Battery Energy Storage: Commitment to Safety & Reliability

Safe & Reliable by Design

Safety is fundamental to all parts of our electric system, including battery energy storage facilities. Battery energy storage technologies are built to enhance electric grid security and reliability, performing during critical high stress periods, and delivering power to the grid during blizzards or heat waves. Battery energy storage technologies are critical to providing the electricity that keeps our lights on, our home appliances running, our homes air conditioned and heated, and our businesses operating.

Photo credit: Tesla

Soldotna, Alaska: Homer Electric installed 46 MW Tesla Megapack system to increase energy capacity along Alaska's rural Kenai Peninsula, providing support to gas turbines and helping to prevent outages.

Battery Energy Storage is the Swiss Army Knife of the Power Grid

Batteries are present in every part of our lives, from mobile phones to watches and laptops – even toothbrushes and lawn mowers. Grid-scale battery energy storage incorporate the same core technology as the batteries that power the phone in your pocket, but at a larger scale and with its own unique set of safety standards certifications and regulations. The power grid resources we rely on are all built to meet safety requirements outlined in our National Electrical Code and detailed in electrical and fire codes.

Battery energy storage facilities are built with expert-certified batteries and specially engineered enclosures, and are designed to meet the nation's most rigorous and extensive safety standards. Grid-scale battery energy storage facilities serve as the Swiss Army knife of the grid, playing various roles to keep the lights on and keep costs low for families and businesses. Battery energy storage will continue to be an essential technology for strengthening America's energy and economic security.

Photo credit: Fluence

A Blueprint for Safety:
Tested, Vetted, & Certified Batteries & Equipment

Battery energy storage technologies are designed to meet and exceed qualification standards. These systems are tested and vetted, certified, and ultimately built to comply with the nation's leading safety standard. **The U.S. battery energy storage industry uses a suite of important certifications and standards that guide the safe design, installation, and operation** of battery energy storage facilities. These documents are regularly updated based on the advice, applied lessons, and research from leading safety experts, fire professionals, fire protection engineers, and scientists. These standards help ensure that battery energy storage facilities are able to perform the role perform their roles as designed, ensuring the electric grid is stable, affordable, and reliable for American communities and businesses.

Certified Batteries

UL 1973 and UL 9540 are critical safety standards that ensure battery energy storage systems operate reliably and securely. UL 1973 certifies the safety and performance of battery cells, modules, and packs, evaluating their ability to withstand thermal runaway, mechanical stress, and electrical faults.

Proven Battery Packs & Systems

The UL 9540 certification builds on this by evaluating the entire battery energy storage system, verifying that it meets rigorous fire, electrical, and functional safety requirements. Together, these standards provide a robust framework that minimizes risks, protects facilities and communities, and instills confidence in the safety of battery energy storage technology.

Battery energy storage systems under UL 9540A undergo thorough testing to ensure that, in the rare case of a fire, the fire will be contained within a single unit located within the secure facility site. These **large-scale fire tests** ensure battery enclosures are designed and installed so that any incidents that do happen are contained and don't spread to other units.

Photo credit: Powin

The UL 9540A test evaluates thermal runaway propagation risks in battery energy storage systems by assessing how battery cells, modules, and packs react to overheating, mechanical damage, or electrical abuse. Conducted at the cell, module, unit, and system levels, this test helps determine fire safety and supports implementation of effective mitigation strategies.

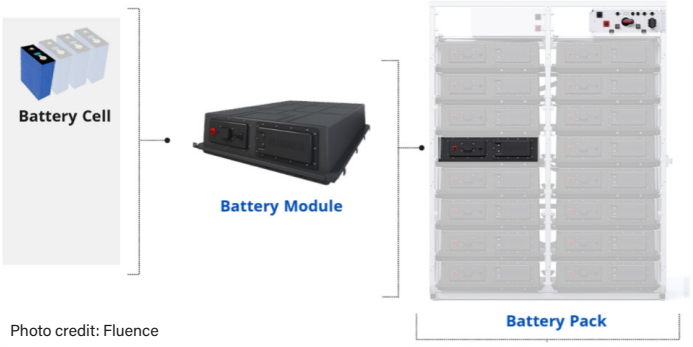
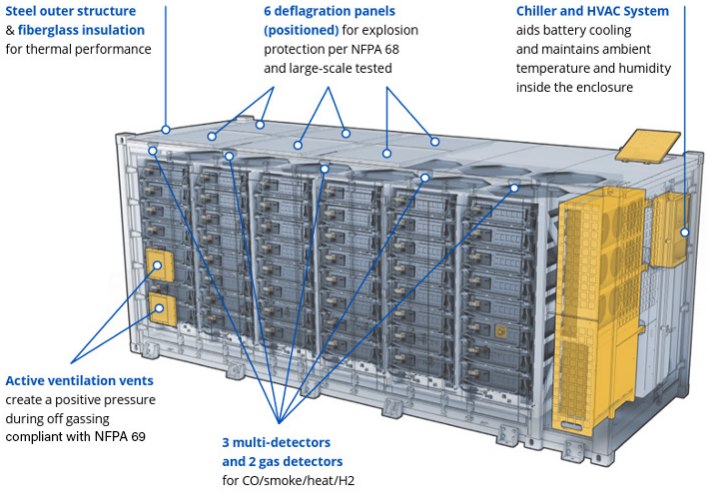


