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Battery Energy Storage Systems:

Guidebook Overview

Jennifer Manierre
Senior Project Manager, Clean Energy Siting

November 15, 2019

New York Energy Policy

- Reforming the Energy Vision (REV) is Governor Andrew Cuomo's strategy to build a clean, resilient and affordable energy system for all New Yorkers
- Clean Energy Standard: 70% carbon-free by 2030
- Clean Energy Fund (CEF)
  - 10-year, $5 billion funding commitment
  - Reshapes NY's energy efficiency, renewable energy and energy innovation programs
  - Reduces the cost of clean energy
  - Accelerates the adoption of energy efficiency to reduce load
  - Increases renewable energy to meet demand
  - Mobilizes private investment in clean energy

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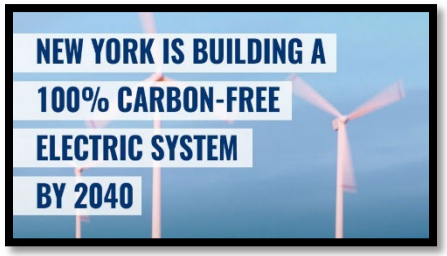
Energy Storage Initiative

A critical resource for enabling New York's clean energy future



- Avoid CO_2 emissions
- Reduce the impact of outages
- Allow intermittent renewables to be available during peak demand
- Create 30,000 jobs by 2030 in New York

2025 STATEWIDE ENERGY STORAGE TARGET

1,500 MW

2030 STATEWIDE ENERGY STORAGE TARGET

3,000 MW

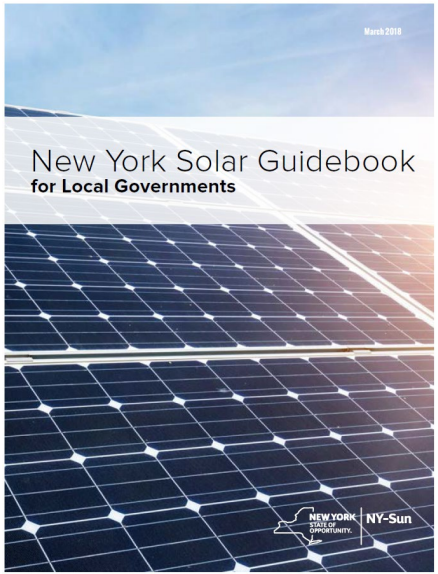
nyserda.ny.gov/energy-storage

NYSERDA Opportunities

- $400 million market acceleration bridge incentives: available for retail, bulk, standalone, and storage plus solar PV
- Technical assistance: permitting, interconnection, customer acquisition, and financing resources

Clean Energy Siting

NYSERDA created the NY Solar Guidebook to assist local governments managing solar energy development in their communities.



NYSERDA offers local governments free one-on-one technical assistance on, but not limited to:

- Property taxes & Payment-in-Lieu-of-Taxes (PILOTs)
- SEQR process
- Adopting zoning laws
- Municipal procurement
- Adopting & Implementing Unified Solar Permit & Energy Storage Permit

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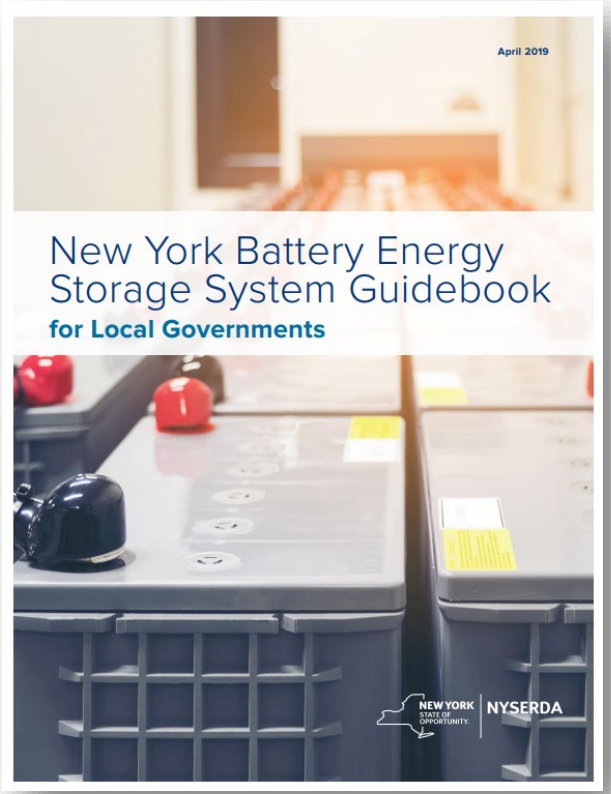
NY Battery Energy Storage Guidebook for Local Governments



Chapter 1 – Battery Energy Storage Model Law

Chapter 2 – Battery Energy Storage Model Permit

Chapter 3 – Battery Energy Storage Inspection Checklist

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Clean Energy Siting Homepage

The Battery Energy Storage Guidebook is available for download here

Clean Energy Siting for Local Governments

- Battery Energy Storage System Guidebook
- Solar Guidebook
- Wind Energy Guide
- Article 10
- Technical Assistance and Workshops
- Clean Energy Siting Email List

Clean Energy Siting for Local Governments

NYSERDA offers several resources to help local governments understand how to manage responsible clean energy development in their communities. These resources include step-by-step instructions and tools to guide the implementation of clean energy, including permitting processes, property taxes, siting, zoning, and more. If you have a question on clean energy siting in your community, or need help with a chapter of the Guidebook, email cleanenergyhelp@nyserda.ny.gov and we'll respond to you within 24 hours. For more hands-on support, learn more about our free training and technical assistance opportunities.

Stay up-to-date with the latest about Clean Energy Siting. Join our email list for local government officials.

*Ask the team any question by sending an email to **cleanenergyhelp@nyserda.ny.gov***

Municipalities can request technical assistance here

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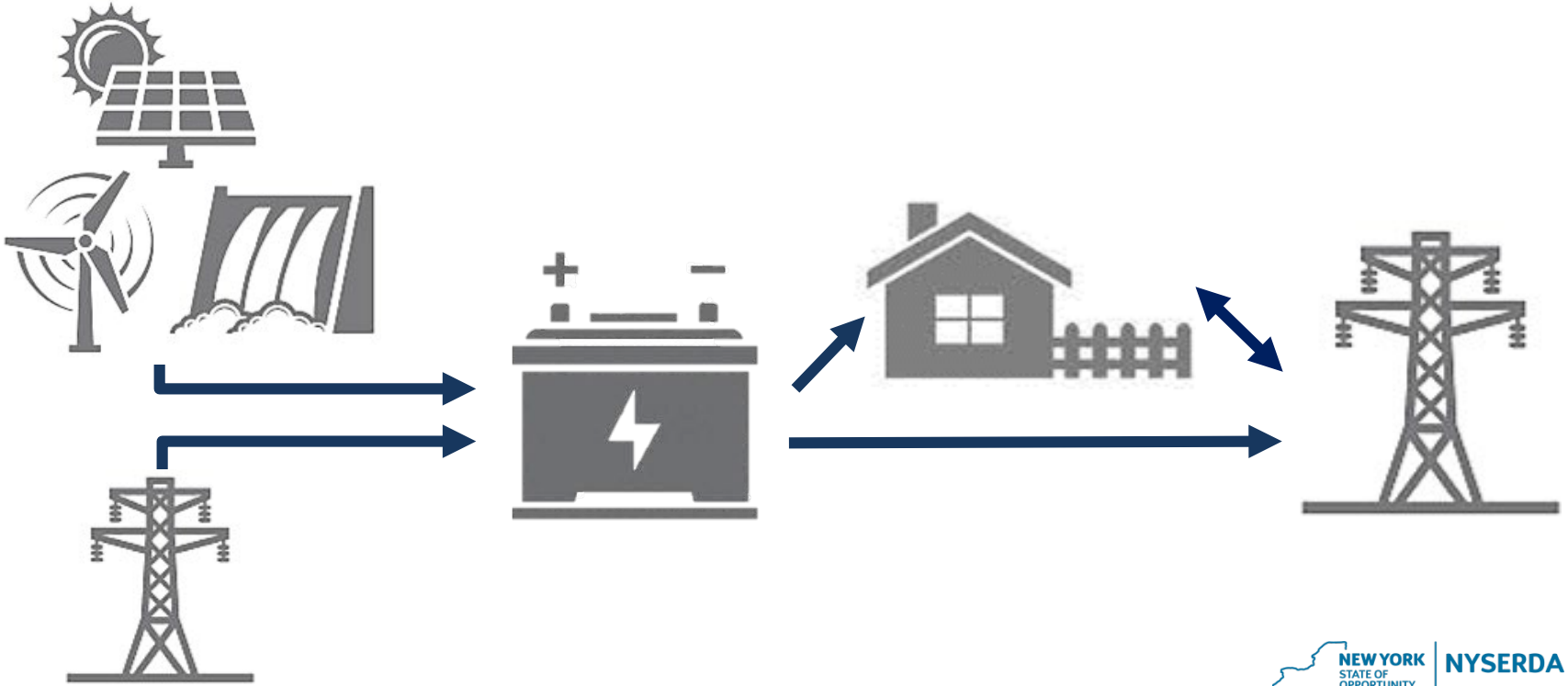
nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Siting

Battery Energy Storage Overview

Introduction to Battery Energy Storage



Battery Energy Storage System Types

Pumped Hydroelectric

Mechanical

- Compressed Air Energy Storage
- Flywheel

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

Chemical (Hydrogen)

