Battery Energy Storage: Getting To Yes

Presented by:
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MEET THE SPEAKER

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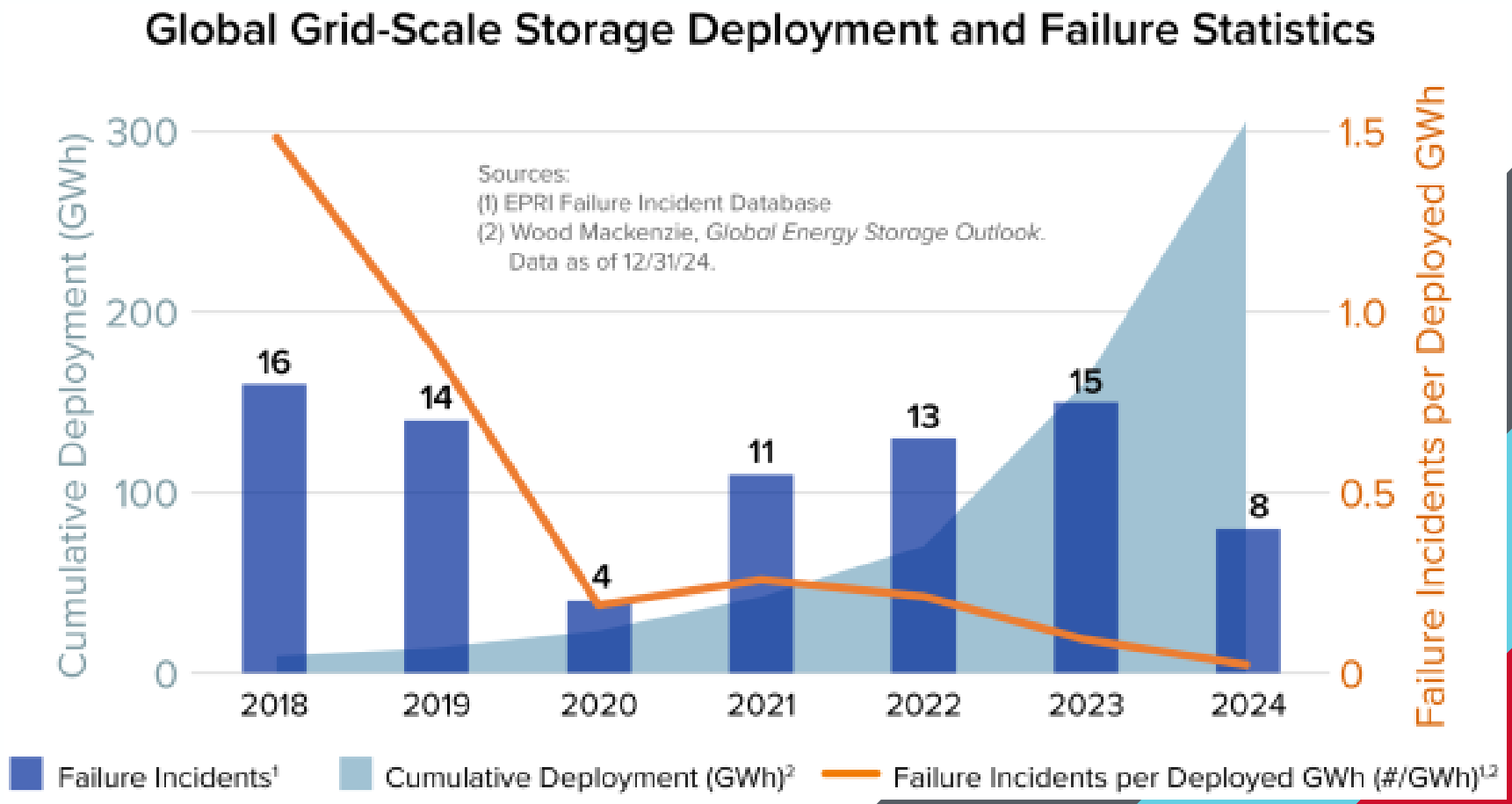
- BESS Fire Safety & Permitting Consultant

