

Chapter 6 - Appendix D

Fatal Flaw Analysis – Energy Storage Technologies¹

Description	Fatal Flaw
Pumped Hydro Energy Storage	✓
Compressed Air Energy Storage (CAES)	✓
Sodium Sulfur Battery (NaS)	✓
Hydrogen Storage/Fuel Cell Generation	✗
Thermal or Pumped Heat Energy Storage	✗
Zinc – Bromine Flow Battery (ZnBr)	✗
Lithium – Ion Battery (Li-Ion)	✗
Advanced Lead Acid Battery	✗
Vanadium Redox Flow Battery	✗
Flywheels	✗

A high-level fatal flaw analysis was conducted as part of the first stage of the supply-side selection analysis. Options that did not pass the high-level fatal flaw analysis consist of those that could not be reasonably developed or implemented by Ameren Missouri for one or more of the following reasons:

- The storage technology is cost prohibitive to install and equally cost prohibitive and/or burdensome to maintain.
- The storage technology, while perhaps advancing, is still in the development or demonstration phase. (Few storage technologies above have utility scale applications that are operational in the United States, and some are still not commercially available even in community or household scale applications.)
- The storage application is overly limited by a short cycle life, especially if deeply discharged.
- Several battery storage applications are limited for various reasons in their scalability to either utility-grade or community-grade installations. The application may, in fact, not be intended for anything other than consumer end-use behind-the-meter.
- The storage application is hampered by low cycle efficiencies or energy densities.
- The storage application is hampered by environmental risk (e.g. batteries whose chemical elements are considered hazardous materials or have combustible tendencies under different operating conditions).

¹ 4 CSR 240-22.040(2)(C)2

Additionally, there are a number of reasons in general why Ameren Missouri may not be able to develop as strong a business case for energy storage as other utilities:

- Ameren Missouri is not currently operating in a capacity-constrained environment from either a generation or energy delivery standpoint.
- Ameren Missouri is not currently operating in a real estate-constrained environment. When line or substation capacity additions are necessary, Ameren Missouri is not typically hampered by physical constraints associated with the expansion and upgrade of facilities.
- Ameren Missouri is not currently subject to the type of power market volatility that warrants the strategic use of energy storage from an arbitrage standpoint.
- Ameren Missouri is not currently hampered by the types of service reliability problems that would make energy storage a strategic option. In fact, as a direct result of a number of reliability-based initiatives undertaken over the past several years, Ameren Missouri customers are experiencing measurably improved levels of electric service reliability.
- Ameren Missouri does not currently have a substantive amount of non-dispatchable intermittent resources in its generation portfolio to warrant a serious consideration of widespread energy storage.

Compliance References

4 CSR 240-22.040(2)(C)2	1
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