Claims vs. Facts

Energy Storage Leading on Safety


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Utility-scale battery energy storage is safe and highly regulated, growing safer as technology advances and as regulations adopt the most up-to-date safety standards.

Background

Energy storage systems (ESS) are critical to a clean and efficient electric grid, storing clean energy and enabling its use when it is needed. Installation is accelerating rapidly—as of Q3 2023, there was seven times more utility-scale energy storage capacity operating than at the end of 2020. This growth is driving job creation, investment in American manufacturing, and is improving grid resilience and energy security.

However, because energy storage technologies are generally newer than most other types of grid infrastructure like substations and transformers, there are questions and claims related to the safety of a common battery energy storage technology, lithium-ion (Li-ion) batteries. All of these questions and claims can be addressed with facts. The industry continues to address these concerns to ensure community confidence in this increasingly essential electric grid infrastructure.

CLAIM: The incidence of battery fires is increasing.

FACTS: Energy storage battery fires are decreasing as a percentage of deployments.

- Between 2017 and 2022, U.S. energy storage deployments increased by more than 18 times, from 645 MWh to 12,191 MWh[1], while worldwide safety events over the same period increased by a much smaller number, from two to 12[2].
- During this time, codes and standards regulating energy storage systems have rapidly evolved to better address safety concerns.


Photo credit: Fluence

CLAIM: Today's larger battery systems use tens of thousands of cells, so fires are inevitable.

FACTS: Cell failure rates are extremely low, and safety features in today's designs further reduce the probability of fires.

- One estimate from 2012 quotes a failure rate ranging from 1 in 10 million to 1 in 40 million cells[3], and there are undoubtedly improvements from these levels.
- Lithium-ion batteries experience extremely low failure rates, as shown by electric vehicle data.
  - Tesla alone sold nearly 900,000 vehicles in the first half of 2023[4]. These sales of new vehicles represent around three-quarters of a billion cells, but safety events involving all EVs on the road globally, from all manufacturers, amounted to just a few dozen fires.
- Today's energy storage systems (ESSs) predominantly use safer lithium-iron phosphate (LFP) chemistry, compared with the nickel-manganese-cobalt (NMC) technology found in EVs.
  - LFP cell failure results in less energy release and a lower probability of fire.
- ESS designs incorporate features to avoid propagation of cell failure within the battery, contributing to improved safety.

1 US Energy Storage Monitor, Q1 2023 full report and 2022 Year in Review, Wood Mackenzie Power & Renewables/American Clean Power Association, https://www.woodmac.com/industry/power-and-renewables/us-energy-storage-monitor/

2 Electric Power Research Institute, BESS Failure Event Database, https://storagewiki.epri.com/index.php/BESS_Failure_Event_Database

3 D. Doughty, Vehicle Battery Safety Roadmap Guidance, National Renewable Energy Laboratory, October 2012, https://doi.org/10.2172/1055366.

4 EV sales: Hyundai overtakes GM, but Tesla's U.S. dominance continues

CLAIM: E-bike and e-scooter fires have resulted in deaths—so large batteries for energy storage may be even more deadly.

FACTS: No deaths have resulted from energy storage facilities in the United States. Battery energy storage facilities are very different from consumer electronics, with secure, highly regulated electric infrastructure that use robust codes and standards to guide and maintain safety.

- E-mobility devices have been lightly regulated in the past, and some products have used poor-quality battery cells and ineffective safety systems.
  - They are also charged inside homes, sometimes along egress routes, creating a high level of risk.
- Like EV batteries, ESS battery systems are highly regulated and subject to stringent certification and testing requirements.
  - The difference in regulation is evident in vehicle statistics. Worldwide, for the first half of 2023, EV FireSafe cites 500+ light electric vehicle (E-bike and E-scooter) battery fires, but only 44 passenger EV fires[5].
  - Additionally, utility-scale energy storage systems are located within secure facilities with site plans explicitly designed around maximizing safety of those operating the facilities and their neighbors.
- The ESS industry meets with and shares best practices with first responders and communities.
  - Lessons learned from earlier ESS incidents have been reflected in the evolution of codes and standards. Often, companies go beyond mandatory testing to test more extreme failure scenarios.
- Altogether, like other electric grid infrastructure, energy storage systems are highly regulated and there are established safety designs, features, and practices proven to eliminate risks to operators, firefighters, and the broader community.
- The industry is committed to meeting these standards, such as NFPA 855, which are regularly updated to reflect the latest evidence-based best practices.

Photo credit: AES

CLAIM: Battery fires emit toxic fumes and pose a risk to the community

FACTS: Past incidents demonstrate that fires are contained within the facility, and air quality in neighboring areas remains at safe levels.

- Laboratory testing of emissions from Li-ion cells in thermal runaway shows that emissions are similar to those found in plastics fires[6].
- During an ESS battery fire, only trace amounts of chemicals are detected in sampling around the event, and overall air quality remains at safe levels.
- During a fire at a Tesla Megapack at Moss Landing in California, air-quality testing showed no hazards to human health[7].

CLAIM: Fire suppression systems should be mandatory for all lithium-ion battery systems.

FACTS: Regulations that aren't vetted by organizations like the National Fire Protection Association or are inconsistent with the International Fire Code may make projects less safe.

- Established national and international codes and standards already require BESS to incorporate the appropriate safety features to contain any potential fires or thermal events.
- Successful suppression of a fire does not guarantee that the underlying thermal runaway event has been terminated, so containing a fire is the best way to protect first responders and communities.
- The energy storage industry is working to avoid events such as the explosion at an installation in McMicken, Arizona, in which four firefighters were injured[8]. Prior to this event, the industry was focused on extinguishing fires as quickly possible, but McMicken showed that explosion can be a greater hazard and fire containment is a better strategy.
- The accepted best practice for the rare ESS fires that do occur is to contain them, managing the burn of the limited affected unit in a controlled manner while protecting nearby structures and equipment. This strategy eliminates any explosion hazard, avoids issues with stranded energy and reignition, and minimizes contaminated runoff of firefighting water.
- Codes and standards are changing to reflect this practice, placing an emphasis on explosion prevention. One proposal for the 2026 edition of NFPA 855, *Standard for the Installation of Stationary Energy Storage Systems*, would forbid installation of traditional clean-agent or aerosol fire suppression systems unless testing demonstrates that use of such systems does not create an explosion risk.

5 EV FireSafe, All Electrified Transport LIB Fire Incidents, Global, 1st January to 30th June 2023, https://www.evfiresafe.com/ev-battery-fire-overview.
6 DNV-GL, Considerations for ESS Fire Safety, Report for Consolidated Edison and NYSERDA, 2017
7 Air quality testing showed no hazards to human health amid battery fire in Moss Landing
8 Arizona ESS Explosion Investigation and Line of Duty Injury Reports Now Available