Energy Storage Forecast Allocation: Significance, Uncertainty and Insights

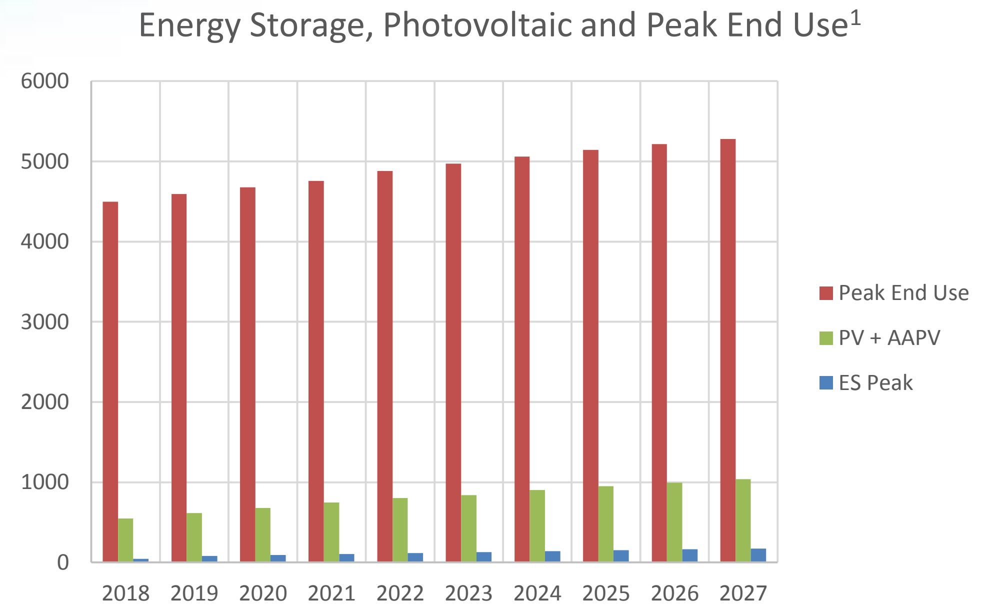
May 16, 2018

Energy Storage Impact: Overview

Overview – Energy Storage vs. Photovoltaics and System Load

Long Term

- 2017 Revised IEPR is the first CEC forecast data available for the nascent energy storage market.
- By 2027, energy storage forecast to be approximately 3% of peak end use in SDG&E service territory.
- The total peak impact is not negligible, but it is still a minor component of peak impacts.
- **Analysis resources should be prioritized in accordance with relative impact.**



[1]CEC: CED 2018-2030 Revised Forecast (Load Modifiers Mid Baseline-Mid AAEE-AAPV, not including EV or climate change inputs

Energy Storage Impact: System Level

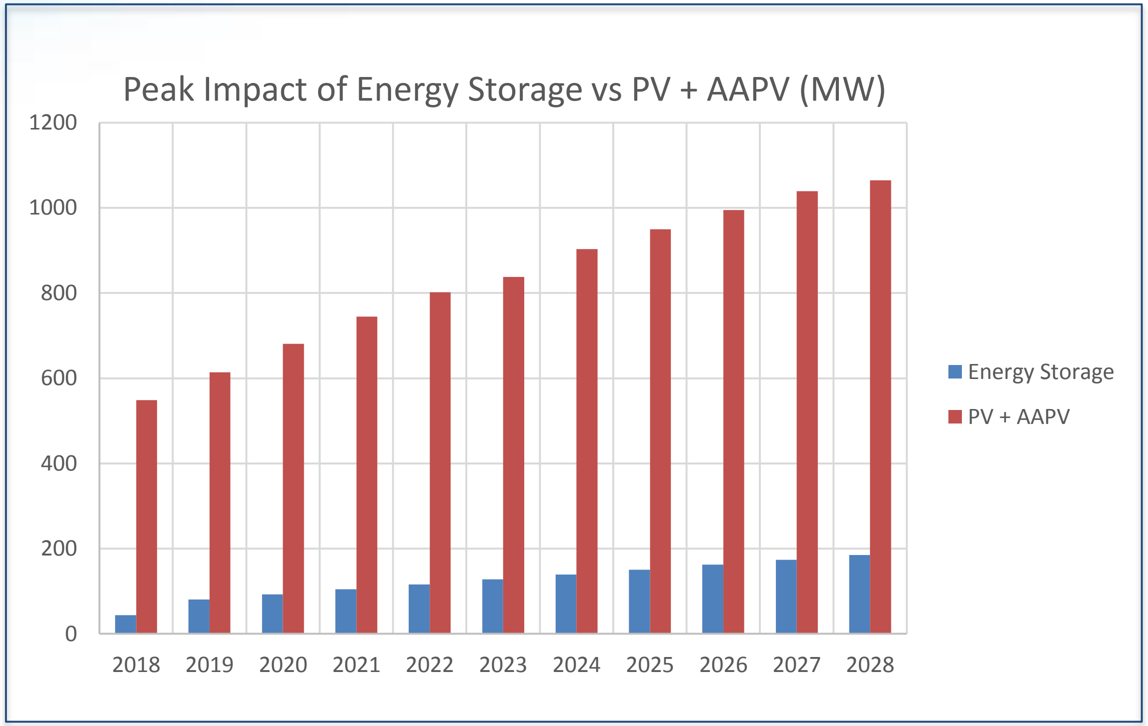
System Level – Energy Storage vs Photovoltaics

