

## Lcos storage

Around the world, energy storage is proving its value as a bankable investment behind and in front of the meter. Depending on your role in a project, the questions you ask and financial models you use to find the answers will be different. For most stakeholders, Levelized Cost Of Storage (LCOS) and Levelized Cost Of Energy (LCOE) offer the greatest flexibility in comparing between technologies and use cases, are the most comprehensive methods, and are closest to realized value.

As the leading supplier of vanadium flow batteries, we're often asked what LCOS means. How is it different from LCOE and other financial analysis tools used to evaluate energy project options, and why are these calculations important to understanding project value?

Answers to these questions depend on your role in the energy project. This article describes how the cost of energy storage impacts each stakeholder and the financial models each stakeholder uses to compare technology alternatives.

Which parties have an active stake in an energy storage project varies throughout the lifetime of the project - some stakeholders are exposed to lifetime project costs, while others have shorter-term interest in the project. Here's a run down of the typical stakeholders and their roles:

/ Developers initiate projects, defining the project in its early phases, determining how the energy storage system will be used-- usually to store and return excess energy from co-located generation and/or low-cost surplus energy to and from the grid. Developers also establish the offtake agreements that help secure financing and often sell projects to owner-operators once they reach a certain level of maturity.

/ Engineering, Procurement and Construction (EPC) firms are typically contracted by the developer and have primary responsibility to ensure the technical, safety, reliability and lifetime specifications are met, but do not typically stay involved in the project once operating.

/ Owners, Operators and Generators include utilities, merchant grid services providers, independent power producers, and businesses who own their own batteries behind the utility meter. These parties take on responsibility for generation and continuous economical and reliable delivery of power to end-users throughout the life of the project.

/ Investors provide the financing for the project, and comprise developers, owner-operators, governments, public or private generators, and/or private investors.

Entities often play multiple roles within projects. Table 1 below summarizes why energy storage costs matter for each stakeholder, and the key financial questions they should be asking.

Even as responsibilities, ownership, and decision points evolve over time, the lifetime costs of storage remain relevant throughout. Why? Because offtake agreements, availability payments, tender evaluation and evaluation of market performance should be based on an accurate understanding of all project lifetime costs.

This is where LCOE and LCOS are preferred methods to CAPEX calculations or an NPV calculation that only looks forward a few years and ignores upsides in revenue, or future costs.

A more insightful definition of LCOS, which relates more specifically to the storage of electricity rather than to the generation per se, excludes the cost of charging the storage that is not related to cycle efficiency and other losses. With different organizations using these terms differently, it is important to be aware of these distinctions and their implications when making comparisons. Both LCOE and LCOS are expressed as units of currency per unit of stored energy discharged (e.g. \$/MWh or €/MWh) and are useful for analyzing and comparing generation project options.

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