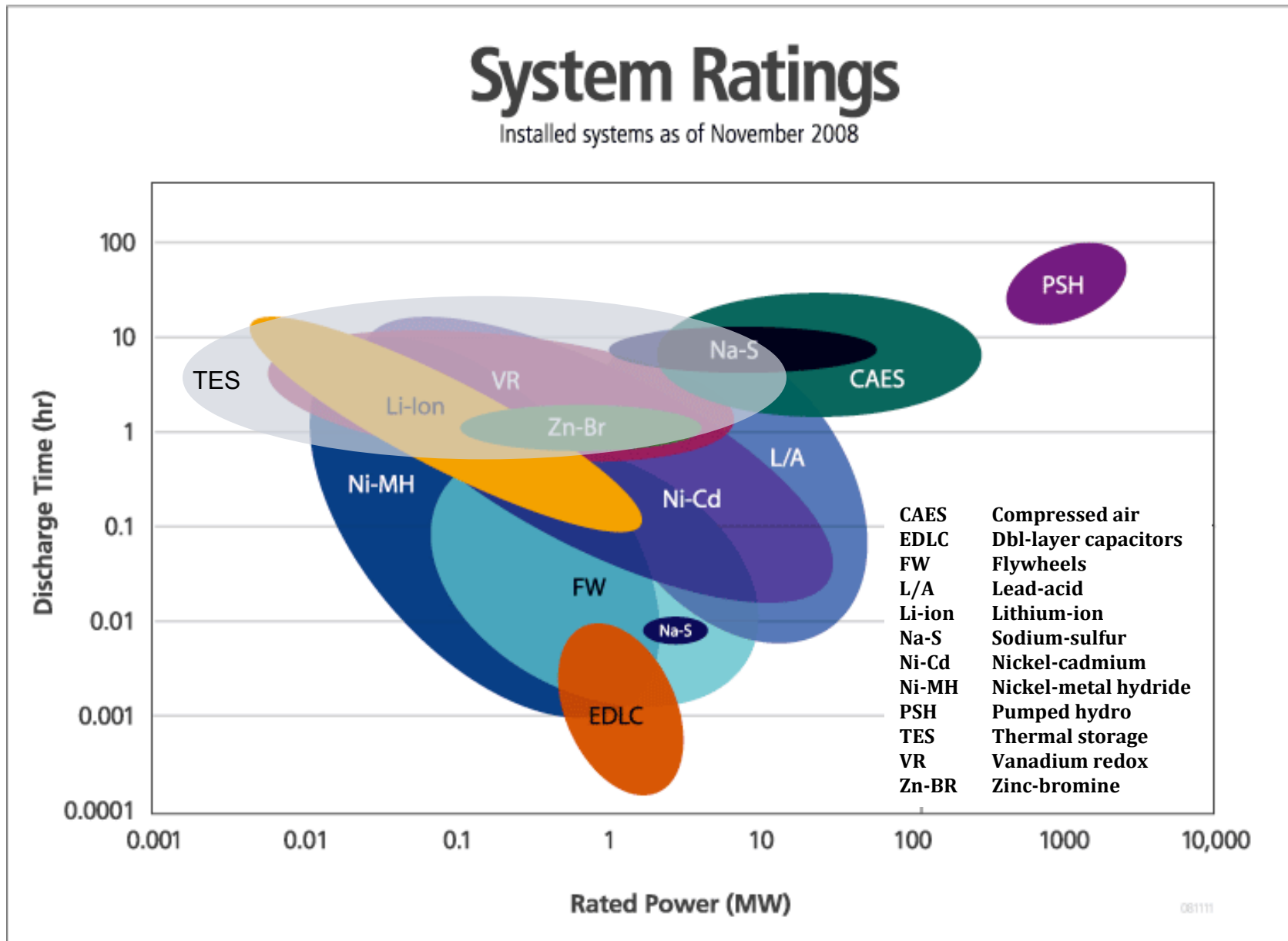
A123
SYSTEMS

Debenham Energy, LLC



- » CA-focused advocacy group representing energy storage stakeholders
- » Focus on storage coupled with renewable energy integrated into the smart grid
- » Immediate work is on distributed applications of energy storage
- » Current priorities/activities include:
 - CPUC
 - SGIP AES implementation
 - DG (DER) cost benefit methodology
 - Smart Grid OIR
 - Storage legislation: AB 44, AB 1536