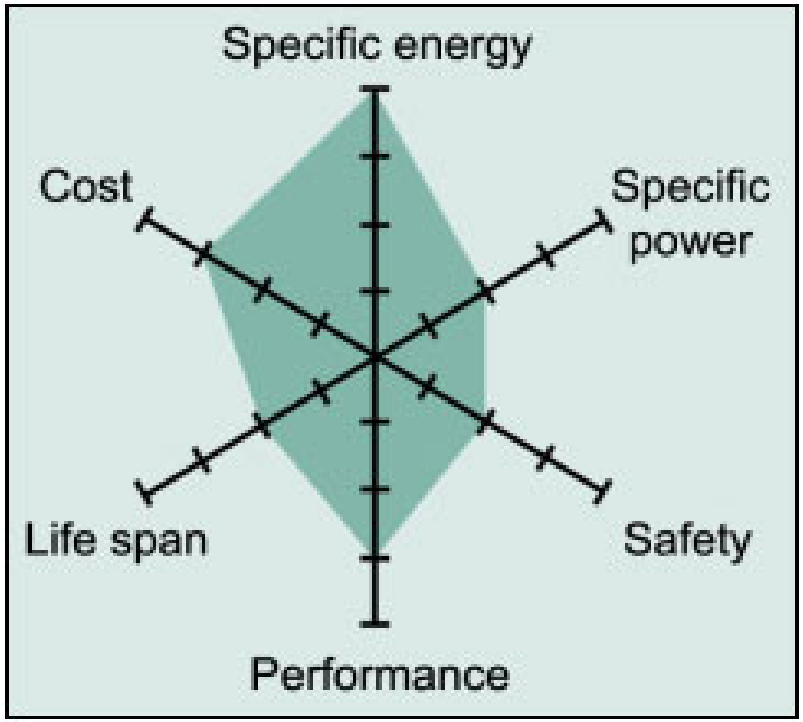
- Power-to-Power (Fuel Cells, etc)
- Power-to-Gas

Electrochemical Battery Types

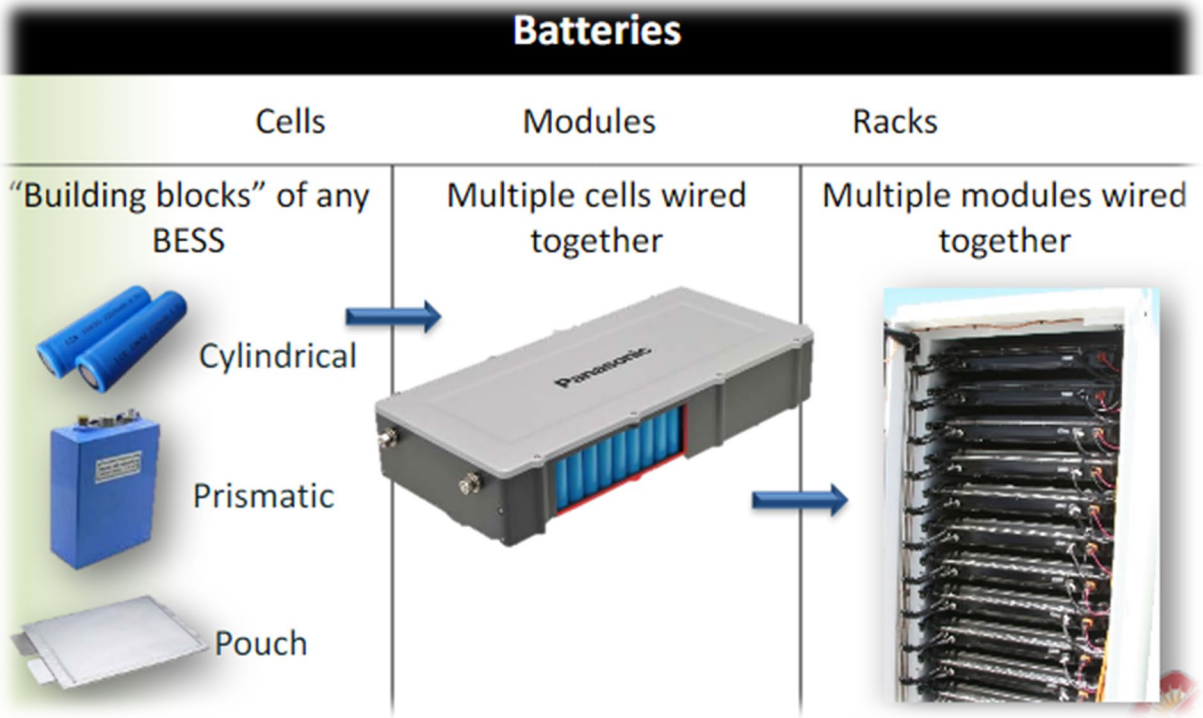
	Lead Acid	Sodium-Sulfur	Flow Batteries	Lithium-Ion
Round-trip efficiency	70-85%	70-80%	60-80%	85-95%
Typical duration	2-6 hours	6-8 hours	4-12 hours	0.25-4 hours
Time to build	6-12 months	6-18 months	6-12 months	6-12 months
Operating cost	High	Moderate	Moderate	Low
Space required	Large	Moderate	Moderate	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

Adapted from: http://cnee.colostate.edu/wp-content/uploads/2018/08/Storage_July2018.pdf

Electrochemical Battery Types

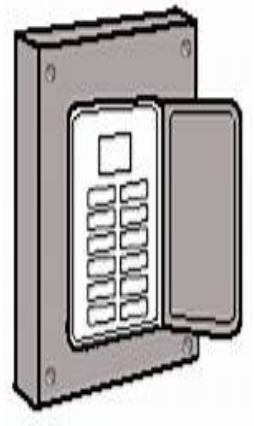


Battery System Design



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

BESS Design and Components



Electrical panel

AC

Inverter

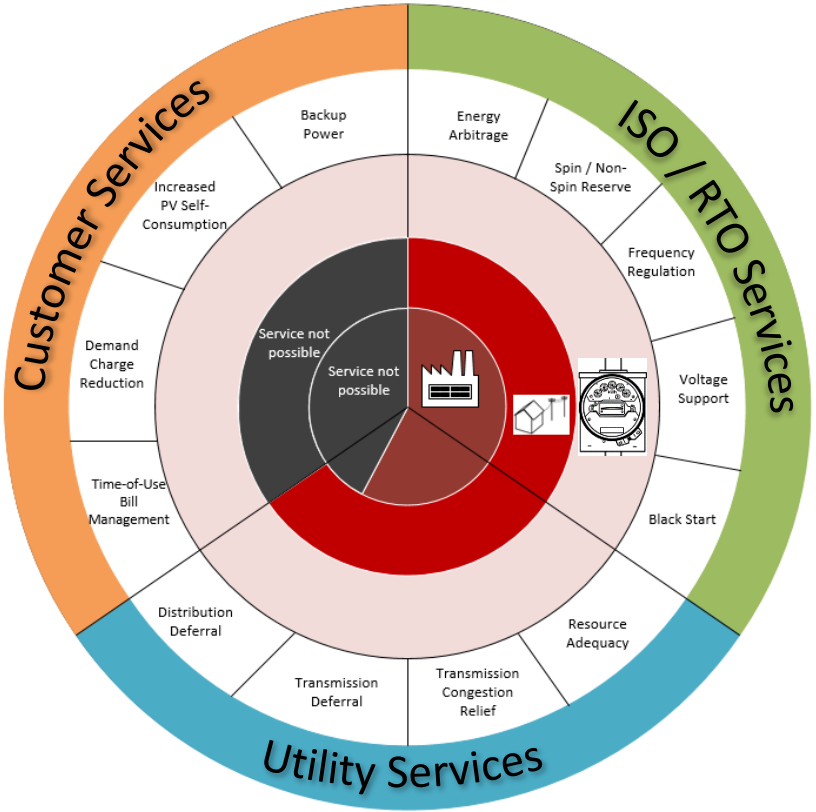
DC

Battery

Battery Management System

- 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

Applications for BESS



CENTRALIZED

TRANSMISSION

DISTRIBUTION

BEHIND THE METER

DISTRIBUTED

Valuable Applications:

Energy storage fits in everywhere on the grid! From a home system to a 400MWh facility, there are numerous different applications that storage can be used for!

- It's not about 'sunshine at night'
- Storage is systemic value, impacting every facet of supply, transmission, and consumption
- A single system can provide multiple values to grid/owner

Batteries can provide up to 13 services to three stakeholder groups

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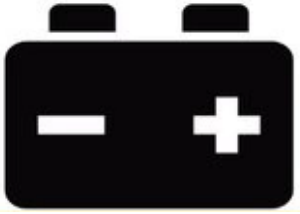
Example: Peaker Replacement



	Gas Peaker	Energy Storage
Range	~80% of capacity – minimum operational limits	200% of capacity –can act as supply or demand
Utilization	Low—only to meet peak demand or emergencies	High—simultaneous grid services
Dispatch Time	Minutes	Seconds
Standby	Costs and emissions	No costs or direct emissions

BESS Locations/Placement

Front of the Meter
"Utility Side"

Utility

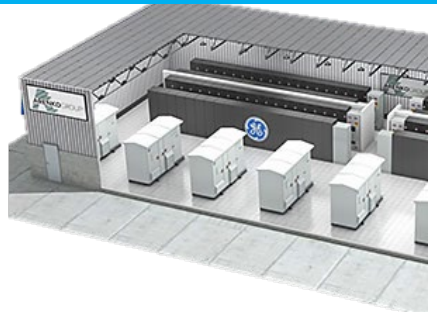
Behind the Meter
"Customer Side"

