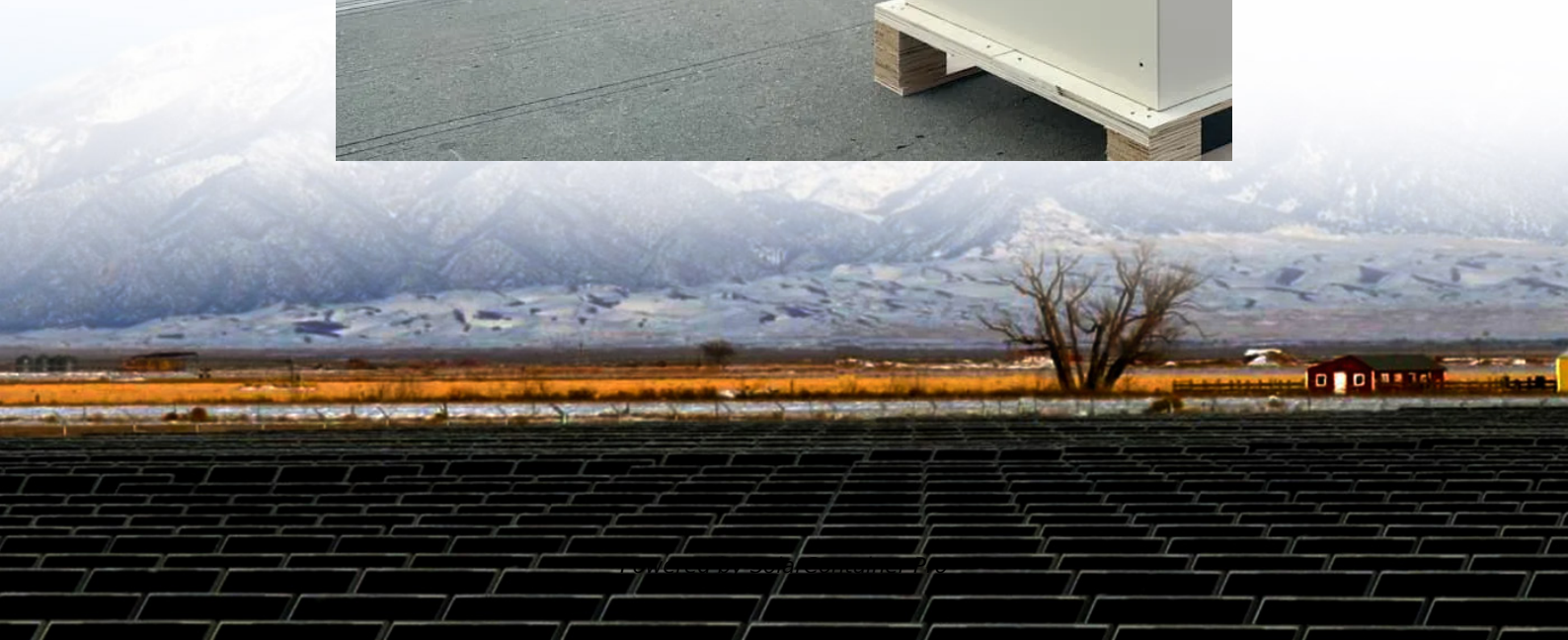


Investment cost of lead-acid battery per kilowatt-hour of energy storage





Overview

The cost comes out to ~\$500 per kWh. Most lead-acid batteries last three to five years. Let's be generous and make it five, assuming perfect operating conditions and impeccable maintenance. \$500 per kWh divided by five yields \$100 per kWh per year. How much does a battery cost per kilowatt-hour?

Battery cost per kilowatt-hour (kWh) refers to the cost to manufacture or purchase one unit of energy storage. If a battery costs \$120 per kWh and has a 10 kWh capacity, it would cost approximately \$1,200. This metric helps compare pricing across different battery technologies and sizes.

How much does a battery cost?

