

Battery Energy Storage for Code Officials

Fire Code Considerations for Battery Energy Storage Systems

06/18/2026



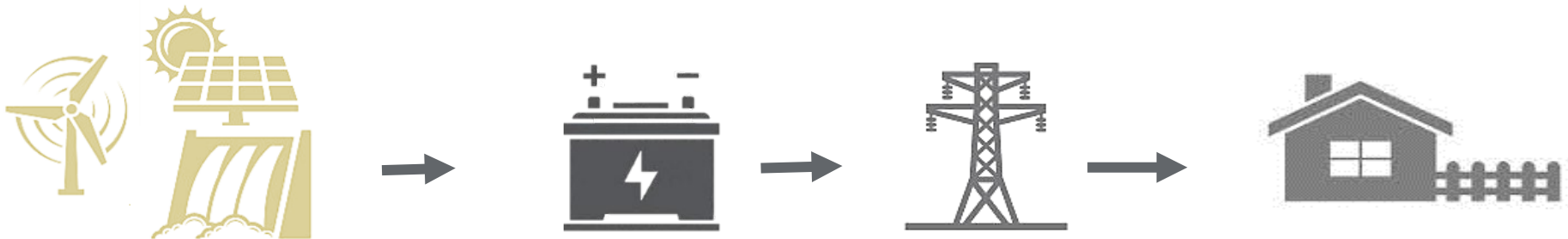
NYSERDA
New York State Energy Research
and Development Authority

Battery Energy Storage Overview

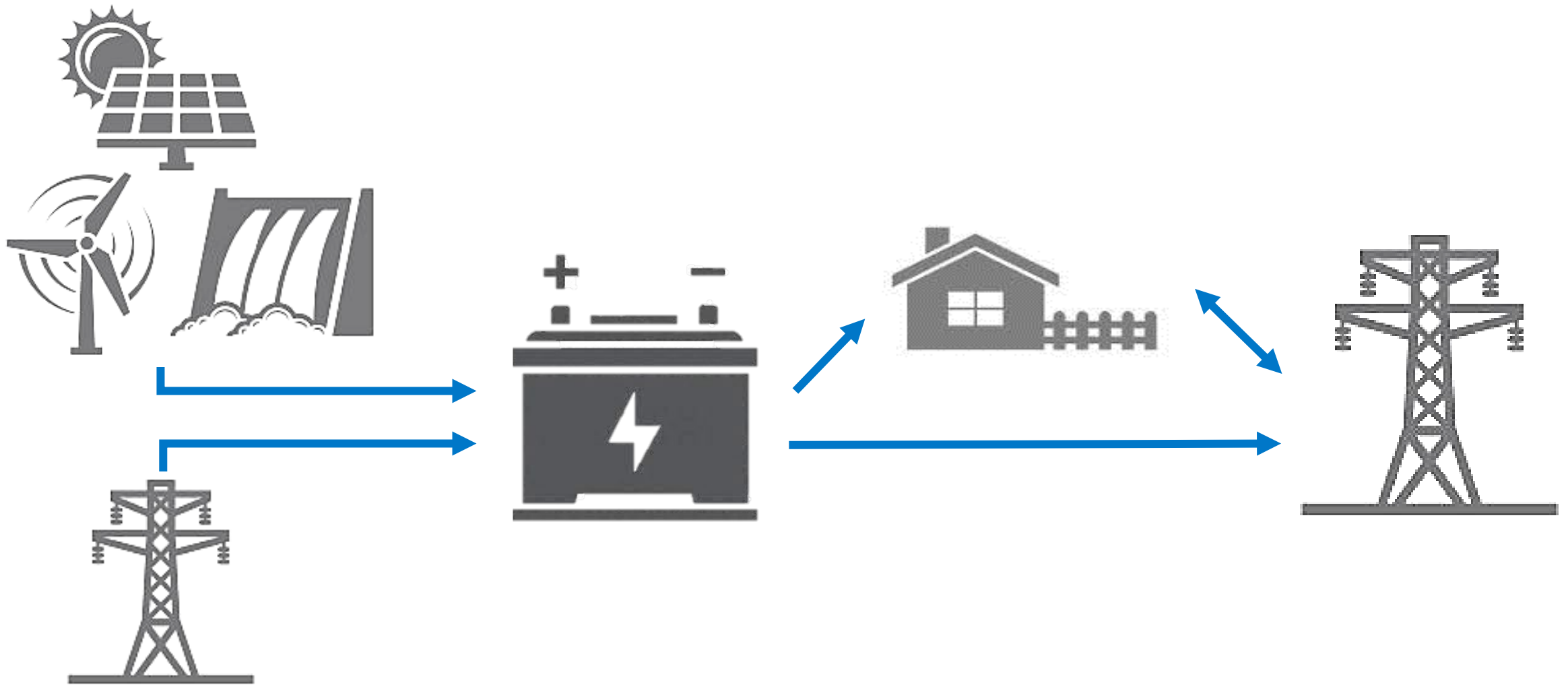
Energy storage acts like a giant battery for the electric grid. It can store extra electricity on sunny days when solar panels are producing more power than we need. Then, it releases that stored energy when we need it most, such as during the evening or on hot days when everyone's using air conditioning.

This helps the grid in two significant ways:

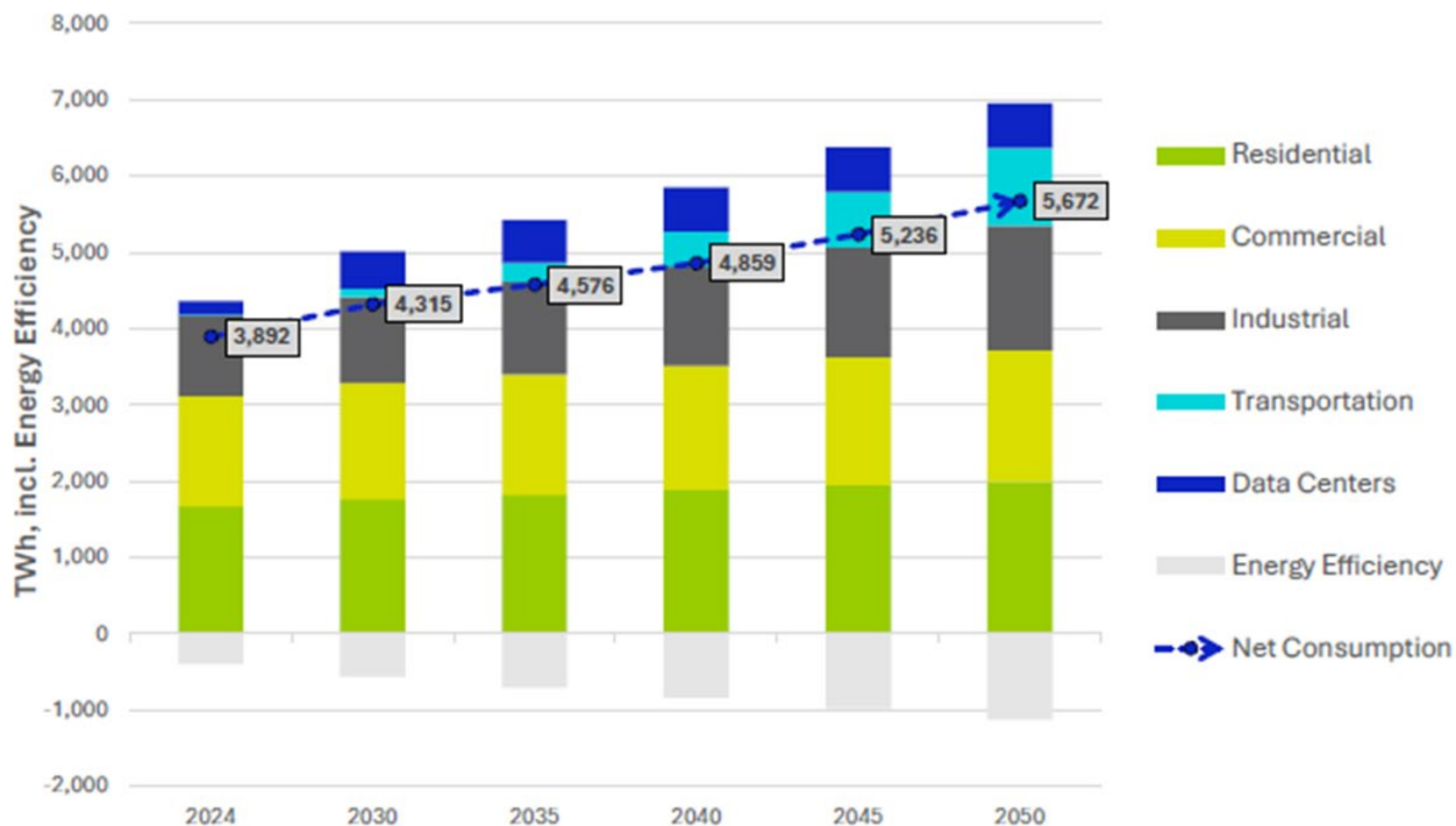
- **Making it more resilient:** If something goes wrong, like a storm knocking out power lines, energy storage can step in to supply electricity, keeping the lights on and essential services running until the problem is fixed.
- **Saving money:** Storage helps avoid the need to turn on expensive power plants only used during peak demand times. By smoothing out supply and demand, it reduces costs for everyone.

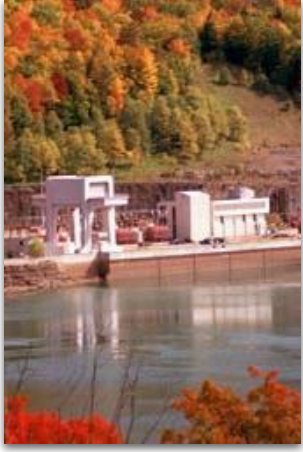


INTRODUCTION TO BATTERY ENERGY STORAGE



U.S. Net Electricity Consumption Projections by Sector





Pumped Hydroelectric



Mechanical

- Compressed Air Energy Storage
- Flywheel



Chemical (Hydrogen)

- Power-to-Power (Fuel Cells, etc.)
- Power-to-Gas



Electrochemical

- Lead acid, Lithium Ion, Sodium Sulfur, Sodium Nickel Chloride
- Flow batteries – Vanadium redox, Zinc-bromine



Thermal

- Sensible – Molten Salt, Chilled Water
- Latent – ice storage, phase change materials
- Thermochemical storage

ELECTROCHEMICAL BATTERY TYPES

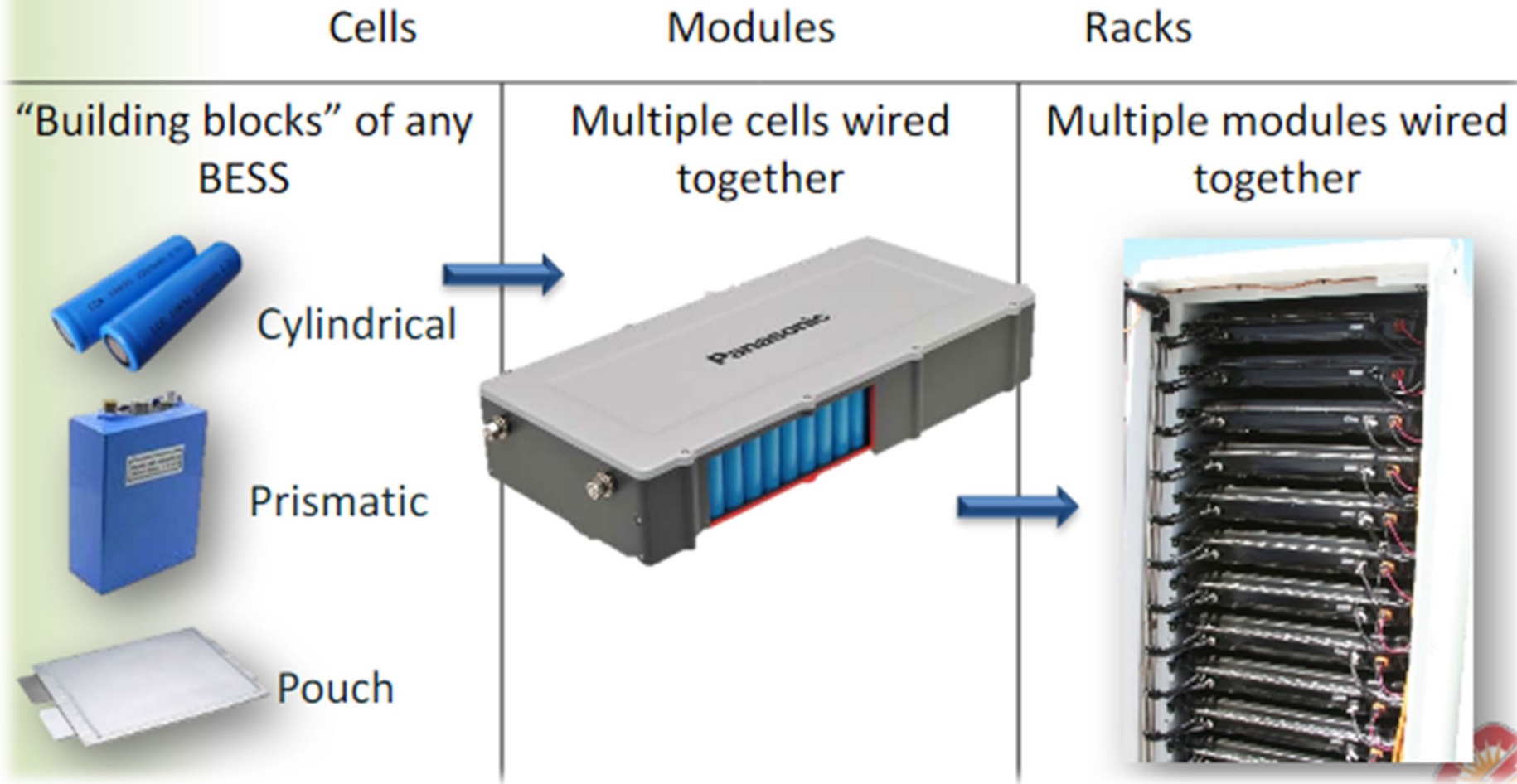
	Lead Acid	Sodium-Sulfur	Flow Batteries	Lithium-Ion
Round-trip efficiency	70-85%	70-80%	60-80%	85-95%
Typical duration	2-6 hours	6-8 hours	4-12 hours	0.25-4 hours
Time to build	6-12 months	6-18 months	6-12 months	6-12 months
Operating cost	High	Moderate	Moderate	Low
Space required	Large	Moderate	Moderate	Small
Cycle life	500-2,000	3,000-5,000	5,000-8,000+	2,000-6,000+
Technology maturity	Mature	Commercial	Early-moderate	Commercial

Why are lithium-ion BESS dominating current market?

- a) high energy density**
- b) declining costs**
- c) high round-trip efficiency**
- d) all of the above**



Batteries



“The Role of Storage and DER for California, Solar + Storage for Resiliency.”
Angelina Galiteva, Founder
Renewables 100 Policy
Institute, November 2017.

Monitors each individual cell within the system

Will alarm if there are potential issues

If required, can isolate affected cells or modules from the total system



Utilities



Grid Operators



Commercial Consumers



Residential Consumers



Increase renewable integration



Balance electricity supply and demand



Keep critical equipment online during power disruptions



Reliable backup power during severe weather and other blackouts



Reduce dependence on fossil-fuel peaker plants



Improve power quality and reliability



Reduce utility bills and generate revenue



Reduce utility bills and generate revenue



Reduce operating expenses



Avoid costly system upgrades

Energy storage technologies have the capacity to benefit each segment of the power system.