Residential

Commercial

Modern Battery Installations Scenarios

Dedicated Use Building



Outdoors Near Exposures

Non-Dedicated Use Building

Outdoors Remote

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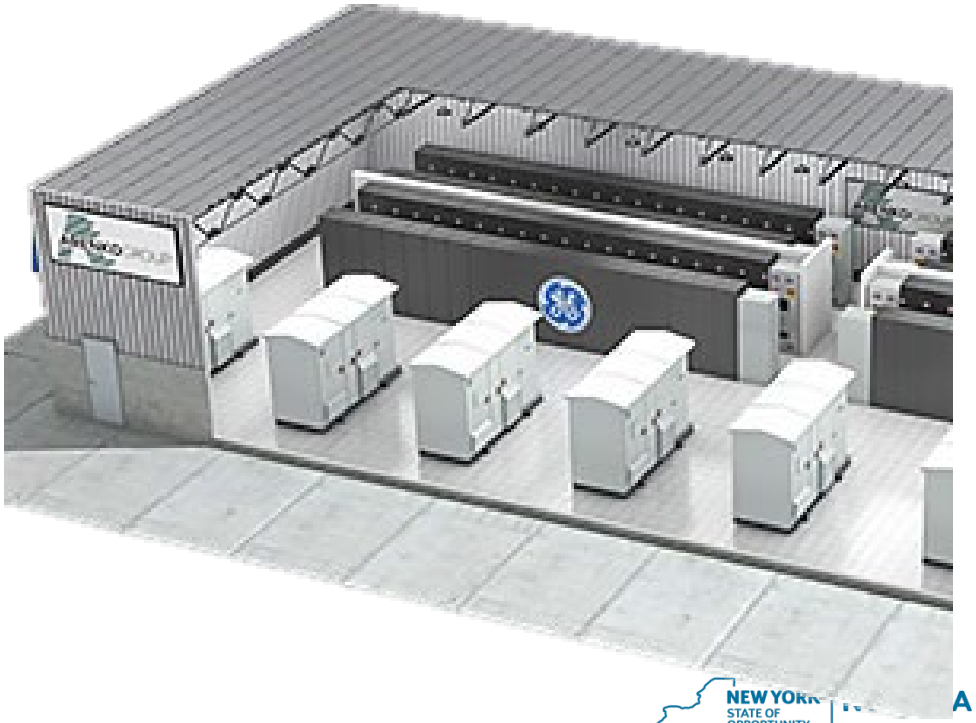
Indoor Installations

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



Indoor Installations

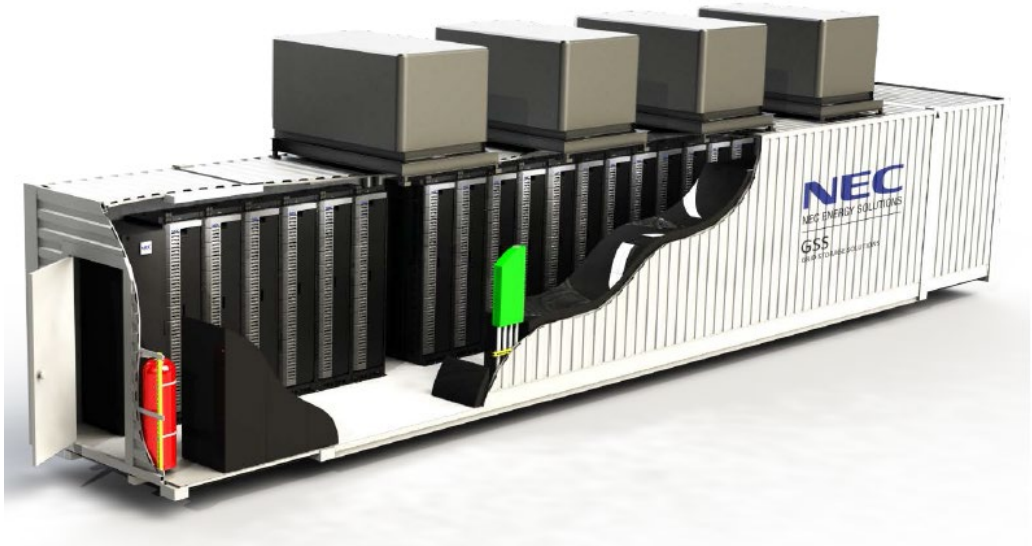
Non-Dedicated Use Buildings

- Contains BESS, but not dedicated use as described previously

Outdoor Installations

1.Remote outdoor installations – 100ft clearance from buildings, lot lines, public ways, stored combustible materials, hazardous materials, high piled stock and other exposure hazards

2.Installations near exposures - not remote as described above



Walk-in Containers

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SDGE, Escondido 120 MW installation

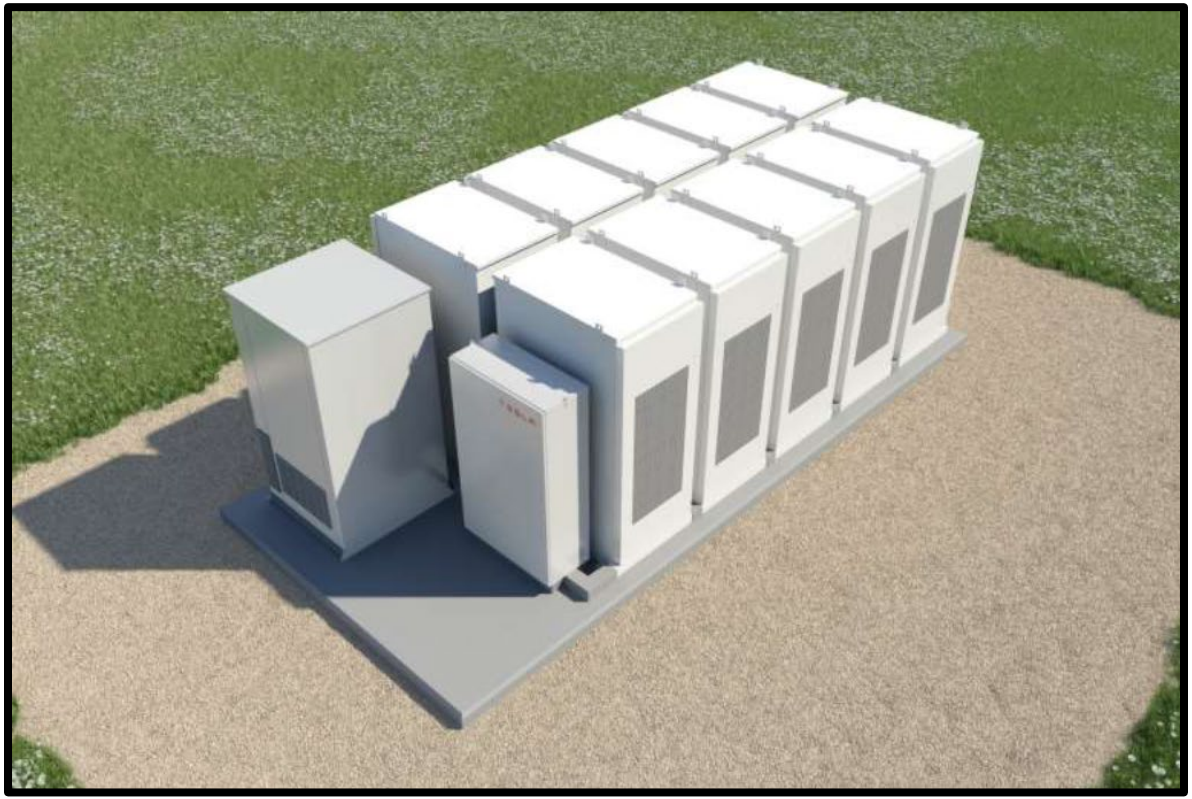
Walk-in Unit Installation

https://www.pathion.com/pathion-power-vault-max/

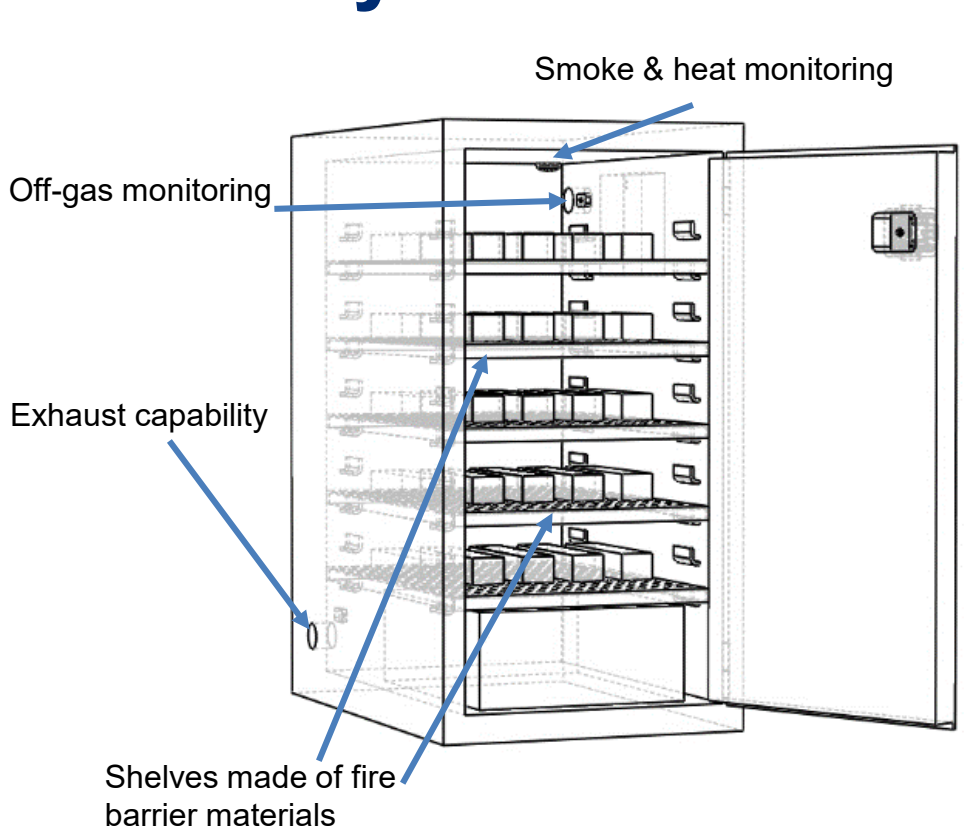
System	Description
1	Cell Packs
2	Fire Suppression System
3	Energy Management System
4	HVAC System
5	Battery Control Panel
6	Power Inverter