Given the nature of these storage assets, an energy capacity-based cost comparison is used as opposed to a power-based one. The results show that the Li-ion battery has the lowest total annualized \$/kWh cost at approximately \$74/kWh of any of the battery energy storage technologies. This is followed by zinc-hybrid cathode technology at \$91/kWh-yr.

How are battery energy storage costs forecasted?

Forecast procedures are described in the main body of this report. C&C or engineering, procurement, and construction (EPC) costs can be estimated using the footprint or total volume and weight of the battery energy storage system (BESS). For this report, volume was used as a proxy for these metrics.

Are lead-acid batteries a cost reduction technology?

Lead-acid batteries are a mature technology, especially in the context of Starting, Lighting Ignition batteries used in automobiles. Hence, a 15 percent cost reduction is assumed as this technology gains penetration in the energy storage space. Table 4.2. Ratio of year 2018 to 2025 costs. (Source: DNV GL 2016).

What are battery capital costs?



Capital costs for all battery systems are presented for battery capital and management systems (expressed in terms of \$/kWh), balance of plant (BOP) (\$/kW), power conversion systems (PCS) (\$/kW), and construction and commissioning (C&C) (\$/kWh). PCS costs are estimated to be the same across all battery technologies except Li-ion.

How much does a lead-acid hybrid battery cost?

Lead-acid hybrid systems, such as the one produced by the manufacturer Ultrabattery, were not considered in this work because of their lower specific energy leading to higher unit energy costs for their 4-hour application. For vanadium redox flow batteries, with two exceptions the cost was in a tight range of \$357–\$584/kWh.



Investment cost of lead-acid battery per kilowatt-hour of energy storage



Further innovation required to achieve \$0.05/kWh target for long

The Department of Energy released its cost analysis for 11 technologies one day before announcing several funding and innovation opportunities for long-duration storage ...

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[Lead batteries for utility energy storage: A review](#)

Lead-acid batteries have been used for energy storage in utility applications for many years but it has only been in recent years that the demand for battery energy storage ...

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Cost Projections for Utility-Scale Battery Storage: 2023 Update

In this work we describe the development of cost and performance projections for utility-scale lithium-ion battery systems, with a focus on 4-hour duration systems. The projections are ...

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Lithium vs. Lead-Acid Batteries: A Dollar per kWh per Year Cost

You get ~20 kWh of capacity for around \$5,000 with typical deep-cycle marine-grade or AGM lead-acid batteries, but say, only ~10 kWh for



around \$4,000 with high-quality ...

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[Grid-Scale Battery Storage: Frequently Asked Questions](#)

Is grid-scale battery storage needed for renewable energy integration? Battery storage is one of several technology options that can enhance power system flexibility and enable high levels of ...

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BESS Costs Analysis: Understanding the True Costs of Battery Energy

To better understand BESS costs, it's useful to look at the cost per kilowatt-hour (kWh) stored. As of recent data, the average cost of a BESS is approximately \$400-\$600 per ...

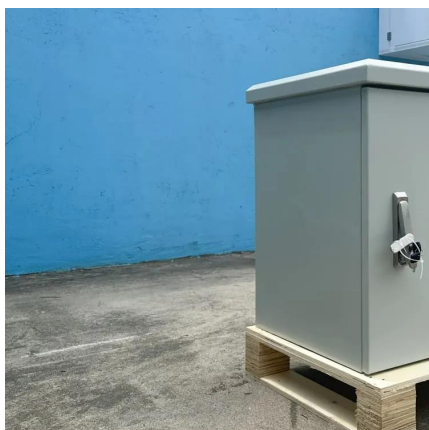
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BESS Costs Analysis: Understanding the True Costs of Battery ...

To better understand BESS costs, it's useful to look at the cost per kilowatt-hour (kWh) stored. As of recent data, the average cost of a BESS is approximately \$400-\$600 per ...