Long Term

- Comparison to PV and AAPV during 10 year forecast period illustrates the modest impact of energy storage relative to other high-impact DER
- By 2027, energy storage is forecast to have 17% of the impact of photovoltaics

Near Term

- In forecast year 2020, energy storage is only forecasted to be 14% of photovoltaic forecast



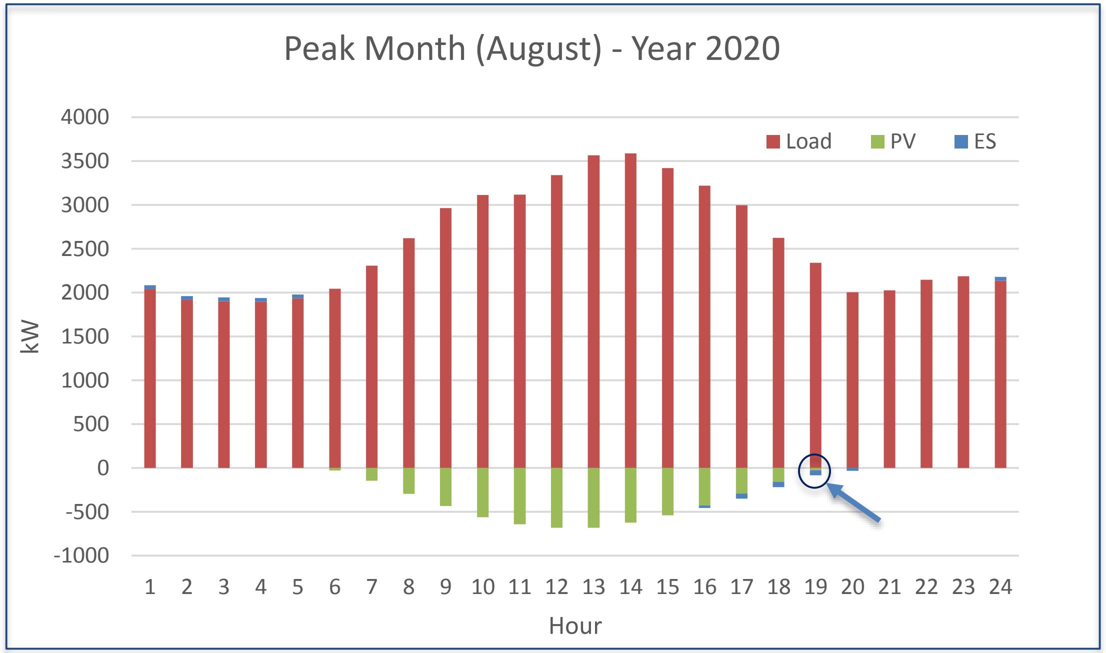
Energy Storage Impact: Circuit Example

Circuit Examples

2018 Distribution Planning Forecast – Sample Circuit A

- Applied the 2017 Revised IEPR DER forecast
- The circuit shown has the **highest energy storage forecast allocation** over next 3 years (using 2018 disaggregation methodology).
- The energy storage allocation is 60 kW.
- After applying load shape estimates, the impact is 2.6% of coincident load.
- For comparison, maximum photovoltaic coincident impact is 21%.

