

Residential Battery Storage

A Primer

Presented by:

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Rebuild Green Expo
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Electric Power Research Institute

Not-for-profit, Collaborative, Research Organization founded in 1972

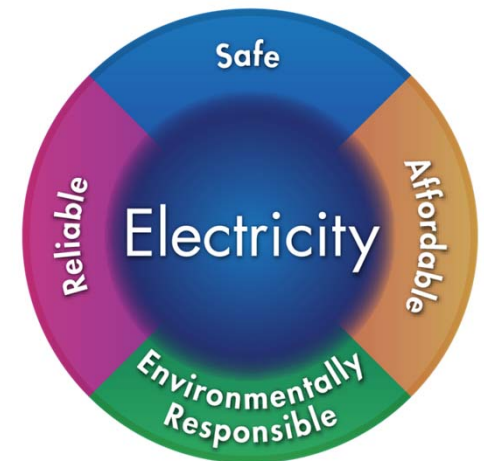
Advancing *safe, reliable, affordable* and *environmentally responsible* electricity for society through global collaboration, thought leadership and science & technology innovation

EPRI does:

- Perform scientific research on technologies related to electric power, transmission, distribution, and end use

EPRI does not:

- Recommend specific products or companies
- Provide opinion without scientific or engineering basis

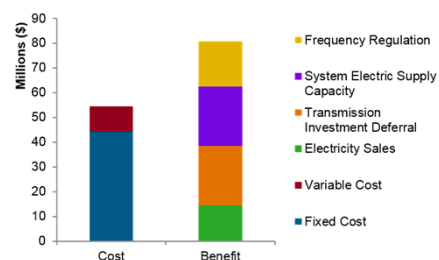


About the EPRI Energy Storage Research Program

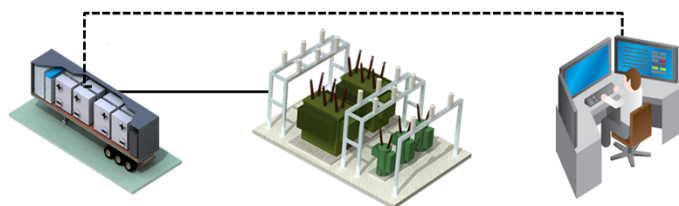
Mission: Advance integration and use of safe, reliable, cost-effective and environmentally responsible energy storage

- New technology testing and demonstration
- Analysis methods and tools
- Guidelines / best practices for grid integration

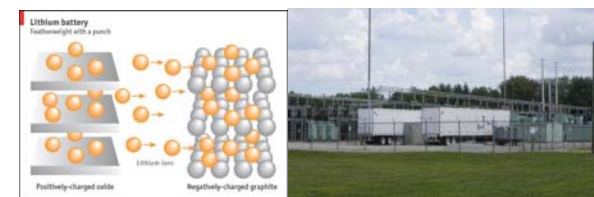
Storage Valuation



Storage Integration

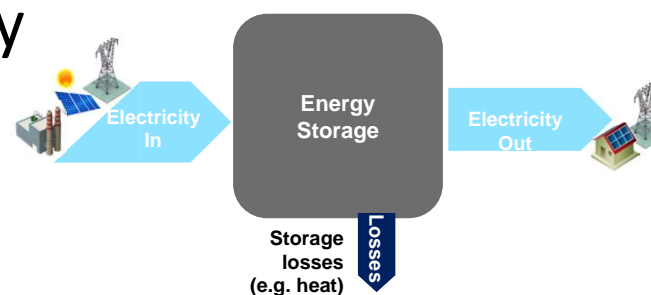
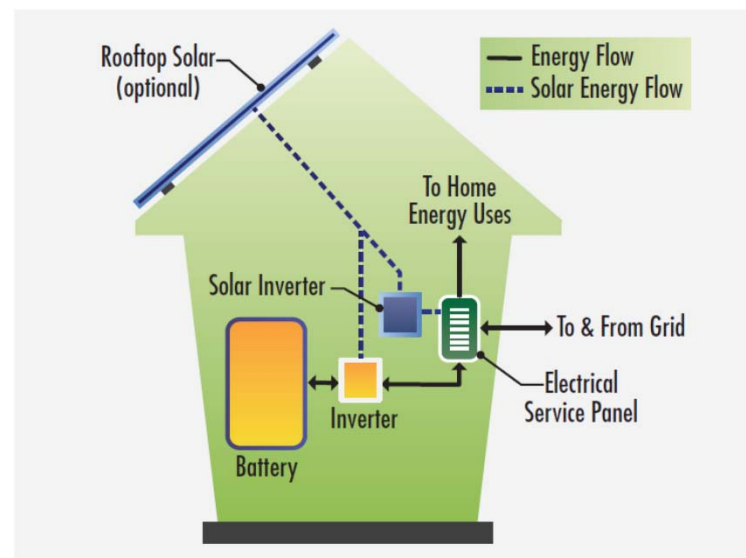


