Energy storage battery industry analysis 200 kWh

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The battery storage technologies do not calculate LCOE or LCOS, so do not use financial assumptions. Therefore all parameters are the same for the R& D and Markets & Policies Financials cases.

The 2023 ATB represents cost and performance for battery storage across a range of durations (1-8 hours). It represents onlylithium-ion batteries (LIBs) - those with nickel manganese cobalt (NMC) and lithium iron phosphate (LFP) chemistries - 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 characterized to the same degree as LIBs, they will be added to future editions of the ATB.

Base year costs for commercial and industrial BESS are based on NREL"s bottom-up BESS cost model using the data and methodology of(Ramasamy et al., 2022), who estimated costs for a300-kWDCstand-alone BESS with four hours of storage. We use the same model and methodology, but we do not restrict the power or energy capacity of the BESS.(Ramasamy et al., 2022)assumed an inverter/storage ratio of 1.67 based on guidance from(Denholm et al., 2017). We adopt this assumption, too.

Key modeling assumptions and inputs are shown in Table 1. Because we do not have battery costs that are specific to commercial and industrial BESS, we use the battery pack costs from(Ramasamy et al., 2022), which vary depending on the battery duration. These battery costs are close to our assumptions for battery pack costs for residential BESS at low storage durations and for utility-scale battery costs for utility-scale BESS at long durations. The underlying battery costs in(Ramasamy et al., 2022)come from(BNEF, 2019a)and should be consistent with battery cost assumptions for the residential and utility-scale markets.

Table 1. Commercial and Industrial LIB Energy Storage Systems: 2022 Cost Benchmark Model Inputs and Assumptions (2021 USD)

100-2,000 kWDC power capacity

We also consider the installation of commercial BESS systems at varying levels of duration (Figure 1). Costs come from NREL"s bottom-up PV cost model(Ramasamy et al., 2022). As shown, the cost per kilowatt-hour is lowered dramatically with additional duration. Therefore, accurately estimating the needed duration in commercial applications is critical to determining the total system cost.

Figure 1. Estimated costs of commercial stand-alone BESS using NREL bottom-up model (2022 benchmark data in 2021$US)

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Available cost data and projections for distributed battery storage are very limited. Therefore, the battery cost and performance projections in the 2023 ATB are based on the same literature review as that done for the utility-scale and residential battery cost projections: battery cost and performance projections in the 2023 ATB are based on a literature review of 14 sources published in 2021 or 2022, as described by Cole and Karmakar(Cole and Karmakar, 2023). Three projections for 2022 to 2050 are developed for scenario modeling based on this literature.

Scenario assumptions for commercial and industrial BESS were derived using a literature review, and are not based on learning curves or deployment projections.

For a 600kW 4-hour battery, the technology-innovation scenarios for commercial-scale BESS described above result in CAPEX reductions of 17% (Conservative Scenario), 36% (Moderate Scenario), and 52% (Advanced Scenario) between 2022 and 2035. The average annual reduction rates are 1.4% (Conservative Scenario), 2.8% (Moderate Scenario), and 4.0% (Advanced Scenario).

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