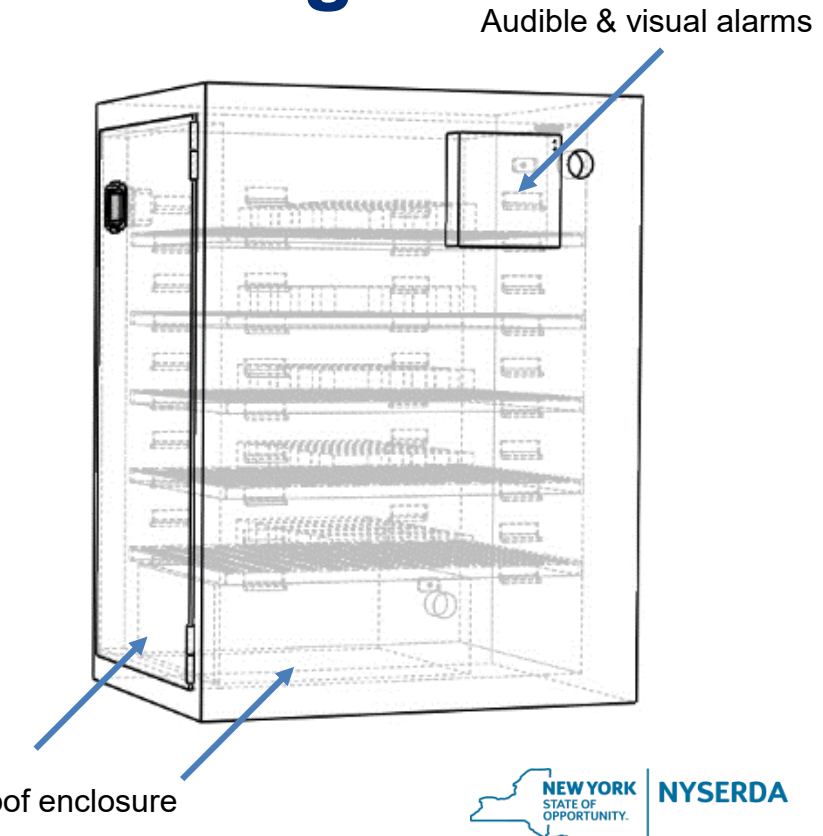
BESS Cabinets

Cabinet System

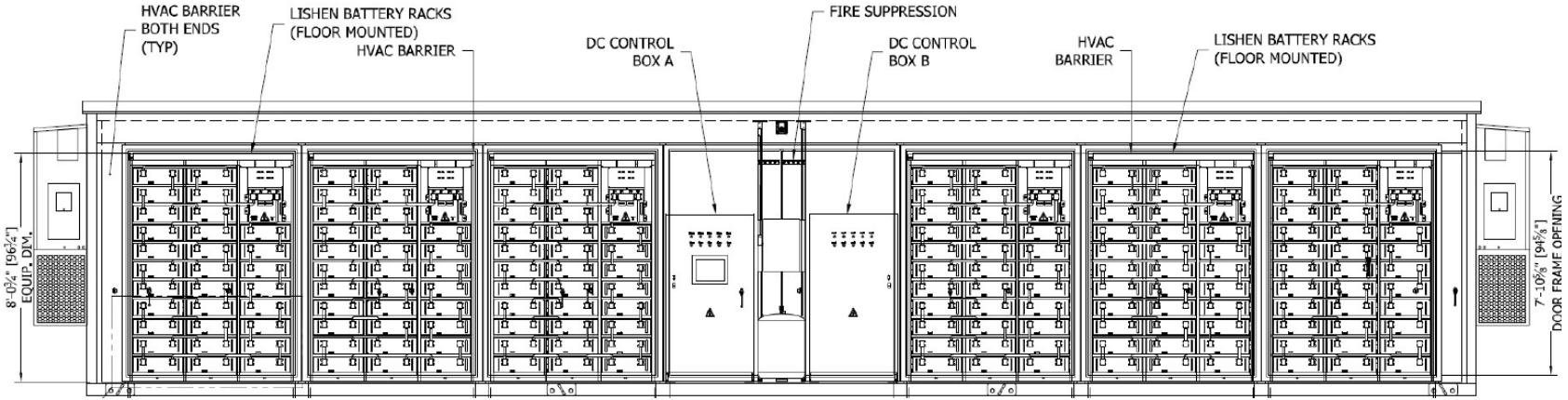


Battery Rack/Cabinet Monitoring





Cabinet System



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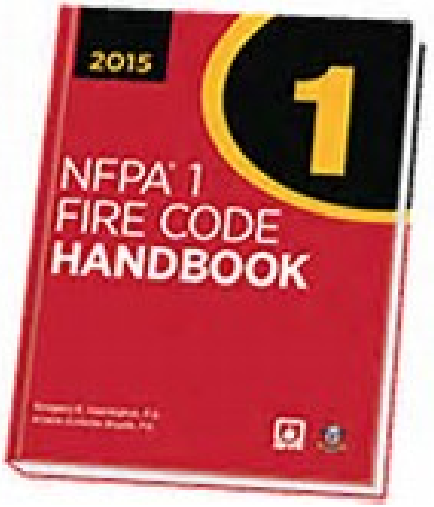
Applicable Codes and Safety Measures

Applicable Codes



Battery Energy Storage System Model Law

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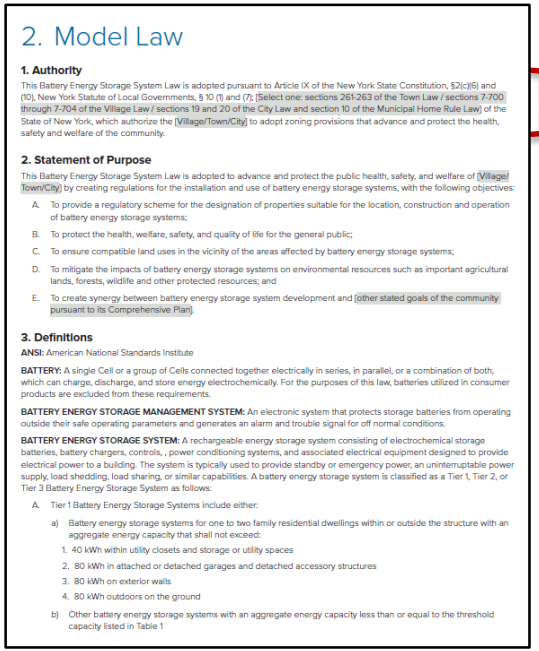
- Section 1: Authority
- Section 2: Statement of Purpose
- Section 3: Definitions
- Section 4: Applicability
- Section 5: General Requirements
- Section 6: Permitting Requirements for Tier 1 Battery Energy Storage Systems
- Section 7: Permitting Requirements for Tier 2 Battery Energy Storage Systems
- Section 8: Permitting Requirements for Tier 3 Battery Energy Storage Systems
- Section 9: Safety
- Section 10: Permit Time Frame and Abandonment
- Section 11: Enforcement
- Section 12: Severability

Section 1: Authority



2. Model Law

1. Authority

This Battery Energy Storage System Law is adopted pursuant to Article IX of the New York State Constitution, §2(c)(6) and (10), New York Statute of Local Governments, § 10 (1) and (7); [Select one: sections 261-263 of the Town Law / sections 7-700 through 7-704 of the Village Law / sections 19 and 20 of the City Law and section 10 of the Municipal Home Rule Law] of the State of New York, which authorize the [Village/Town/City] to adopt zoning provisions that advance and protect the health, safety and welfare of the community.

2. Statement of Purpose

This Battery Energy Storage System Law is adopted to advance and protect the public health, safety, and welfare of [Village/Town/City] by creating regulations for the installation and use of battery energy storage systems, with the following objectives:

A. To provide a regulatory scheme for the designation of properties suitable for the location, construction and operation of battery energy storage systems;

B. To protect the health, welfare, safety, and quality of life for the general public;

C. To ensure compatible land uses in the vicinity of the areas affected by battery energy storage systems;

D. To mitigate the impacts of battery energy storage systems on environmental resources such as important agricultural lands, forests, wildlife and other protected resources; and

E. To create synergy between battery energy storage system development and [other stated goals of the community pursuant to its Comprehensive Plan].

3. Definitions

ANSI: American National Standards Institute

BATTERY: A single Cell or a group of Cells connected together electrically in series, in parallel, or a combination of both, which can charge, discharge, and store energy electrochemically. For the purposes of this law, batteries utilized in consumer products are excluded from these requirements.

BATTERY ENERGY STORAGE MANAGEMENT SYSTEM: An electronic system that protects storage batteries from operating outside their safe operating parameters and generates an alarm and trouble signal for off normal conditions.