Photo credit: Fluence

At the unit level, systems include a variety of advanced safety features designed to mitigate and eliminate hazards.



"Regulators and policymakers should be aware of required codes and standards, because those must be incorporated into local regulations. NFPA 855 requires all battery energy storage systems be listed to UL 9540, a standard that incorporates the entire system: the enclosure, the communications, the HVAC...a whole systems approach."

Kara Gerczynski, Division Chief, Fire Prevention and Administration, The Elizabeth (CO) Fire Protection District

A Blueprint for Safety: Battery Energy Storage Projects are Built to Exceed the Most Rigorous Safety Standards

As the premier national standard for battery energy storage safety, NFPA 855 guides the collaboration between the battery energy storage industry and firefighters to maximize the safe and reliable performance of battery energy storage as critical grid infrastructure. **NFPA 855 provides mandatory requirements** for the design, installation, commissioning, operation, maintenance, and decommissioning of battery energy storage facilities, distinguished by battery energy storage technology

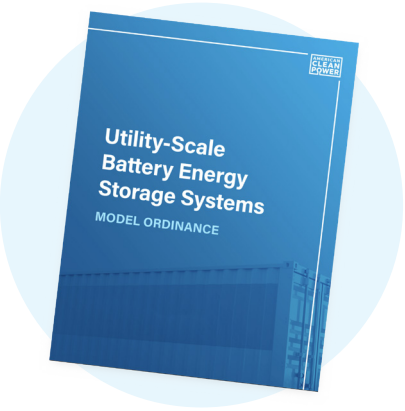
In addition to requiring tested and certified batteries and equipment, NFPA 855 includes standards for metrics such as maximum energy and spacing between units and lists several submittals that must be made to the regulating governmental entity, including a hazard mitigation analysis (HMA), an emergency response plan (ERP), and details of all the safety features in the system.

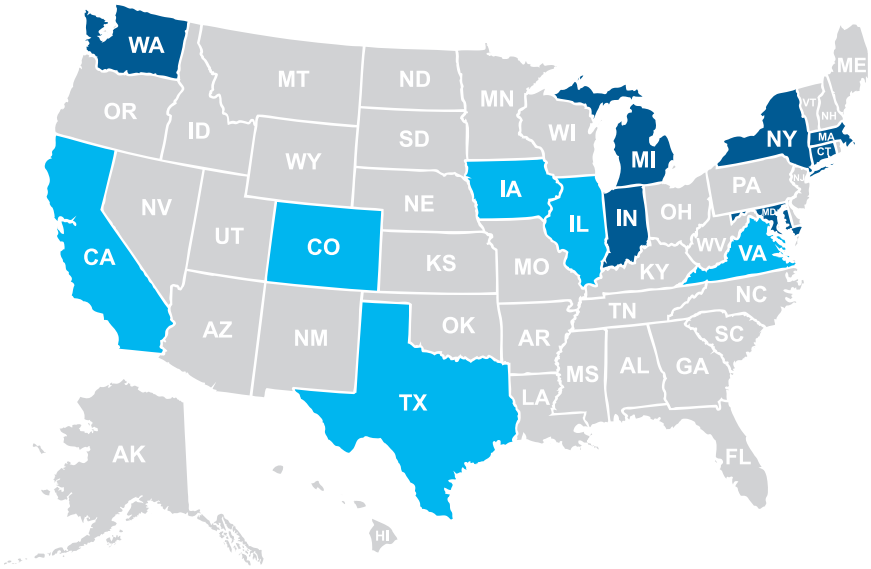
Plus Power's Kapolei Energy Storage Facility on Oahu, Hawai'i

