

LUNA BATTERY ENERGY STORAGE SYSTEM

Fire Prevention and Safety

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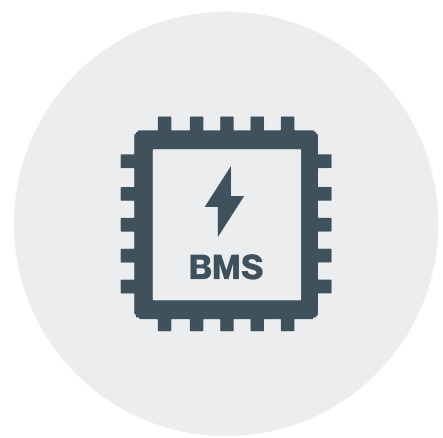
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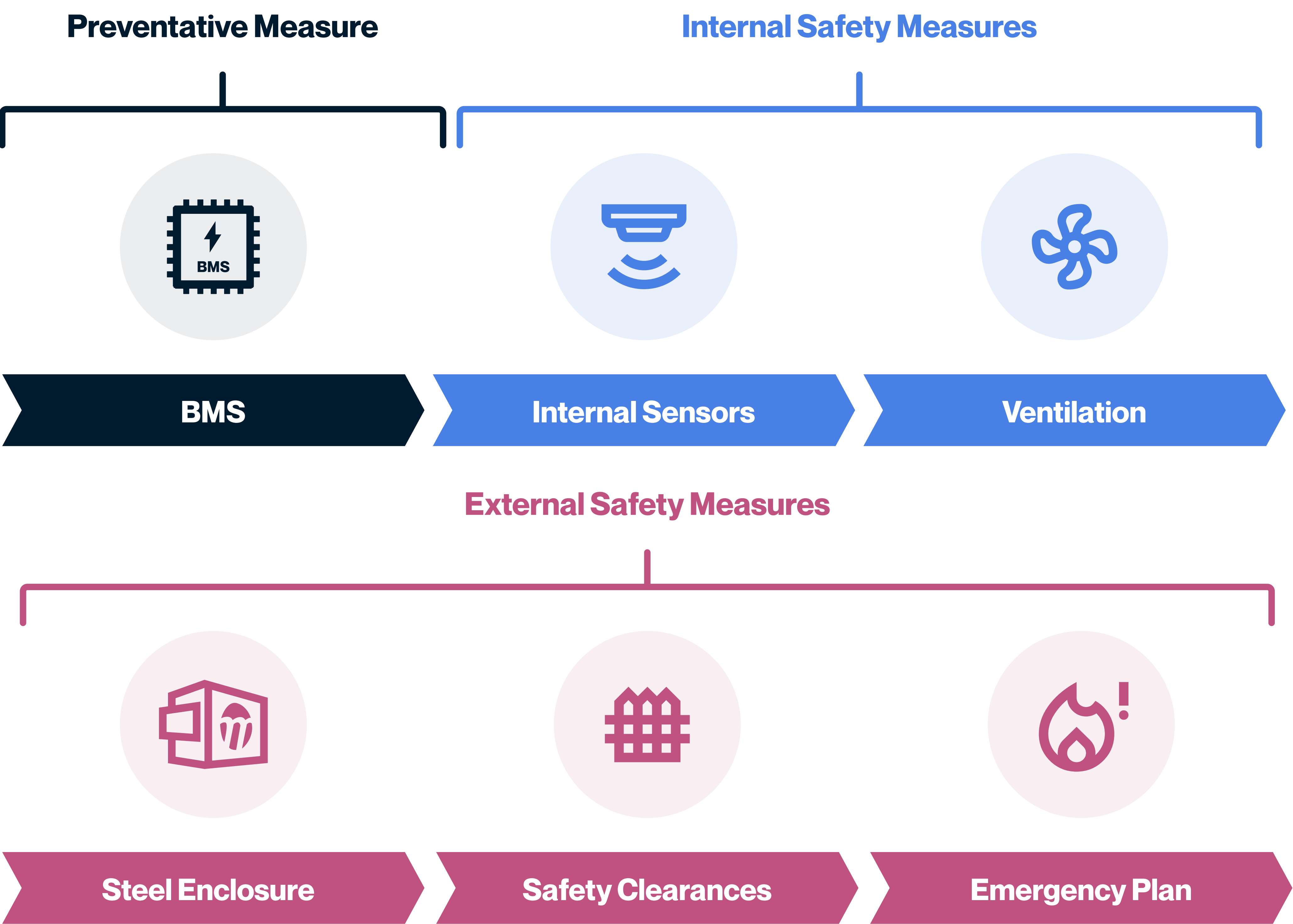


