Contributions of Solar + Storage to Future Power Needs

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The Resource Planning Model (RPM) is a capacity expansion model that simulates least-cost investments in and operation of a generation and transmission system.

Specialized for analysis of a *regional* electric system over a utility planning horizon (10-30 years):

- Includes hourly chronological dispatch of five dispatch periods
- High spatial resolution of existing and new resources
- Real-world transmission system
Algorithmic Structure

- Sequentially solves for resources that meet system needs at least cost
- 8760 methods adjust reduced-order co-optimization to dynamically account for VG & storage technology capacity value and curtailment impacts
PV + Battery Technologies

- Utility-scale PV array coupled with Lithium Ion battery
- “Strongly-DC Coupled” connection mechanism, with the battery connected to the PV array behind the inverter
Scenarios Analyzed

PV + Battery Technology Inclusion

Yes or No

Baseline RE

High RE

Renewable Penetration

Photovoltaic and Battery Technology Costs

Low Costs

Mid Costs

Low Costs

Mid Costs
Capacity Credit Methods

- Coupled technology should have an increased capacity credit due to increased dispatchability
- Still energy limited, so should not get full capacity credit
- Modified load duration curve methodology used, following a heuristic dispatch of the coupled technology
Capacity Credit of PV + Battery

Chart showing capacity credit of PV + Battery over different years.
Curtailment Methods

- Coupled technology expected to have reduced curtailment compared to stand-alone PV
- Storage not able to reduce curtailment of other resources
- Modified load duration curve methodology used, following a heuristic dispatch of the coupled technology
Curtailment of PV + Battery

![Graph showing curtailment of PV + Battery over years from 2020 to 2045. The graph compares utility PV and utility PV + battery systems, with box plots indicating the distribution of curtailment percentages.]
Installed PV + Battery Technologies

Inverter Capacity (GW)

<table>
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<th>Year</th>
<th>SRSG</th>
<th>NWPP_US</th>
<th>CAMX</th>
<th>RMPP</th>
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Technology
- PV & 2 hr Li-ion battery, 50% cap
- PV & 4 hr Li-ion battery, 50% cap
- PV & 4 hr Li-ion battery, 71% cap
- PV & 8 hr Li-ion battery, 50% cap
PV + Battery Dispatch

System Operation:
- Direct PV Output
- Discharge from Battery
- PV Charging Battery

Chart showing generation (MW) over the hour of dispatch period for different scenarios.
Thank you

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