Battery Failure Sequences/Diagnosis

Hazards Associated with Lithium-ion BESS:

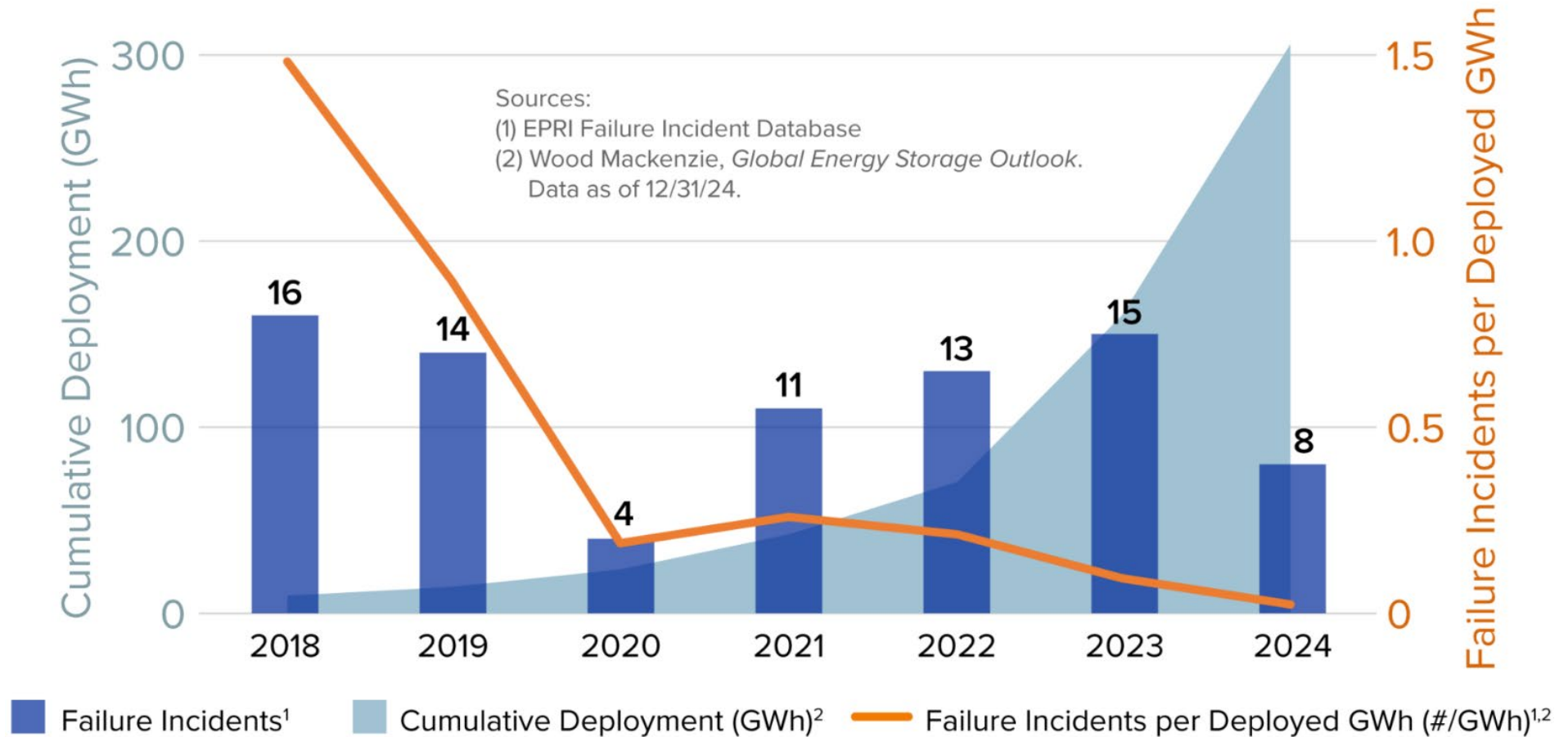
- Thermal runaway, fire, re-ignition, stranded energy
- Deflagration
- Electrical risks
- Smoke and gas release

Failure Modes for Lithium-ion BESS:

- Thermal abuse (overheating, external heating)
- Electric abuse (over-charging, over-discharging)
- Mechanical abuse (impact, puncture, crushing)
- Factory defects (dendrites, etc.)
- Component failure (any protection system)



Global Grid-Scale Storage Deployment and Failure Statistics



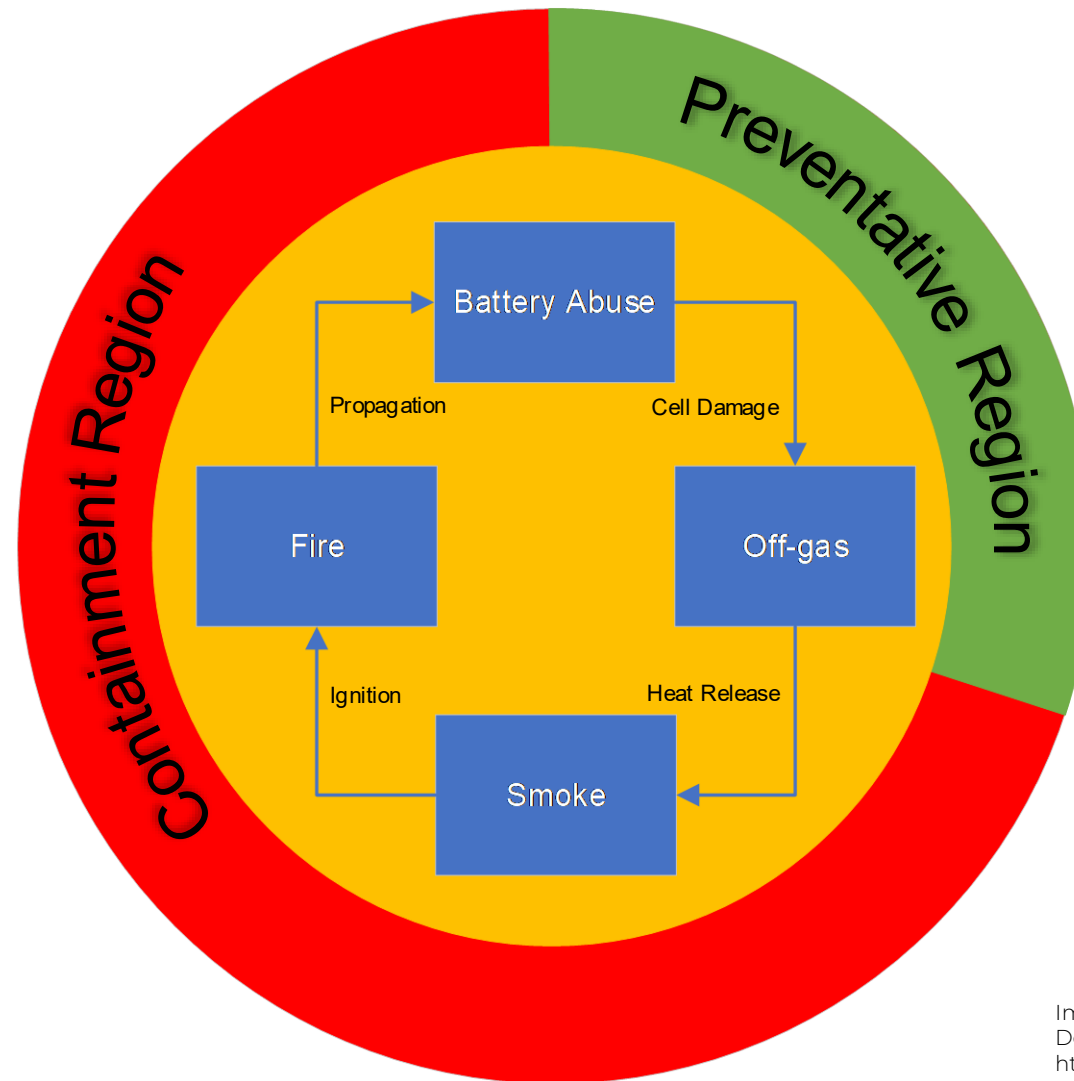


Image adapted from: "Compliance Requirements and Fault Detection." Steve Cummings, Nexceris, LLC, June 28, 2018 - http://energystorage.org/system/files/resources/nfpa_webinar_combined_slides_v5.pdf

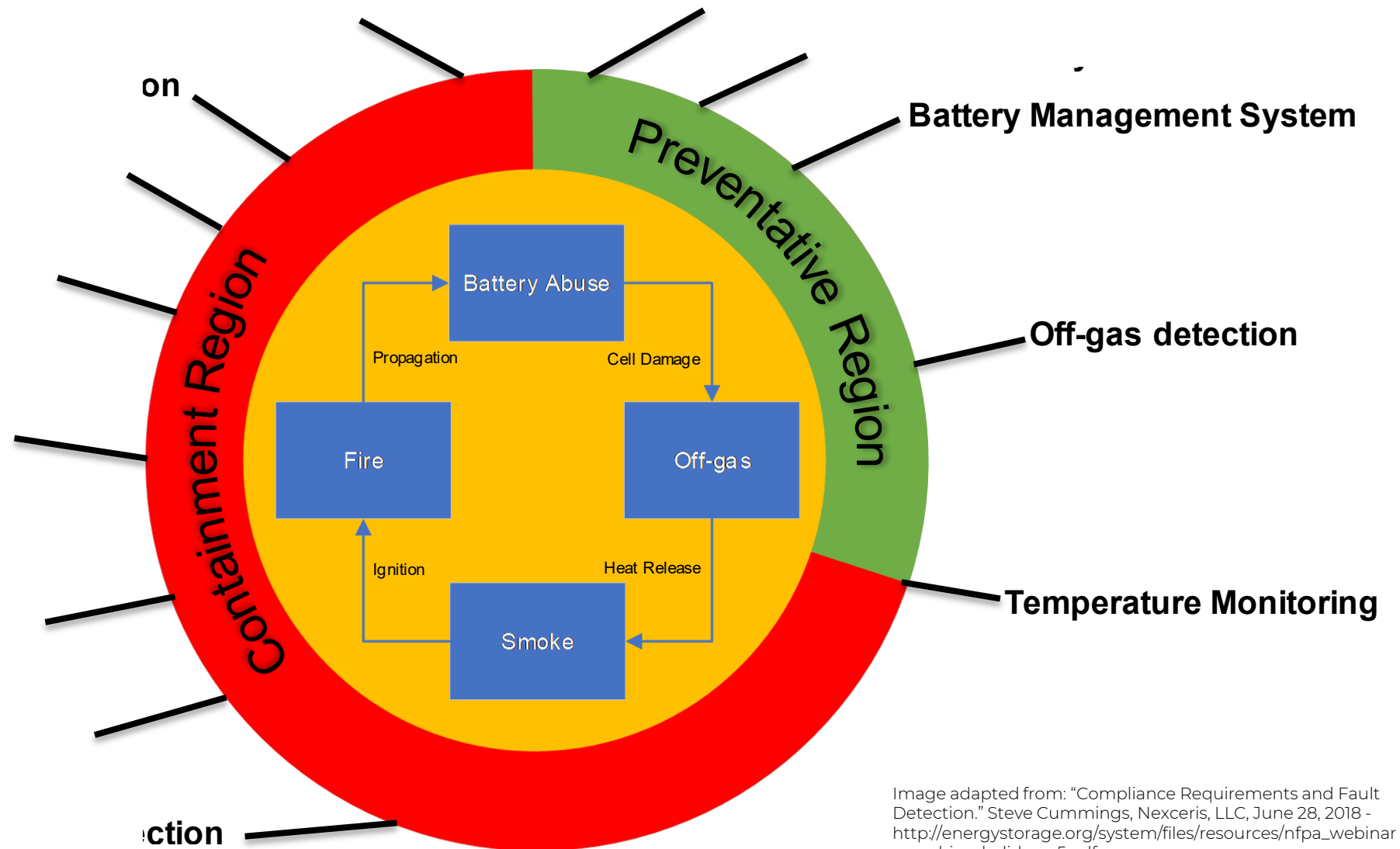


Image adapted from: "Compliance Requirements and Fault Detection." Steve Cummings, Nexceris, LLC, June 28, 2018 - http://energystorage.org/system/files/resources/nfpa_webinar_combined_slides_v5.pdf

Code Evolution for BESS in New York State

Evolution of ESS Codes and Standards:

2016: Underwriters Laboratory (UL) publishes 1st ed. of UL 9540 (technology listing standard)

2017: UL publishes 1st ed. of UL 9540A (technology testing method)

2018: International Code Council (ICC) introduces Chapter 12, Energy Storage Systems to International Fire Code (IFC)

2019:

- National Fire Protection Association (NFPA) releases NFPA 855
- UL publishes 4th ed. of UL 9540A
- ICC introduces draft 2021 IFC & IRC

2023: NFPA issues updated NFPA 855

2024: ICC issues updated IFC



2019 Energy Storage Supplement amended New York State's Uniform Code, effective July 1, 2019

New York 2020 Fire Code were based on 2018 International Fire Code (IFC)

Fully implemented in the 2020 NYS Uniform Code, effective May 12, 2020

March 2025 - Issuance of final Fire Safety Working Group (FSWG) Fire Code Recommendations for NYS Uniform Code.

On July 2025, the Code Council adopted the FSWG's recommendations for the 2025 NYS Fire Code effective Dec 31st, 2025.

Applicable without the need for adoption at the local level

Proposed Draft Fire Code Updates

1. Require independent peer reviews for all projects
2. Expand the requirement for explosion control to include BESS cabinets
3. Require qualified personnel are available for dispatch within 15 minutes and able to arrive on scene within four hours
4. Extend safety signage requirements beyond BESS unit itself: perimeter fences / security barriers and include a map of site, BESS enclosures, and associated equipment
5. Ensure that Battery Management System (BMS) data is monitored by 24/7 staffed Network Operations Center (NOC). Critical failure notifications should be immediately communicated.
6. Incorporate requirements for closed-circuit television (CCTV) systems, for continuous monitoring and a post-event analysis
7. Remove the Fire Code exemption for BESS projects owned or operated by electrical utilities to ensure that all projects comply with the Fire Code

Proposed Fire Code Additions

1. Fire Code mandating special inspections for BESS installations to ensure thorough safety and compliance
2. Include “cabinets” in all Fire Code requirements that pertain to rooms, areas, or walk-in units, except for fire suppression requirements, as they may be inappropriate for cabinets
3. Require monitoring of fire detection systems by a central station service alarm system to ensure timely, proper notification to the local fire department
4. Include requirement for an Emergency Response Plan (ERP) and annual local first responder training

The Problem

Local AHJs need better support to properly review energy storage projects.

What Has Been Done

Peer reviews are thorough design reviews to ensure code compliance and they are now a requirement for all NYSERDA-funded projects.

Three nationally renowned expert firms are contracted to conduct peer reviews on behalf of NYSERDA.

- **Camelot Energy Group** – Seasoned renewable industry engineering professionals with deep energy storage experience.
- **DNV** – Energy storage fire safety experts who perform peer reviews on behalf of NYC Dept. of Buildings and others.
- **ESRG** – Energy storage fire safety experts consisting of former first responders and engineers.