Evaluation and Demonstration

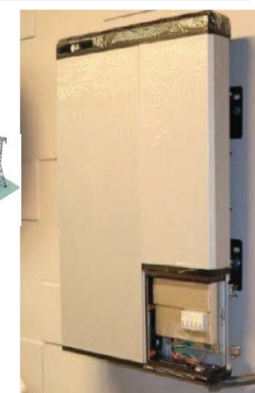


What is Residential Battery Storage?

- Stores electricity at one time and releases later
- May be charged from utility power grid or on-site solar PV
- General consists of battery, inverter, control system and protection
- Typically utilizes lithium ion battery technology similar to electric vehicles and inverters similar to solar PV



Source:
CALM
AC

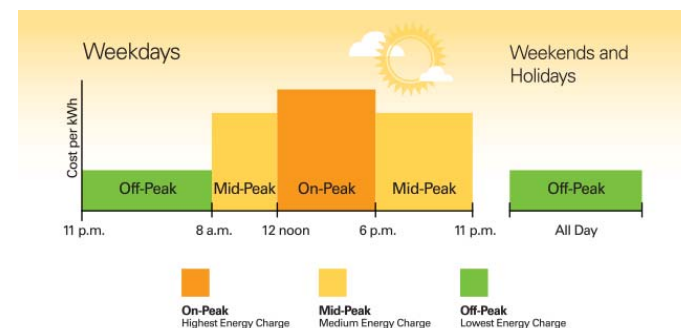


Why would a homeowner invest in energy storage?

- Backup power for grid outages
 - Clean, quiet, resilient power
 - Can enable solar PV to operate in an outage
 - Outage events may increase during high wildfire risk periods for some customers



- Electric bill savings
 - Shift solar energy and electric demand
 - Time-of-use electricity tariffs are becoming more common

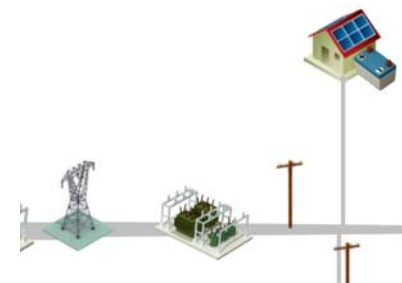


Illustrative time-of-use tariff

Source: Southern California Edison

Why would a homeowner invest in energy storage? (cont.)

- Payments for “grid services” (future)
 - Sharing control with utility may enable more efficient grid planning and operations
 - Future programs may enable customers to be paid for services for storage operation
- Potential Incentives
 - Federal solar investment tax credit (ITC)
 - 30% credit may apply to systems where solar and storage are tied and where storage charges from solar power
 - Phase out begins after 2019
 - Sonoma Clean Power Advanced Energy Rebuild incentive
 - \$5000 credit for solar and storage systems
 - <https://sonomacleanpower.org/programs/advanced-energy-rebuild>
 - California Self-Generation Incentive Program (SGIP)
 - Currently \$0.40/Wh with phase out from subscription
 - https://www.pge.com/en_US/small-medium-business/energy-alternatives/private-solar/understand-the-solar-process.page



