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Battery Energy Storage Systems and Long-Term Warranties

Getting a 10-year warranty on a battery energy storage system even though your cell phone battery dies every 2 years

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Power outages cost the U.S. economy up to $70 billion annually, according to a Department of Energy study. Battery energy storage systems (BESSs) enable system operators and utility providers to store energy for later use and perform many functions to make the electrical grid smarter and more resilient. While these systems rely on battery life, the batteries in a BESS can last much longer than the average cell phone battery—but how much longer?

Installing BESSs involves technical and operational risks for utility operators and investors. To mitigate risks, BESS manufacturers may offer warranties for 10 years or more based on performance estimates. However, purchasers of BESSs must choose the level of warranty coverage and pay a premium for this coverage. If the manufacturer's performance estimates are inaccurate and a purchaser does not seek adequate warranty coverage, then BESS purchasers may unknowingly be assuming significant financial risk that may not ultimately be covered by the manufacturer and can have large financial implications on the long-term costs of a BESS.

BESS Risks: Why Warranties Are Necessary

With the increased use of clean energy, especially due to global concern about climate change, BESSs have become more widespread because they enhance the flexibility of the electrical grid and improve the stability of distribution networks while reducing dependence on fossil fuels. To aid the decarbonization of the economy, President Biden's 2021 American Jobs Plan promises to create a more resilient grid, with the goal of achieving 100% carbon-free electricity through renewable energy sources by 2035. The plan also calls for $15 billion in demonstration projects for climate R&D priorities, including utility-scale energy storage systems like BESSs.

In response to support from federal and state governments and declining prices for lithium-ion batteries, many utilities and other stakeholders are investing in BESSs as part of their efforts to reduce greenhouse emissions. Consequently, in 2020 U.S. installations of advanced energy storage went beyond the 1Gw mark for the first time in history when 1,464MW/3,487MWh of new energy storage (composed almost entirely of lithium-ion battery systems) went online.

While many BESSs plan for a long-term performance of 10 years or more in the field, these new technologies still carry reliability and safety risks, including

- **Performance Loss:** Batteries degrade and lose power/capacity over time, and the BESS may no longer be able to meet performance requirements.
- **Mechanical/Electrical Breakdowns:** Incorrectly installed equipment or the degradation of critical components can cause failures over time.
- **Fire:** Batteries (including lithium-ion) are susceptible to catching fire due to failure or abuse, which can lead to the explosive release of combustible gasses.
- **Environmental Impact:** Run-off fire suppressant (water or other) from a lithium-ion battery fire can cause environmental damage due to metals content or hazardous chemicals from the batteries and cells.

Is a 10-Year BESS Warranty a Realistic Risk to Assume?

Lithium-ion batteries have been proven to last for 10 or more years in satellites, so it's not unrealistic to assume that lithium-ion batteries could last for 10 years or more in a properly designed and operated BESS. However,

accurate BESS performance forecasting is highly complex, so predicting performance for 10+ years can be risky for manufacturers, utility operators, integrators, investors, and other stakeholders if the performance projection is not representative of what might happen in the field.

In evaluating performance estimates, it's important to remember that widespread deployment of BESSs is relatively new, so long-term data on real-world reliability, maintenance requirements, and longevity are still being collected. The underlying battery chemistry and construction also greatly affect design, controls, and reliability. The value of a warranty will often be something the utility, operator, or investor needs to evaluate. For the same reasons that it is important to understand whether the cost of the warranty is appropriate, it is important for the manufacturer to ensure their performance estimates are accurate enough to account for the cost of (potential) service and replacement of BESS batteries, cells, and other components.

Because it's not feasible for battery and systems manufacturers to test every possible use scenario, some performance projections may have practical limitations that mean they are not always directly applicable to a BESS operator's intended use. Stakeholders should also consider whether the performance consistency has been accurately measured—can the manufacturer guarantee the system will perform in the same manner, every time, for every project?

Because warranties are structured based on performance estimates, stakeholders can protect themselves by ensuring the inputs and data are accurate, representative, and applicable to their use case. When performance estimates incorporate these key elements, users will be better prepared to meet their performance and reliability metrics, and they can have greater confidence that their warranty will limit their risk to the appropriate level for their system's actual performance.

In the future, with the acceleration of battery technology and analysis of long-term data acquired from real-world systems, performance and warranties may be extended. Perhaps some of this research might even help extend the life of cell phone batteries beyond 2 years.

How Exponent Can Help

Exponent's battery and energy storage experts have deep knowledge and experience with BESS installations, from the system level down to the materials level, to help ensure that the data used in performance projections and BESS warranties reflect real-world operating conditions. We have significant testing capabilities, so if a performance estimate can't be made from the available data, we can acquire the data ourselves to ensure the projections are based on robust scientific methodology and technical insights, providing an independent third-party evaluation. Drawing from backgrounds such as electrochemistry, material science, and mechanical and electrical engineering, we also have a long history of performing failure analysis, giving us tremendous insight into proactive risk assessments and design failure modes and effects analyses (DFMEAs).

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