Process and Result

- Peer reviewers looking for compliance with FCNYS, NEC, and other applicable standards.
- Peer reviewers will work on project plans with applicant until approved and then produce a report and approval letter for applicant to pass on to the local government.



Special Expert Qualifications

Licensed in the NY State as P.E.

OR

Special Expert

- Accredited by specific education and/or experience with BESS
- Demonstrated technical knowledge and experience in design and operations of BESS



Documents to be reviewed by the Peer Reviewer:

- Site Plan
- Emergency Operations Plan
- UL 9540A Report
- Hazard Mitigation Analysis
- Manufacturer Specs
- UL Listings/NFPA Standards
- Electrical Drawings
- Explosion Control Verification
- Monitoring Procedures
- Alarm Verification Criteria
- Fire Protection System

Who can perform Peer Review for BESS?

- a) Town Supervisor
- b) Fire Department Chief
- c) Qualified Special Expert
- d) Landowner

2025 Fire Code of NYS

Section 1207 Electrical Energy Storage Systems

Scope - Battery energy storage systems that exceed the following thresholds:

Technology	Energy Capacity ^a
Capacitor ESS	3 kWh
Flow batteries ^b	20 kWh
Lead-acid batteries, all types	70 kWh ^c
Lithium-ion batteries	20 kWh
Nickel-cadmium batteries (Ni-Cd), nickel metal hydride (Ni-MH) and nickel zinc (Ni-Zn) batteries	70 kWh
Nonelectrochemical ESS ^d	70 kWh
Other battery technologies	10 kWh
Other electrochemical ESS technologies	3 kWh
Sodium nickel chloride batteries	70 kWh
Zinc manganese dioxide batteries (Zn-MnO ₂)	70 kWh

For SI: 1 kilowatt hour = 3.6 megajoules.

a. Energy capacity is the total energy capable of being stored (nameplate rating), not the usable energy rating. For units rated in amp-hours, kWh shall equal rated voltage times amp-hour rating divided by 1,000.

b. Shall include vanadium, zinc-bromine, polysulfide-bromide and other flowing electrolyte-type technologies.

c. Fifty gallons of lead-acid battery electrolyte shall be considered equivalent to 70 kWh.

d. Covers nonelectrochemical technologies such as flywheel and thermal ESS.

CONSTRUCTION DOCUMENTS

- Location and layout diagram
- Details on the fire-resistance rating of assemblies
- Quantities and types of BESS
- Manufacturer's specifications, ratings and listings
- Description of energy storage management systems and operation
- Location and content of required signage
- Details on fire suppression and detection, thermal management, ventilation, exhaust, and deflagration venting systems
- Support arrangement for installation, including seismic restraint
- Commissioning and Decommissioning plans
- A fire safety and evacuation plan in accordance with Section 404.
- Peer reviewer identification and qualifications



As per 1201.1 - chapter 12 scope including 1207.1.5.1: ESS under the exclusive control of an electric utility or lawfully designated agency plans deemed critical infrastructure shall be reviewed by the Fire Code Official and need an operating permit.

Subject to security and disclosure limitations required by law.

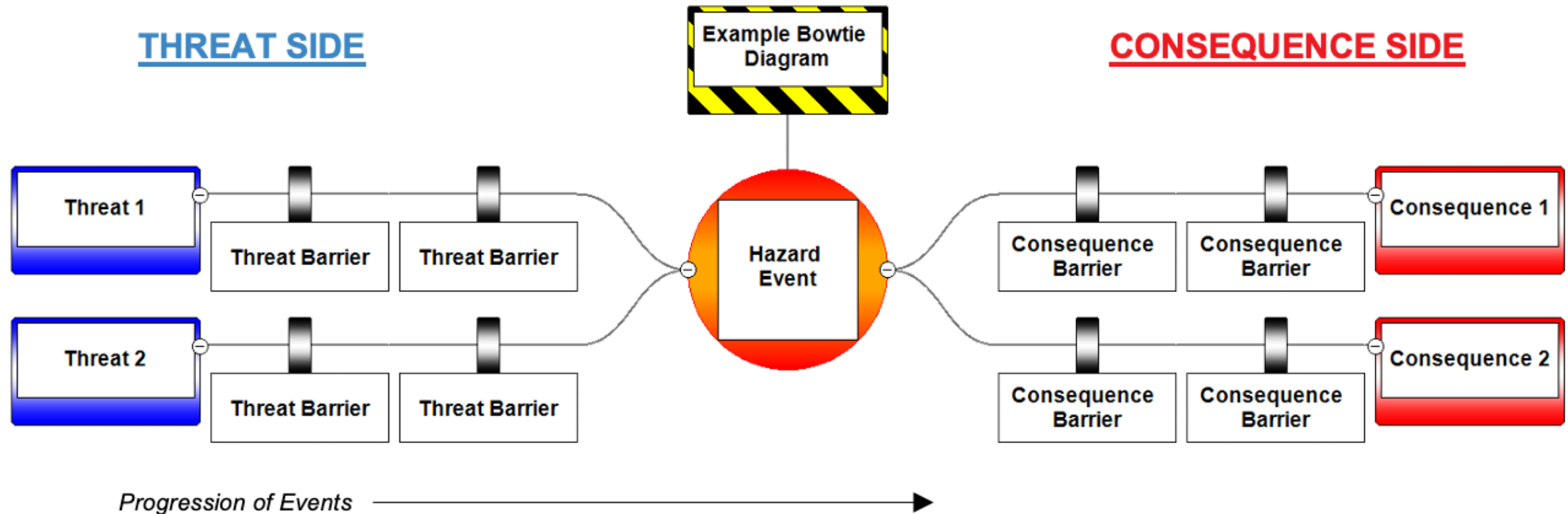
Hazard Mitigation Analysis

HMA will evaluate the consequences of failure modes

1. A thermal runaway condition in a single electrochemical ESS unit.
2. A mechanical failure of a nonelectrochemical ESS unit.
3. Failure of any BMS or fire protection system within the ESS equipment that is not covered by the product listing failure mode effects analysis (FMEA).
4. Failure of any required protection system external to the ESS like ventilation (HVAC), exhaust ventilation, smoke detection, fire detection, gas detection or fire suppression system.

Analysis approval

- Fires will be contained within unoccupied ESS rooms or areas for the minimum duration of the fire-resistance-rated separations identified in Section 1207.7.4.
- Fires involving the ESS will allow occupants or the general public to evacuate to a safe location.



Pre-2020 lithium-ion systems exceeding code thresholds require an FMEA or approved hazard mitigation analysis.

Analysis must evaluate thermal runaway detection, notification, and responder safety.

Identified hazards trigger a corrective action plan with defined improvements and timeline.

LARGE-SCALE FIRE TEST

- Where required, must be conducted in accordance with UL 9540A or approved equivalent
- Demonstrates that fire will not spread to adjacent systems and will be contained for duration of fire-resistance rating of assemblies
- The test report shall be provided to the fire code official for review and approval.
- UL 9540A test is required for UL 9540 equipment listing if received after February 2020.



What is Large-Scale Fire Testing not supposed to demonstrate?

- a) that an energy storage system unit will never catch on fire**
- b) that a fire will not spread to an adjacent energy storage system unit**
- c) that the unit will contain the fire for the duration of the assemblies' fire-resistance rating**

HAZARD SUPPORT

- BESS owner shall mitigate the hazard or remove damaged equipment from the premises.
- BESS owner shall dispatch hazard support personnel within 15 min and arrive to the premise within 4 hrs, to respond to possible ignition or re-ignition of a damaged BESS and remain on duty after the fire department leaves the premise until the damaged BESS equipment is removed from the premises or earlier if the fire code official indicates the public safety hazard has been abated.
- On-duty hazard support personnel responsibilities:
 - Fire watch
 - Notify FD if a fire occurs
 - Maintain until decommissioning is finished
 - Help evacuate building if needed



Have been trained in operations associated with the ESS facility.

Knowledge in Fire safety plan, pre-incident plan, emergency operations plan, HMA.

**Completed all the following classes:
ICS-100; IS-200; IS-700**

COMMISSIONING PLAN

- Outlines commissioning activities to be conducted prior to system being placed in service.
 - Installed according to plan and manufacturer's specs
 - Testing that will take place on all components
 - Training plan for facility and operating staff
 - Identifies personnel responsible for responding to incidents
- Plan must be approved prior to initiating.
- Report approved prior to final inspection.
- Includes a decommissioning plan and operation and maintenance documentation.



DECOMMISSIONING PLAN



- Submitted as part of Commissioning Plan.
- Notify AHJ prior to decommissioning.
- Description of activities to remove system from service and facility:
 - Contingencies for removing intact system from service
 - Contingencies for removing system damaged by fire or another event

Operation and Maintenance Manual

- Provided to owner and system operator prior to system being put into operation.
- Retained at an onsite location.
- Outlines all **required maintenance***, contact information, diagrams, desired set points, and inspection, service, and testing schedules and logs.

* Required maintenance pertains also to site maintenance (keeping site free of combustible materials, vegetation, snow, ice, etc.).

ONGOING INSPECTION AND MONITORING

ESS shall be inspected & tested periodically (according to O&M manual) and records shall be maintained



Photo Credit: NineDot Energy

A third-party inspection must be performed by a registered P.E. or special expert every 3 years or more frequently as decided by the local Fire Code Official.

[NY] 1207.14.1 ESS third party safety inspection.

The ESS third party fire safety inspection shall cover the following:

1. Structural integrity and weather tightness of enclosures.
2. Operation and maintenance of the ESS.
3. Emergency operations plan.
4. Hazard mitigation analysis.
5. Electrical inspection.
6. Explosion control verification.
7. Monitoring procedures and history.
8. Alarm activation criteria and history.
9. System performance concerns.
10. Fire protection system(s) inspection and testing records.
11. Ventilation system.
12. Other items as requested by the *authority having jurisdiction*.

All systems are listed in accordance with UL 9540 “Standard for Energy Storage Systems and Equipment.”

- Except certain lead-acid/ nickel-cadmium systems under exclusive control of communications utilities.

Chargers, inverters, and energy storage management systems are covered as part of UL 9540 listing or listed separately.

- Inverters for utility interactive systems are listed under UL 1741.

Non-identical repairs are considered retrofits, subject to permit application and many of the same requirements as a new system.





Retrofit requires a building permit



All new components in the retrofit must comply with the ESS listing or the updated design criteria in the code.



The altered system must meet the same safety, protection, and performance requirements as a new installation



All repairs must be documented in the service records log.

Monitors and balances within the manufacturer's specifications

- Cell voltages
- Currents
- Temperatures

BMS shall disconnect electrical connections to the BESS or place it in a safe condition if potentially hazardous temperatures or other conditions such as short circuits, over voltages, or under voltages are detected.



If any thresholds are exceeded BMS must notify local FD, AHJ, Hazard Support Personnel and the Manufacturer.

Remote monitoring must automatically send system data as needed and show changes in system status immediately.

Alerts must notify responsible parties of abnormal conditions (local FD, Fire Code Official, hazard support personnel)

Monitoring must track the required ESS safety parameters.



What are the functions of a Battery Energy Storage Management System?

- a) Monitoring cell voltages, currents, & temperature**
- b) Ability to isolate malfunctioning cells**
- c) Ability to notify the system operator if a malfunction occurs**
- d) All of the above**

**Must be of
non-combustible
construction.**

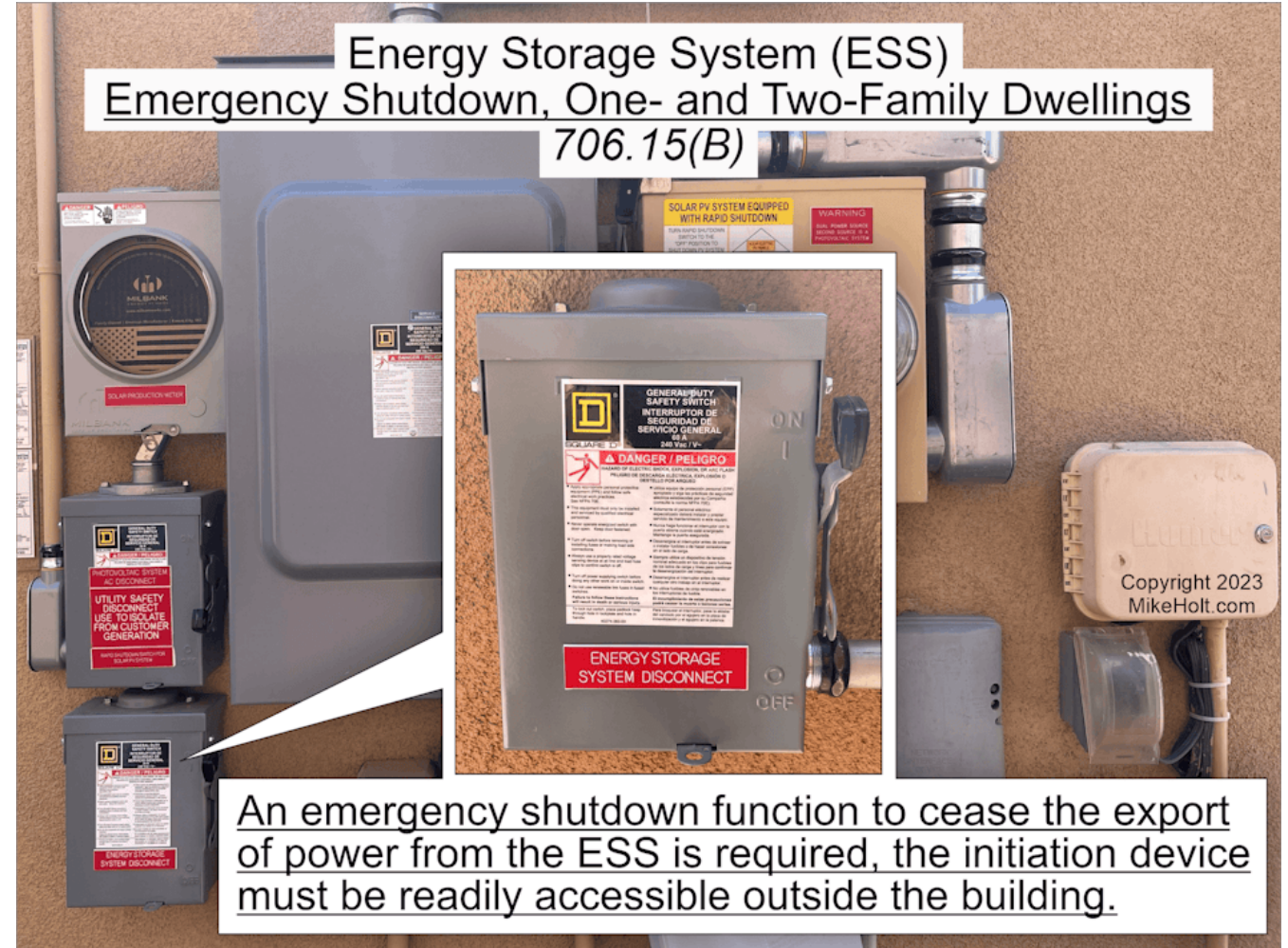


Electrical Disconnects

- Electrical Disconnect should be installed near the main electrical service.
- If not, placards shall be placed at the main electrical service indicating the location of the disconnect.

