

DOE EAC Facilitating a Transforming Grid Storage Panel

Battery Energy Storage System Fire Safety

6/7/2023

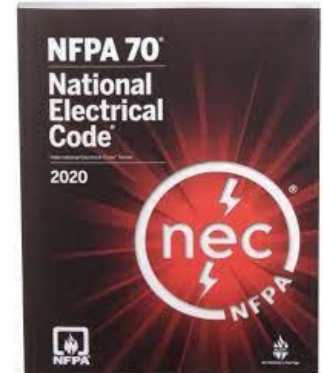
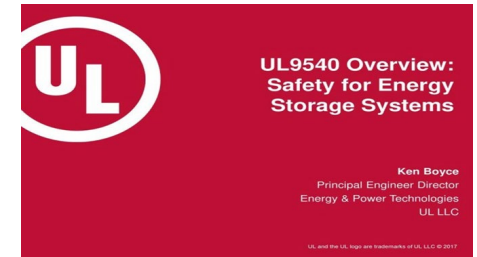


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Is the fire problem with batteries and other energy storage safety concerns being addressed and what do you think DOE can best do to ensure safer deployment moving forward?

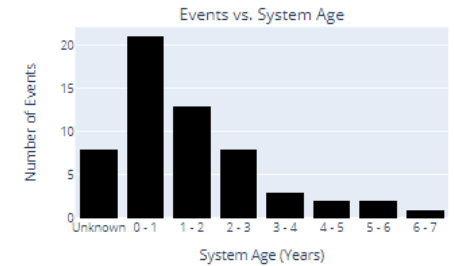
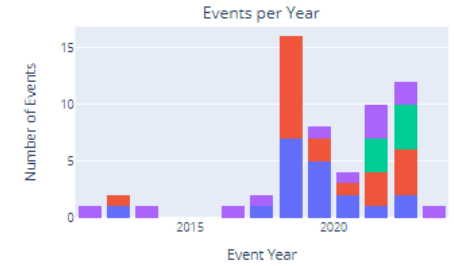
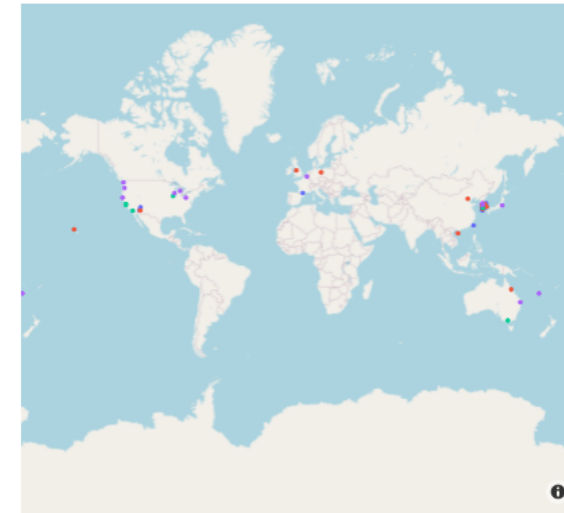
- Yes – The problem is being addressed by many parties
 - Codes and Standards Teams
 - International Fire Code 2021
 - National Fire Prevention Association 70 and 855
 - Underwriters Lab 9540 and 9540A
 - National Electric Safety Code C2
 - AHJ's
 - Industry Groups
 - EEI
 - EPRI
 - IEEE
 - Manufacturers
 - Burn testing moving to complete energy storage units
 - Utilities
 - Implementing standards and best practices
- DOE impact
 - Work with states to adopt the most current codes
 - Ensure product shipped into the US meets these standards



EPRI BESS Failure Event Database

- [BESS Failure Event Database - EPRI Storage Wiki](#)

System Size ■ < 5MWh ■ 5 - 50 MWh ■ 50 MWh < ■ Unknown



BESS Failure Event Database

This is a public resource for documenting publicly-available data on battery energy storage failure events from around the world. All information included is available in the linked public documents. If there is a public event that is not included in the BESS Fire Event Database, please email the relevant information and link to supporting info to our [Storage Safety email](#).

If you would like to be notified when a new event is added to this database or are interested in other EPRI energy storage safety research resources and opportunities please reach out to our [Storage Safety email](#).

Stationary Energy Storage Failure Events

This table tracks utility and C&I scale energy storage failure events with publicly available information.

Note: Missing values in this table reflect unknowns.