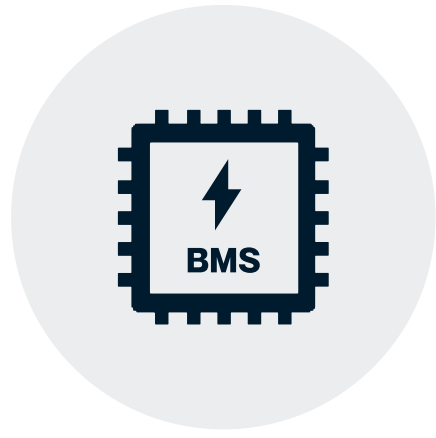
Introduction

This document outlines the fire prevention measures designed for Moment Energy's Luna Battery Energy Storage Systems (BESS). As a company focused on repurposing electric vehicle batteries into sustainable battery energy storage solutions, Moment Energy recognizes the critical importance of safety, particularly concerning potential fire hazards associated with BESS technology.

These robust safety protocols and preventative measures are implemented to mitigate these risks. The document also describes our comprehensive emergency response plan. Our commitment to safety is paramount, and this document demonstrates the proactive approach we take to ensure the secure and reliable operation of our BESS units.

The document covers all aspects of fire safety, from design and installation to operation and maintenance, and reflects our dedication to exceeding industry best practices and regulatory requirements.





Battery Management System (BMS)

Moment Energy's Luna BESS utilizes an advanced Battery Management System (BMS) as the primary defence for fire protection. This technology acts as the "brain" of the system, constantly monitoring the health and performance of individual battery cells within the BESS. Its primary function in fire prevention is the continuous sensing and analysis of critical cell parameters, specifically over-voltage and over-temperature conditions.



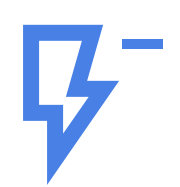
Real-time Monitoring

The BMS continuously monitors each cell for voltage and temperature. This data is collected and analyzed at 25 ms intervals, providing a granular view of the battery's condition.



Over-Voltage Detection

An over-voltage condition can indicate a cell malfunction or charging issue, potentially leading to thermal runaway. The BMS is programmed with pre-defined voltage thresholds. If a cell's voltage exceeds this threshold, the BMS flags the condition, and shuts down the module affected.



Under-Voltage Detection

An under-voltage condition can indicate a cell malfunction, excessive discharge, or a problem with the discharging circuit. The BMS constantly monitors individual cell voltages. If any cell's voltage drops below a pre-defined threshold, the BMS flags the condition and can take action, such as disconnecting the affected module or triggering an alert, to prevent further damage and ensure safe operation.



Over-Temperature Detection

Similarly, excessive cell temperature is a critical warning sign. The BMS monitors cell temperature and compares it against pre-set limits. If a cell's temperature rises beyond the safe operating range, the BMS triggers an alert and shuts down the module.



Automated Safe State Transition

Upon detecting either an over-voltage or over-temperature condition, the BMS doesn't just issue a warning. It's designed to take immediate, automated action to bring the BESS to a safe state. This may involve several steps, including:

- **Ceasing Charging/Discharging:** The BMS will immediately halt any ongoing charging or discharging processes, preventing further energy input or output that could exacerbate the problem.
- **Cell Balancing:** If the issue is related to cell imbalance, the BMS may attempt to rebalance the cells to equalize their voltage and temperature.
- **Controlled Shutdown:** In more severe cases, the BMS may initiate a controlled shutdown of the BESS, isolating the affected cell or module to prevent propagation of the thermal event.
- **Alerting Operators:** The BMS will also send alerts to designated personnel, notifying them of the detected issue and the actions taken.

This multi-layered approach, with its focus on real-time monitoring and automated response, makes the BMS a crucial first line of defence in preventing thermal runaway and mitigating fire risks within Moment Energy's BESS. It acts as a proactive safeguard, constantly ready to intervene at the earliest signs of a potential problem.



Internal Sensors

While the BMS is designed to be highly reliable, Moment Energy incorporates multiple redundant safety layers. In the unlikely event that the BMS fails to fully mitigate a hazardous situation, a secondary line of defence comes into play: a network of internal sensors strategically placed within the BESS enclosure. These sensors detect various potential hazards that could indicate an escalating issue, providing an additional layer of protection.