Photo credit: Plus Power

Industry is Advancing Safety Standards Across the United States

The battery energy storage industry advocates for the adoption and enforcement of the latest and most rigorous safety standards. The industry has worked to **incorporate NFPA 855 as a requirement for permitting battery energy storage projects in states** like Indiana and Maryland — and continues to advocate for the latest safety standards in states like California, Texas, Illinois, and Virginia. Uniform adoption of the nation's most rigorous safety standards across jurisdictions ensures that across the United States, regardless of the community or the state, the most vetted and trusted safety strategies, designs, and equipment are used to guide battery energy storage deployment. To support state and local governments, the battery energy storage industry has developed an **NFPA 855-centered model ordinance** that can serve as the basis for new or updated permitting rules.





The battery energy storage industry has worked in partnership with fire officials and state governments to adopt NFPA 855, ensuring all battery energy storage facilities are held to the highest standards. The industry continues to work with state policymakers across the country to update safety rules, including mandatory initial and annual refresher training for first responders.

Adopted NFPA 855 Provisions

Pending Safety Policy Changes

Battery Energy Storage Facilities are Built to be Good Neighbors

Fire-related incidents at battery energy storage facilities are incredibly rare. There have been 23 incidents in the last 10 years at U.S. operating battery energy storage facilities. This coincides with battery energy storage deployment growth of more than 25,000% since 2018. Past incidents demonstrate that fires are contained within the facility, and air quality in neighboring areas remains at safe levels. Compared to the 23 reported incidents at battery energy storage facilities, NFPA estimates that there were more than 210,000 fuel-based vehicle fire incidents in 2023 alone. While any risk of fire raises legitimate community concerns, there has never been a fire incident at a battery energy storage facility that has spread beyond the secure site of the grid-scale facility.

Air and water quality monitoring and testing for all historical fires at grid-scale battery energy storage facilities have found no risk to public health, neighboring properties, or the surrounding community. A survey of all official investigations, testing, and monitoring results at fire incidents across the country has shown that there has been no demonstrated risk to neighboring properties or the broader community as a result of a battery energy storage fire. Laboratory testing of emissions from Li-ion cells in thermal runaway shows that emissions are similar to those found in plastics or couch fires – largely analogous to a car that has caught fire on a highway. During an ESS battery fire, only trace amounts of chemicals are detected in expert sampling and analysis around the event, and overall air quality remains at safe levels.

Photo credit: Enel

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The the number of reported safety incidents that have occurred at operating grid-scale battery energy storage facilities in the United States over the last decade. There are thousands of facilities operating across the United States and as deployment has grown by more than 25,000% since 2018, incidents have remained incredibly rare.

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There have been no recorded instances where a battery energy storage fire or safety incident has caused air emissions that pose a health risk to the community. All historical official monitoring and investigations have found that emissions from fires at NFPA compliant facilities do not pose a hazard to communities. While even campfires can create emissions with risks, battery energy storage facilities are designed to contain any impacts to the secure facility site.

Partnering with Fire Departments & Emergency Responders

Battery energy storage companies work with local fire departments and first responders to share information about risks, response plans, and safety measures related to battery energy storage technologies. Every battery energy storage facility maintains a safety plan and emergency response plan tailored to the unique project, developed in collaboration with local fire officials. The industry is committed to providing high quality and regular training for first responders and fire department personnel to ensure that in the rare event of an incident, there is a shared plan for coordinating response that puts the safety of personnel first.

"I really believe the industry is growing in a positive way right now—we're learning more, we're gaining knowledge, we're looking at other agencies that have understanding of how to regulate these systems, as well as involving the developers and operators early in the process."

Capt. Michael Nicholas, Former Captain, Kern County Fire Department, Bakersfield CA

Applying Lessons Learned:
A Commitment to a Safe Future

The battery energy storage industry is committed to applying lessons learned and preventing future safety incidents, however rare they may be. With transparency and a commitment to a safe and reliable energy future in America, below are takeaways from two anomalous safety incidents that have occurred at grid-scale battery energy storage facilities.

McMicken – Surprise, Arizona

The Safety Incident: On April 19, 2019, a significant fire incident occurred at the McMicken Battery Energy Storage System in Surprise, Arizona. Lack of proper ventilation led to a buildup of gases. First responders opened the enclosure door, introducing oxygen that allowed the accumulated gases to ignite the accumulated gases, resulting in an explosion that injured several firefighters. This has been the only U.S. grid-scale battery storage incident resulting in reported injuries.

