



POWER SYSTEM GAME CHANGER

Energy storage has been called the 'holy grail' of the electric power system.

Currently, grid operators struggle to balance supply and demand in real time, which causes a host of problems:

- Large fleets of idling power plants
- Difficulty matching variable customer loads and generation supply
- Costly generation assets which are utilized for only a few days per year
- Poor grid reliability

Grid-scale energy storage systems respond quickly to these imbalances, shaping and shifting energy to when it is needed most, providing enormous benefits:

- Greater electric system reliability
- More economical use of existing assets
- Faster response of the grid to changing loads
- Reduced greenhouse gas emissions
- Improved ability to integrate renewable energy

ENERGY STORAGE SOLUTIONS

Energy storage resources include:

- Batteries
- Flywheels
- Chilled water & ice
- Molten salt
- Compressed air
- Pumped hydro power

XTREME POWER



Notrees Wind Farm Project, West Texas: Xtreme Power's (36MW x 15 minutes) battery based energy storage system at Duke Energy's 153MW wind farm.

THE UBIQUITOUS STORAGE MODEL

Energy storage is already a key enabler in the consumer electronics, transportation and emergency backup industries: a ubiquitous everyday tool. Now it is poised to be a game changer for the electric power system.

The modern power grid was designed before it was feasible to store energy. In the old system, demand was predictable and fossil-based generation was stable.

Today, with the implementation of renewable energy and the electrification of transportation, the nature of demand and supply is changing, and becoming more difficult to manage.

REGULATIONS ARE DRIVING ADOPTION

Today, legislation and regulations around the country are being amended to enable energy storage to be paid for its high performance when deployed on the grid.

These market changes are creating tremendous business opportunities, shaping the landscape for investment, market entry, new business models and the grid-wide asset mix for decades to come.

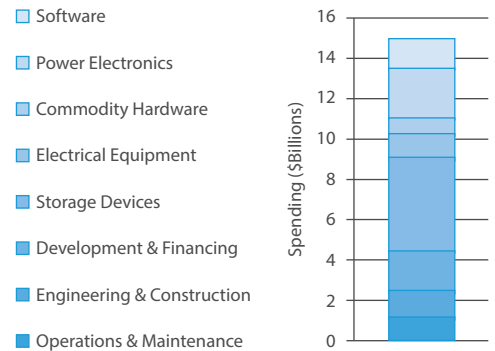
For more information, visit:
www.storagealliance.org/content/storage-resources.htm

SUMITOMO



Yokohama Smart City project, Japan: Sumitomo Electric's redox flow battery (1MW x 5 hours) located at Sumitomo Electric Industries (SEI) facility, links the world's largest redox flow battery with Japan's largest concentrated PV array

GRID-CONNECTED ENERGY STORAGE 2020 U.S. MARKET SIZE (\$B)*



* 2020 U.S. Annual Market Size of \$10-\$15 billion, based on current and projected utility spending
Source: Strategen Consulting

A FAVORABLE REGULATORY LANDSCAPE FOR STORAGE:

Federal Investment Tax Credit (ITC) – storage can be eligible for a 30% Investment Tax Credit (ITC) when integrated with renewables.

FERC Order 755 – requires new tariffs to be created nation-wide resulting in higher frequency regulation payments for fast responding storage assets in wholesale markets.

CA Self-Generation Incentive Program (SGIP) – millions of dollars are available for behind-the-meter storage projects in California, up to \$3.15M per project.

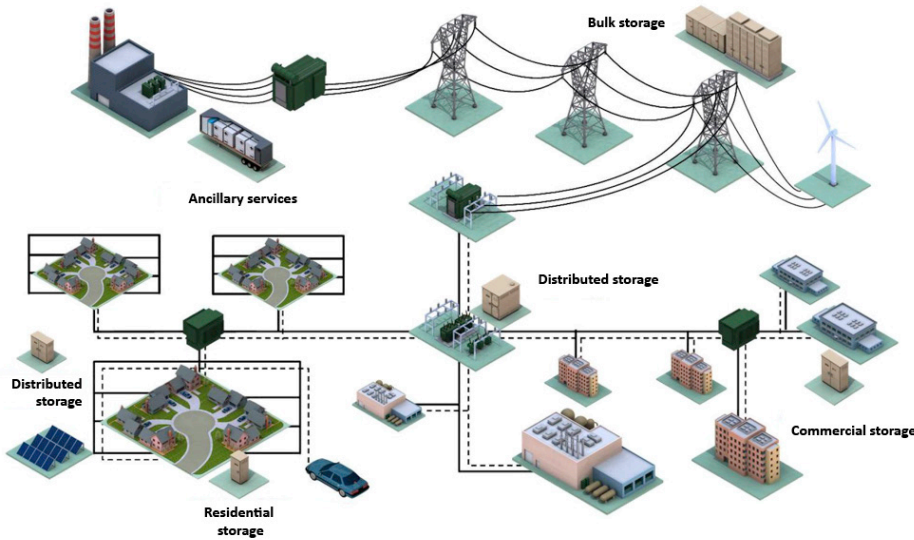
CA Long-Term Procurement Planning (LTPP) Phase 1 – CA Public Utilities Commission (CPUC) decision requires Southern California Edison to procure at least 50MW of energy storage to meet long term local capacity requirements.