BATTERY ENERGY STORAGE SYSTEM: A rechargeable energy storage system consisting of electrochemical storage batteries, battery chargers, controls, , power conditioning systems, and associated electrical equipment designed to provide electrical power to a building. The system is typically used to provide standby or emergency power, an uninterruptable power supply, load shedding, load sharing, or similar capabilities. A battery energy storage system is classified as a Tier 1, Tier 2, or Tier 3 Battery Energy Storage System as follows:

A. Tier 1 Battery Energy Storage Systems include either:

a) 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:

1. 40 kWh within utility closets and storage or utility spaces
2. 80 kWh in attached or detached garages and detached accessory structures
3. 80 kWh on exterior walls
4. 80 kWh outdoors on the ground

b) Other battery energy storage systems with an aggregate energy capacity less than or equal to the threshold capacity listed in Table 1

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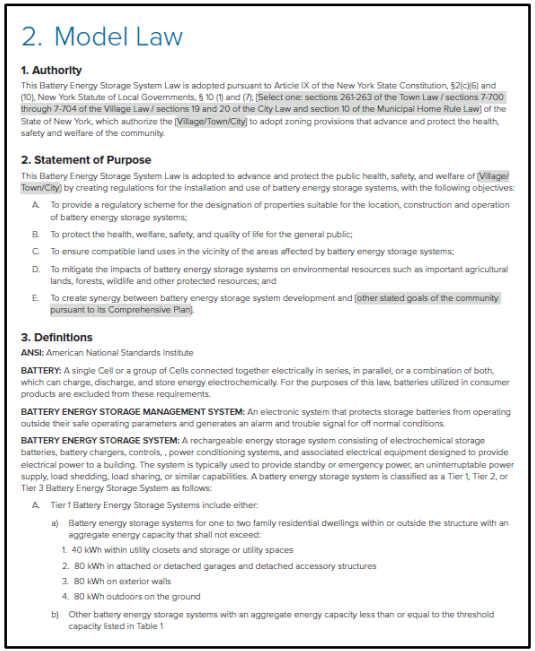
Section 2: Statement of Purpose



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F. To create synergy between battery energy storage system development and [other stated goals of the community pursuant to its Comprehensive Plan].

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Section 3: Definitions

System Sizes

Tier 1

a) 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:**
   1. 40 kWh within utility closets and storage or utility spaces
   2. 80 kWh in attached or detached garages and detached accessory structures
   3. 80 kWh on exterior walls
   4. 80 kWh outdoors on the ground

b) Other battery energy storage systems with an aggregate energy **capacity less than or equal to** the threshold capacity listed in the Table

Battery Energy Storage System Tier 2 Threshold Quantities

Battery Technology	Capacity
Flow batteries	20 kWh
Lead acid, all types	70 kWh
Lithium, all types	20 kWh
Nickel cadmium (Ni-Cd)	70 kWh
Nickel metal hydride (Ni-MH)	70 kWh
Other battery technologies	10 kWh

Tier 2

Systems with an aggregate system **capacity greater than** the values in the Table and **less than 600 kWh**

Tier 3

a) Battery energy storage systems with an aggregate energy capacity **greater than or equal to 600kWh**

b) Battery energy storage systems with **more than one storage battery technology** is provided in a room or indoor area

Section 6-8: Permitting Requirements

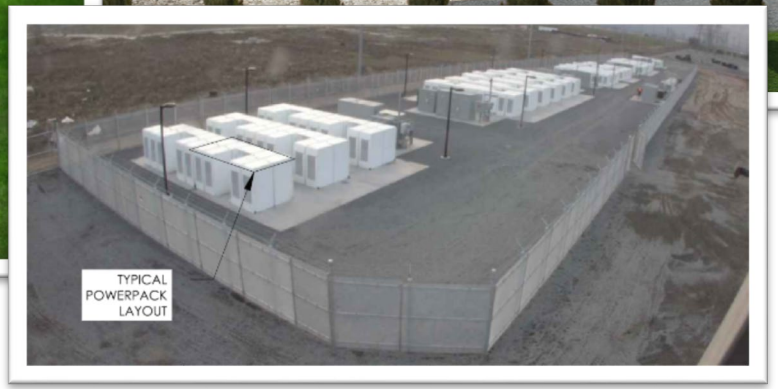
Section 6: Tier 1 Battery Energy Storage Systems	• Battery Energy Storage System Permit • Inspection Checklist
Section 7: Tier 2 Battery Energy Storage Systems	• Battery Energy Storage System Permit • Inspection Checklist • Applicable fire code and Appendix 2
Section 8: Tier 3 Battery Energy Storage Systems	• Special Use Permit • Site Plan Review • Applicable fire code and Appendix 2

Tier 1 BESS Installation Photos

Tier 2 BESS Installation Photos

http://www.optimumnanolithiumbattery.com/ess-energy-storage-battery/optimumnano-100kwh-energy-storage-cabinet.html

Tier 3 BESS Installation Photos



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Battery Energy Storage System Model Permit

Tier 1 and Tier 2 Requirement

Overview

The Model Permit is intended to help local government officials and AHJs establish the minimum submittal requirements for electrical and structural plan review that are necessary when permitting residential and small commercial battery energy storage systems.

Additionally, battery energy storage systems shall comply with all applicable provisions of the codes, regulations, and industry standards as referenced in the New York State Uniform Fire Prevention and Building Code.

The Battery Energy Storage System Model Permit is based on the 14th Edition of the National Electric Code (NEC), which is anticipated to be adopted by New York State in 2020. NYSERDA will continue to update the Guidebook as these codes and standards evolve.

The workable version of this document can be found at nyserda.ny.gov/Energy-Storage-Guidebook, under Battery Energy Storage System Model Permit tab.

PERMIT APPLICATION

Battery Energy Storage System Model Permit

Note: Language in [ALL CAPS] below indicates where local jurisdictions need to provide information specific to the jurisdiction. Language in italics indicates explanatory notes from the authors of this document that may be deleted from the distributed version.

This application and the following attachments will constitute the Battery Energy Storage System Permitting Package.

- This application form, with all fields completed and bearing relevant signatures.
- Permitting fee of $[ENTER FEE HERE], payable by [ENTER VALID PAYMENT METHODS, If checks are allowed INCLUDING WHO CHECKS SHOULD BE MADE PAYABLE TO]
- Required Construction Documents for the battery energy storage system being installed, including required attachments.

Completed permit applications can be submitted electronically to [EMAIL ADDRESS] or in person at [BUILDING DEPARTMENT ADDRESS] during business hours [INDICATE BUSINESS HOURS].

Permit determinations will be issued within [TIMELINE] calendar days upon receipt of complete and accurate applications. The municipality will provide feedback within [TIMELINE] calendar days of receiving incomplete or inaccurate applications.

Questions about this permitting process may be directed to [MUNICIPAL CONTACT INFORMATION].

This application and the following attachments will constitute the Battery Energy Storage System Permitting Package.

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- Permitting fee of $[ENTER FEE HERE], payable by [ENTER VALID PAYMENT METHODS, If checks are allowed INCLUDING WHO CHECKS SHOULD BE MADE PAYABLE TO]
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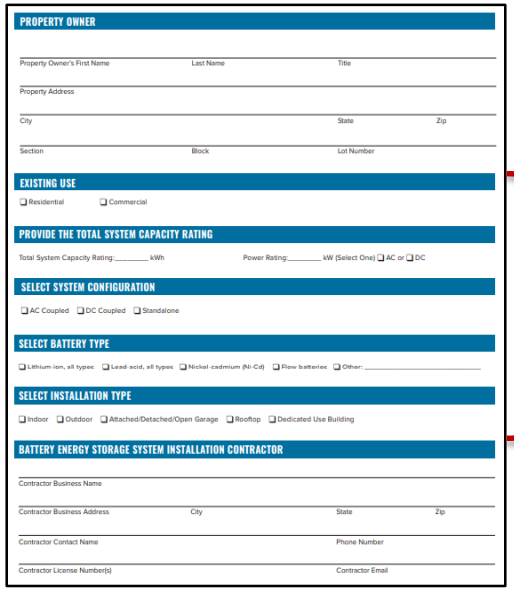
Battery Energy Storage System Model Permit

Tier 1 and Tier 2 Requirement



PROPERTY OWNER

Property Owner's First Name | Last Name | Title

Property Address

City | State | Zip

Section | Block | Lot Number

EXISTING USE

❑ Residential ❑ Commercial

PROVIDE THE TOTAL SYSTEM CAPACITY RATING

Total System Capacity Rating:_____ kWh Power Rating:_____ kW (Select One) ❑ AC or ❑ DC

SELECT SYSTEM CONFIGURATION

❑ AC Coupled ❑ DC Coupled ❑ Standalone

SELECT BATTERY TYPE

❑ Lithium-ion, all types ❑ Lead-acid, all types ❑ Nickel-cadmium (Ni-Cd) ❑ Flow batteries ❑ Other: _____

SELECT INSTALLATION TYPE

❑ Indoor ❑ Outdoor ❑ Attached/Detached/Open Garage ❑ Rooftop ❑ Dedicated Use Building

