# 12 kWh lithium-ion battery energy storage

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A 100 kWh EV battery pack can easily provide storage capacity for 12 h, which exceeds the capacity of most standalone household energy storage devices on the market already. For the degradation, current EV batteries normally have a cycle life for more than 1000 cycles for deep charge and discharge, and a much longer cycle life for less than 100 ...

By the end of 2022 about 9 GW of energy storage had been added to the U.S. grid since 2010, adding to the roughly 23 GW of pumped storage hydropower (PSH) installed before that. Of the new storage capacity, more than 90% has a duration of 4 hours or less, and in the last few years, Li-ion batteries have provided about 99% of new capacity.

Battery storage costs have changed rapidly over the past decade. In 2016, the National Renewable Energy Laboratory (NREL) published a set of cost projections for utility-scale lithium-ion batteries (Cole et al. 2016). Those 2016 projections relied heavily on electric vehicle

Decentralised lithium-ion battery energy storage systems (BESS) can address some of the electricity storage challenges of a low-carbon power sector by increasing the share of self-consumption for photovoltaic systems of residential households.

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2021 costs for residential BESS are based on NREL"s bottom-up BESS cost model using the data and methodology of(Ramasamy et al., 2021), who estimated costs for both AC- and DC-coupled systems. We use the same model and methodology but do not restrict the power or energy capacity of the BESS to two options. Key modeling assumptions and inputs are shown in Table 1. We assume 2021 battery pack costs of $252/kWhDC 2020 USD (Ramasamy et al., 2021)

As with utility-scale BESS, the cost of a residential BESS is a function of both the power capacity and the energy storage capacity of the system, and both must be considered when estimating system cost. Furthermore, the Distributed Generation Market Demand (dGen) model does not assume specific BESS system sizes and it needs an algorithm to estimate residential BESS system cost based on the attributes of the residences (agents) it generates.

We develop an algorithm for stand-alone residential BESS cost as a function of power and energy storage capacity using the NREL bottom-up residential BESS cost model(Ramasamy et al., 2021)with some modifications.

Available cost data and projections are very limitedfor distributed battery storage. Therefore, the battery cost and performance projections in the 2022 ATB are based on the same literature review as for utility-scale and commercial battery cost projections. The projections are based on a literature review of 19 sources published in 2018 or 2019, as described by Cole and Frazier(Cole and Frazier, 2020). Three projections from 2020 to 2050 are developed for scenario modeling based on this literature.

NREL does not maintain future cost projections for residential BESS for the ATB as it does for utility-scale systems. Instead, we base residential BESS cost projections on the NREL bottom-up cost model for residential systems combined with component cost projections from BNEF. BNEF has published cost projections for a 5-kW/14-kWh BESS system through 2030(Frith, 2020), with the projections being based on learning rates and future capacity projections.

Definition:The bottom-up cost model documented by(Ramasamy et al., 2021)contains detailed cost bins for both solar only, battery only, and combined systems. Though the battery pack is a significant cost portion, it is a fraction of the cost of the battery system. This cost breakdown is different if the battery is part of a hybrid system with solar PV or a stand-alone system. The total costs by component for residential-scale stand-alone battery are demonstrated in Figure 2 for two different example systems.