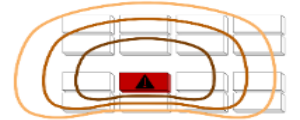
Show entries

Search: Export ▾

Location	Energy (MWh)	Power (MW)	Module Type	Application	Installation	Event Date	System Age (yr)	State During Accident	Source
US, PA, Millvale			SimpliPhi Power (LFP)	Solar Integration	Urban	30 January 2023		Operational	WTAET
South Korea, Jeollanam-do, Yeongam-gun, Geumjeong-myeon	251			Solar Integration	Rural	27 December 2022	1.8	Operational	E2News.com
South Korea, Jeollanam-do, Damyang-gun, Mujeong-myeon, Deokgok-ri	9.1	2.5	Samsung SDI	Solar Integration	Rural	8 December 2022	5.5	Operational	E2News.com
China, Hainan	50	25	Ruipu	Solar Integration		20 October 2022	0	Commissioning	china5e.com
US, CA, Moss Landing	730	182.5	Tesla	Energy Shifting, Ancillary Services	Substation	20 September 2022	0.5	Operational	KSBW News
South Korea, Incheon		103		Energy Shifting	Factory	6 September 2022		Operational	Teller Report
US, CA, Rio Dell			Lead Acid	Solar Integration / Backup	Rural	3 August 2022	4	Operational	KRCR
US, AZ, Chandler	40	10	LG Chem [NMC]		Substation	18 April 2022	3	Operational	AZ Central
US, CA, Valley Center	560	140	LG Energy Solution		Substation	5 April 2022	0.2	Operational	Valley Road Runner
Longjing, Taichung City, Taiwan	1	1		Solar Integration	Power Plant	30 March 2022	2	Operational	Economic Daily

Showing 1 to 10 of 50 entries

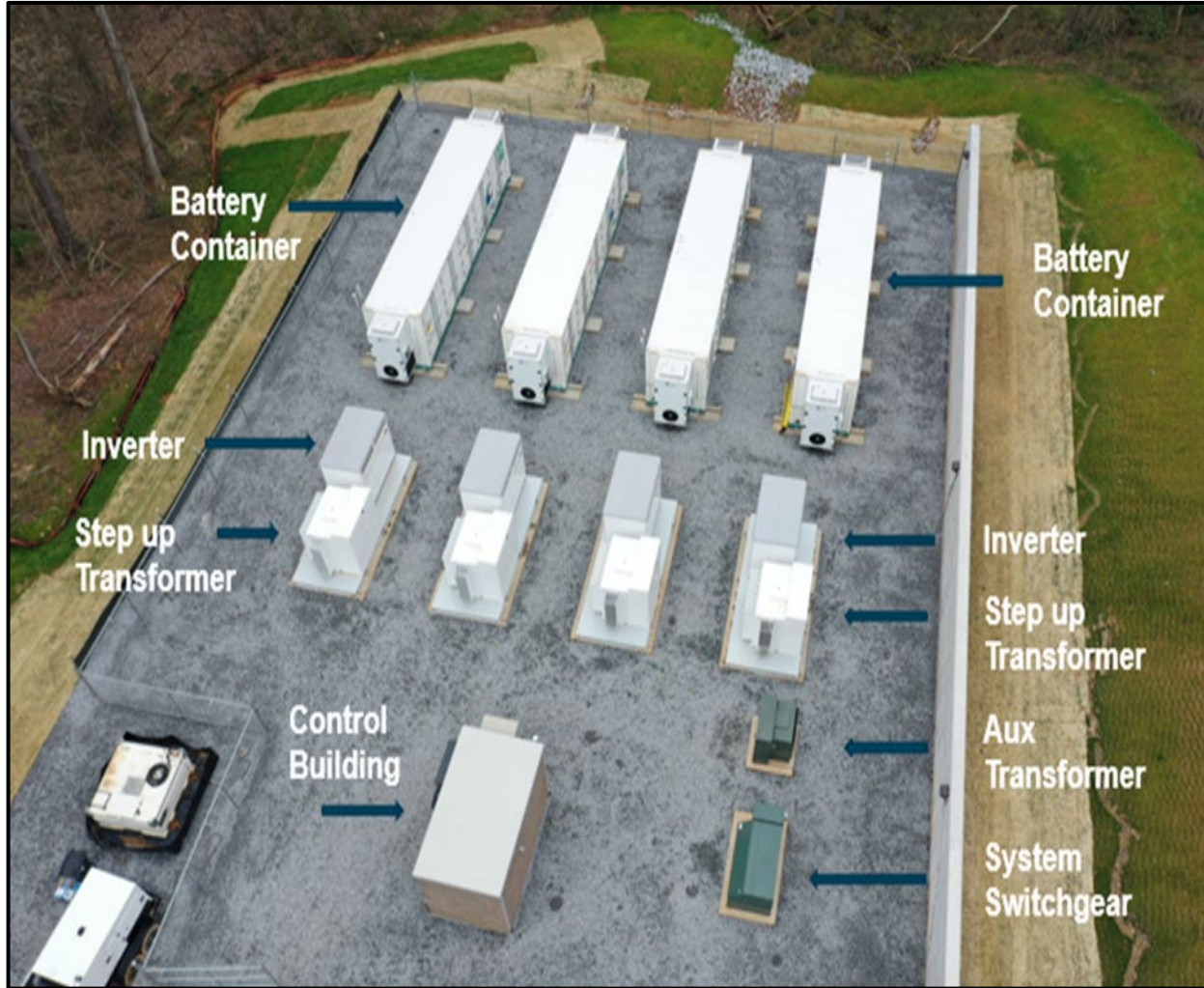
Previous 1 2 3 4 5 Next



Hazards of Li-ion Batteries

- A malfunction takes place – Overheating, overcharging or short circuit
- Off-Gas Generation – Damaged cell relieves pressure venting hydrogen, carbon monoxide, carbon dioxide and other hydrocarbons
- Thermal Runaway – Chemical reactions or shorts inside the battery that continue until there are no reactive agents left
 - Once the cell goes into thermal runaway, there is no way to stop the reaction. Also, fire re-ignition is possible
- Explosion Risk – Even if thermal runaway is avoided, the enclosure could contain high amounts of hydrogen