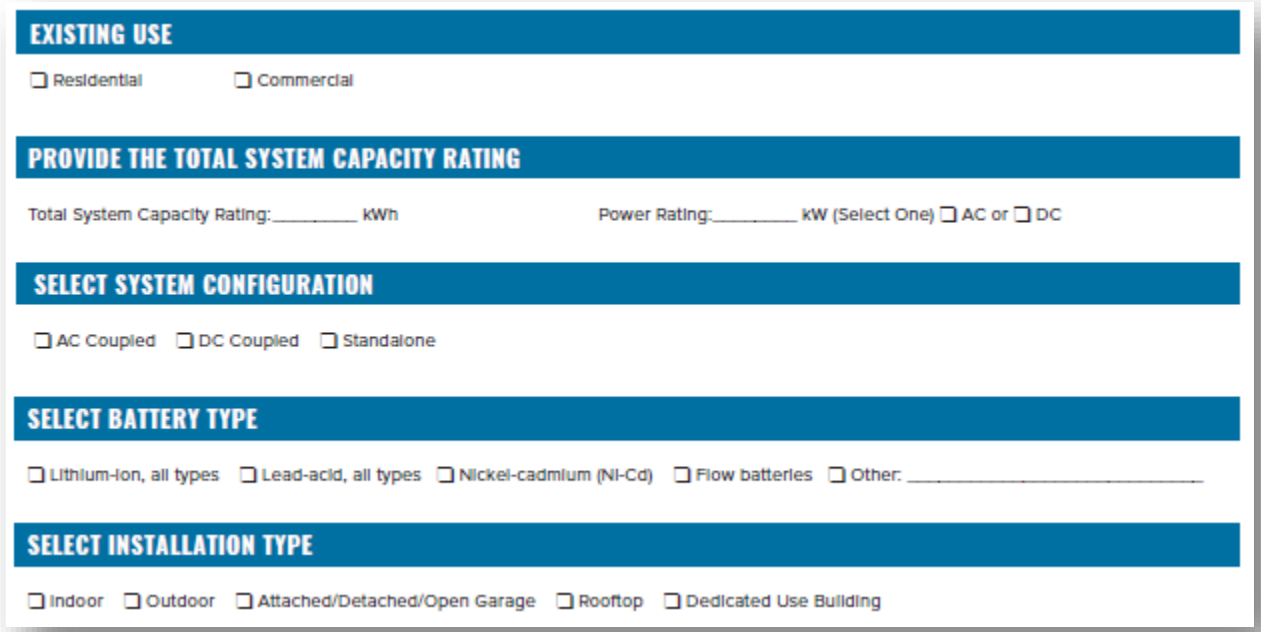
BATTERY ENERGY STORAGE SYSTEM INSTALLATION CONTRACTOR

Contractor Business Name

Contractor Business Address | City | State | Zip

Contractor Contact Name | Phone Number

Contractor License Number(s) | Contractor Email



EXISTING USE

❑ Residential ❑ Commercial

PROVIDE THE TOTAL SYSTEM CAPACITY RATING

Total System Capacity Rating:_____ kWh Power Rating:_____ kW (Select One) ❑ AC or ❑ DC

SELECT SYSTEM CONFIGURATION

❑ AC Coupled ❑ DC Coupled ❑ Standalone

SELECT BATTERY TYPE

❑ Lithium-ion, all types ❑ Lead-acid, all types ❑ Nickel-cadmium (Ni-Cd) ❑ Flow batteries ❑ Other: _____

SELECT INSTALLATION TYPE

❑ Indoor ❑ Outdoor ❑ Attached/Detached/Open Garage ❑ Rooftop ❑ Dedicated Use Building

NEW YORK STATE OF OPPORTUNITY. NYSERDA

Battery Energy Storage System Model Permit

Tier 1 and Tier 2 Requirement

Electrician Business Name

Electrician Business Address | City | State | Zip

Electrician Contact Name | Phone Number

Electrician License Number(s) | Electrician Email

Please sign below to affirm that all answers are correct and that you have met all the conditions and requirements to participate in this unified process.

Property Owner's Signature | Date

Battery Energy Storage System Company Representative Signature | Date

PERMITS AND APPROVALS REQUIRED

The following permits are the minimum requirements for battery energy storage systems installed with an aggregate energy capacity up to 600 kWh.

1. Battery Energy Storage System Permit
2. [LIST TYPE OF PERMIT(S) REQUIRED BY THE LOCAL JURISDICTION, i.e., ELECTRICAL OR BUILDING PERMIT].

SUBMITTAL REQUIREMENTS

In order to submit a complete permit application for a new battery energy storage system, the applicant must include:

a) Completed Application form on page 2.

b) Construction Documents, with listed attachments. Construction Documents must be stamped and signed by a New York State Registered Architect or New York State Licensed Professional Engineer.

General Requirements

- Minimum plan size is 11"x17" with a minimum font of 10.
  - Include 4 full sets of plans and 2 sets of supporting documents.
- Include the applicable codes on the cover sheet for the project.
- Include the complete scope of work on the cover sheet for the project.
- All battery energy storage systems, all dedicated use buildings, and all other buildings or structures that (1) contain or are otherwise associated with a battery energy storage system and (2) subject to the NYS Uniform Fire Prevention and Building Code (Uniform Code) and/or the NYS Energy Conservation Construction Code(Energy Code) shall be designed, erected, and installed in accordance with all applicable provisions of the Uniform Code, all applicable provisions of the Energy Code, and all applicable provisions of the codes, regulations, and industry standards as referenced in the Uniform Code, the Energy Code, and the [Village/Town/City] Code.

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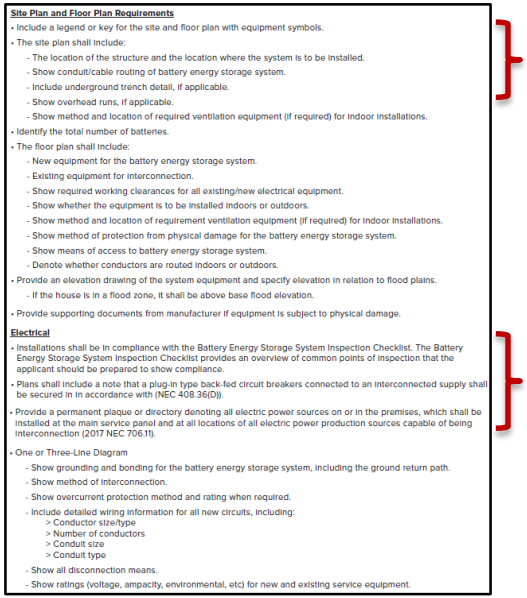
NEW YORK STATE OF OPPORTUNITY. NYSERDA

Battery Energy Storage System Model Permit

Tier 1 and Tier 2 Requirement



Site Plan and Floor Plan Requirements

- Include a legend or key for the site and floor plan with equipment symbols.
- The site plan shall include:
  - The location of the structure and the location where the system is to be installed.
  - Show conduit/cable routing of battery energy storage system.
  - Include underground trench detail, if applicable.
  - Show overhead runs, if applicable.
  - Show method and location of required ventilation equipment (if required) for indoor installations.
- Identify the total number of batteries.
- The floor plan shall include:
  - New equipment for the battery energy storage system.
  - Existing equipment for interconnection.
  - Show required working clearances for all existing/new electrical equipment.
  - Show whether the equipment is to be installed indoors or outdoors.
  - Show method and location of requirement ventilation equipment (if required) for indoor installations.
  - Show method of protection from physical damage for the battery energy storage system.
  - Show means of access to battery energy storage system.
  - Denote whether conductors are routed indoors or outdoors.
- Provide an elevation drawing of the system equipment and specify elevation in relation to flood plains.
  - If the house is in a flood zone, it shall be above base flood elevation.
- Provide supporting documents from manufacturer if equipment is subject to physical damage.

Electrical

- Installations shall be in compliance with the Battery Energy Storage System Inspection Checklist. The Battery Energy Storage System Inspection Checklist provides an overview of common points of inspection that the applicant should be prepared to show compliance.
- Plans shall include a note that a plug-in type back-fed circuit breakers connected to an interconnected supply shall be secured in in accordance with (NEC 408.36(D)).
- Provide a permanent plaque or directory denoting all electric power sources on or in the premises, which shall be installed at the main service panel and at all locations of all electric power production sources capable of being interconnection (2017 NEC 706.11).
- One or Three-Line Diagram
  - Show grounding and bonding for the battery energy storage system, including the ground return path.
  - Show method of interconnection.
  - Show overcurrent protection method and rating when required.
  - Include detailed wiring information for all new circuits, including:
    - > Conductor size/type
    - > Number of conductors
    - > Conduit size
    - > Conduit type
  - Show all disconnection means.
  - Show ratings (voltage, ampacity, environmental, etc) for new and existing service equipment.

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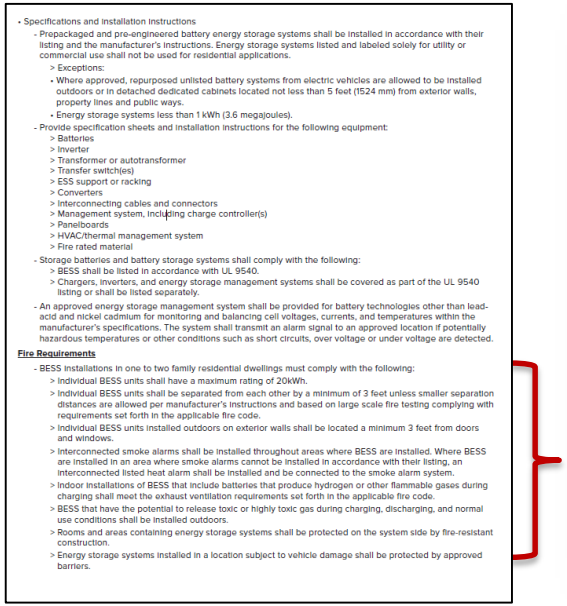
NEW YORK STATE OF OPPORTUNITY. NYSERDA

Battery Energy Storage System Model Permit

Tier 1 and Tier 2 Requirement



- Specifications and installation instructions
  - Prepackaged and pre-engineered battery energy storage systems shall be installed in accordance with their listing and the manufacturer's instructions. Energy storage systems listed and labeled solely for utility or commercial use shall not be used for residential applications.
    - > Exceptions:
    - Where approved, repurposed unlisted battery systems from electric vehicles are allowed to be installed outdoors or in detached dedicated cabinets located not less than 5 feet (1524 mm) from exterior walls, property lines and public ways.
    - Energy storage systems less than 1 kWh (3.6 megajoules).
  - Provide specification sheets and installation instructions for the following equipment:
    - > Batteries
    - > Inverter
    - > Transformer or autotransformer
    - > Transfer switch(es)
    - > ESS support or racking
    - > Converters
    - > Interconnecting cables and connectors
    - > Management system, including charge controller(s)
    - > Panelboards
    - > HVAC/thermal management system
    - > Fire rated material
  - Storage batteries and battery storage systems shall comply with the following:
    - > BESS shall be listed in accordance with UL 9540.
    - > Chargers, inverters, and energy storage management systems shall be covered as part of the UL 9540 listing or shall be listed separately.
  - An approved energy storage management system shall be provided for battery technologies other than lead-acid and nickel cadmium for monitoring and balancing cell voltages, currents, and temperatures within the manufacturer's specifications. The system shall transmit an alarm signal to an approved location if potentially hazardous temperatures or other conditions such as short circuits, over voltage or under voltage are detected.