German Energy Storage Initiative – \$65M total budget available for energy storage systems smaller than 30 kW, up to EUR 800 (USD 1,080) per kWh of storage.

For recent project information please visit the Department of Energy's International Energy Storage Database:
www.sandia.gov/ess/database



THE ROLES OF STORAGE ON THE GRID



Source: Electric Power Research Institute

ADDRESSING NEW GRID CHALLENGES

Modern energy storage is ideally suited to address today's grid challenges.

A 50 MW natural gas power plant can only deliver 40 MW of high-value flexible capacity to the grid, while 50MW of fast responding energy storage can deliver 100MW of flexible capacity – more than twice as much. It can also respond up to ten times faster to changing grid needs and customer demand. When this superior performance is accounted for, energy storage can be more cost effective than natural gas in these expanding flexible applications.

A DISRUPTIVE TECHNOLOGY CLASS CREATING MASSIVE MARKET OPPORTUNITY

Because it can be applied throughout the entire electric power system, energy storage provides a vast ecosystem of new opportunity. Opportunities range from large transmission-scale projects down to residential-scale home/EV charging solutions. All along the value chain, new products and services are needed:

- Financing
- Hardware
- Software
- Monitoring & controls
- Installation
- Maintenance services

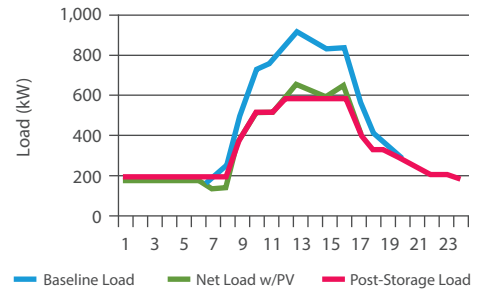
Energy storage is a vital and inevitable part of the evolution of our power system. It is the 'bridge' toward greater use of local renewable energy and ultimately greater energy security and independence for generations to come.

(1) SCE TOU8-B tariff, CA high school load profile
 (2) Incremental value of storage only; PV savings and costs netted out
 (3) Accounts for replacement costs of unplanned cell failures

> CASE STUDY: CUSTOMER BILL MANAGEMENT WITH PV IN CALIFORNIA

Storage + 350 kW PV system - 13.0% incremental IRR

LOAD SHAPE IMPACTS (JULY)



KEY ASSUMPTIONS (1)

- Site: CA high school load profile
- PV System Size: 350kWp
- Storage System Size: customer-sited 100kW, 2h ESS
- Ownership: all-equity turnkey purchase
- Storage CAPEX: \$943/kWh (\$1,886/kW)
- Integrated Storage + PV Project CAPEX Reduction: 10%
- Battery round trip AC efficiency: 85%
- Incentives: NONE

STORAGE OPEX ASSUMPTIONS

- 10yr Cell Stack Replacement Costs: \$200/kWh
- 10yr Inverter Replacement Costs: \$100/kW
- Fixed O&M: \$10/kW-yr
- Variable O&M: \$0.01/kWh discharged (3)

RESULTS (2)

- After-Tax IRR: 13.0%
- Year 1 Electric Bill Savings: \$26,656 (8%/yr reduction in the electric bill for the facility (4))
- With the addition of participation in the CAISO frequency regulation market during off-peak hours, the IRR is 16.7% (5)

(4) Doubling the energy storage system size to 200kW, 2h would increase the Year 1 Electric Bill Savings to \$52,635 and would be a 16%/yr reduction in the electric bill for the facility

(5) Off-peak F/R market participation value is assumed to be \$111/kW-yr in CAISO and has a Pay-for-Performance factor of 2.0x; OPEX for regulation assumed to be at the retail rate (SCE TOU8-B)

Source: Strategen Consulting LLC

ENERGY STORAGE NORTH AMERICA

SAVE THE DATE

SEP 10-12, 2013
 SAN JOSE, CALIFORNIA
www.esnaexpo.com
 Or scan the QR-Code

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