*Photovoltaic shown is new retrofit (non-AAPV) forecasted adoption

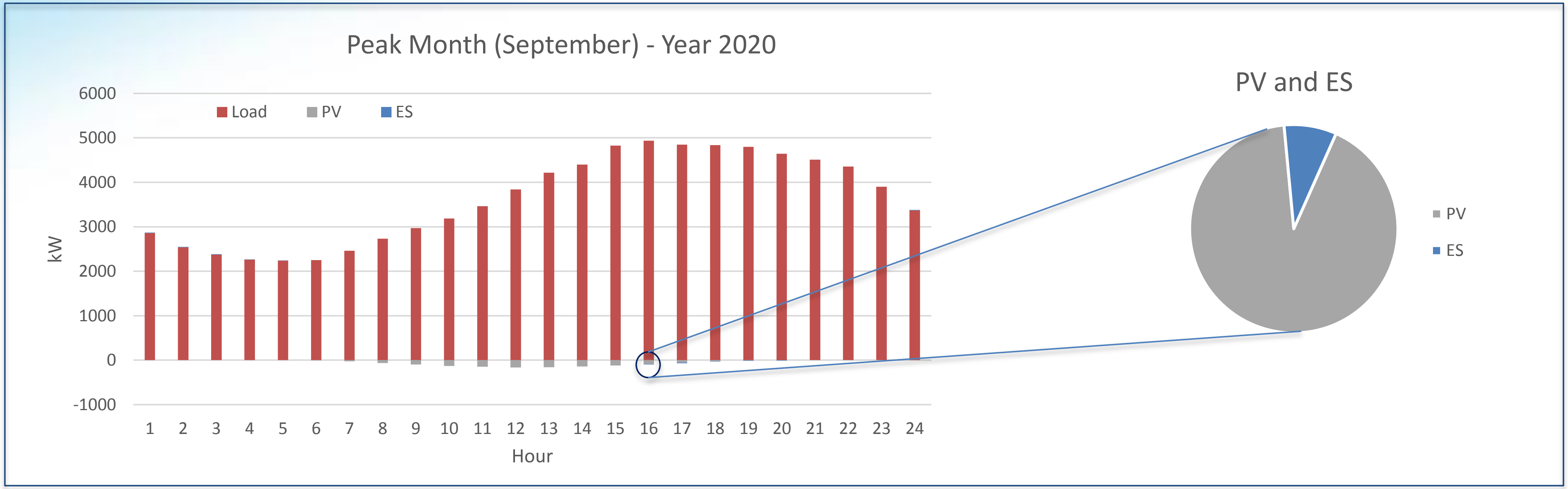


Energy Storage Impact: Circuit Example

Circuit Examples

2018 Distribution Planning forecast – Sample Circuit B

- **Average energy storage forecast allocation** for year 2020 – 15 kW
- Maximum 0.3% of coincident load. PV coincident impact is 4.3%



Energy Storage Disaggregation Strategy: Overview

Overview

- Nascence of storage market and comparatively small IEPR forecast impact (e.g., ~3% of system peak demand over next 10 years) suggests a two-pronged approach may be warranted
  - 1. Limited adoption history and data available may warrant simpler techniques early in product lifecycle
  - 2. As adoption grows, if additional data become available regarding adoption likelihood, and if updated IEPR forecasts appear to suggest higher impact levels, more rigorous methods could potentially be applied.
    - Analysis of storage systems and markets is more complicated & resource intensive than solar-PV only.
    - Level of analysis should be commensurate with available data & forecast impact relative to other DERs
- This following discusses key uncertainties, insights, and lessons learned, and suggests near-term and possible longer-term approaches and considerations for energy storage forecast allocation.

Energy Storage Disaggregation Strategy: Near Term

SDGE connected
A Sempra Energy utility

Near term: uncertainties, insights, and lessons learned

- Limited adoption data available for statistical analysis
  - Early in adoption S-curve
  - Could be helpful if IEPR forecast were disaggregated by sector (Residential, Commercial)
- Proposed near-term allocation strategy
  - Residential storage highly correlated with PV adoption (combined systems). Propose allocating storage proportional to PV adoption as reasonable proxy
  - Commercial adoption tends to be driven by peak shaving, and thus could be allocated as a function of circuit-level load factor
- Absence of reliable impact shape data
  - Dispatch timing has greater uncertainty than PV generation, and would be dependent on each customer's load.
  - Outside of utility control, difficult to guarantee availability for distribution system needs
  - Dependent on system configuration (e.g., stand-alone, combined PV + storage) & future rate structures