Fire Requirements

- BESS installations in one to two family residential dwellings must comply with the following:
  - > Individual BESS units shall have a maximum rating of 20kWh.
  - > Individual BESS units shall be separated from each other by a minimum of 3 feet unless smaller separation distances are allowed per manufacturer's instructions and based on large scale fire testing complying with requirements set forth in the applicable fire code.
  - > Individual BESS units installed outdoors on exterior walls shall be located a minimum 3 feet from doors and windows.
  - > Interconnected smoke alarms shall be installed throughout areas where BESS are installed. Where BESS are installed in an area where smoke alarms cannot be installed in accordance with their listing, an interconnected listed heat alarm shall be installed and be 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.
  - > BESS that have the potential to release toxic or highly toxic gas during charging, discharging, and normal use conditions shall be installed outdoors.
  - > Rooms and areas containing energy storage systems shall be protected on the system side by fire-resistant construction.
  - > Energy storage systems installed in a location subject to vehicle damage shall be protected by approved barriers.

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Section 8: Tier 3 Systems Permitting Requirements

Process for Approval

- Choose which zoning district(s) to permit systems.
- Applications shall be reviewed for completeness within 10 business days.
- Applications shall be subject to a public hearing and a notice shall be published in the official newspapers 5 days in advance.
- Referred to the [County Planning Department] pursuant to General Municipal Law § 239-m as required.
- Upon closing the public hearing, the reviewing board shall have 62 days to take action on the application. The 62-day period may be extended.

Requirements for Approval

1. Floodplain
2. Utility Lines and Electrical Circuitry
3. Signage
4. Lighting
5. Vegetation and Tree-cutting
6. Noise
7. Decommissioning
8. Site Plan Application
9. Special Use Permit Standards
10. Ownership Changes

Section 8: Tier 3 Permitting Requirements

B-D: Floodplain, Utility Lines and Electrical Circuitry, Signage

B. Floodplain – Obtain necessary local floodplain development permits if proposed within Special Flood Hazard Areas

C. Utility Line and Electrical Circuitry – On-site lines placed underground if possible, except main service connection and new interconnection equipment

D. Signage – In compliance with ANSI Z535, indicate technology type, rated capacity, special hazards, suppression systems, and emergency contact. As required by NEC, emergency shutoff information and voltage warning

Section 8: Tier 3 Permitting Requirements

E-G: Lighting, Vegetation and Tree-cutting, and Noise

E. Lighting – Minimum necessary for safety and operation, shielded from abutting properties

F. Vegetation – 10 ft buffer from combustible vegetation, some types of single specimens allowed if they don't readily transmit fire, tree removal minimized to extent possible

G. Noise – [1 hour] maximum allowable noise level of [60] dBA as measured at the outside wall of any Non-participating Residence and Occupied Community Building

Section 8: Tier 3 Permitting Requirements

H: Decommissioning

Decommissioning Plan

i. Anticipated life of system;

ii. Estimated decommissioning costs;

iii. How estimate was determined;

iv. Method of ensuring available funds for decommissioning and restoration;

v. Method to keep decommissioning cost current; and

vi. Manner in which system will be decommissioned and Site restored.

Decommissioning Fund

Applicant to continuously maintain a fund or bond payable to the city/town/village for removal of the system for the life of the facility

- Form and amount approved/determined by the city/town/village
- May consist of a letter of credit from a State of New York licensed-financial institution
- All costs of financial security borne by the applicant

Section 8: Tier 3 Permitting Requirements

I: Site Plan Application

1. Property lines and physical features of site
2. Proposed changes to landscape, grading, vegetation, lighting, etc.
3. A one or three-line electrical diagram showing layout, equipment components and associated National Electric Code compliant mechanisms
4. Equipment specification sheet for the proposed battery energy storage system components
5. General information including name, address, and contact info of system installer and owner/operator
6. Name, address, phone number and signature of the project applicant and owners, demonstrating their consent to the use of the property for the system
7. Zoning district designation
8. **Commissioning plan**
9. **Fire safety compliance plan**
10. **Operations and maintenance plan**
11. Erosion and sediment control and storm water management plans
12. Signed and sealed engineering documents by a NYS Licensed Professional Engineer, or Registered Architect
13. **Emergency operations plan**

Section 8: Tier 3 Permitting Requirements

Appendix 1: Commissioning Plan

APPENDIX 1: Commissioning Plan

The battery energy storage system commissioning plan shall comply with the Uniform Code and include, at a minimum, the following information:

1. A narrative description of the activities that will be accomplished during each phase of commissioning including the personnel intended to accomplish each of the activities.
2. A listing of the specific BESS and associated components, controls and safety related devices to be tested, a description of the tests to be performed and the functions to be tested.
3. Conditions under which all testing will be performed, which are representative of the conditions during normal operation of the system.
4. Documentation of the owner's project requirements and the basis of design necessary to under-stand the installation and operation of the BESS.
5. Verification that required equipment and systems are installed in accordance with the approved plans and specifications.
6. Integrated testing for all fire and safety systems.
7. Testing for any required thermal management, ventilation or exhaust systems associated with the BESS installation.
8. Preparation and delivery of operation and maintenance documentation.
9. Training of facility operating and maintenance staff.
10. Identification and documentation of the requirements for maintaining system performance to meet the original design intent during the operation phase.
11. Identification and documentation of personnel who are qualified to service, maintain and decommission the BESS, and respond to incidents involving the BESS, including documentation that such service has been contracted for.

http://www.abb.com/cawp/seitp202/25bd70f96d93c5bfc12580d400543938.aspx

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Section 8: Tier 3 Permitting Requirements

Appendix 3: Operations and Maintenance Plan

APPENDIX 3: Operation and Maintenance Manual

The Operation and Maintenance Manual shall be provided to both the BESS owner and their operator before the battery energy storage system is put into operation. The energy storage system shall be operated and maintained in accordance with the manual and a copy of the documentation shall be retained at an approved onsite location to be accessible to facility personnel, fire code officials, and emergency responders.

In addition to complying with the Uniform Code, the battery energy storage system Operation and Maintenance Manual shall, at a minimum, include design, construction, installation, testing and commissioning information associated with the battery energy storage system as initially approved after being commissioned, as well as the following information:

1. Manufacturer's operation manuals and maintenance manuals for the entire BESS or for each component of the system requiring maintenance, that clearly identify the required routine maintenance actions.
2. Name, address and phone number of a service agency that has been contracted to service the BESS and its associated safety systems.
3. Maintenance and calibration information, including wiring diagrams, control drawings, schematics, system programming instructions and control sequence descriptions, for all energy storage control systems.
4. Desired or field-determined control set points that are permanently recorded on control drawings at control devices or, for digital control systems in system programming instructions.
5. A schedule for inspecting and recalibrating all BESS controls.
6. A service record log form that lists the schedule for all required servicing and maintenance actions and space for logging such actions that are completed over time and retained on site.
7. Inspection and testing records

https://www.nrel.gov/esif/partnerships-raytheon.html

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Section 8: Tier 3 Permitting Requirements

Appendix 2: Supplemental Guidance for Developing Fire Safety Compliance Plan

- Outlines safety recommendations pertaining to hazard mitigation analysis
- Location and construction
- Fire-extinguishing systems
- Fire control and suppression
- Ventilation
- Spill control and neutralization
- Thermal runaway
- Safety caps
- Explosion control
- Special considerations for indoor and outdoor installations

http://fire-suppression-systems.com/fire-suppression-systems/applications/battery-energy-storage/

Section 8: Tier 3 Permitting Requirements

Appendix 4: Emergency Operations Plan

APPENDIX 4: Emergency Operations Plan

An emergency operations plan shall include the following information:

a. Procedures for safe shutdown, de-energizing, or isolation of equipment and systems under emergency conditions to reduce the risk of fire, electric shock, and personal injuries, and for safe start-up following cessation of emergency conditions.

b. Procedures for inspection and testing of associated alarms, interlocks, and controls.

c. Procedures to be followed in response to notifications from the Battery Energy Storage Management System, when provided, that could signify potentially dangerous conditions, including shutting down equipment, summoning service and repair personnel, and providing agreed upon notification to fire department personnel for potentially hazardous conditions in the event of a system failure.

d. Emergency procedures to be followed in case of fire, explosion, release of liquids or vapors, damage to critical moving parts, or other potentially dangerous conditions. Procedures can include sounding the alarm, notifying the fire department, evacuating personnel, de-energizing equipment, and controlling and extinguishing the fire.

e. Response considerations similar to a safety data sheet (SDS) that will address response safety concerns and extinguishment when an SDS is not required.