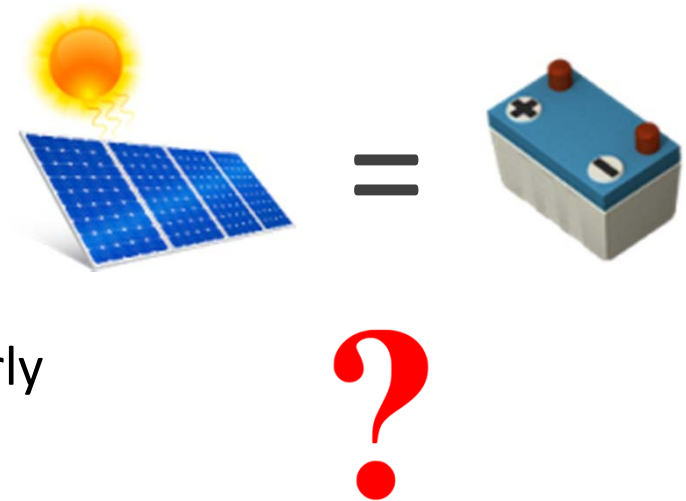
Does battery storage make financial sense?

- **Answer: Sometimes, but it's complicated.**
- **Why?**
 - Value of backup power can be subjective and difficult to assign
 - Depends on risk of outage and how critical the appliances are
 - Bill savings are uncertain in the future
 - Utility tariff designs change each year
 - Customer usage patterns are also changing: e.g. electric vehicles
 - Costs of batteries are falling, but still high
 - Rebates and other incentives are significant

Important to perform a careful analysis for each case to assess and design

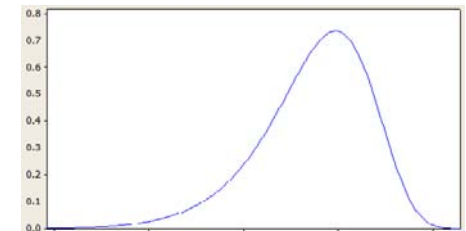
Does battery storage need solar PV?

- **Answer: Not necessarily, but it can help.**
- Potential synergies
 - Backup power
 - Solar provides a source for extended, possibly indefinite backup power during outage – if properly sized, managed (and if the sun shines!)
 - Incentives
 - may require solar (e.g. solar ITC + SCP advanced energy rebuild)
 - Design simplicity benefits
 - integrated solar + battery designs (e.g. “DC-coupled” designs that share an inverter)



What are the risks of battery storage?

- Fire and electrical safety
 - Protect against physical damage and extreme temperatures
 - Ensure battery has passed safety certifications
 - Install and operate within manufacturers specs and in compliance with codes
 - Use trained electricians, consult safety literature and manufacturer
- Reliability
 - Warranties frequently 10-15 years, but track record of performance is not that long
 - Some degradation of performance (energy capacity and efficiency) should be expected throughout life
- System end of life / recycling
 - Currently the recycling technology and infrastructure for lithium ion batteries is still under development



Tips for Considering Battery Storage

1. Perform analysis before investment
 - Understand your electricity usage and potential solar output
 - Careful PV and battery storage design needed for back up power and maximizing economics
2. Create a separate electrical subpanel for ‘loads to be backed up’
 - Prioritize: A/C and electric water heaters very difficult to back up
 - Motor loads typically will trip battery inverters (soft-start / inverter based fridge needed)
3. Reserve space for battery outside of living spaces
 - Emerging building and fire codes (e.g. California Fire Code / NFPA 855)

More resources

- EPRI 1 page info sheet available with additional information: “Residential Battery Energy Storage”
- Interest to support research and advance knowledge in storage?
 - Contact Ben Kaun (Sebastopol-based)
 - We are interested in data to support analysis and model-building
 - Customer load data, PV generation data, system performance, etc

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