Energy Storage Disaggregation Strategy: Possibilities for Longer Term

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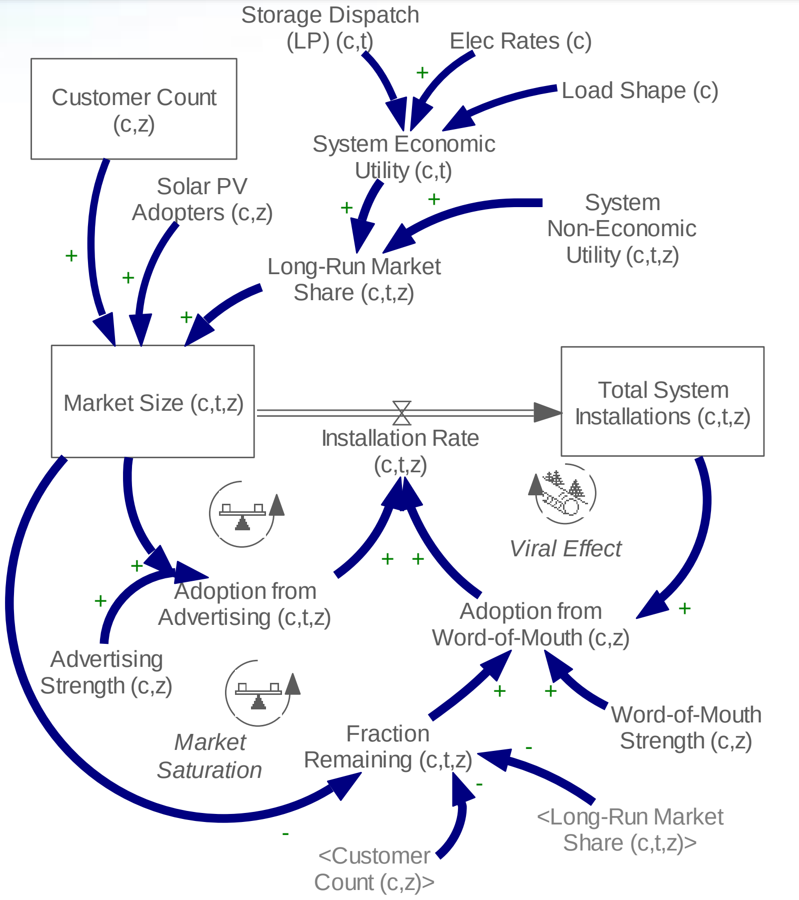
Longer term: possible methods to reduce uncertainty

- Drivers of adoption (market potential)
  - Discrete Choice Analysis using a nested logit market share model (e.g., CEC-led or otherwise publicly available study) could be leveraged if available
  - Could help shed light on adoption as a function of economic (e.g., bill savings) & non-economic (e.g., resiliency) factors
- Granular adoption forecasting & calibration
  - Diffusion parameters from PV analysis might be used until sufficient data exist to warrant independent calibration of these parameters for storage systems
- Calculation of economics
  - More complicated than for other DERs (e.g., PV)
  - Could use representative load shapes for largest customer segments, combined with linear programming (LP) for battery dispatch

Causal Diagram for Storage



c: customer segment; t: technology (stand-alone, new solar PV + storage, retrofit storage on solar PV); z: ZIP Code

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Key Uncertainties

1. Limited Data and Historical Adoption
2. Charging/Dispatch Patterns

Lessons Learned

- Paired PV-Storage system adoption is increasing
- Current historical data is insufficient to build a robust allocation method

Proposed Improvements

1. Data and Historical Adoption
   - Continue to track installations
   - Gather additional datasets/studies which might provide indicators of future adoption
2. Charging/Dispatch Patterns
   - Work to better understand behavior of customers who have adopted storage
3. Collaboration with CEC
   - Share lessons learned to improve system level assumptions

BTM Energy Storage

Key Uncertainties	Proposed Enhancements to Allocation Method
<u>Forecast Uncertainties:</u> • Rate of customer adoption of BTM energy storage over the forecast horizon • Charge/discharge patterns of BTM energy storage devices • Potential CCA BTM energy storage programs <u>Allocation Uncertainties</u> • Lack of data on local variations in BTM energy storage adoption. • Lack of data on local variations in charge/discharge patterns for BTM energy storage devices • Lumpiness issues related to procurements of BTM energy storage under DIDF/IDER • Potential CCA BTM energy storage programs	• As more BTM ES devices are adopted by customers, collect and analyze data for use in more sophisticated allocation models. • Consider EPIC funded project to begin addressing gaps in understanding range of possible BTM energy storage adoption and operation characteristics. • Develop methodology to better understand and incorporate potential CCA BTM energy storage programs • Develop a “block load adjustment” methodology for BTM ES in interconnection queue and for ES procured to provide distribution services via ES RFO or DIDF/IDER.