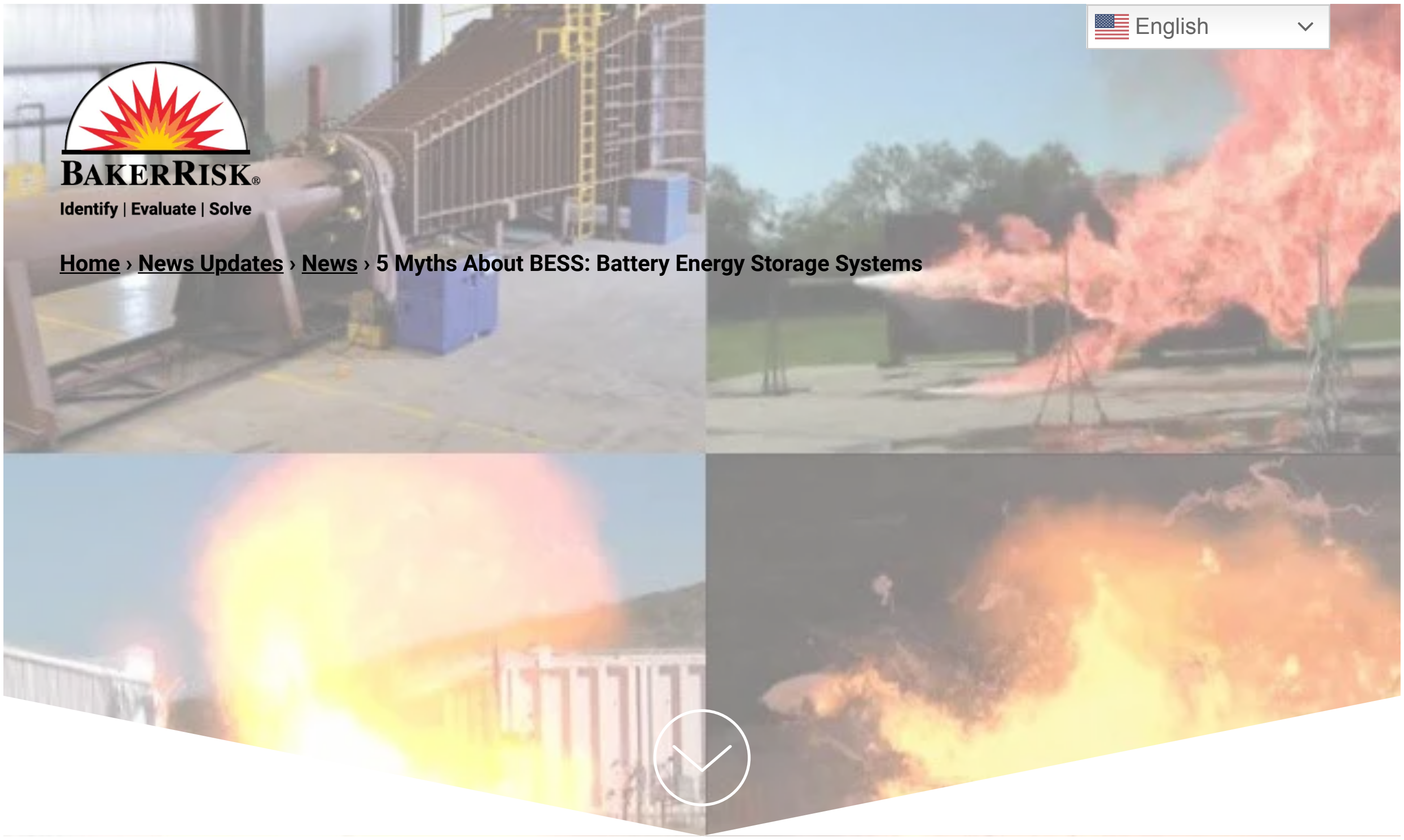

5 Myths About BESS: Battery Energy Storage Systems

January 3, 2023

Five Myths and Misconceptions Around BESS & Lithium Battery Safety

Driven primarily by concerns about climate change and resource availability, the demand for renewable and sustainable forms of energy has soared. But intermittency in sectors like wind and solar power — a disruption caused by the inconsistency of the weather — has made them less reliable as forms of energy. These limitations, however, have been primarily offset by the use of Battery Energy Storage Systems (BESS), a means of storing the energy produced until it is needed.

Lithium-ion (Li-ion) batteries have long been the most common type of battery used in BESS, offering numerous advantages such as size and power density, making them affordable and versatile as a means of storage. However, these batteries aren't perfect; they can fail, so it's essential to understand what's true and what isn't about lithium-ion batteries and the systems they make up.