STORAGE DEPLOYMENT AND FAILURE STATISTICS



CONSIDERATIONS FOR OPERATORS SELECTING CORRECT TECHNOLOGY:

1. UL 9540 Listing
2. Successful UL 9540A and large-scale fire tests
3. Based on burn test results, can the combustible gas concentration reduction system evacuate enough off gas to keep the concentration below the 25% LEL

CONSIDERATIONS FOR OPERATORS SELECTING CORRECT TECHNOLOGY (CONT.):

4. What type of NFPA 69 compliant systems are used (Concentration Reduction System)

5. Fire Alarm Design - What points within the concentration reduction system need monitoring.

6. What are the ongoing operational costs for testing and maintaining the fire safety systems.

WHEN SHOULD DEVELOPERS ENGAGE LOCAL STAKEHOLDERS AND WHAT NEEDS TO BE PREPARED FOR THIS MEETING

WHAT TO EXPECT:

- Progressive County Planning Departments and Fire Authorities are working more closely during Land Use Approval submission reviews to ensure the following items are addressed before granting land approval:
  - Site plan submitted showing adequate set back of Incident Command Post from nearest battery enclosure.
  - Access roads are upwind, are of adequate width and surfaced for emergency response in inclement weather.
  - Fire water tank and fire alarm annunciation panel are collocated near the entrance and upwind of BESS yard.

WHAT DOES A BESS SUBMISSION TO FIRE AUTHORITIES NEED TO INCLUDE?

INCLUDE IN YOUR BESS SUBMISSION TO FIRE AUTHORITIES:

- Hazard Mitigation Analysis (HMA) incorporating FRA with site specific considerations
- Fire Risk Analysis (FRA) of selected technology
- Failure Modes and Effects Analysis (FMEA)
- NFPA 69 compliant system design and performance of this system during large scale fire test.
- Burn test results : UL9540A and Large-Scale Fire Test Reports
- Technology listings

INCLUDE IN YOUR BESS SUBMISSION TO FIRE AUTHORITIES:

- Emergency Response Plans during construction, commissioning, operations and decommissioning.
- Incident reporting procedures.
- Triggers to notify Fire Authorities when fire life safety systems are offline or being worked on.
- Testing and Maintenance Plans for fire life safety systems including auxiliary backup power systems. Include the method for submitting testing and maintenance results to fire authorities.