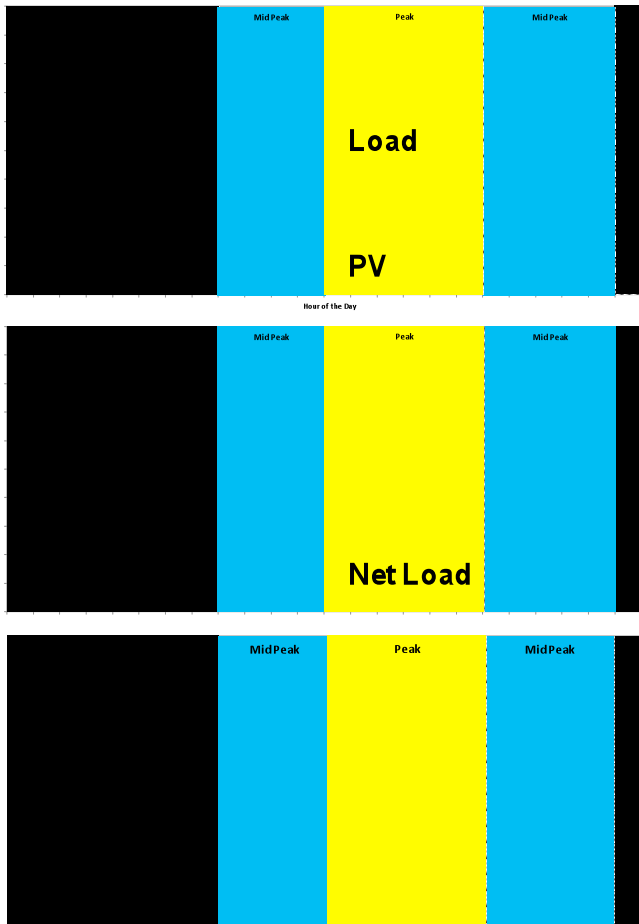
There are many commercially available energy storage technologies today



Source: Electricity Storage Association

Storage effectively integrates renewables into the smart grid (solar example)

Distributed Solar + Storage



Load & Solar Generation

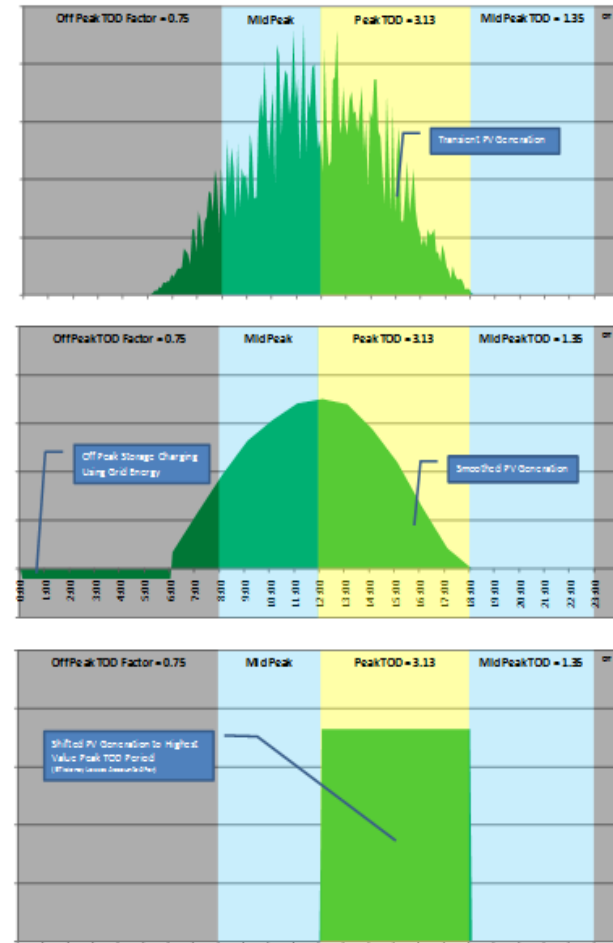


Net Load is Still Coincident with Peak Demand Charges



Storage to Shift Net Peak Load to Off Peak Periods

Wholesale Solar + Storage



Solar Generation



Output Firming (Smoothing) with the Assistance of Storage



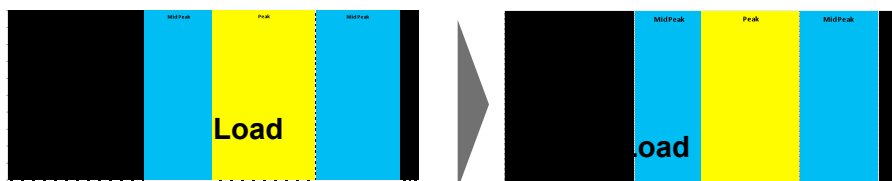
Storage to Shift Generation to Peak Periods

Storage + distributed renewables: 1 + 1 = 3

Integration delivers a better value proposition than either technology alone. Solar example:

Storage* – Standalone (IRR 4.8%)

- Charge at night and discharge during peak to reduce demand charges



Solar – Standalone (IRR = 4.1%)

- Generate energy during day to offset load and avoid energy costs



Solar *with* Storage

Storage + Solar (IRR = 5.9%; 6.8% with SGIP & ITC on both)

- ✓ Obtain full demand savings on storage + avoided energy costs of solar
- ✓ Obtain synergies thru more efficient charging of battery with solar
- ✓ Reduce total system costs by sharing inverters, equipment
- ✓ Potential to leverage FITC for both technologies
- ✓ Potential to provide emergency back up capabilities

