Utility-Scale Lithium-Ion Battery Storage Fire Safety

FREQUENTLY ASKED QUESTIONS

This utility-scale battery storage system serves the town of Sterling, MA.

Photo: Clean Energy Group.

What is utility-scale battery storage?

A utility-scale battery energy storage system stores energy from other sources, such as solar arrays or the electric grid, to be discharged and used at a later time. Also called grid-scale or large-scale storage, these systems are usually composed of a series of energy storage containers and can range from a few megawatts in size to hundreds of megawatts spanning multiple acres of land.

Utilities are increasingly investing in battery storage resources because they are able to charge from the grid when electricity prices and demand are low and deliver energy back to the grid when electricity prices and demand are high, which lowers energy system costs and improves reliability. And as more intermittent resources like solar and wind are connected to the grid, utilities can use battery storage to balance supply and demand and fill the gaps when renewable resources are not generating power.

While utility-scale battery storage systems can be composed of different materials, lithium-ion batteries are the most common. This fact sheet focuses exclusively on safety considerations for utility-scale lithium-ion batteries.

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Is utility-scale battery storage safe?

In general, utility-scale battery storage systems are very safe. While utility-scale battery installations are required to adhere to strict safety codes and standards, they can pose a fire risk due to the large volume of energy stored onsite. When a lithium-ion battery system malfunctions, whether due to damage, manufacturer defect, or poor maintenance, there's a risk of overheating and thermal runaway. Thermal runaway occurs when lithium-ion cells enter an uncontrollable, self-heating state, which leads to a fire that can spread to nearby cells if not properly contained. Thermal runaway can also be triggered by an exposure to high heat, such as from a fire in a nearby building or wildfire. Fires involving lithium-ion batteries can grow and spread quickly, emitting harmful gases and smoke. Because of the size of utility-scale battery storage systems, if fires ignite deep within the system, they can be difficult to detect and suppress. If the battery system is installed with insufficient ventilation, flammable gases can accumulate within a battery container, increasing the risk of explosion. It's important to note that thermal runaway is a risk for all devices that use lithium-ion batteries, including smartphones, laptops, EVs, and e-scooters, not just for larger battery storage systems.

How common are fires at utility-scale lithium-ion battery storage facilities?

A few large-scale battery storage fires have garnered media attention: a January 2025 fire at the Moss Landing Vistra Power Plant in California, a July 2023 fire at the Convergent Energy facility in Lyme, New York, and a April 2019 fire at the McMicken facility in Arizona. However, the overall rate of incidents has sharply decreased as the battery storage industry has matured. Between 2018 and 2023, the global grid-scale battery energy storage failure rate dropped 97%. There have been no reported deaths from lithium-ion battery storage incidents in the United States since 1995. Since 2012, 25 large-scale battery storage projects, including utility-scale projects, have reported fires. Today's relatively low battery storage safety risk is primarily due to improved technologies, standards, and codes.

What safety standards and best practices currently exist for utility-scale battery storage?

Safety standards are embedded at every step in the development and operation of utility-scale battery storage projects, from the selection of materials within the battery cells to the consideration of larger-scale community health impacts. Standards including NFPA 855, UL 9540A, and others established by the International Building Codes, International Fire Codes, and American Society of Civil Engineers help ensure that new utility-scale installations include safety features that mitigate fire risk and limit community impacts if a fire does occur.

Best practices include:

- Use of battery management systems, which track battery performance and can turn on cooling systems if the battery gets too hot.
- Installation of early fire detection systems and tools such as air sampling and smoke detectors, which can identify issues before they turn into serious fire incidents.
- Safe battery storage enclosures designed to contain fires and prevent explosion or reignition.
- Coordination between utilities and local emergency responders so they are aware of the location and type of battery on-site.
- Up-to-date training on how to extinguish battery fires for first responders.

What can community members do to ensure that safety best practices are followed?

Community members can request information from developers, utility companies, or local governments about whether the safety standards and best practices listed above have been followed at locally sited large-scale battery storage facilities. Community members can also ask how the facility operators will follow local rules such as noise limits, setback distances, and safety barriers; how often safety checks are done; for details on emergency alert system plans; for clear evacuation or shelter-in-place plans; and for environmental impact reports. Community members have the right to ask for extra safety features beyond the minimum required by law, and for clear information about how facility operators will keep the community safe.

If an incident does occur, community members can request environmental testing to check for pollution and follow up with local environmental agencies to ensure the area is cleaned up and restored.

There's been a fire at a battery storage facility in my community. Are there any health or environmental impacts that I should be concerned about?

The health and environmental impacts of a battery storage fire vary depending on the fire's severity as well as fire suppression methods used. A third-party review of large-scale battery energy storage system fires in the US since 2012 found that none of the incidents resulted in widespread contaminant risks. Studies show that toxic gas emissions, which include hydrogen fluoride, carbon monoxide, and hydrogen cyanide, are largely confined to the immediate vicinity of the fire and rapidly dissipate outdoors.

First responders typically allow battery fires to burn out, using water to contain the fire within the affected area an cool targets if needed. Studies show that while lithium-ion battery fires do produce chemical byproducts, the risk for groundwater contamination is low.

Learn More

- To learn more about utility-scale battery storage safety, see slides and recordings from Clean Energy Group's July 2025 webinar with Captain Richard Birt, a solar and battery storage fire safety expert and founder of Solar and Fire Educators (SAFE).
- To learn more about battery energy storage, see Clean Energy Group's report *Understanding Solar+Storage: Answers to Commonly asked Questions About Solar PV and Battery Storage*.
- Additional fact sheets related to lithium-ion battery storage safety are available on Clean Energy Group's website.