85 kWh photovoltaic battery energy storage

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The PV-plus-battery technology uses the same ten resource categories as the utility-scale PV technology. See the Resource Categorization section of the utility-scale PV page for a description of these ten resource categories.

Technology innovation scenarios for PV-plus-battery are a combination of standalone utility-scale PV and utility-scale battery technology innovation scenarios (e.g., the Conservative Scenario for PV-plus-battery technology uses the Conservative Scenarios of both standalone utility-scale PV and utility-scale battery technologies). For details, see the scenario descriptions for utility-scale PV and the scenario descriptions for utility-scale battery storage.

This year scenario assumptions for utility-scale PV plus battery energy storage system (BESS) were derived using the standalone cost projections of PV & battery systems and are not based on learning curves or deployment projections.

For a 130-MWDC PV array, a 78-MWDC nameplate battery (60-MWDC usable with 4-hour duration), and a shared 100-MWAC inverter, the technology-innovation scenarios for utility-scale PV plus BESS described above result in CAPEX reductions of 18% (Conservative Scenario), 36% (Moderate Scenario), and 49% (Advanced Scenario) between 2022 and 2035. The average annual reduction rates are 1.3% (Conservative Scenario), 2.6% (Moderate Scenario), and 3.5% (Advanced Scenario).

Between 2035 and 2050, the CAPEX reductions are 10% (1% per year average) for the Conservative Scenario, 19% (1.3% per year average) for the Moderate Scenario, and 24% (1.6% per year average) for the Advanced Scenario.

This section describes the methodology to develop our reported CAPEX, O& M, and capacity factor values. For assumptions that are standardized for all technologies in the 2023 ATB, seelabor cost,regional cost variation,materials cost index,scale of industry,policies and regulations, andinflation.

Utility-scale PV-plus-battery projections are driven primarily by CAPEX cost improvements, along with improvements in energy yield, operating cost, and cost of capital (for the Market + Policies Financial Assumptions Case). For more information, see the Financial Cases and Methods page.

Though CAPEX is one driver of cost reductions over time, R& D efforts continue to focus on other areas to lower the cost of energy from utility-scale PV-plus-battery, such as longer system lifetime and improved performance. Three 2030 projections are developed for scenario modeling as bounding levels:

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The 2023 ATB assumes base year estimates and future projections have fixed component sizing that is consistent with the description in the Representative Technology section of this page. Plant costs are represented with a single estimate per innovation scenario because CAPEX does not correlate well with solar resource availability. All cost values are presented in 2021 real USD.

In general, our cost assumptions for utility-scale PV-plus-battery are rooted in the cost assumptions for the independent utility-scale PV and 4-hour battery storage technologies. Therefore, our primary contribution is to capture the cost factors that are influenced by the coupling of utility-scale PV and battery technologies, including its influence on site preparation, land acquisition, hardware, installation labor, interconnection and permitting costs, and other factors.

Base Year: The Base Year (2021) is based on Q1 2022 costs as reported in(Ramasamy et al., 2022). The 2023 cost estimate is developed using the bottom-up cost modeling method from the National Renewable Energy Laboratory"s (NREL"s) U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, With Minimum Sustainable Price Analysis: Q1 2022(Ramasamy et al., 2022).

Variable O& M costs for the battery component are likely to be nonzero because of the cycle degradation typical of LIB storage; however, all our assumed O& M costs are fixed in nature--not variable--which is consistent with those reported for independent battery storage. Items included in O& M costs are noted in the table below.