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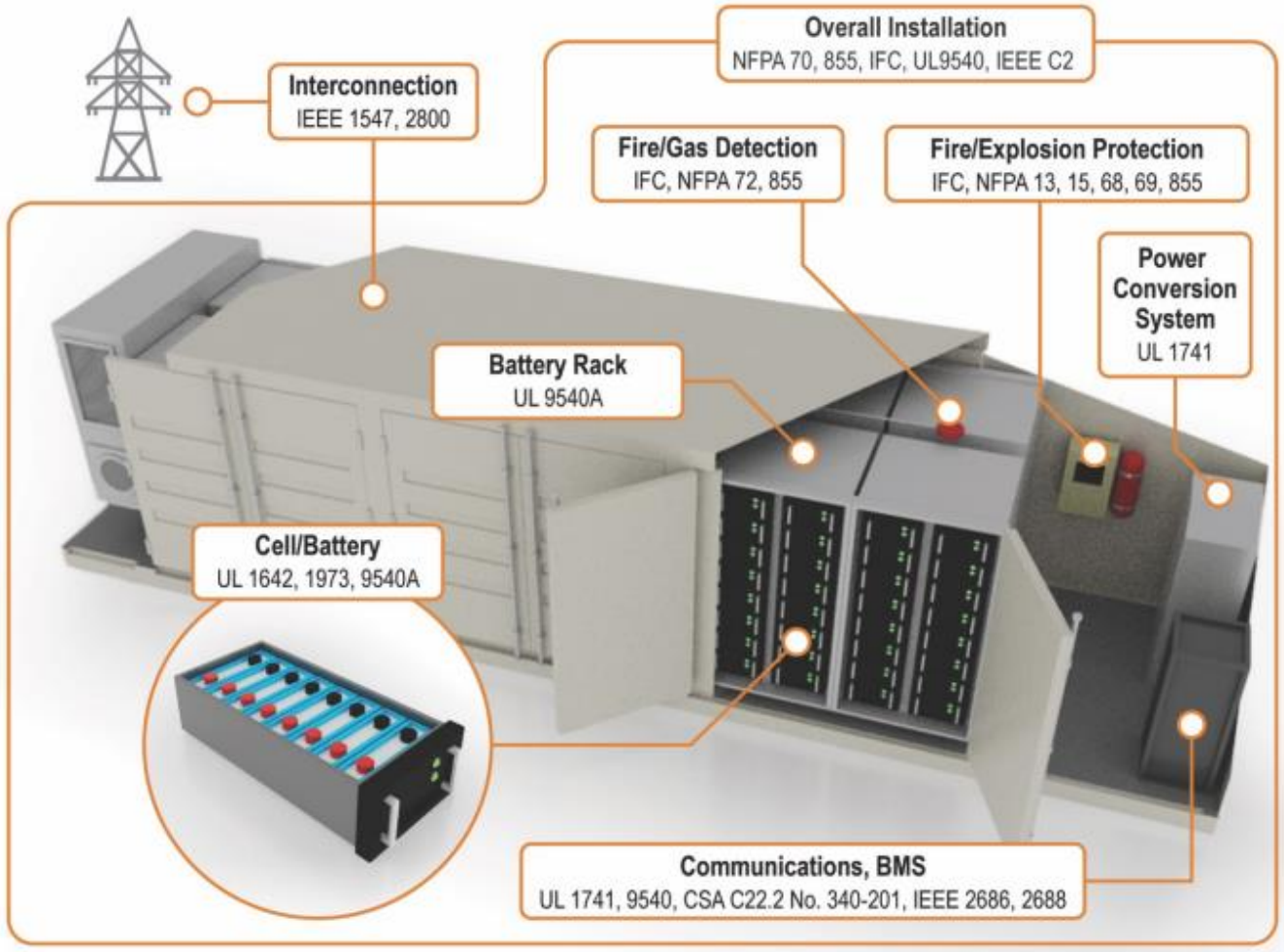
Codes & Standards



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UL Safety Standards:

UL 9540/1973/1741– Integrated Systems, Battery Management Systems, Inverters, Converters, Controllers, and Interconnection System Equipment for Use with Distributed Energy Resources

- These requirements cover the overall control systems as an integrated system, the Battery Management system(BMS) inverters, converters, charge controllers, and interconnection system equipment.
- Requirements of International Fire Code (IFC), National Electrical Code (NEC) and NFPA 855
- To protect safety, prevent shock, and personal injury

Safety Standards:

9540A – Standard Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems

- This is tested at the cell, module, and unit level to evaluate thermal propagation from one area to another.

NFPA 855 – Standard for the Installation of Stationary Energy Storage Systems

- This is how the site is designed to fire code, involving proper setbacks to further prevent propagation, and to give plenty of safety setbacks

NFPA 69– Standard on Explosion Prevention Systems

- This is how Sungrow utilizes hydrogen sensors in conjunction with active ventilation to purge any buildup of hydrogen and prevent any risk of explosion. Typically designed in conjunction with site controller Uninterrupted Power Supply and small generator, so the active purge is not reliant on grid power.

NFPA 72– National Fire Alarm and Signaling Code

- This is how the site is designed with the fire alarm system, with a fire alarm control panel outside of the gate so first responders have information to work with. It also is related to the separate power system mentioned in NFPA 69.

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UTILITY SCALE BESS YARD SITE LAYOUT

INCLUDE IN YOUR BESS SUBMISSION TO FIRE AUTHORITIES:

- Site layout =
  - Incident Command Post location and access considerations
  - Fire water tank size and location
  - Auxiliary backup power design and location (power is for louvers, exhaust fans and HVAC environmental control systems)
  - Refueling considerations for auxiliary backup power system
  - Proper enclosure spacing based on large scale burn test results

BESS Incident Lessons Learned

- Battery fires can occur from thermal abuse during charging or discharging, mechanical failures, or environmental influences like water intrusion. However, between 2018 and 2023, the BESS failure rate (incidents per gigawatt installed) fell by 97% largely due to current rigorous codes and improvements in manufacturing.