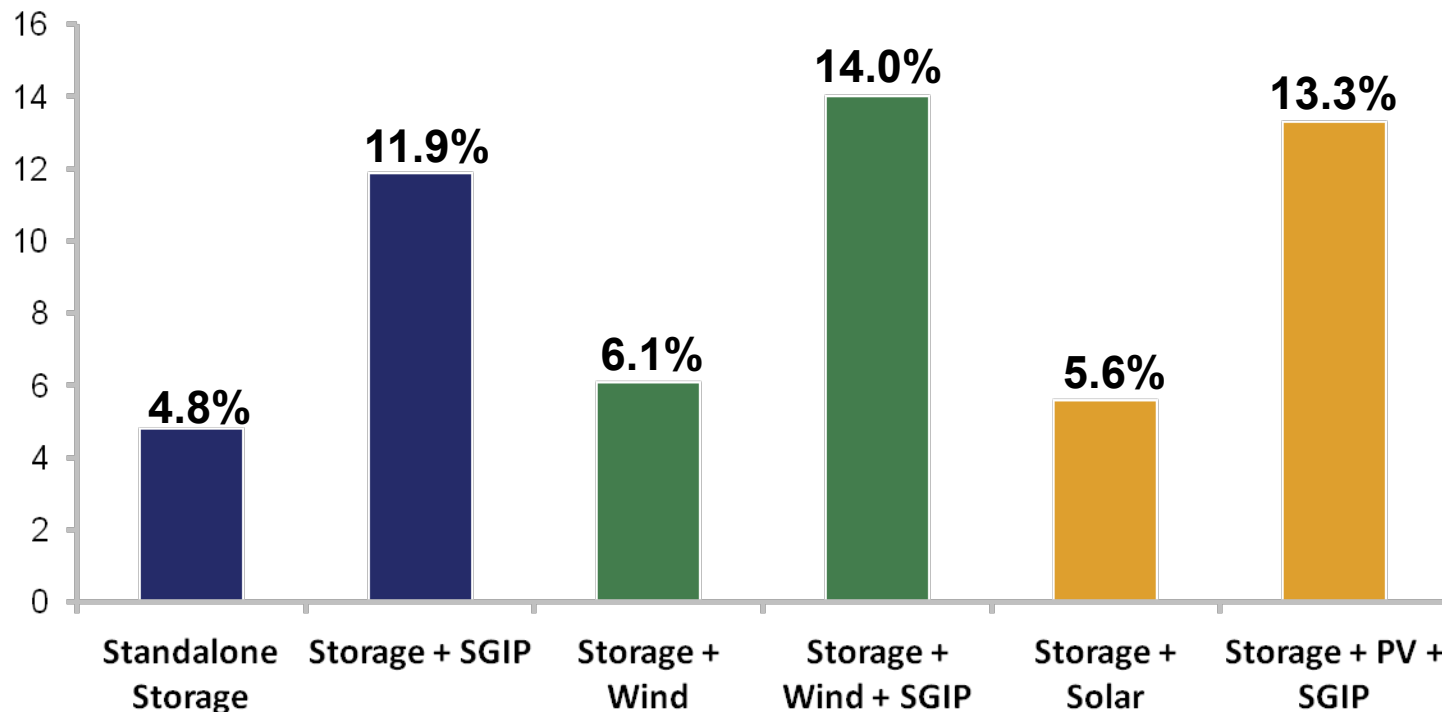
*Assumptions: Storage assumptions same as previous slide; PV assumptions – turn-key all equity purchase, SCE TOU 8, \$5/Wp CAPEX, 30% FITC, \$0.15/kWh CSI PBI

Assumptions: 100kW, 6h, 65% AC roundtrip efficiency battery; 350kWp PV & turbine systems; \$475kWh (\$2,850/kW) battery CAPEX, \$0.075/kWh discharged & \$6/kW fixed battery OPEX; SCE TOU-8 tariff, California high school load profile; \$2/W SGIP incentive

Thank you for your leadership with the SGIP!

The SGIP will have a significant impact on end-customer returns, accelerating deployment of grid connected storage

Incremental IRR of Battery for the End Customer – Illustrative Battery Example



Assumptions: 100kW, 6h, 65% AC roundtrip efficiency battery; 350kWp PV & turbine systems; \$475kWh (\$2,850/kW) battery CAPEX, \$0.075/kWh discharged & \$6/kW fixed battery OPEX; SCE TOU-8 tariff, California high school load profile; \$2/W SGIP incentive

Benefits of Storage – Renewable Integration

“Enabling technologies such as fuel switching in ‘smart’ appliances, dispatch-able load from plug-in hybrid or other electric vehicles, or stationary energy storage would be required to enable very high levels of PV contribution (>20%) to the electric power system”.

- NREL Denholm & Margolis, April 2006

“When PV penetration reaches sufficiently high levels (e.g., 5 to 20% of total generation), the intermittent nature of PV can begin to have noticeable, negative effects on the entire grid” [requiring storage]

- US DOE, SEGIS-ES, July 2008

“Storage will need to be part of our portfolio if going to 15 to 20 percent wind at a national level, otherwise it won’t be efficient at a lower level and it won’t get us where we want to go environmentally”

- Electric Power Research Institute, March 2009

StrateGen Overview: Our Firm

StrateGen helps businesses create sustainable value through clean energy solutions

