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Energy Storage (ES) Systems

- Various technologies are able to store energy for later use on the grid
- Battery-based systems are being deployed by utilities and have become economically viable
- Approximately 534 MW are currently operating in California
Power Supply Portfolio Future Needs

- Energy storage needed to balance oversupply of intermittent renewables required by state mandates
- More dispatchable resources needed to supplement existing generation fleet during outages to maintain grid reliability
- Battery-based ES systems are available utility-scale products to address peak periods (evening ramp) and negative pricing (oversupply)

ES Configurations

- Capacity and Duration
  - Up to 50 Megawatts (10% of system peak)
  - Short duration (2 hour discharge) provides best value
  - Scalable ES to meet future needs
- 2 potential ES configurations
  - Stand-alone ES
  - Solar + ES
  - Direct install or power purchase agreement
ES Cost Analysis

- Reviewed ES costs against potential wholesale market opportunities
- Engaged consultant to validate analysis and provide additional ES performance metrics
- Direct installation offers approximately 21% - 37% greater returns compared to PPA
- Costs expected to drop by time of RFP

<table>
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<th>Forecast of Installed Cost and Payback</th>
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<tr>
<td>Battery Duration</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>1 hr</td>
</tr>
<tr>
<td>2 hr</td>
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<td>4 hr</td>
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Own or Lease Energy Storage?

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<tr>
<th>Ownership Structure</th>
<th>Pros</th>
<th>Cons</th>
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<tr>
<td>Direct Install (Design-Build)</td>
<td>• Greater net return over project life</td>
<td>• Potential issues with siting, design, construction, coordination, and maintenance</td>
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<td></td>
<td>• Utility staff gains direct experience for future deployments</td>
<td>• Decommissioning responsibilities</td>
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<td></td>
<td>• Access to low interest financing</td>
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<tr>
<td>Power Purchase Agreement (Lease)</td>
<td>• Simpler project management</td>
<td>Less financial benefit over project duration</td>
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<td>• Third-party responsible for ES performance (battery degradation) and decommissioning</td>
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- RFP will be issued for both products to compare battery technology options, market rates, risk terms, pairing with solar, and vendor experience
Assembly Bill 2514

- Enacted in 2010 – Requires all electric utilities to evaluate and develop procurement target for ES systems if viable
  - Subsequent evaluations required every 3-years
- 2014 Evaluation – Concluded ES systems not viable due to high costs and concerns about system efficacy
- 2017 Evaluation – Set 1 MW pilot project by 2021, and up to 10 MW in 2026
- 2020 Evaluation – Eliminates 1MW pilot due to economies of scale and sets new target of up to 50 MW by 2026

Historical Trends in ES Pricing

- Cost of ES battery packs has fallen nearly 85% over the past decade
- Revenue opportunities are also projected to drop in the future
- These trends have influenced APU’s strategy for the timing and sizing of potential ES projects

Source: Bloomberg NEF
AB 2514 Recommendations

• 0 MW by December 31, 2021
  • ES technologies continue to mature while prices decline
  • Wholesale energy prices are becoming increasingly volatile
  • Proof-of-concept pilot project no longer required due to economies of scale and better established market
• Up to 50 MW by December 31, 2026
  • Total capacity range for one or more projects
  • APU is still evaluating the optimal procurement method (own vs lease) to meet this new recommended target
  • Potential sites for utility-owned: Canyon Power Plant or next to existing substation

Questions?