Battery energy storage technology development 590 kWh

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The 2022 ATB represents cost and performance for battery storage across a range of durations (2-10 hours). It represents lithium-ion batteries (LIBs)--focused primarily on nickel manganese cobalt (NMC) and lithium iron phosphate (LFP) chemistries--only at this time, with LFP becoming the primary chemistry for stationary storage starting in 2021. There are a variety of other commercial and emerging energy storage technologies; as costs are well characterized, they will be added to future editions of the ATB.

Battery cost and performance projections in the 2022 ATB were based on a literature review of 13 sources published in 2018 or 2019, as described by Cole et al.(Cole et al., 2021). Three projections from 2020 to 2050 are developed for scenario modeling based on this literature.

Projected Utility-Scale BESS Costs: Future cost projections for utility-scale BESS are based on a synthesis of cost projections for 4-hour duration systems in(Cole et al., 2021)and the BNEF cost projections for utility-scale BESS(BNEF, 2019b)(Frith, 2020). The Cole et al. cost projections are based ona literature survey that includes results from 13 studies of BESS costs. The BNEF cost projections are based on learning rates and deployment projections for utility-scale BESS that are broken down at the system component level. Both projections extend to 2050.

Figure3. Utility-scale BESS Moderate Scenario cost projections, on a $/kWh basis (left) and a $/kW basis (right) Projections assume a 60-MWDC project. Note that 2020 costs correspond to Figure -1 and Figure 2.

Definition:The bottom-up cost model documented by(Ramasamy et al., 2021)contains detailed cost components for battery only systems costs (as well as combined with PV). Though the battery pack is a significant cost portion, it is a minority of the cost of the battery system. These costs for a 4-hour utility-scale stand-alone battery are detailed in Table 1.

Within theATB Dataspreadsheet, costs are separated into energy and power cost estimates, which allows capital costs to be constructed for durations other than 4 hours according to the following equation:

The cost and performance of the battery systems are based on an assumption of approximately one cycle per day. Therefore, a 4-hour device has an expected capacity factor of 16.7% (4/24 = 0.167), and a 2-hour device has an expected capacity factor of 8.3% (2/24 = 0.083). Degradation is a function of this usage rate of the model and systems might need to be replaced at some point during the analysis period. We use the capacity factor for a 4-hour device as the default value for ATB due to anticipation that 4-hour durations are more typical in the utility-scale market.

Round-trip efficiency is the ratio of useful energy output to useful energy input.(Mongird et al., 2020)identified 86% as a representative round-trip efficiency, and the 2022 ATB adopts this value. In the same report, testing showed 83-87%, literature range of 77-98%, and a projected increase to 88% in 2030.

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