Action Taken: explosion prevention was a top priority integrated into the 2023 updates to NFPA 855. Since the McMicken event, there have been no subsequent injuries to responding fire or emergency personnel at a U.S. battery energy storage facility.

> "There are a lot of requirements that have evolved through NFPA 855 off of the lessons learned at McMicken. These requirements have made it so that you're not going to have explosions or the incident like at McMicken. The worst case scenario is that you have one container burn up and not propagate to the next container. It's a whole different game now."

Bobby Ruiz, Former Fire Chief, Peoria, AZ, Former Assistant Fire Chief, Phoenix AZ, Project Director – Hiller Company, Phoenix AZ

Phase 1 – Moss Landing, California

The Safety Incident: In January 2025, a significant fire event occurred at the Moss Landing Power Plant in California. The fire, which destroyed most of a 300-MW battery array, was contained within the facility, and no injuries were reported. This fire represents the largest safety event at a grid-scale battery energy storage facility, largely due to its placement in a 75-year-old gas turbine facility not originally built to house modern battery energy storage system. While the investigation into the root cause and its impacts are still ongoing, air emissions monitoring and water testing has shown that there is no risk to public health or the surrounding community.

Action Taken: industrial and utility-scale battery energy storage facilities should not be sited in buildings or enclosures that were not specifically designed to safely house them. The newest edition of NFPA 855, to be finalized and published in 2025, eliminates the possibility of facilities being built without proper large-scale fire testing, which would prevent the scale and impact of a fire like this from happening again.

Under the large-scale fire testing required in the latest edition of NFPA 855, facilities would be required to compartmentalize units in a way that would eliminate the possibility of the large-scale burn seen at Moss Landing. The fire event at Moss Landing was 240 times larger than what would be seen in a single unit fire at a standard 5 MWh containerized unit. The Moss Landing incident is an anomaly that the industry is committed to preventing from ever happening again.

The battery energy storage industry has proposed policy recommendations for the State of California to take up to ensure the safety of all currently operating and future battery energy storage systems. This includes requiring facilities comply with the most up-to-date edition of NFPA 855 and that older facilities review and correct any outdated features.

Ensuring a Safe & Reliable Future

Policy Considerations for State & Local Governments

Safety is the first and foremost priority for our community of battery energy storage manufacturers, developers, and operators. The battery energy storage industry is committed to working with state and local agencies to address concerns raised by the Moss Landing incident and promote safety at all battery energy storage system facilities. To that end, the battery energy storage community has **published policy recommendations for state and local communities** to consider to maximize the safety of all future and operating battery energy storage facilities.

Although the scale and impact of the Moss Landing incident was an anomaly, a proactive and comprehensive response is needed to ensure the implementation of appropriate and effective safety solutions at all existing and future battery energy storage facilities. The industry supports the speedy implementation of the latest edition of NFPA 855 to minimize both the likelihood of future incidents and the risks to communities and first responders if they do occur. The following policy provisions were developed as recommendations for California policymakers.

1 ENSURING SAFETY AT ALL NEW BATTERY ENERGY STORAGE FACILITIES

The battery energy storage industry actively promotes the adoption and enforcement of the latest national fire safety standards. The industry has supported the integration or adoption of National Fire Protection Association (NFPA) Standard 855 (Standard for the Installation of Stationary Energy Storage Systems) in nearly a dozen states and continues to support policymakers in their effort to establish uniform best **practices**. **Adopting and enforcing the latest edition of NFPA 855 is the best approach to ensure safety at all future battery energy storage facilities.**

2 ADVANCING SAFETY ACROSS OPERATING BATTERY ENERGY STORAGE FACILITIES

The energy storage industry is committed to working with state and local officials to review the existing fleet of battery energy storage facilities across California for potential safety risks and to take necessary corrective actions.

These actions include 1) **inspecting** certain facilities built prior to NFPA 855 adoption, 2) conducting **hazard mitigation analysis**, 3) consider the use of **fire barriers** or engineered solutions to meet **large-scale fire testing requirements**, 4) and ensuring all facilities have **emergency response plans**.

3 PARTNERING WITH COMMUNITIES & FIRE OFFICIALS

In addition to promoting the use of best practices and the latest safety features and strategies, the energy storage industry is committed to engaging local communities and fire officials to ensure their specific safety concerns and needs are addressed. The industry works with fire officials on **safety planning** and stands ready to partner with the state to continuously improve safety practices, inform **siting and permitting** processes, and provide educational support and **training** to state and local personnel.

Photo credit: LG Energy Solution Vertech