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Lithium vs. Lead Acid Batteries: A 10-Year Cost Breakdown for Energy

Discover why lithium batteries deliver 63% lower LCOE than lead acid in renewable energy systems, backed by NREL lifecycle data and UL-certified performance metrics?

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The Ultimate Guide to Battery Energy Storage Systems (BESS)

Maximize your energy potential with advanced battery energy storage systems. Elevate operational efficiency, reduce expenses, and amplify savings. Streamline your energy ...

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Lead Acid Battery Statistics 2025 By Renewable Energy Storage

Charge and discharge efficiency can vary significantly, ranging from 50% to 95%, depending on factors like design and use case. Regarding cost-effectiveness, they offer an ...

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Cost Projections for Utility-Scale Battery Storage: 2021 ...

In order to differentiate the cost reduction of the energy and power components, we relied on BNEF battery pack projections for utility-scale plants (BNEF 2019, 2020a), which reports ...

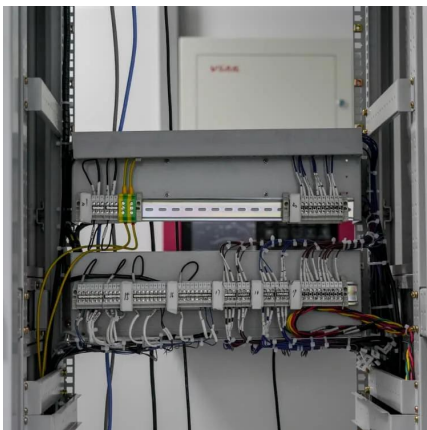
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[Cost models for battery energy storage systems](#)

The study presents mean values on the levelized cost of storage (LCOS) metric based on several existing cost estimations and market data on energy storage regarding three different battery ...

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A comparative life cycle assessment of lithium-ion and lead-acid

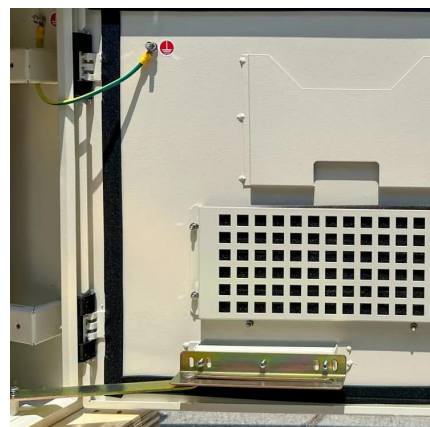
The cradle-to-grave life cycle study shows that the environmental impacts of the lead-acid battery measured in per "kWh energy delivered" are: 2 kg CO₂eq (climate change), ...

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Lead Acid vs LFP cost analysis , Cost Per KWH Battery Storage

In summary, the total cost of ownership per usable kWh is about 2.8 times cheaper for a lithium-based solution than for a lead acid solution. We note that despite the higher facial cost of ...

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Lithium vs. Lead-Acid Batteries: A Dollar per kWh per Year Cost

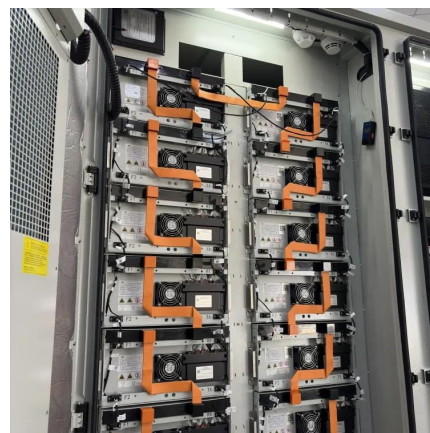
Learn the key factors affecting the actual cost of batteries. See a. head-to-head dollar per kWh per year comparison of lead-acid vs. LFP to see which one is a better deal. ...

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[Energy Storage Cost and Performance Database](#)

In support of this challenge, PNNL is applying its rich history of battery research and development to provide DOE and industry with a guide to current energy storage costs and performance ...

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