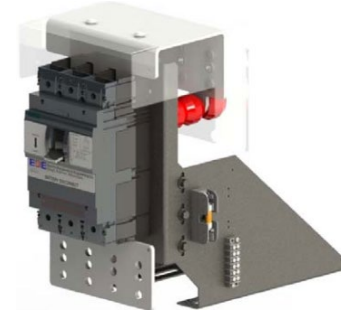


Electrical Disconnects – Residential System Example



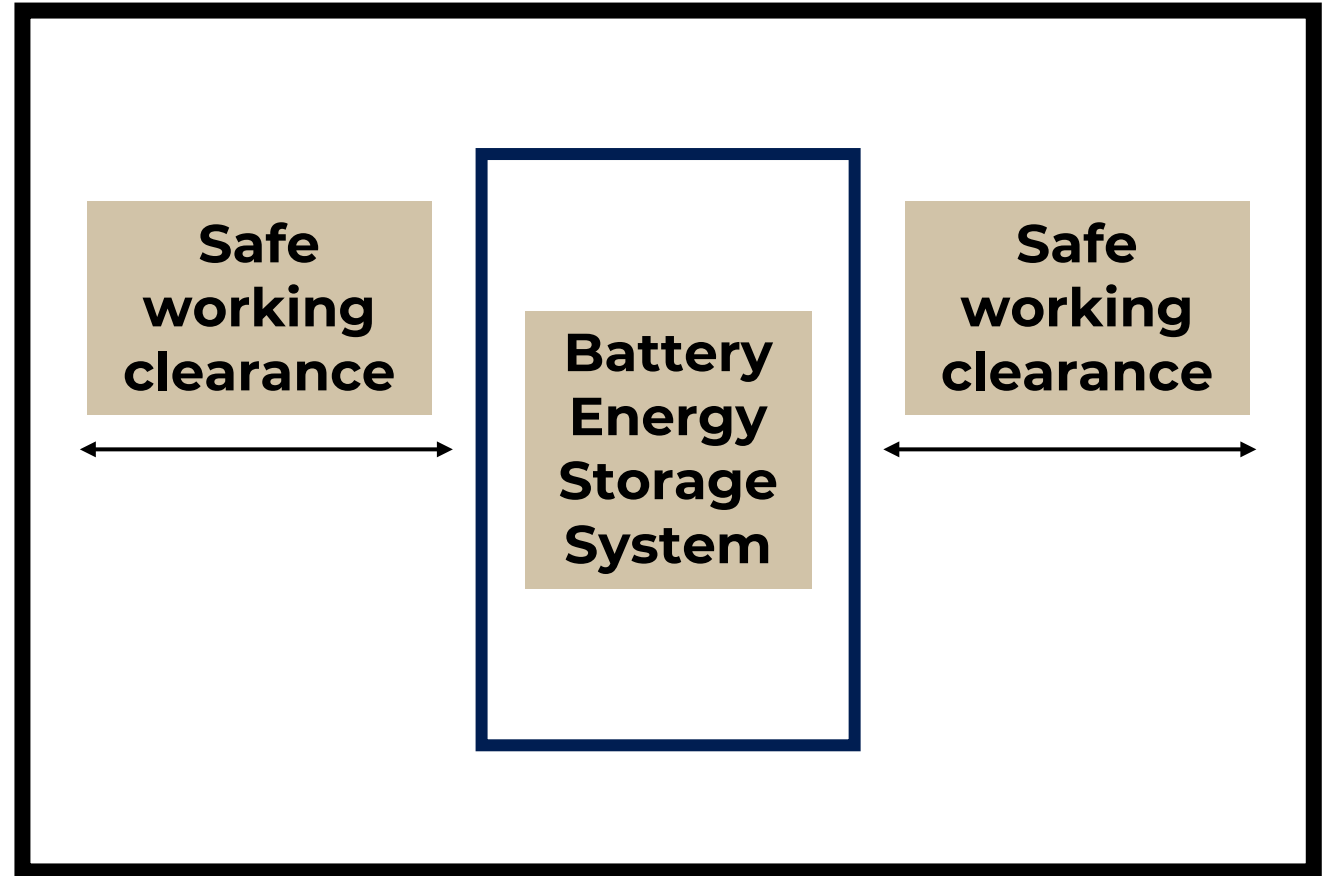
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Working Clearances

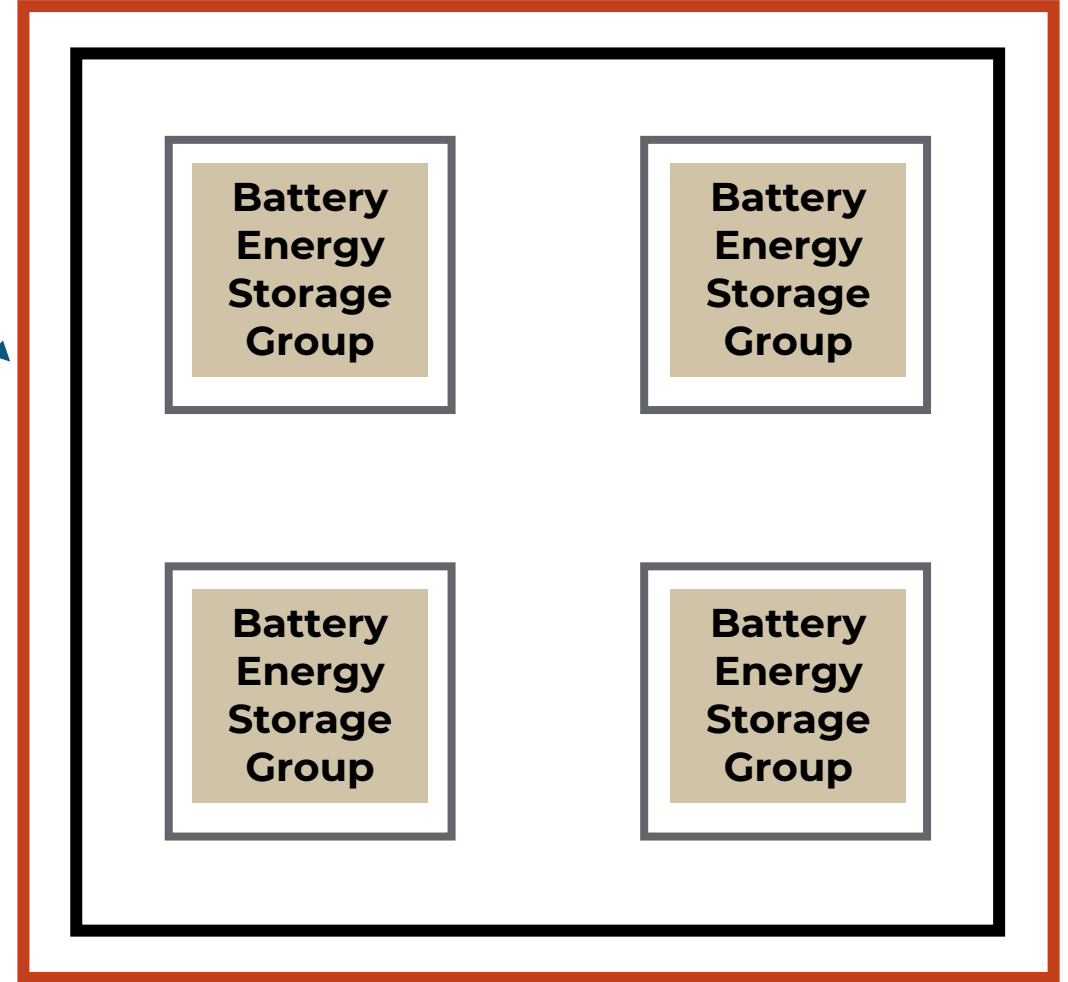
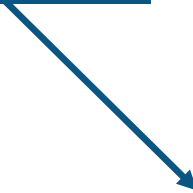
Access and working space clearance should be maintained around electrical equipment to permit ready and safe operation and maintenance of such equipment.



Fire-Resistance Rated Construction

- Rooms and other indoor areas containing BESS shall be separated from other areas of the building.
- BESS shall be permitted to be in the same room with the equipment they support.

Fire-
Resistance
Rated
Separation

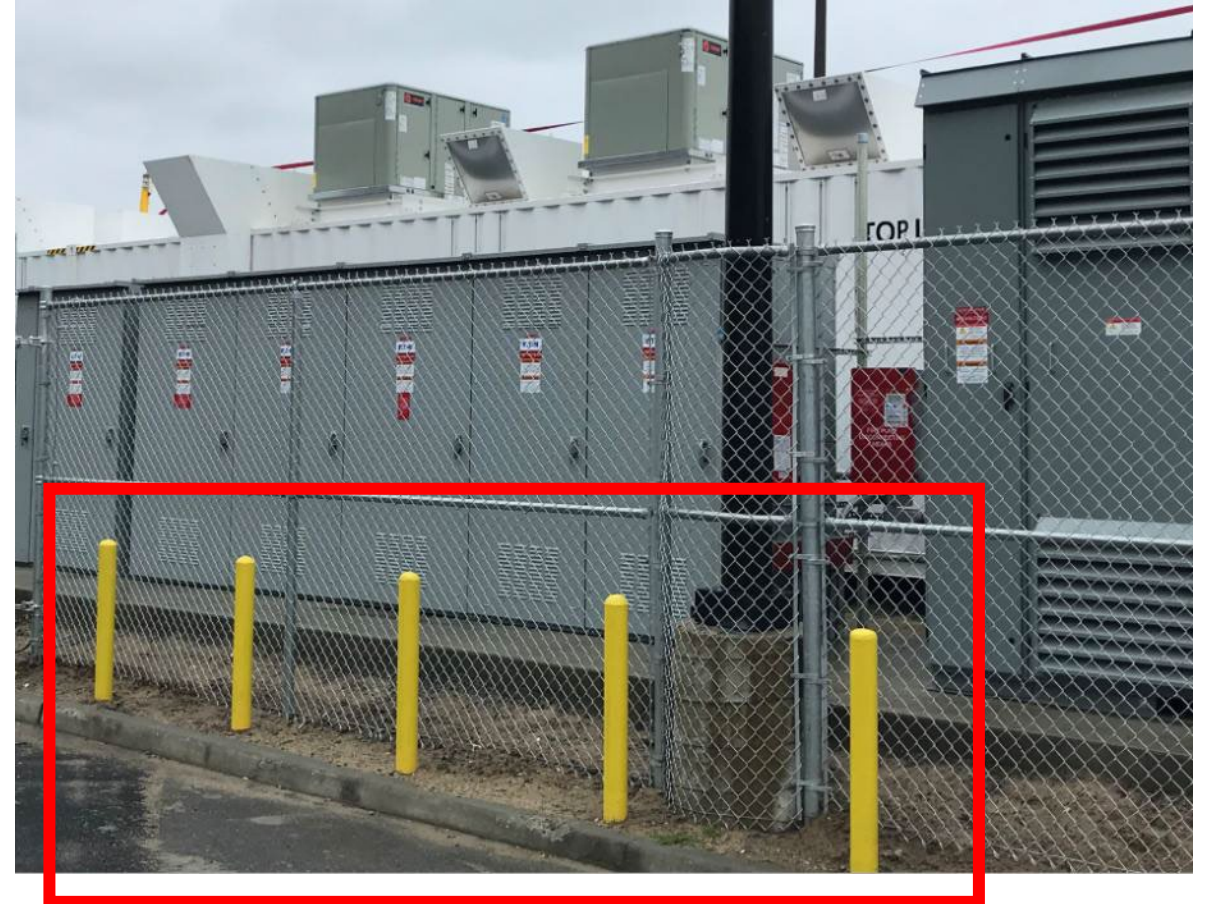


Seismic and Structural Design

BESS shall comply with the seismic design requirements in Chapter 16 of the Building Code of New York State and shall not exceed the floor loading limitation of the building.

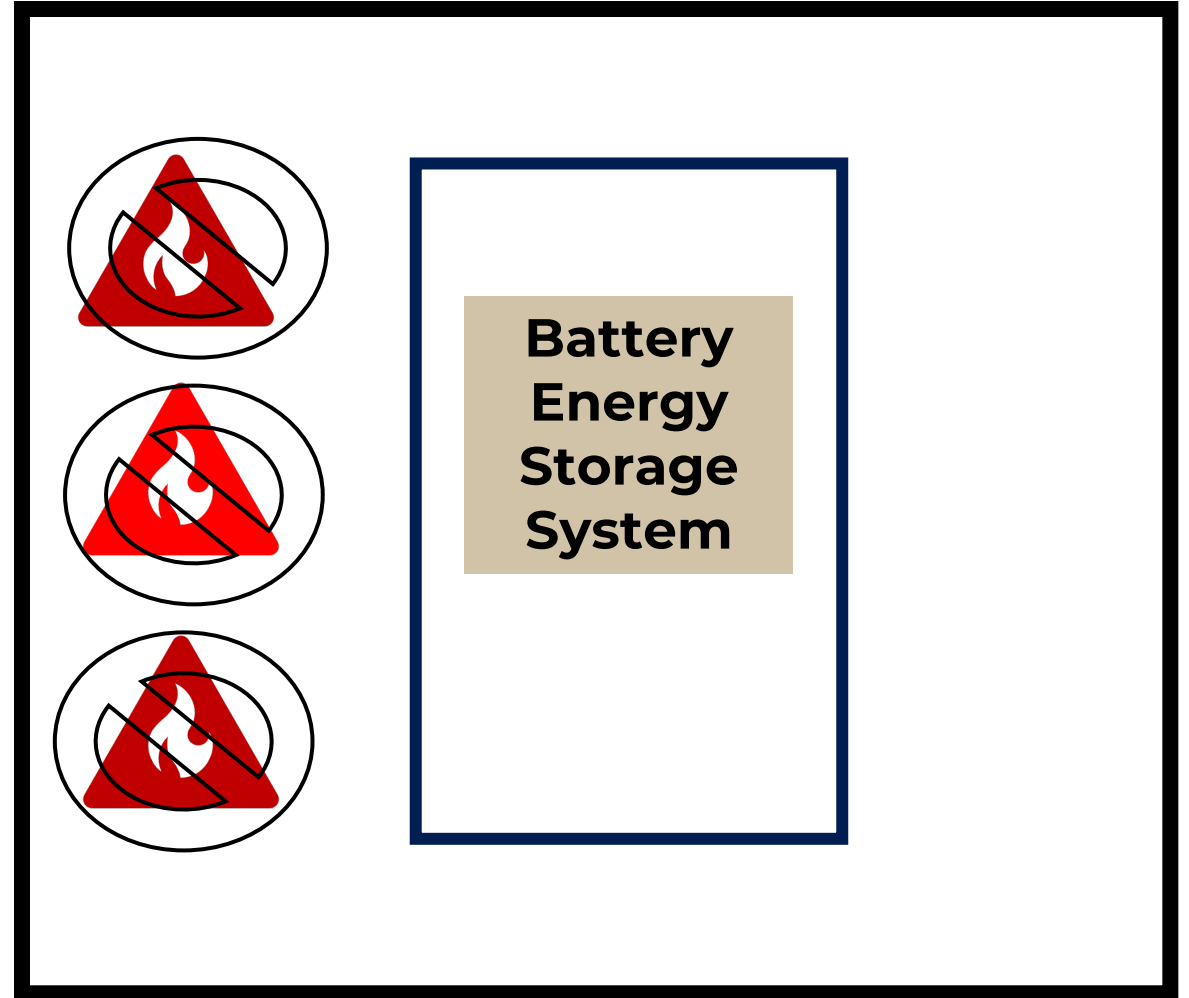
Vehicle Impact Protection

Where BESS are subject to impact by motor vehicle, including forklifts, vehicle impact protection must be provided.