Typical BESS Site Layout



Warning Strobes



Fire Suppression



Gas Detection



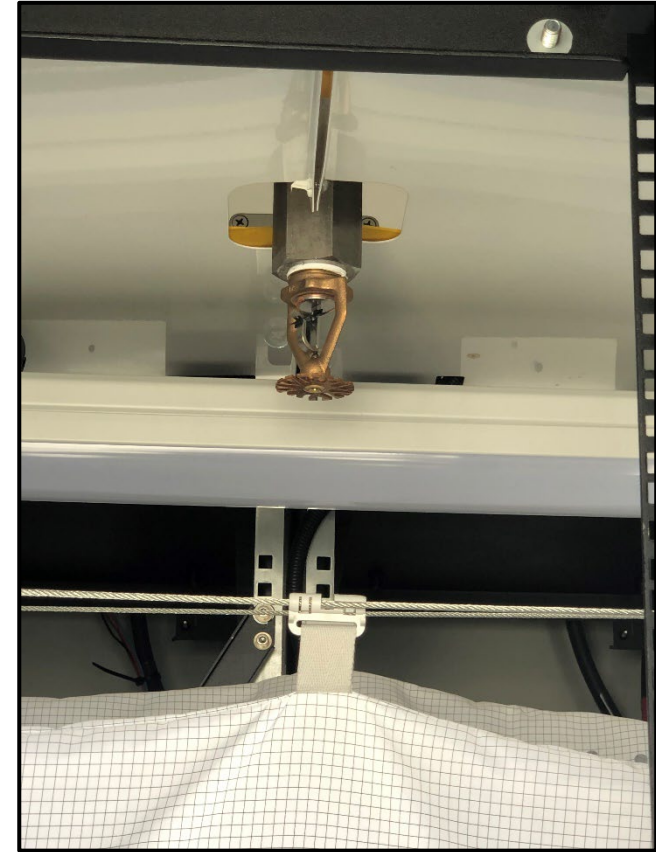
Gas Ventilation



Deflagration Panels



Container Flooding



Site Safety Systems

- Site Fencing
 - 1 psi maximum at fence line based on blast analysis
- First Responders Station
 - Exterior strobes
 - Main fire alarm panel
 - Fire suppression pull station
 - Emergency stop pushbutton
 - Dry pipe hook-ups for container flooding



First Responder Station



First Responders



Safety Brochure given to all first responders



911 message in CAD to provide first responders a warning they are responding to a BESS site

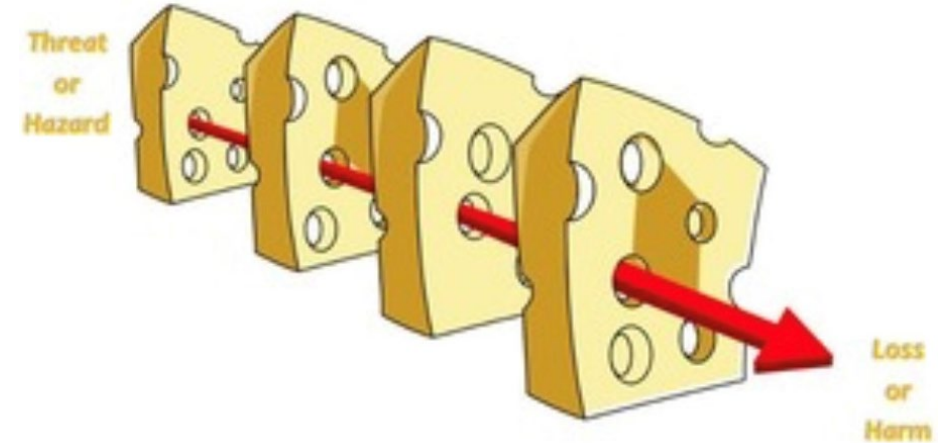


In-depth on-site training with the local fire departments who respond to our site

Container Safety Systems

All battery containers and cabinets have the following:

- Exterior strobes and audible alarms
- Fire alarm control panel
- Smoke and thermal detectors
- Fire suppression system (dry chemical)
- Gas detection system
- Gas ventilation activated by high gas alarm
- Deflagration panels to direct any blast upward
- Container flooding system



Large Scale Fire Testing



Photo used with permission from Hiller

Large Scale Fire Testing



Photos used with permission from Hiller



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