Residential Battery Storage
A Primer

Presented by:
Ben Kaun, Program Manager, Energy Storage Program, EPRI

Rebuild Green Expo
February 22, 2019
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
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
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](https://sonomacleanpower.org/programs/advanced-energy-rebuild)
  - California Self-Generation Incentive Program (SGIP)
    - Currently $0.40/Wh with phase out from subscription
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

Contact:
Ben Kaun
Program Manager, Energy Storage
Electric Power Research Institute
E-mail: bkaun@epri.com
Phone: 650-855-2208
Together...Shaping the Future of Electricity