Combustible Storage

Combustible materials shall not be stored in BESS rooms, areas, or walk-in units.



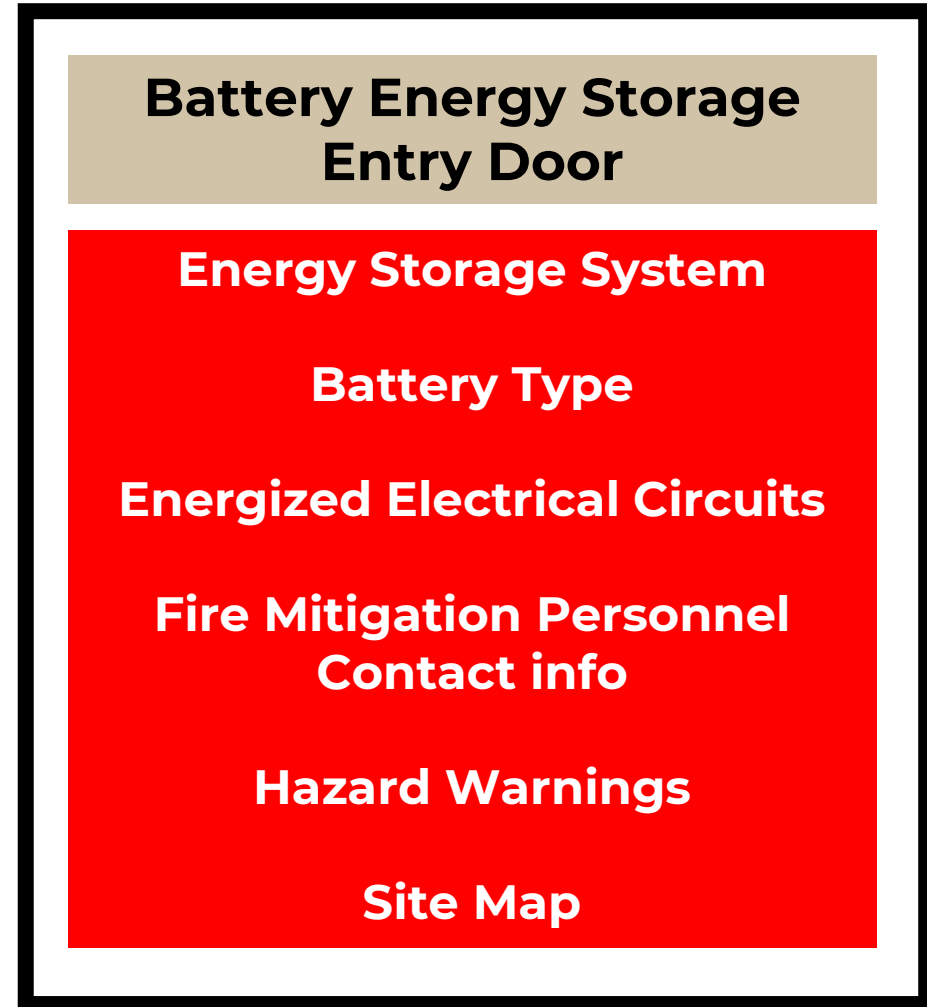
Toxic and Highly Toxic Gases

BESS that may release toxic gas during charging, discharging, and normal use conditions shall be provided with a hazardous exhaust system.



Signage

- Approved signs shall be provided on or adjacent to all entry doors for BESS rooms or areas and on enclosures of BESS cabinets and walk-in units.
- The signage shall include the following or equivalent: 





Signage

- Minimum size: 18 by 24 inches
- Compliant with NEC signage compliance

What is NOT required on the signage for entry doors for BESS rooms, areas, cabinets, or walk-in units?

- a) Name of the company who installed the system**
- b) Battery Type**
- c) Contact info for fire mitigation personnel**
- d) “Energized Electrical Circuits”**



Security of Installations

- Rooms, areas, and walk-in units in which BESS are located shall be secured against unauthorized entry and safe-guarded in an approved manner.
- For systems above thresholds from table 1207.5 video monitoring is required.
- Ensure that security enhancements do not inhibit the required air flow to or exhaust from the BESS.



Occupied Work Centers

For BESS in occupied work centers:

- Housed in locked noncombustible cabinets or enclosures.
- BESS in cabinets shall be located within 10 feet of the equipment they support.

Open Rack Installations

BESS shall be allowed on open racks when they are installed in a separate equipment room, and only authorized personnel have access to the room.



Focus International, "Battery Rack Series" 2019



Walk-in Units

Walk-in units shall only be entered for inspection, maintenance, and repair of the BESS and equipment.

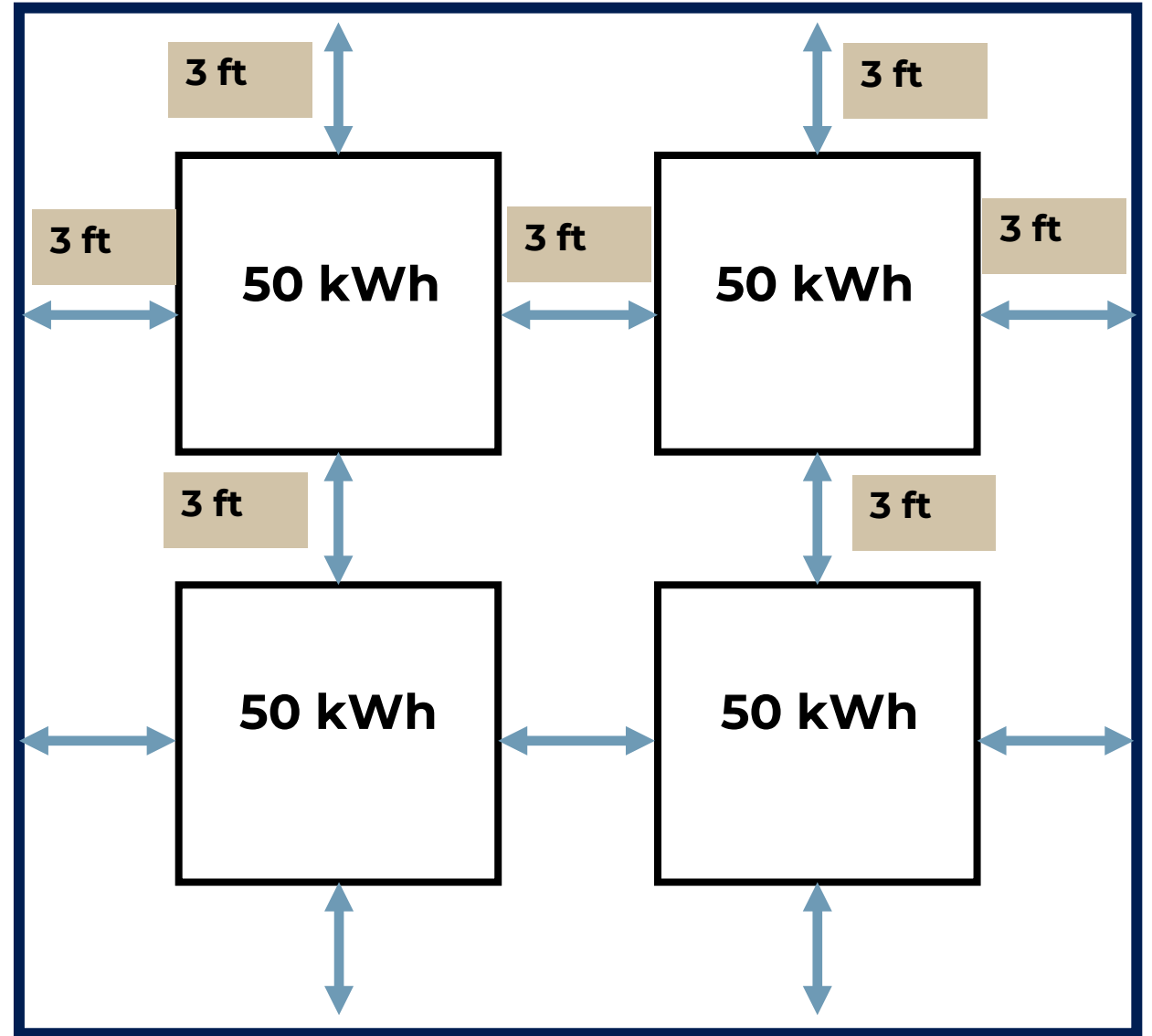
Fire Safety Compliance: Electrochemical BESS Protection

Size and Separation

- Segregated into groups not exceeding 50 kWh
- Each group separated a minimum of 3 feet from other groups and from walls in the storage room or area

Lead-acid and nickel-cadmium battery systems in facilities under the exclusive control of communications utilities and operating at less than 50 VAC and 60 VDC in accordance with NFPA 76 are exempt.

Larger capacities or smaller separation distances based on large scale fire testing



Maximum Allowable Quantities (MAQ)

Fire areas within rooms, areas, and walk-in energy storage system units containing electrochemical energy storage systems shall not exceed the maximum allowable quantities.

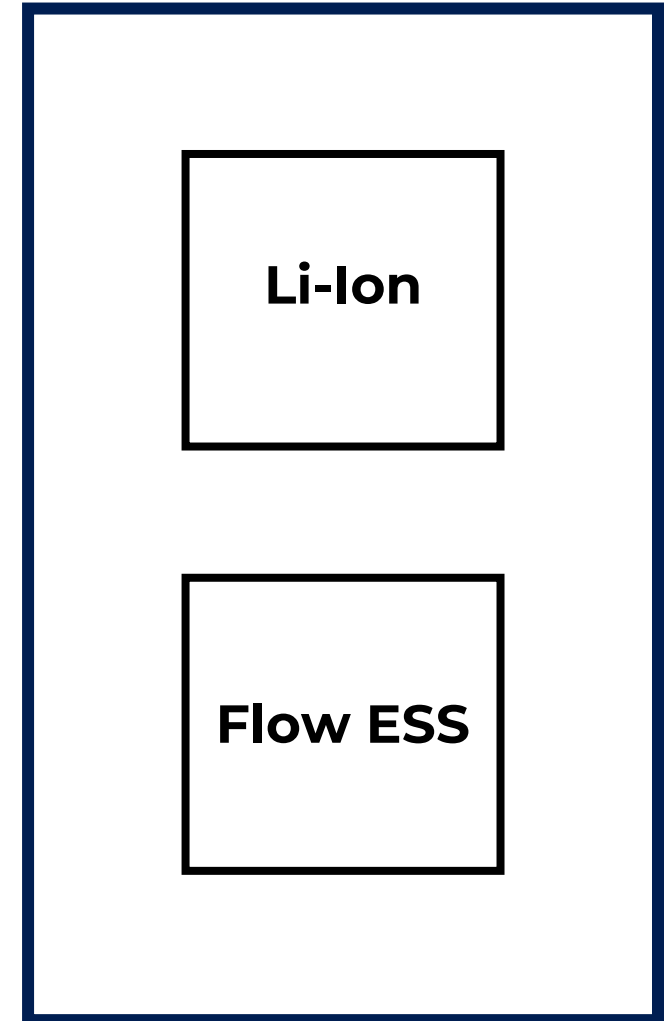
TABLE 1207.5—MAXIMUM ALLOWABLE QUANTITIES OF ELECTROCHEMICAL ESS	
TECHNOLOGY	MAXIMUM ALLOWABLE QUANTITIES ^a
STORAGE BATTERIES	
Flow batteries ^b	600 kWh
Lead-acid, all types	Unlimited
Lithium-ion	600 kWh
Nickel-cadmium (Ni-Cd), nickel-metal hydride (NI-MH) and nickel zinc (Ni-Zn)	Unlimited
Sodium nickel chloride	600 kWh
Zinc-manganese dioxide (Zn-MnO ₂)	Unlimited
Other battery technologies	200 kWh
CAPACITORS	
All types	20 kWh
OTHER ELECTROCHEMICAL ESS	
All types	20 kWh
For SI: 1 kilowatt hour = 3.6 megajoules. a. For electrochemical ESS units rated in amp-hours, kWh shall equal rated voltage times the amp-hour rating divided by 1,000. b. Shall include vanadium, zinc-bromine, polysulfide-bromide and other flowing electrolyte-type technologies.	

1. Where approved by the fire code official, systems that exceed the amount in this table, shall be permitted based on HMA and LSFT.
2. Lead-acid and nickel-cadmium battery systems in facilities under the exclusive control of communications utilities and operating at less than 50 VAC and 60 VDC is accordance with NFPA 76 are exempt.
3. Dedicated use buildings are exempt.

Mixed Electrochemical Systems

Where areas contain different types of electrochemical energy technologies, the total aggregate quantities of the systems shall be determined based on:

$$\frac{\left(\begin{array}{c} \text{Quantity} \\ \text{of Tech 1} \end{array} \right)}{\left(\begin{array}{c} \text{MAQ of} \\ \text{Tech 1} \end{array} \right)} + \frac{\left(\begin{array}{c} \text{Quantity} \\ \text{of Tech 2} \end{array} \right)}{\left(\begin{array}{c} \text{MAQ of} \\ \text{Tech 2} \end{array} \right)} + \frac{\left(\begin{array}{c} \text{Quantity} \\ \text{of Tech n} \end{array} \right)}{\left(\begin{array}{c} \text{MAQ of} \\ \text{Tech n} \end{array} \right)} = \text{Shall not exceed 100\%}$$



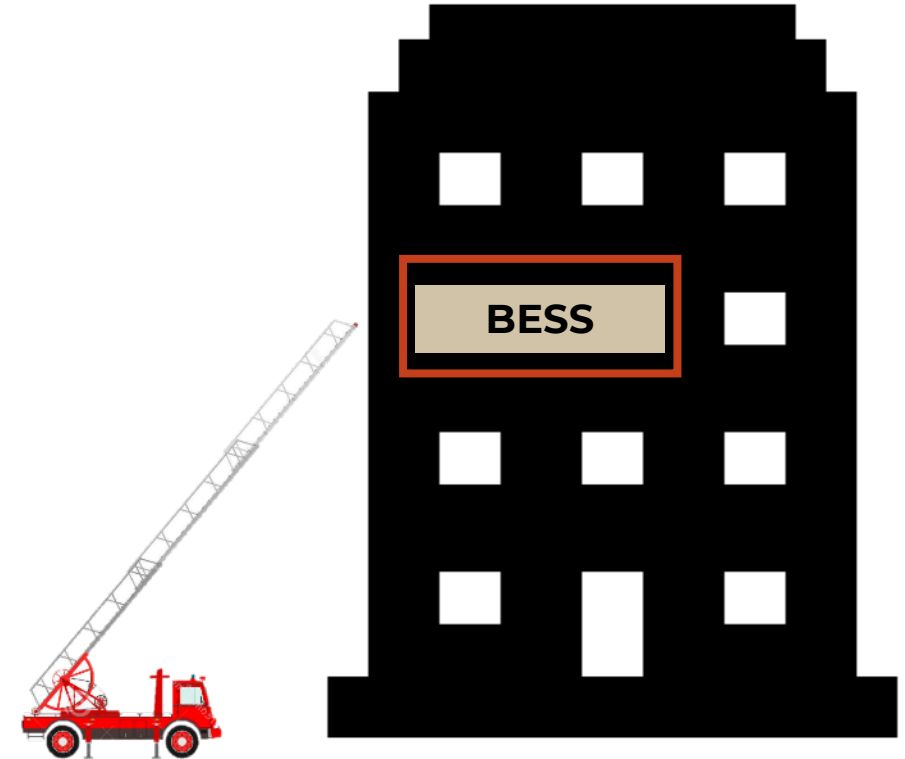
Elevation

BESS shall not be located on:

- Floors more than 75 ft above the lowest level of fire department vehicle access.
- Floors located below the lowest level of exit discharge.