- In the instance of an incident occurring that results in a fire, the industry best practices advise to monitor adjacent exposures and to let the involved unit consume itself safely. This approach addresses concerns with stranded energy and additionally, the heat from the fire safely consumes many toxics produced.

BESS Incident Lessons Learned (cont.)

- Current code direction is to not include suppression systems within the containers and that water should be used only to cool adjacent exposures. The fire safety emphasis is on early gas or smoke detection with integrated exhaust system activation.

- All fire alarm devices are monitored at a UL Central Station 24/7 per NFPA 72. The monitoring station would then contact fire dispatch on any detector activation.

BESS Incident Lessons Learned (cont.)

- Arriving first in emergency responders would look for site contact information at the entrance and make direct contact with a site representative prior to taking any action.

- Site representatives can provide valuable diagnostic information on the involved enclosure and adjacent enclosures' battery status.

- Sites have the ability to remotely disconnect the BESS site from the grid to ensure optimum life safety.

BESS Incident Lessons Learned (cont.)

- A multi-agency command post can be established once the site representative arrives and makes a face to face with emergency response personnel.

- The Large-Scale Fire Test that is required by code for the battery technology demonstrates that a fire located in the unit under test will not propagate to adjacent enclosures. This creates a finite fire area of involvement and gives first responders valuable insight on how best to manage the incident.

Ongoing Testing & Maintenance Schedules For Annual Operational Permit Approval

HOW TO STAY IN GOOD STANDING WITH LOCAL STAKEHOLDERS

- The long-term relationship for these projects is between the BESS operators and the local Fire Department.

- Fire Authorities will likely require documentation of maintenance reports as part of the operational permit approval.

ONGOING TESTING AND MAINTENANCE SCHEDULES FOR ANNUAL OPERATIONAL PERMIT APPROVAL (CONT.):

- The California Public Utility Commission has recently included BESS operators in SB38 and General Order 167-C regulations.
  - The regulations specified in GO 167-C require documentation to be collected and submitted by BESS operators regarding ongoing fire system testing and maintenance.

- The intervals for testing and maintenance are still found in the fire code for most fire safety systems components.
  - However, issues like louver maintenance, exhaust CFM output levels and filter changes are not clearly specified and reference using manufacturer's suggested intervals.
  - Due to extreme environmental exposures for fire safety systems, these manufacturers' suggested maintenance intervals may be inadequate and more frequent service schedule intervals should be initiated.

ONGOING TESTING AND MAINTENANCE SCHEDULES FOR ANNUAL OPERATIONAL PERMIT APPROVAL (CONT.):

- Ensure all fire alarm initiation and notification devices are tested per fire code mandated intervals.

- Ensure fire pumps are serviced and maintained per manufacturer's and fire code requirements.

- Ensure all concentration reduction system components (Exhaust fans, louvers and air filters) are maintained and tested to ensure operational readiness.

Ongoing Multi-Agency Incident Response Training

ONGOING MULTI-AGENCY INCIDENT RESPONSE TRAINING (CONT.):

- Ongoing training is required to ensure that as new types of technologies are added in different phases of the BESS compound, that all first responders and BESS operations staff stay aligned on incident expectations.

- Ensure that contact lists for operations staff are updated and sent to the local Fire Department at least semi-annually.

- Ensure site staff are trained on incident reporting procedures and are prepared to engage with first responders to provide critical information on the nature and location of the emergency incident.

ONGOING MULTI-AGENCY INCIDENT RESPONSE TRAINING (CONT.):

- Conduct an annual tabletop multi-agency drill with local Fire Department and operations staff to ensure emergency response procedures are current and incident expectations are communicated.

- Consider requiring operations staff to train using the Incident Command System for emergency response coordination. This ensures that common terminology is used by site personnel and first responders. It also provides a reliable organizational structure that will facilitate safe and timely incident mitigation.

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THANK YOU

We are always available for your questions.

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