Battery Energy Storage in the Australian National Electricity Market

Potential commercial viability

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Who else contributed?

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Commonwealth Scientific and Industrial Research Organisation (CSIRO)

- People: 6500
- Budget: $1B+
- Locations: 58
- Flagships: 12

Map showing various locations in Australia with corresponding CSIRO sites and number of sites. For example:
- Perth: 3 sites
- Adelaide: 2 sites
- Sydney: 5 sites
- Melbourne: 5 sites
- Brisbane: 6 sites
- Hobart: 5 sites

Legend:
- Precincts
- CSIRO site
Battery Storage in the Australian electricity market: overview

- Overview
- Key Question(s)
- Key Assumptions
- Main results
- Questions raised and limitations
Main Question

• Under what circumstances will electricity customers find it economically viable to install battery energy storage?

• Under various
  • Customer scales and load profiles
  • Tariff alternatives
  • Whether or not PV is installed

• Tariff alternatives considered
  • Flat – energy based (with or without PV)
  • Time-of-Use (with or without PV)
  • Maximum Demand (capacity, with or without PV)

• Presentation based on *Future energy storage trends: An assessment of the economic viability, potential uptake and impacts of electrical energy storage on the NEM 2015–2035*
Key Assumptions

- Battery prices projected using technological learning models
- Tariffs and rebates.
  - Tariffs based on existing in current market, scaled by a price index.
  - PV rebates based on existing legislation
- Load profiles based on a finite number of “representative customers” at a handful of representative scales
- Residential analysis only, since there is limited load profile data available for non-residential
Key Assumptions

• Battery management based on heuristic according to tariff, rather than optimised
• Financial comparison only of with and without storage, no consideration of customers changing load profile, tariff, or on-site generation (PV).
• Batteries and PV system sizes selected for high benefit-cost ratio rather than high NPV, under low solar Feed-in-Tariff
• Uptake rate based on logistic function with parameters dependent on payback period only, and calibrated to PV experience
Battery Management Heuristic

- For Flat Tariff
  - No value in storage

- For Time of Use Tariff
  - Charge during off-peak hours until full, discharge during peak hours until empty

- For Capacity Tariff
  - Charge if demand greater than target till full, discharge if demand less than target until empty

- For PV
  - Charge if net demand is negative until full, discharge if positive until empty

- For PV with time of use
  - Charge if net demand negative or off-peak, discharge if demand positive during peak
Key Assumptions

• Battery Costs
Key Assumptions

- Solar PV Costs

![Projected PV system cost graph](image-url)
Key Assumptions

- Customer Load profile
Key Results

• Payback periods
• Indicative uptake
• Indicative impact on load profile
Payback periods

- Payback periods: Without PV, Time of Use

- No payback for Capacity Tariff
Payback periods

- Payback periods: With PV, Time of Use/ Flat
Payback periods

- Payback periods: Bundle PV and Battery, Time of Use/ Flat...
Indicative Uptake?

• With PV
Indicative Uptake?

- Time of Use Tariff
Indicative Impact on load profile

- Typical Day... Without/ with PV
Indicative Impact on load profile

- Maximum Day... Without/ with PV
Aggregate Impact
Aggregate Impact

• Low PV case
Aggregate Impact

• High PV case
Aggregate Impact

• High Time of Use Tariff Case
Questions raised and limitations

• Customer Load Diversity
• Future evolution of tariffs
• Impact of peak demand reduction at various scales in the supply network hierarchy.
• Tariff switching, behaviour change, leaving the grid, demand reduction technologies
• How best can incentives under a highly regulated industry be aligned to economically efficient outcomes?
You are welcome