Where approved by the fire code official, installations shall be permitted on higher or lower floors

Lead-acid and Nickel-cadmium battery systems less than 50 VAC and 60 VDC installed in facilities under the exclusive control of communications utilities in accordance with NFPA 76.





Fire Detection

- Automatic smoke detection system or radiant energy sensing fire detection system shall be installed.
- Alarm signals shall be transmitted to a central station.
- Examples: VESDA (air-sampling), Vent Gas Detection, Heat Detection (cable or spot), IR detection.

True or False: For lithium-ion battery systems exceeding 600 kWh, Hazard Mitigation Analysis & Large-Scale Fire Testing are both required

Fire Suppression Systems

- Automatic sprinkler system with minimum density of 0.3gpm/ft² or determined based on large-scale fire testing

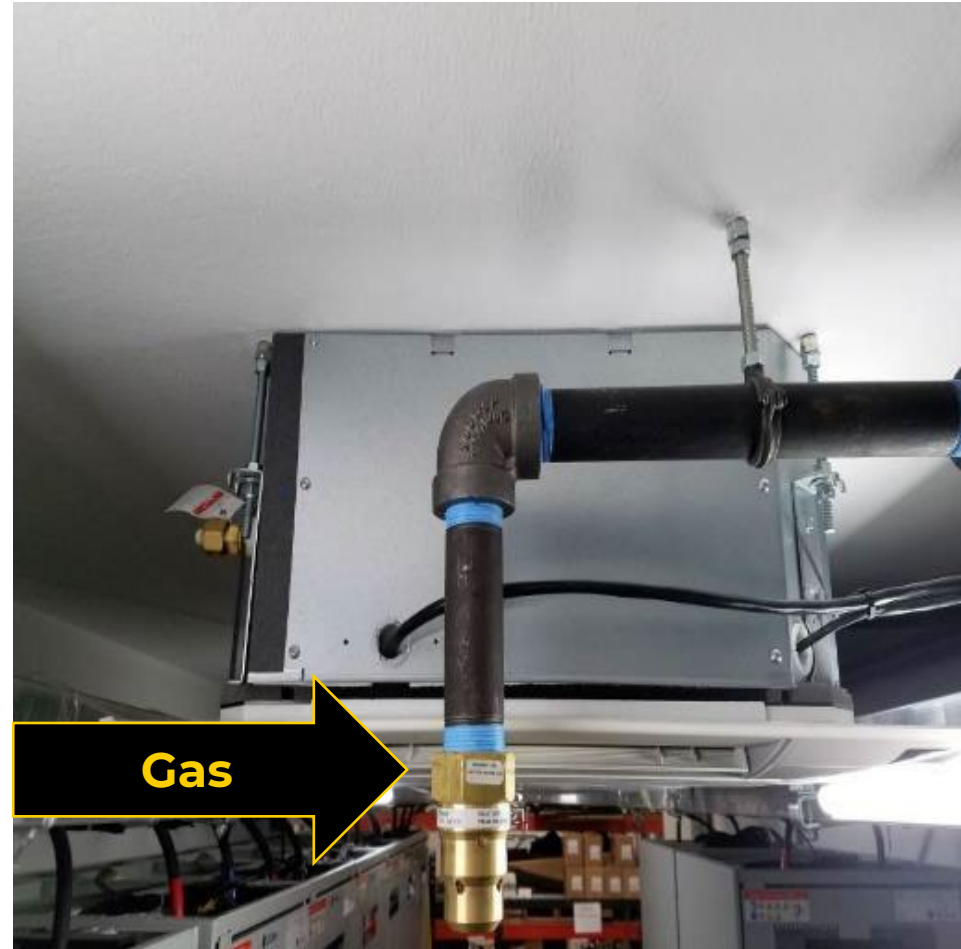
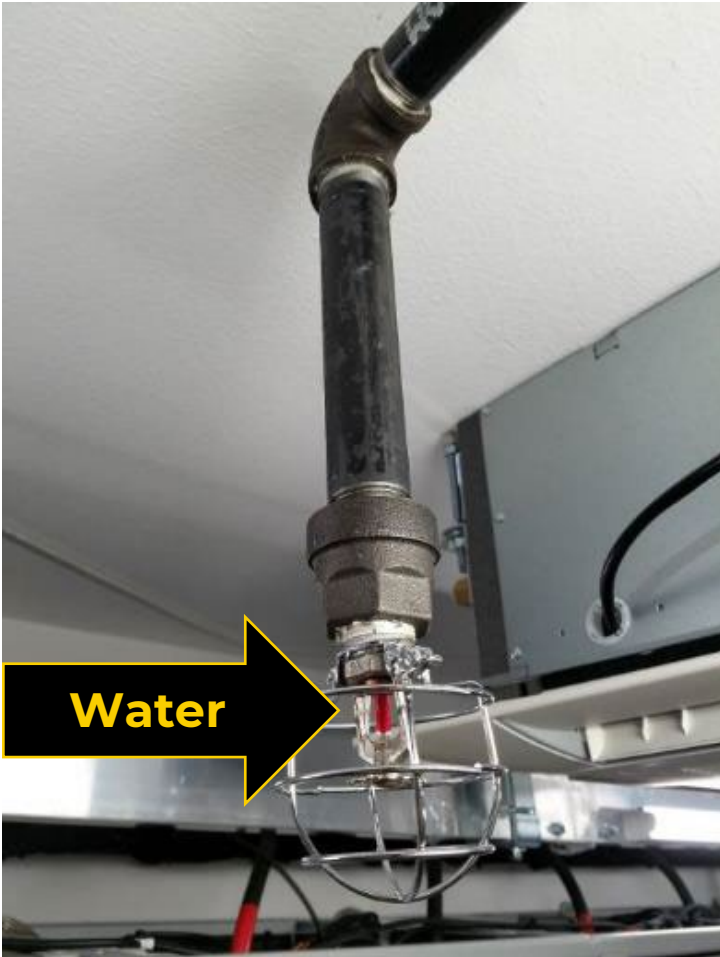
OR

- Alternate automatic fire extinguishing systems designed and installed in accordance with Section 904, approved by the fire code official based on large-scale fire testing:
 - NFPA 12, Standard on Carbon Dioxide Extinguishing Systems
 - NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection
 - NFPA 750, Standard on Water Mist Fire Protection Systems
 - NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems
 - NFPA 2010, Standard for Fixed Aerosol Fire Extinguishing Systems

Outdoor non-walk in systems DO NOT NEED Fire Suppression System



Indoor Fire Suppression



Maximum Enclosure Size

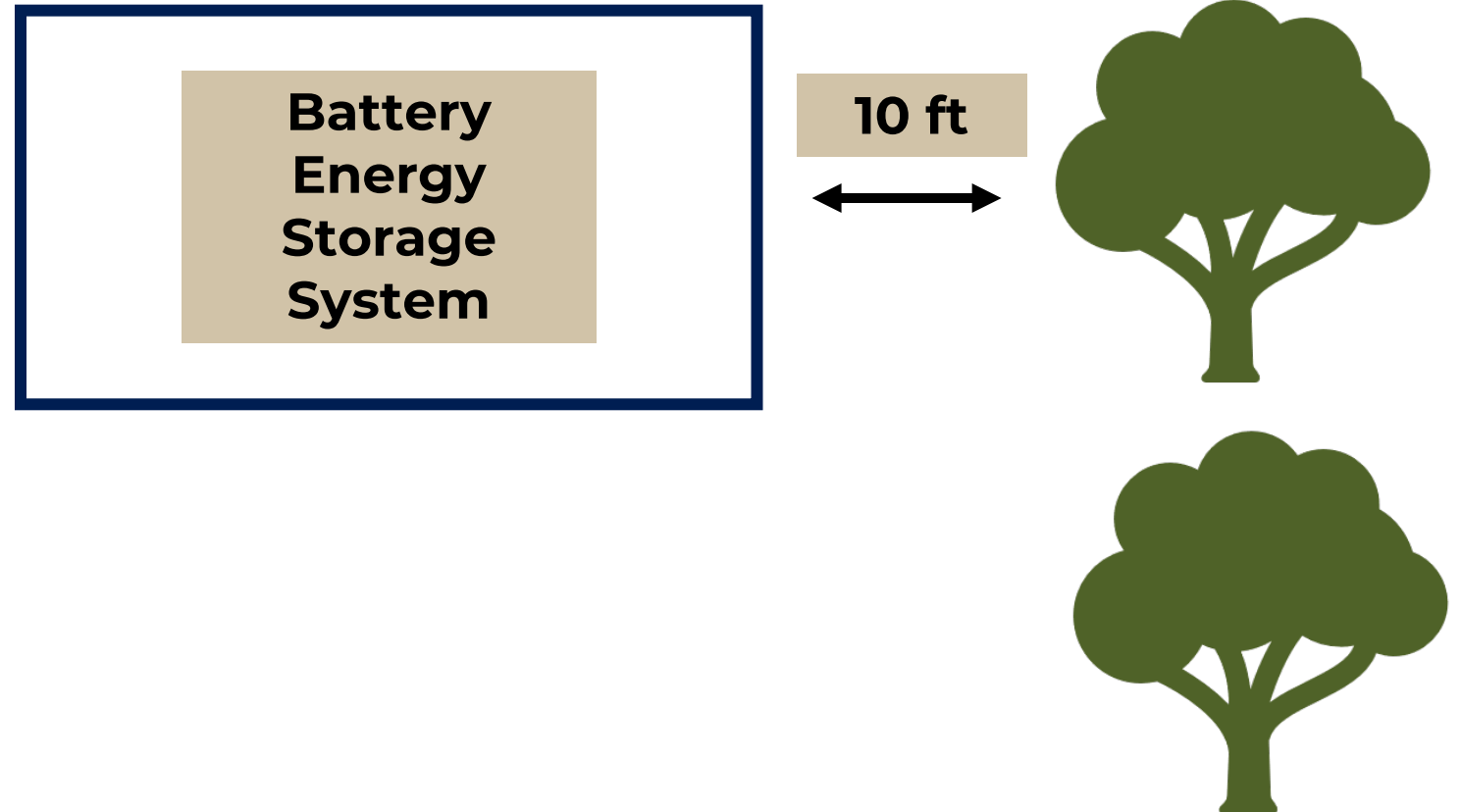
Outdoor walk-in units shall not exceed 4,028 cubic feet, not including bolt-on HVAC and related equipment.

**made from non-combustible material - accordingly rated and listed to the environment where intended to be used.*



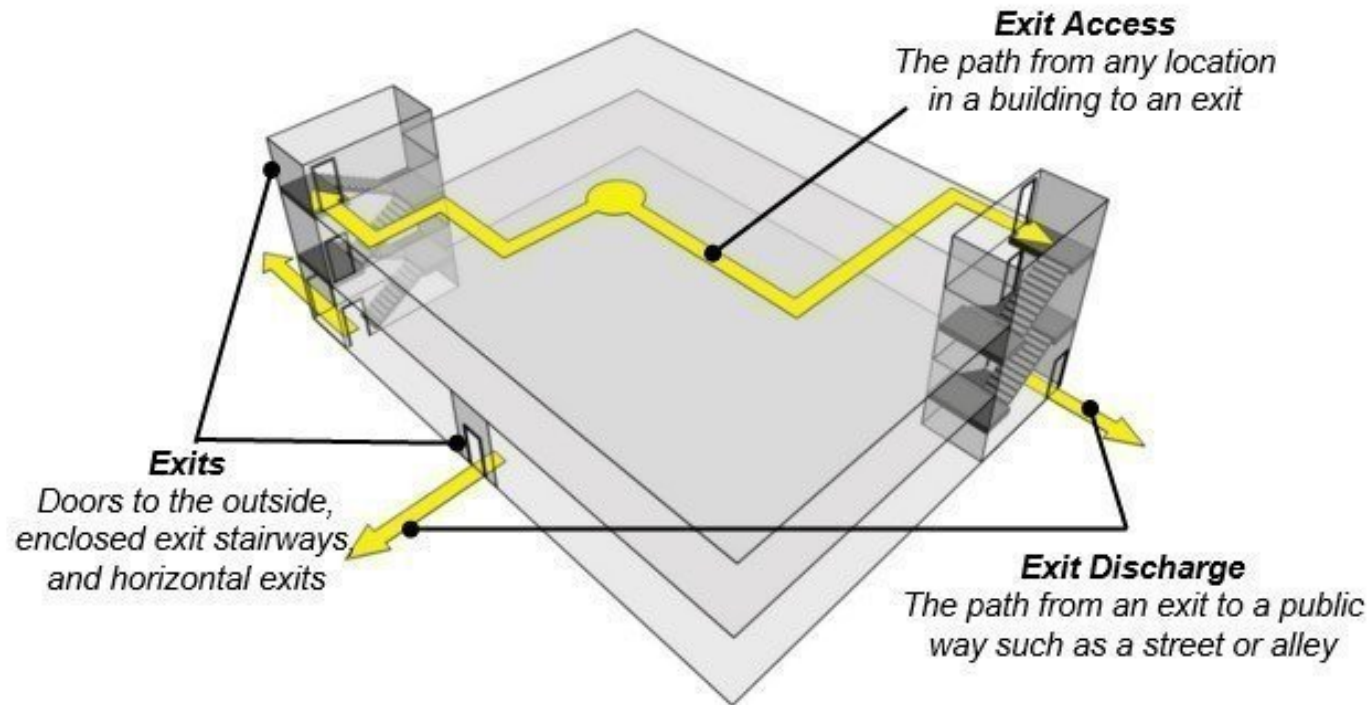
Vegetation Control

Areas within 10 feet of each side of outdoor BESS shall be cleared of combustible vegetation and other growth.



Means of Egress Separation

BESS outdoors and in open parking garages shall be separated from any means of egress to ensure safe egress under fire conditions, but no less than 10 ft.



"Means of Egress" Upside Innovations, 2019.

Fire Safety Compliance: Technology Specific

ELECTROCHEMICAL BESS TECH SPECIFIC PROTECTIONS

Compliance Required ^b	Battery Technology						Other Energy Storage System and Battery Technologies ^b	Capacitor Energy Storage System ^b
	Lead-acid	Ni-Cad and Ni-MH and NI-Zn	Zn-MnO ₂	Lithium-Ion	Flow	Sodium nickel chloride		
1207.6.1 Exhaust ventilation	Yes	Yes	Yes	No	Yes	No	Yes	Yes
1207.6.3 Explosion Control	Yes ^{a, g}	Yes ^{a, g}	Yes	Yes	No	Yes	Yes	Yes
1207.6.4 Safety Caps	Yes	Yes ^a	No	No	No	No	Yes	Yes
1207.6.2 Spill control and neutralization	Yes ^c	Yes	Yes ^f	No	No	No	Yes	Yes
1207.6.5 Thermal runaway	Yes ^d	Yes	Yes ^e	Yes ^e	Yes	Yes	Yes ^e	Yes

a. Not required for lead-acid and nickel-cadmium batteries at facilities under the exclusive control of communications utilities that comply with NFPA 76 and operate at less than 50 VAC and 60 VDC.

b. Protection shall be provided unless documentation acceptable to the *fire code official* is provided that provides justification why the protection is not necessary based on the technology used.

c. Applicable to vented-type (i.e., flooded) nickel-cadmium and lead-acid batteries.

d. Not required for vented-type (i.e., flooded) batteries.

e. The thermal runaway protection is permitted to be part of a battery management system that has been evaluated with the battery as part of the evaluation to UL 1973.

f. Not required for batteries with jelled electrolyte.

g. Not required for lead-acid and nickel-cadmium battery systems that are used exclusively for fixed guideway transit or passenger rail systems for either the operation of rolling stock or for signaling and communication equipment and are located outdoors or in *building* spaces used exclusively for such installations.

