530 kWh energy storage cost

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The dominant grid storage technology, PSH, has a projected cost estimate of $262/kWh for a 100 MW, 10-hour installed system. The most significant cost elements are the reservoir

The 2022 Cost and Performance Assessment provides the levelized cost of storage (LCOS). The two metrics determine the average price that a unit of energy output would need to be sold at to cover all project costs inclusive of taxes, financing, operations and maintenance, and others.

The 2020 Cost and Performance Assessment provided installed costs for six energy storage technologies: lithium-ion (Li-ion) batteries, lead-acid batteries, vanadium redox flow batteries, pumped storage hydro, compressed-air energy storage, and hydrogen energy storage.

Cost and performance metrics for individual technologies track the following to provide an overall cost of ownership for each technology: cost to procure, install, and connect an energy storage system; associated operational and maintenance costs; and; end-of life costs.

This report updates those cost projections with data published in 2021, 2022, and early 2023. The projections in this work focus on utility-scale lithium-ion battery systems for use in capacity expansion models. These projections form the inputs for battery storage in the Annual Technology Baseline (NREL 2022).

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Each year, the U.S. Department of Energy (DOE) Solar Energy Technologies Office (SETO) and its national laboratory partners analyze cost data for U.S. solar photovoltaic (PV) systems to develop cost benchmarks. These benchmarks help measure progress towards goals for reducing solar electricity costs and guide SETO research and development programs. Read more below to find out how these cost benchmarks are modeled and download the data and cost modeling program.

Market analysts routinely monitor and report the average cost of PV systems and components, but more detail is needed to understand the impact of recent and future technology developments on cost. Consequently, benchmark systems in the utility-scale, commercial, and residential PV market sectors are evaluated each year. Each benchmark system is representative of what is currently being installed in the United States and is

defined in sufficient detail to assess the impact of system size, module efficiency, overhead, and many other factors on cost.

Unlike most PV cost studies that report values solely in dollars per watt, SETO"s PV system cost benchmark reports values using intrinsic units for each component. For example, the cost of a mounting structure is given in dollars per square meter of modules supported by that structure. This measure is independent of how much power is produced by those modules, making it possible to assess the benefit of improving PV module efficiency (the structure"s cost per module area is divided by the module"s power output per module area to obtain the cost per watt for that structure when used with those modules). This approach is intended to allow any input parameter in the model to be varied by up to a factor of two (up or down) to assess its impact on cost.

All costs reported are represented two ways: Minimum Sustainable Price (MSP) and Modeled Market Price (MMP). MSP is the minimum price (with inflation adjustment) that a company can charge for its product or service in a balanced, competitive market and remain financially solvent for the long term, assuming that each of the company"s input costs also represent the MSP for that cost element. MMP is the actual price in the current market, which may differ from MSP as a result of temporary market distortions. MSP is the more useful metric for long-term planning, including R& D direction and predicting the future of the power grid. MMP is the more useful metric for short-term planning, including the impact of tax and trade policies.