Smoke Detectors

These photoelectric detectors are highly sensitive to smoke particles and thermal runaway gases, a common early indicator of a developing fire. They are strategically placed within the BESS enclosure to detect any smoke generation rapidly. Early smoke detection allows for prompt intervention before a fire can fully ignite.



Heat Detectors

These sensors are designed to trigger an alarm if the temperature exceeds a pre-defined threshold, indicating a potential thermal event. Heat detectors can provide independent confirmation of a thermal issue, even if the BMS hasn't detected a specific cell problem.



Hydrogen Sensors

In case of cell failure or overcharging, battery cells can release hydrogen gas. Hydrogen sensors are deployed within the BESS to detect any build-up of hydrogen gas. These sensors identify potentially hazardous conditions before they escalate into a fire or explosion.

Redundancy and Integration

These internal sensors are designed with redundancy in mind. Multiple sensors of each type are placed throughout the Luna BESS to ensure comprehensive coverage and minimize the risk of a single point of failure. The sensor readings are integrated into a central monitoring system, providing a holistic view of the BESS's condition.

Alarm and Response

When these sensors detect a hazardous condition, they trigger an immediate alarm. This alarm can be local (within the Luna BESS unit) or remote, alerting designated personnel to the potential issue. The alarm triggers pre-defined emergency protocols, including automatically shutting down the Luna BESS, activating fire suppression systems, and notifying emergency services.

This network of internal sensors provides a critical backup to the BMS, acting as a "fail-safe" mechanism to detect and respond to potential hazards that might otherwise go unnoticed. It further reinforces Moment Energy's commitment to ensuring the highest level of safety for its BESS deployments.



Ventilation

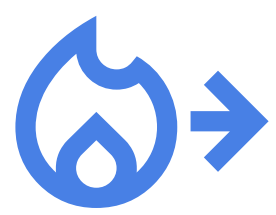
Our safety strategy includes both robust preventative measures and systems designed to mitigate the impact of any potential fire.

Here's a breakdown of the ventilation system's role in fire safety:



Flammable Gas Removal

The ventilation system's critical function is rapidly removing any flammable gases that may be released from the battery cells during a thermal event. As discussed earlier, failing battery cells can produce hydrogen and other flammable gases. If these gases accumulate within the BESS enclosure, they create a significant fire and explosion risk. The ventilation system is designed to quickly exhaust these gases, preventing them from reaching dangerous concentrations.



Smoke and Heat Extraction

In the event of a fire, the ventilation system plays a crucial role in removing smoke and heat from the enclosure. Smoke can obscure visibility, making it difficult to assess the situation and fight the fire. Heat build-up can further exacerbate the thermal runaway process and potentially damage surrounding equipment. The ventilation system helps to clear the air, improve visibility, and control the spread of fire.



Controlled Airflow

The ventilation system is not just about moving air; it's about doing so in a controlled manner. The airflow is carefully designed to ensure that flammable gases and smoke are effectively channelled away from sensitive components and personnel. This controlled airflow also helps to prevent the fire from spreading to other parts of the BESS or adjacent areas.



Integration with Detection Systems

The ventilation system is often integrated with the fire and gas detection systems. When sensors detect smoke, heat, or flammable gases, the ventilation system can be automatically activated to begin its extraction process. This ensures a rapid and coordinated response to a potential fire hazard.



Emergency Response Support

The ventilation system removes smoke and heat, making it safer and easier for emergency responders to access the BESS in the event of a fire. This can be critical in containing the fire and preventing further damage.



Steel Enclosure

Moment Energy's Luna BESS features a robust steel enclosure as a critical safety measure. This enclosure is designed to contain any potential deflagration or fire event within the BESS, preventing it from spreading. It acts as a fire-resistant barrier, giving emergency responders time to intervene. Constructed from high-grade steel, it withstands high temperatures and pressures and integrates with other safety systems like ventilation and fire suppression. Essentially, the enclosure is a key safety feature, minimizing the impact of any potential incident.





Safety Clearances

To prevent fire from spreading, Moment Energy employs several key safety measures:

Safety Zone

A clearance is required around each BESS unit and is maintained as a firebreak. This area is covered with non-flammable materials like rock, eliminating anything that could catch fire.