Do all electrochemical BESS types require the same fire safety requirements? (Y/N)

- Yes, electrochemical BESS have the same requirements regardless of chemistry.**
- No, many safety requirements vary based on the hazards associated with different battery chemistries**



Explosion control (Li-Ion, Lead-Acid, Ni-Cad, Ni-MH)

Provided for rooms, areas, ESS cabinets or walk-in units containing BESS (per Section 911, i.e., NFPA 68 or NFPA 69)

- Deflagration venting (NFPA 68)
 - Pressure panels
- Deflagration prevention (NFPA 69)
 - Exhaust fans
 - 25 % of LFL

* Alternative compliance permissible via variance

NFPA 69 Exhaust Ventilation System



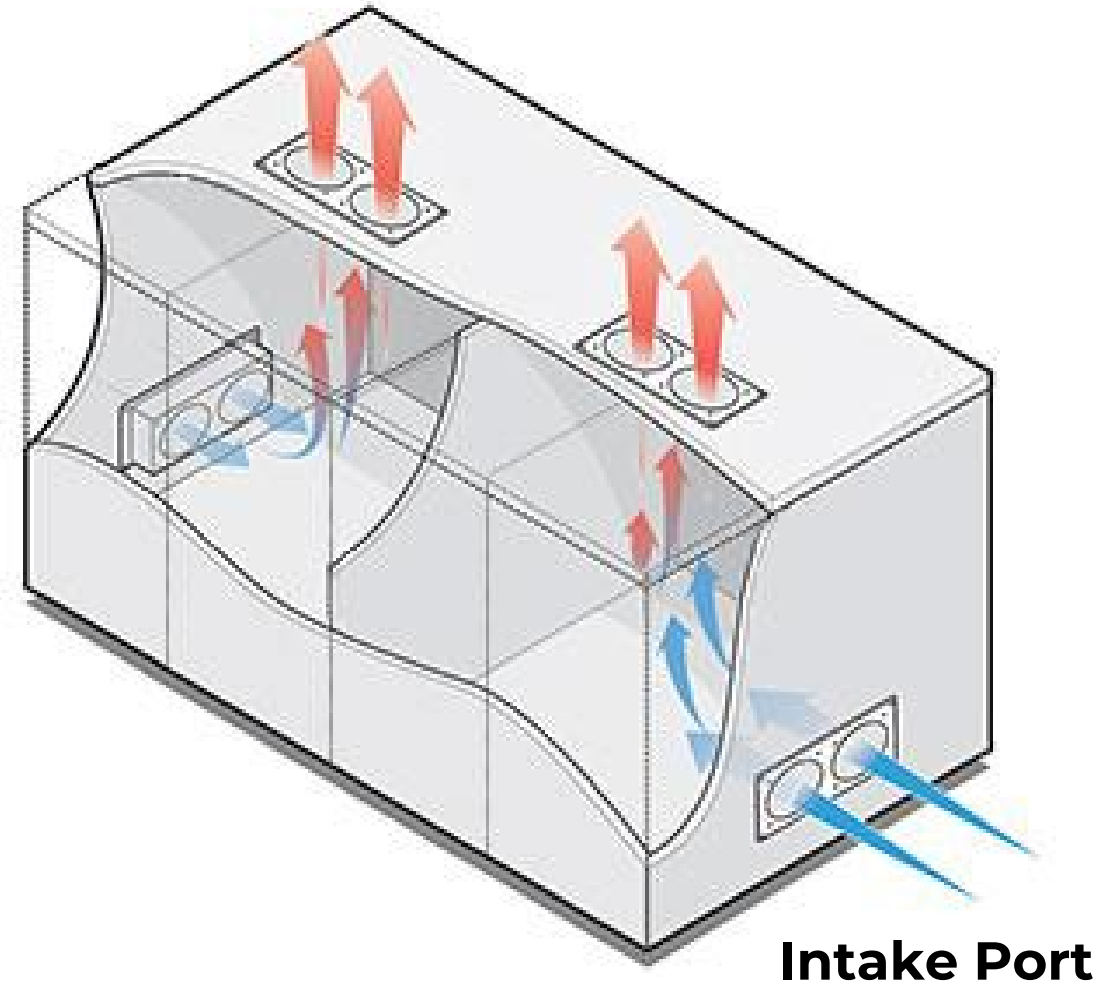
Intake Port



Exhaust Fan



Exhaust Fan



Intake Port

EXCEPTIONS

- UL 9540A shows no flammable gas release from ESS cells/modules.
- Documentation proves ESS cannot generate >25% LFL under fault or thermal-runaway conditions.
- UL 9540A confirms cabinets do not eject debris or shrapnel.
- Lead-acid or Ni-Cd systems under 50 VAC / 60 VDC in telecom facilities (communications-utility controlled).
- UL 1778-listed lead-acid UPS in one cabinet, within one fire area, used for standby power.
- Lead-acid or Ni-Cd systems in fixed-guideway transit or passenger rail, located outdoors or in dedicated ESS rooms.

Signage (explosion control)

If explosion control panels are present, the following signage should be posted:

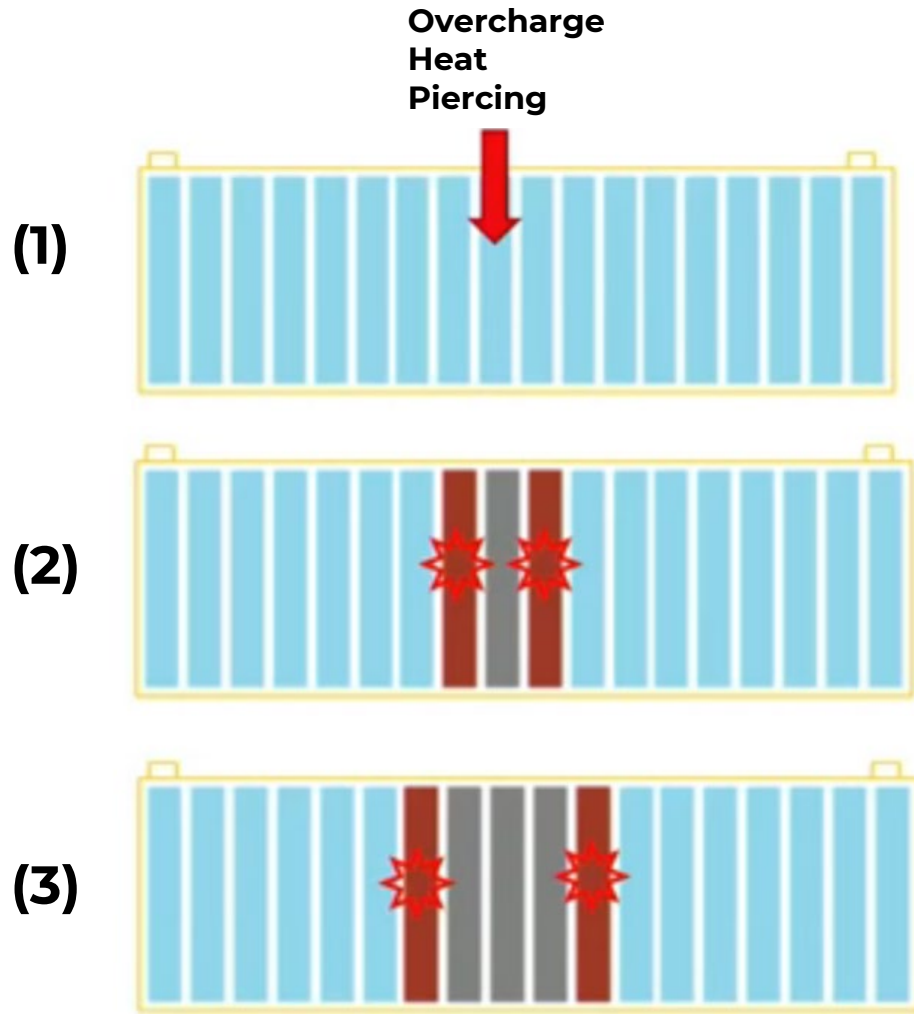
- 24 x 18-inch sign:
EXPLOSION PANEL STAY CLEAR
- Located on the panel or next to the panel
(on the container)





Gas Detector

- As part of NFPA 69 explosion prevention system, gas detection designed to activate the ventilation system where the flammable gas exceeds 25% of the LFL and remain active until the flammable gas detected is less than 25% of the LFL.
- Initiate distinct audible and visible alarms, transmit an alarm to an approved location, de-energizing of the battery charger, activate the mechanical ventilation, and 2 hours of standby power.



Thermal Runaway (Li-Ion, Lead-Acid, Ni-Cad, Ni-MH)

- BESS shall be provided with a listed device or other approved method to prevent, detect, and minimize the impact of thermal runaway.
- UL1973 - The thermal runaway protection is permitted to be part of a BMS that has been evaluated with the battery as part of the evaluation to UL 1973.

Electrochemical Protections for NON-Lithium-Ion BESS

Exhaust Ventilation (Lead Acid, Flow Ni-Cad and Ni-MH)

- Ventilation designed to limit the maximum concentration of flammable gas to 25% of the LFL **OR** provide continuous ventilation at a rate of not less than 1 ft³/min/ft²
- Standby power shall be provided for minimum of two hours
- Exhaust ventilation shall be supervised by central or remote station
- **Gas Detector** is also applicable





Battery Spill Containment. (n.d.). Retrieved June 07, 2019, from <https://www.sbsbattery.com/products-services/by-product/battery-spill-containment-systems.html>

Spill control and Neutralization (Lead Acid, Flow Ni-Cad and Ni-MH)

- Required for areas containing free-flowing liquid electrolyte or hazardous materials.
- **Spill control** shall prevent the flow of liquid electrolyte to adjoining rooms or areas.
- An approved method to **neutralize** spilled liquid electrolyte capable of neutralizing a spill from the largest battery or vessel to a pH between 5.0 and 9.0.

Safety Caps (Lead Acid, Flow Ni-Cad and Ni-MH)

- Vented batteries and other BESS shall be provided with flame arresting safety caps
- Hydrogen release
- Pressure build up



Stationary/Utility Flooded Battery Vent Caps" Storage Battery Systems, Inc. 2018.

Do lithium-ion batteries require spill control and neutralization? (Y/N)

- Yes, lithium-ion batteries pose a spill risk.**
- No, the electrolyte for lithium ion is not liquid.**

Fire Safety Compliance: Location Specific

Dedicated Use Building



Non-Dedicated Use Building



Outdoors Near Exposures



Outdoors Remote



OUTDOOR INSTALLATIONS

Compliance Required	Remote Installations ^a	Installations Near Exposures ^b
1207.4 All ESS installations	Yes	Yes
1207.8.3 Clearance to exposures	Yes	Yes
1207.5.5 Fire suppression systems	Yes ^c	Yes
1207.5.2 Maximum allowable quantities	No	Yes
1207.5.6 Maximum enclosure size	Yes	Yes
1207.5.8 Means of egress separation	Yes	Yes
1207.5.1 Size and separation	No	Yes ^d
1207.5.4 Smoke and automatic fire detection	Yes	Yes
1207.6 Technology-specific protection	Yes	Yes
1207.5.7 Vegetation control	Yes	Yes

a. See Section 1207.8.1.

b. See Section 1207.8.2.

c. Where approved by the fire code official, fire suppression systems are permitted to be omitted.

d. In outdoor walk-in units, spacing is not required between ESS units and the walls of the enclosure.

Remote Outdoor Installations

100ft clearance from buildings, lot lines, public ways, stored combustible materials, hazardous materials, high piled stock and other exposure hazards



Installations Near Exposures

not remote as described above



REMOTE OUTDOOR

- Fire suppression system can be omitted when approved by fire code official.
- Not subject to Maximum Allowable Quantities (other limits apply)
- Not subject to size and separation limits.



OUTDOOR NEAR EXPOSURES

- Fire Suppression is required (other automatic systems can be allowed if LSFT has been done and approved by Fire Code official).
- In outdoor walk-in units, spacing is not required between ESS units and the walls of the enclosure.



Applicable for BOTH: Remote and Near-Exposure Installation

- General Installation requirements
- Clearance to exposures
- Maximum enclosure size
- Means of egress separation
- Smoke and automatic fire detection
- Technology-specific protection
- Vegetation control

Clearance to Exposures

Clearance ≥ 10 ft from lot lines, public ways, buildings, stored combustible materials, hazardous materials, high-piled stock, and other exposure hazards

Exceptions to reduce clearance to 3 ft:

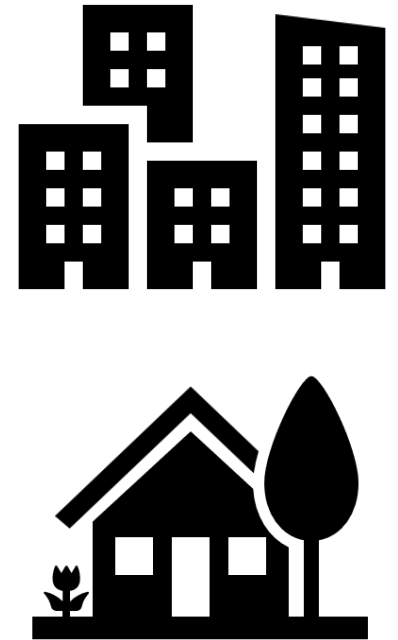
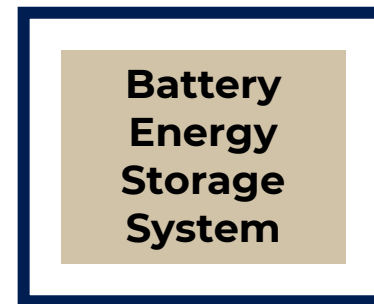
All exposures:

**1-hour fire barrier 5 ft above
and around system boundary**

Buildings:

**Wall adjacent to system is noncombustible,
2-hour fire rated, with no openings
or combustible overhangs.**

**Noncombustible, weatherproof enclosure
around system and large-scale fire testing
demonstrates fire won't spread.**



For outdoor installations, which safety requirements are not applicable if the installation is considered 'remote'?