Myth #1: There are standards that risk managers and facilities managers can use to guide them toward creating policies and processes.

Though standards like the National Fire Protection Association 855 (NFPA 855) have been published and continue to be refined, there are fewer standards and forms of guidance regarding Energy Storage Systems compared to other industries. With interest in BESS steadily increasing and the decrease in lithium-ion battery prices, standards are being quickly created and revised. However, the BESS industry is still in its infancy, and policy creation is ongoing. For this reason, working with risk engineering organizations is especially important to develop safe processes and risk assessments for your facility.

Myth #2: Failure rates of BESS at battery storage facilities are well-known and published.

Currently, the communication of data on the state of failure rate research could be better. Publicly available data on BESS reliability is limited and inconsistent, and much of the recorded information was collected in highly controlled and fixed conditions. Due to the variability of real-world use, this data can be unhelpful in determining actual risk. Furthermore, there isn’t yet any consensus on how to present data, making combining or evaluating datasets challenging. Fortunately, research is progressing significantly, and public data storage platforms are providing familiar and easily navigable locations to find and share data. Some well-known platforms include the Battery Archive and the National Renewable Energy Laboratory.

Myth #3: Lithium-ion fires are similar to other industrial fires and don't require specific planning.

An important concept when talking about lithium-ion batteries and their associated risks is "thermal runaway." Physical damage to a lithium-ion battery cell, degradation due to extreme temperatures, ageing, or poor battery maintenance are among the many potential causes of thermal runaway. Once triggered, thermal runaway is a chain reaction within the battery that leads to an uncontrollable, self-heating state that can result in a violent ejection of gas, shrapnel, smoke, fire, and the potential for deflagration/explosion. Although any industrial fire is bad, lithium-ion battery fires are especially dangerous and possess unique attributes that make them very difficult to extinguish. However, if they are extinguished, they are prone to reignition that could result in deflagration and injury to personnel or emergency responders in their vicinity. Current guidance for responders is to maintain a safe distance and focus their efforts on cooling adjacent units where possible, and to let the fire run its course.

The existing fire mitigation technologies may be able to supress the battery fire but fail to cool the batteries at the cell level to prevent thermal runaway propagation. In that context, we do not yet have a ‘silver bullet’ fire mitigation solution for Li-ion batteries. Currently, water-based fire mitigation, with its known disadvantages, is still being considered the best bet to supress battery fires due to its superior cooling properties, low cost, and availability. A multi-layered strategy which includes early detection and fire suppression specific to battery configuration, application, and location needs to be developed and reviewed on a case-by- case basis.

Myth #4: Damaged batteries are not a threat unless they are on fire.

Though the danger may not be immediately apparent, defects in battery energy storage systems can be active threats in the spaces in which they are used. Defects in the chemical makeup of the battery modules may make them prone to overheating, causing a chemical reaction. The by-products of these reactions can increase the pressure in the battery cells, causing cell walls to expand and the derivatives to leak out. In many cases, these by-products are combustible and could ignite. Batteries should be effectively and routinely maintained to ensure fire risks stay as low as possible.

Myth #5: Structures containing BESS don't need to be designed for explosion hazards.

Although the technology is continuously improving and considered safe, lithium-ion batteries contain flammable electrolytes that can create unique hazards when battery cells become compromised. Due to the risk of thermal runaway and the combustible gases this process generates, fires and explosions should be viewed as entirely possible and planned for appropriately.

To address safety issues around BESS, NFPA 855, NFPA 68 and several other fire codes require any BESS the size of a small ISO container or larger to be provided with some form of explosion control. An effective way of designing BESS explosion prevention systems is through computational fluid dynamics (CFD), a simulation tool that generates predictions based on fluid motion laws. Computational fluid dynamics is frequently used for simulating the accidental release of flammable gas and can effectively design systems to mitigate damage. Should the "worst-case scenario" occur, these standards and tools can effectively ensure the structures that house these complex systems can manage the hazards appropriately.

Though relatively new, battery energy storage systems are becoming increasingly essential within the commercial power landscape. Of course, they aren't without their risks, and the safety standards are still being defined. Still, with specific steps, industries can effectively use these systems to optimize their system's energy solutions better and do so safely in the process. These steps are only effective if done by trained, experienced professionals like BakerRisk.

BakerRisk consultants not only apply leading methodologies for risk management but also help develop industry guidance and understand how to customize methods so that each client's specific circumstances are considered. In addition, our team takes lessons from case studies, incident investigations, collective years of experience with the energy industry, and internal research and testing to fill the gap in risk management for renewable and low-carbon energy solutions.

Don't wait until a BESS threat appears — contact BakerRisk today.

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