Inner Clearance

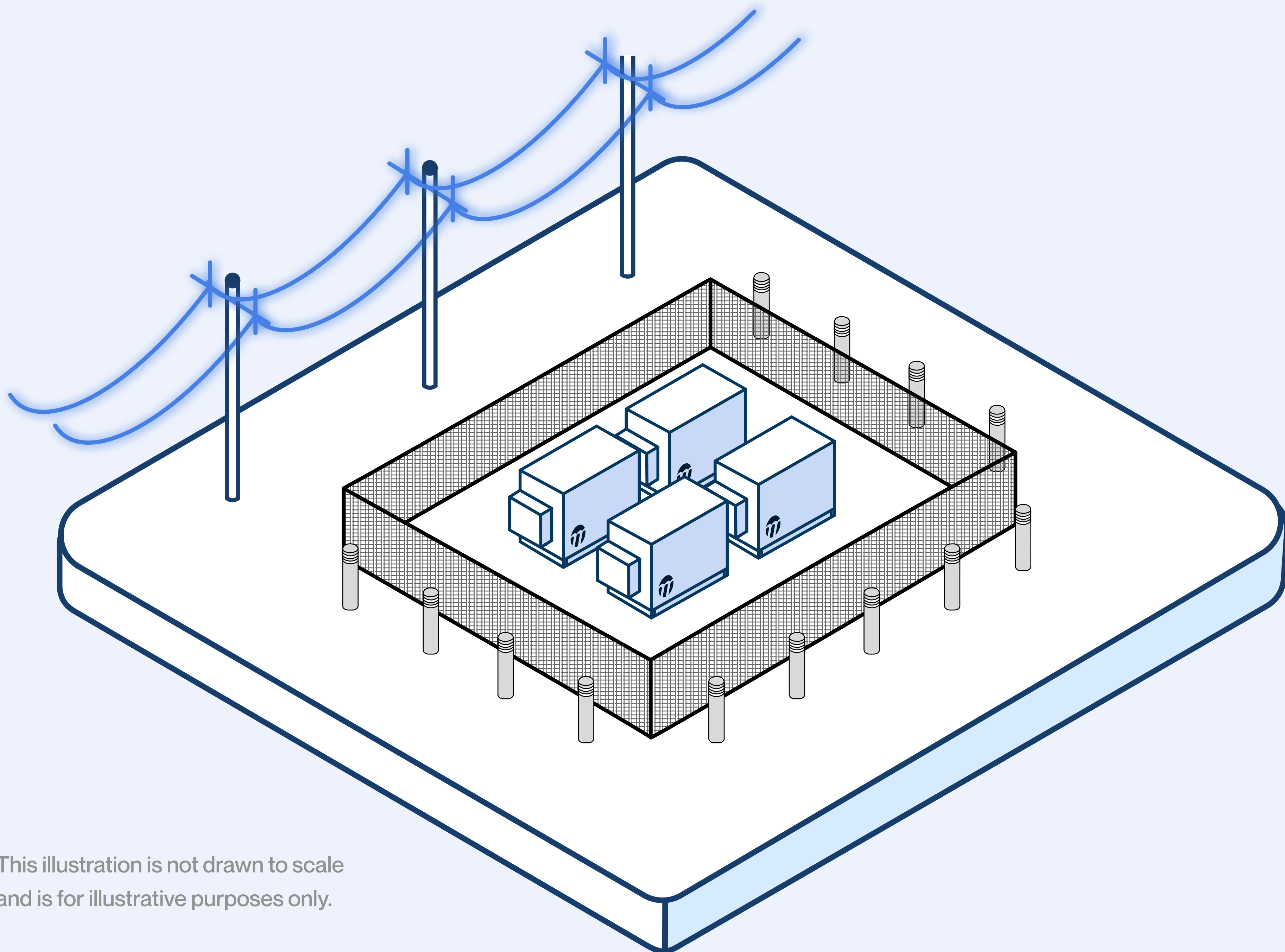
Inside the fenced area, a further clearance directly surrounding the BESS is kept completely clear of any flammable materials, including landscaping.

Vehicle Protection

Where vehicles might drive nearby, protective bollards are installed around the fence to prevent accidental collisions with the BESS.

Code Compliance

These measures adhere to fire and electrical safety codes for BESS installations such as NFPA 855, NFPA 70, NFPA 72, and CSA C22.1.





Emergency Plan

To ensure a swift and effective response in the event of a fire, each BESS installation includes a comprehensive Emergency Responder's Guide. This guide, developed by Moment Energy in full compliance with NFPA 855 standards, provides critical information and procedures for facility staff, maintenance personnel, and emergency responders to diagnose and address potential fire hazards appropriately. Placed in a readily accessible location, the guide details essential information about the BESS, including system schematics, shutdown procedures, and potential hazards. This resource is crucial for minimizing risks to people, property, and the environment by enabling informed and rapid intervention in emergency situations.



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