- a) Size and separation**
- b) Maximum allowable quantities**
- c) General Installation Requirements**
- d) A and B**

OUTDOOR INSTALLATION

**Max
Enclosure
Size**

**Means of
Egress**

**Security of
Installations**

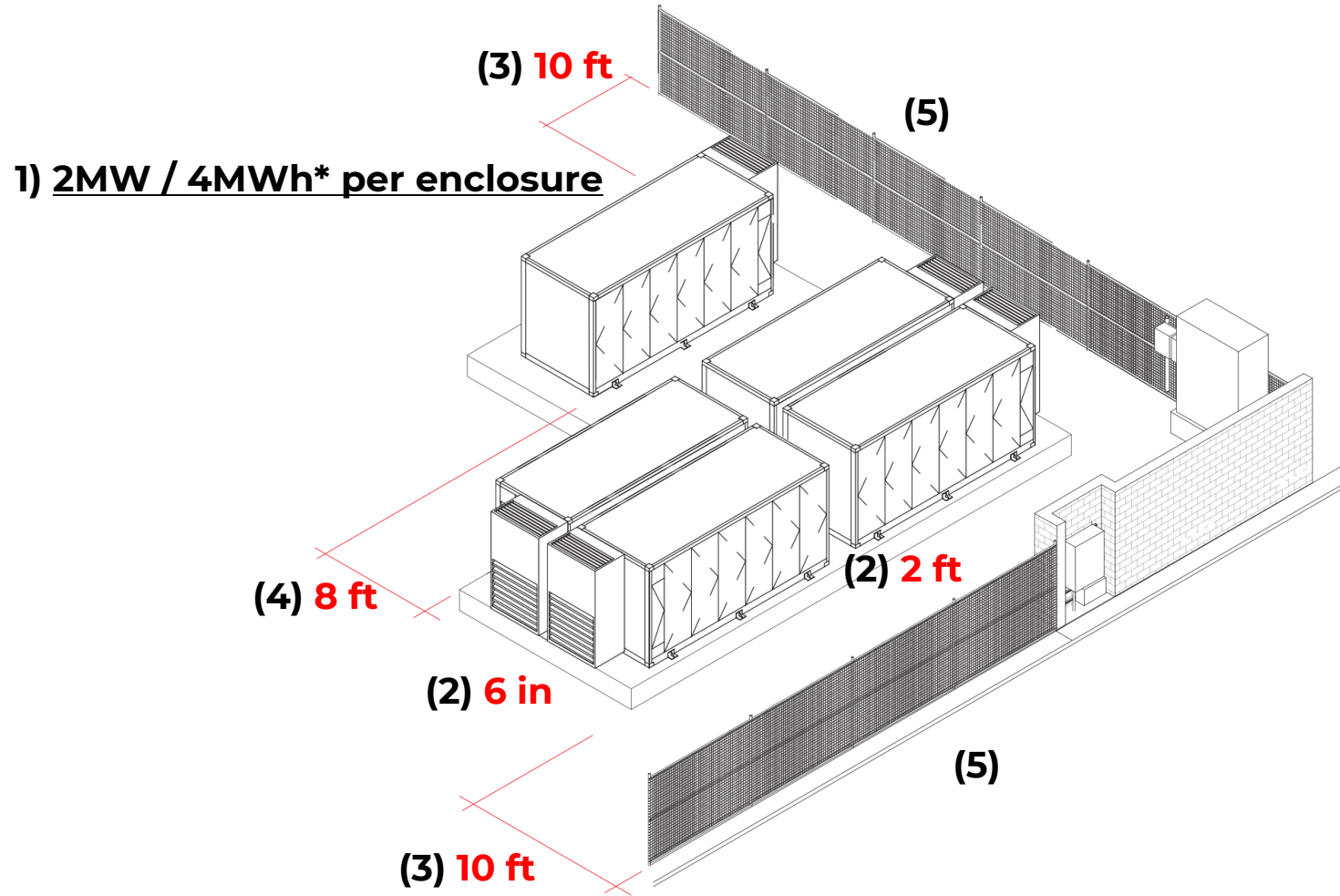
HVAC Units

Exhaust Ventilation



SDGE, Escondido 120 MW installation

OUTDOOR INSTALLATION



- ***MAQ >600kWh, exception 1.** allows [fire code official approval of] larger systems based on review of HMA and appropriate fire testing
- **Size and separation (50kWh groups separated 3 ft), exception 4.** allows [fire code official approval of] larger groups with less separation based on review of appropriate fire testing
- **Clearance to exposures:** 10 ft min from lot lines and public ways
- **Working clearances:** Access and working space per NPFA 70 and manufacturer instructions
- **Security of installations:** Fencing

BESS CABINETS & CABINET SYSTEMS



Most New York State systems are non-walk cabinet systems made from non-combustible materials.



WALK-IN UNIT



#	Description
1	Battery rack
2	Fire Suppression System
3	Energy Management System
4	HVAC
5	Battery Control Panel
6	Power Inverter

Image from: <https://www.pathion.com/pathion-power-vault-max/>



Exterior Wall Installations

May be installed on exterior walls if:

- Max capacity of each unit $\leq 20\text{kWh}$
- Otherwise in compliance with Section 1207.1.7
- Installed according to manufacturer specifications
- Individual unit separation ≥ 3 ft
- Units ≥ 5 ft from doors, windows, operable openings into buildings, or HVAC inlets

Exception: smaller separation for 4 and 5 based on large-scale fire testing

INDOOR INSTALLATIONS

Compliance Required	Dedicated Use Buildings ^a	Non-Dedicated Use Buildings ^b
1207.7.3 Dwelling units and sleeping units	NA	Yes
1207.5.3 Elevation	Yes	Yes
1207.5.5 Fire suppression systems	Yes ^c	Yes
1207.4.4 Fire-resistance-rated separations	Yes	Yes
1207.4 General installation requirements	Yes	Yes
1207.5.2 Maximum allowable quantities	No	Yes
1207.5.1 Size and separation	NA	Yes
1207.5.4 Smoke and automatic fire detection^e	Yes ^d	Yes
1207.6 Technology specific protection	Yes	Yes

NA = Not Allowed.

a. See Section 1207.7.1.

b. See Section 1207.7.2.

c. Where *approved* by the fire code official, fire suppression systems are permitted to be omitted in dedicated-use buildings located more than 100 feet (30.5 m) from buildings, lot lines, public ways, stored combustible materials, hazardous materials, high-piled stock and other exposure hazards.

d. Where *approved* by the fire code official, alarm signals are not required to be transmitted to a central station, proprietary or remote station service in accordance with NFPA 72, or a constantly attended location where local fire alarm annunciation is provided and trained personnel are always present.

e. Lead-acid and nickel-cadmium battery systems installed in Group U buildings and structures less than 1,500 square feet (139 m²) under the exclusive control of communications utilities, and operating at less than 50 VAC and 60 VDC in accordance with NFPA 76, are not required to have an *approved* automatic smoke or fire detection system.

Dedicated Use Buildings

- Only used for BESS, electrical energy generation, or grid related operations.
- No unauthorized access, only maintenance.
- If separate areas for admin, no more than 10% of building area and direct means of egress.



Non-Dedicated Use Buildings (Room/Indoor Area Containing BESS)

- Contains BESS but not dedicated use as described above.
- → the primary use of the building is different, for example: hospital



Fire-Resistance Rated Separations

2-hour fire barriers (§707 Building Code of NYS)
and 2-hour fire rated horizontal assemblies
(§711 Building Code of NYS)

- Dedicated use buildings:
 - Separated admin and support personnel areas
- Non-dedicated use buildings:
 - Separate from other building areas

- **Rooftop installations** – installations are those located on the roofs of buildings.
- **Open parking garage installations** – installations are those located in a structure or portion of a structure that complies with Section 406.5 of the International Building Code.

Compliance Required	Rooftops ^a	Open Parking Garages ^b
1207.4 All ESS installations	Yes	Yes
1207.9.3 Clearance to exposures	Yes	Yes
1207.9.4 Fire suppression systems	Yes	Yes
1207.5.2 Maximum allowable quantities	Yes	Yes
1207.5.6 Maximum enclosure size	Yes	Yes
1207.5.8 Means of egress separation	Yes	Yes
1207.9.6 Open parking garage installations	No	Yes
1207.9.5 Rooftop installations	Yes	No
1207.5.1 Size and separation	Yes	Yes
1207.5.4 Smoke and automatic fire detection	Yes	Yes
1207.6 Technology specific protection	Yes	Yes

a. See Section 1207.9.1.

b. See Section 1207.9.2.

Clearance to Exposures

Clearance $\geq$ 10 ft from:

- Buildings, except building on which BESS is mounted
- Any portion of BESS building elevated above rooftop on which system is installed
- Lot lines
- Public ways
- Stored combustible materials
- Locations where motor vehicles can be parked
- Hazardous materials
- Other exposure hazards

Exceptions to reduce clearance to 3 ft:

1-hour fire barrier 5 ft above and around system boundary.

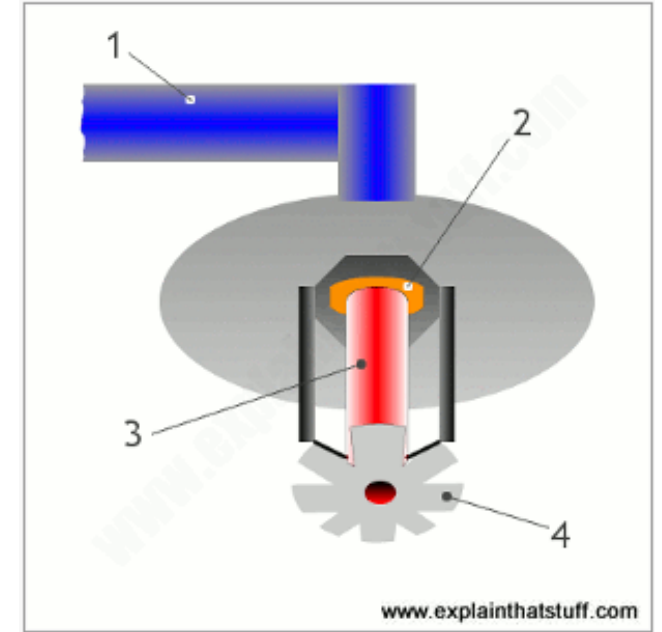
Noncombustible, weatherproof enclosure around system and large-scale fire testing demonstrates fire won't spread.

Fire Suppression System

Automatic fire suppression system required:

- Inside enclosure of walk-in units
- BESS on parking levels not open to the sky

* For cabinet systems: Fire suppression system should be outside of the unit



Exception:

Large-scale fire testing demonstrates fire will not impact exposures in open parking garages

Water under pressure in a pipe (1) is held in place by a small plug (2), itself held in place by a glass bulb filled with glycerin (3). When a fire breaks out, the bulb breaks, releasing the plug, allowing the water to hit the flower-shaped deflector, which spreads it around in a spray.

Rooftop Installations

- Emergency personnel stairway access to roof
- Service walkways from access point to system, ≥ 5 ft in width
- Located away from edge of roof $\geq$ distance equal to height of system, no less than 5 ft
- Roofing materials under and within 5 ft of system must be noncombustible or Class A rating ASTM E108 or UL 790
- Class I standpipe outlet installed at roof location
- System ≥ 10 ft from fire service access point on roof

Rooftops and Open Parking Garages

≥ 50ft from building HVAC air inlets

Exception:

May be ≥ 25 feet if automatic fire alarm system monitoring the radiant-energy sensing detectors de-energizes ventilation system connected to air intakes upon detection of fire

2025 Residential Code of NYS

Section R330:

Energy Storage Systems

RESIDENTIAL BESS INSTALLATION PHOTOS



RESIDENTIAL STORAGE EXAMPLES



Battery energy storage systems for one- to two-family residential dwellings within or outside the structure with an aggregate energy capacity that shall not exceed:

- 40 kWh within utility closets and storage or utility spaces.
- 80 kWh in attached or detached garages and detached accessory structures.
- 80 kWh on exterior walls.
- 80 kWh outdoors on the ground.

A single-family homeowner wants to install a BESS in their garage with a capacity exceeding 80kWh. Should it be installed in accordance with Section R330 of the NYS Residential Code, or Section 1207 of the NYS Fire Code?

- a) Section R330 of the NYS Residential Code**
- b) Section 1207 of the NYS Fire Code**

RESIDENTIAL – SIZE AND SEPARATION



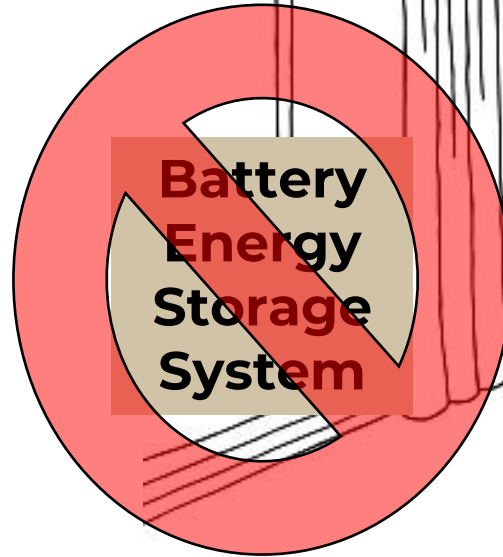
- Individual BESS units shall have a maximum rating of 20 kWh.
- Individual BESS units shall be separated from each other by a minimum of 3 feet.
- Individual BESS units installed outdoors on exterior walls shall be located a minimum 3 feet from doors and windows.

Rooms and areas containing energy storage systems shall be protected on the system side by no less than 5/8-inch Type X gypsum board or equivalent, installed on the walls and ceiling of the room or area.

Attached garages containing energy storage systems shall be protected on the system side by fire-resistant construction in accordance with Section R302.

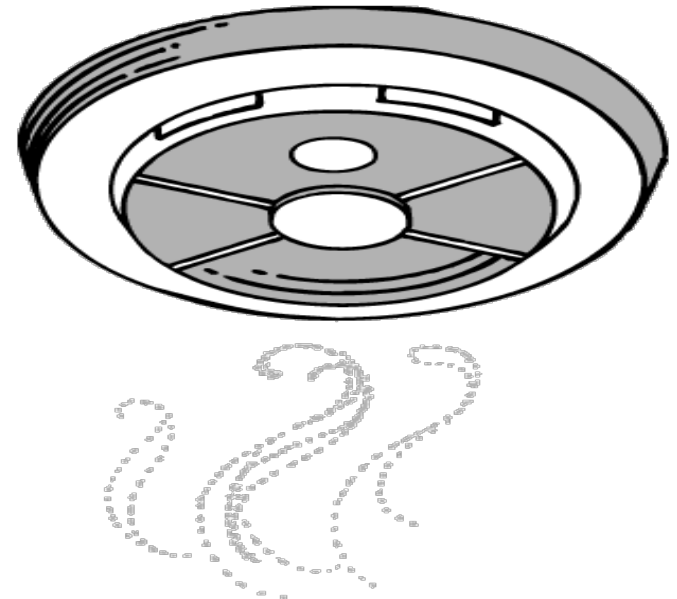
Dwelling units and sleeping units

BESS shall not be installed in sleeping units or in habitable spaces of dwelling units



Smoke alarms shall be installed in the area the BESS is installed.

Where smoke alarms cannot be installed, a heat alarm shall be installed and connected to the smoke alarm system.



Indoor installations of BESS that include batteries that produce hydrogen or other flammable gases during charging, shall meet the exhaust ventilation requirements set forth in the applicable fire code.

If there is potential for release of toxic or highly toxic gas during charging, discharging, and normal use conditions, shall be installed outdoors.

QUESTIONS?

Contact CleanEnergyHelp@nyserda.ny.gov for additional information

Helpful Links:

**Clean Energy Siting
Homepage**

nyserda.ny.gov/Siting

**Battery Energy Storage
Guidebook**

nyserda.ny.gov/energy-storage-guidebook