Impacts of PV System Configuration, Retail Tariffs and Annual Household Consumption on Payback Times for Residential Battery Energy Storage

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HOUSEHOLD BATTERY STORAGE

SO HOT RIGHT NOW
Are we there yet?
When will we get there?

What factors influence the payback time of household PV + storage?

Energy Consumption?  Storage Size?

Tariff?  PV Size?

https://www.solarchoice.net.au/blog/battery-storage-price-index-august-2018/
### Method

<table>
<thead>
<tr>
<th>House size</th>
<th>Annual usage</th>
<th>PV size (small / medium / large)</th>
<th>Battery size (small/medium/large)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>&lt;3200kWh</td>
<td>2kWp / 4kWp / 6kWp</td>
<td>3kWh / 6kWh / 9kWh</td>
</tr>
<tr>
<td>Medium</td>
<td>3200 – 7000kWh</td>
<td>2.5kWp / 5kWp / 7.5kWp</td>
<td>4kWh / 8kWh / 12kWh</td>
</tr>
<tr>
<td>Large</td>
<td>&gt;7000kWh</td>
<td>3.25kWp / 6.5kWp / 9.75kWp</td>
<td>5kWh /10kWh /15kWh</td>
</tr>
</tbody>
</table>

PV and BES allocated to all households, sized according to annual usage

Nine different size combinations (small/med/large) tested

Four different tariff-based operation strategies
Battery Logic Model

Flat tariff

- **LMP < 0?**
  - **No**
  - **Batt > 0?**
    - **No**
      - **Draw from Grid**
    - **Yes**
      - **Draw from Battery**
  - **Yes**
    - **Battery full?**
      - **No**
        - **Draw from Grid**
      - **Yes**
        - **Charge Battery**

- **Peak time?**
  - **No**
    - **LMP < 0?**
      - **No**
        - **Draw from Grid**
      - **Yes**
        - **Charge Battery**
  - **Yes**
    - **Battery full?**
      - **No**
        - **Charge Battery**
      - **Yes**
        - **Export to Grid**
Homes with low energy consumption frequently export PV generation

Even with small PV
It doesn’t take a lot of storage to make a big difference to exports.

It’s about how you use the storage.
Results

- Savings are proportional to annual consumption

- Savings are lower on demand tariff
STORAGE IS REALLY REALLY RIDICULOUSLY GOOD LOOKING

But can’t quite pay for itself yet in most cases…
## Payback times

### Average simple payback time in years according to scenarios for homes on the TOU tariff

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Small Homes</th>
<th>Medium Homes</th>
<th>Large Homes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PV Only</td>
<td>PV with BES</td>
<td>PV Only</td>
</tr>
<tr>
<td>Sm PV / Sm Batt</td>
<td>11.45</td>
<td>9.3</td>
<td>9.09</td>
</tr>
<tr>
<td>Sm PV / M Batt</td>
<td>5.91</td>
<td>15.03</td>
<td>4.38</td>
</tr>
<tr>
<td>Sm PV / Lge Batt</td>
<td>25.82</td>
<td>19.76</td>
<td>17.57</td>
</tr>
<tr>
<td>M PV / Sm Batt</td>
<td>10.98</td>
<td>8.76</td>
<td>8.15</td>
</tr>
<tr>
<td>M PV / M Batt</td>
<td>6.31</td>
<td>13.72</td>
<td>4.51</td>
</tr>
<tr>
<td>M PV / Lge Batt</td>
<td>23.97</td>
<td>17.76</td>
<td>15.04</td>
</tr>
<tr>
<td>Lge PV / Sm Batt</td>
<td>10.77</td>
<td>8.56</td>
<td>7.58</td>
</tr>
<tr>
<td>Lge PV / M Batt</td>
<td>6.51</td>
<td>12.75</td>
<td>4.71</td>
</tr>
<tr>
<td>Lge PV / Lge Batt</td>
<td>22.52</td>
<td>16.58</td>
<td>13.54</td>
</tr>
</tbody>
</table>

- If you only have PV, the smaller, the better.
- BUT
- If you have storage, the more PV, the better!
With the optimal setup payback doesn’t take long

Rapid household uptake in coming years is likely
Return on Investment

At no time in the next 5 years does PV+BES beat PV alone

Small homes match ROI with PV first

But large homes have higher ROI

Not in paper
Many of our publications are available at:
www.ceem.unsw.edu.au