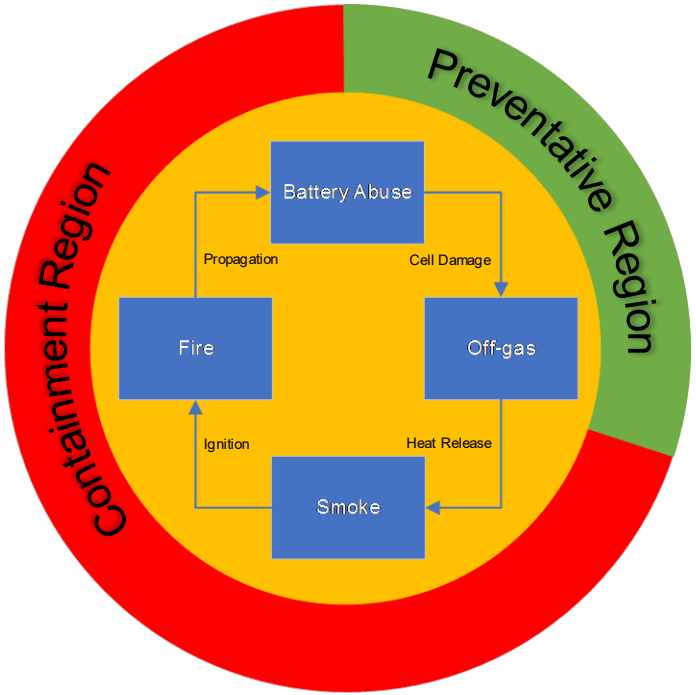
f. Procedures for dealing with battery energy storage system equipment damaged in a fire or other emergency event, including maintaining contact information for personnel qualified to safely remove damaged battery energy storage system equipment from the facility.

g. Other procedures as determined necessary by the [Village/Town/City] to provide for the safety of occupants and emergency responders.

h. Procedures and schedules for conducting drills of these procedures.

Fire Safety Compliance

Appendix 2: Fire Safety Compliance



Thermal runaway - What happens?

1. **Battery Abuse –** potentially electrical, mechanical, thermal or physical abuse of the battery that results in some kind of cell damage
2. **Off-gassing/Venting** due to rise in internal temperature – still time to prevent thermal runaway
3. **Smoke** – thermal runaway has begun and must be contained
4. **Fire** – thermal runaway is underway and must be contained, propagation likely
5. **Propagation** to other cells if not contained

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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

Appendix 2: Fire Safety Compliance

Protection Methods for Stages of Thermal Runaway Battery Failure

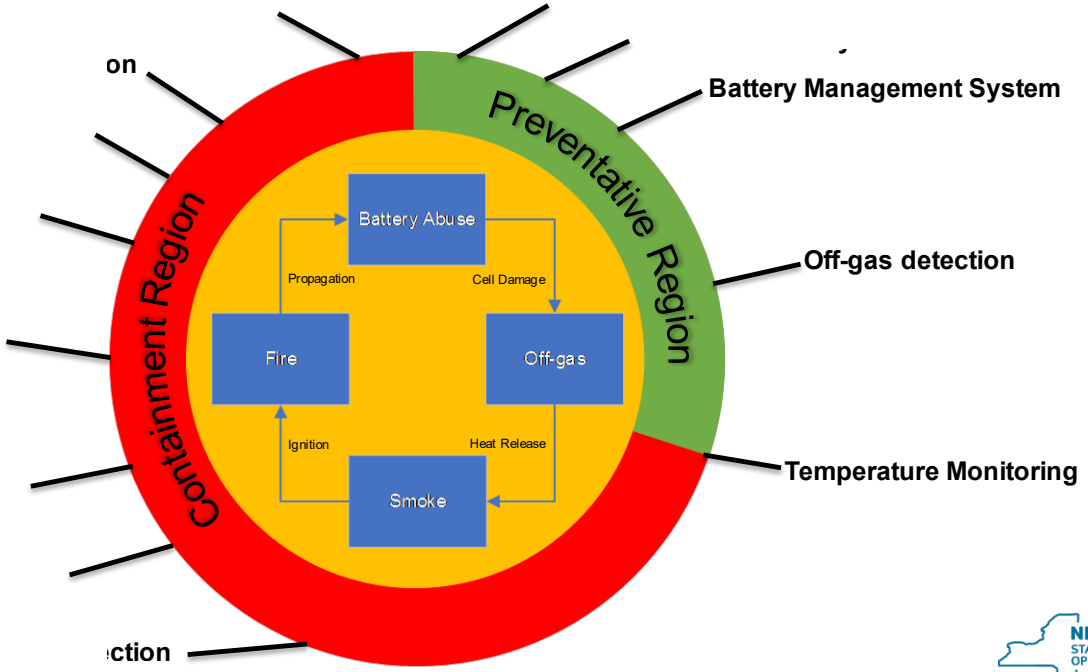

Image adapted from: "Compliance Requirements and Fault Detection." Steve Cummings, Nexceris, LLC, June 28, 2018 - http://energystorage.org/system/files/resources/nfpa_webinar_combined_slides_v5.pdf

Appendix 2: Fire Safety Compliance

7. Electrochemical BESS technology specific protection

Compliance Required	Battery Technology				Other BESS and Battery Technologies
	Lead-acid	Ni-Cad & Ni-MH	Lithium-ion	Flow	
7.1 Exhaust ventilation	Yes	Yes	No	Yes	Yes
7.2 Spill control and neutralization	Yes	Yes	No	Yes	Yes
7.3 Explosion control	Yes	Yes	Yes	Yes	Yes
7.4 Safety Caps	Yes	Yes	No	Yes	Yes
7.5 Thermal runaway	Yes	Yes	Yes	Yes	Yes

Electrochemical BESS Tech Specific Protections

Exhaust ventilation

- 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

Intake port

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Electrochemical BESS Tech Specific Protections

Gas Detector

- Gas detection system designed to activate the ventilation system where the flammable gas exceeds 25% of the LFL and remain activated 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

"Managing Fire Risk from Lithium-ion Batteries" Fire Sector Summit, Denios, July 2018

Electrochemical BESS Tech Specific Protections

Spill control and neutralization

- 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

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

Electrochemical BESS Tech Specific Protections

Explosion control

Provided for rooms, areas, or walk-in units containing BESS

1. Deflagration venting
   - Pressure panels
2. Deflagration prevention
   - Exhaust fans
   - 25 % of LFL

NEW YORK STATE OF OPPORTUNITY. NYSERDA

Electrochemical BESS Tech Specific Protections

Safety caps

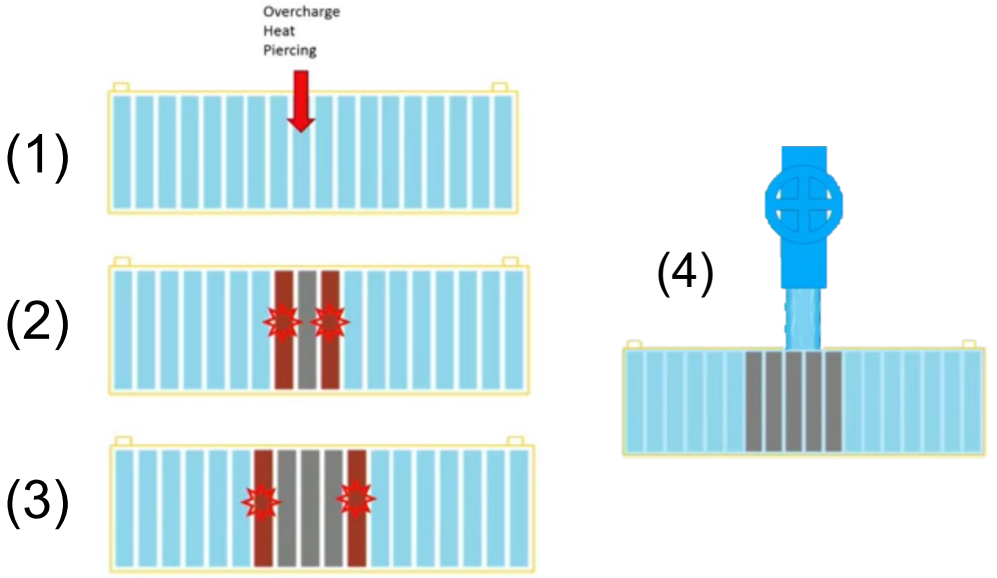
- Vented batteries and other BESS shall be provided with flame arresting safety caps
- Hydrogen release
- Pressure build up

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

Electrochemical BESS Tech Specific Protections

Thermal runaway

- BESS shall be provided with a listed device or other approved method to prevent, detect, and minimize the impact of thermal runaway.



*Opening and A strategy for fighting lithium-ion battery fires. Marko Hassinen, Emergency Services College, November 2018

Appendix 2: Fire Safety Compliance

8. Indoor Installations

1. **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
2. **Non-dedicated use buildings** – contains BESS, but not dedicated use as described above

Compliance Required	Dedicated Use Buildings	Non-Dedicated Use Buildings
5. General Installation Requirements	Yes	Yes
6.1. Size and separation	Yes	Yes
6.3. Elevation	Yes	Yes
6.4. Smoke and automatic fire detection	Yes	Yes
6.5. Fire suppression systems	Yes	Yes
8.3. Dwelling units and sleeping units	NA	Yes
8.4. Fire-resistance rated separations	Yes	Yes
7. Technology specific protection	Yes	Yes

Appendix 2: Fire Safety Compliance

9. Outdoor Installations

1. **Remote outdoor installations** – 100ft clearance from buildings, lot lines, public ways, stored combustible materials, hazardous materials, high piled stock and other exposure hazards
2. **Installations near exposures** - not remote as described above

Compliance Required	Remote Installations	Installations Near Exposures
5. General Installation Requirements	Yes	Yes
6.1 Size and separation	No	Yes
6.4. Smoke and automatic fire detection	Yes	Yes
6.5. Fire suppression systems	Yes	Yes
6.6. Maximum enclosure size	Yes	Yes
6.7. Vegetation control	Yes	Yes
6.8. Means of egress separation	Yes	Yes
9.3. Clearance to exposures	Yes	Yes
7. Technology specific protection	Yes	Yes

Hazard Mitigation Analysis

HMA will evaluate the consequences of failure modes

- Thermal runaway in a single BESS rack, module, or unit
- Failure of any battery management system
- Failure of any ventilation system
- Voltage surges on the primary
- Short circuits on the load side of BESS
- Failure of smoke or gas, fire suppression.
- Failure of spill neutralization or containment system

Analysis approval

- Fires will be contained for the minimum duration of the fire-resistance and detected in time to allow occupants to safely evacuate
- Toxic and highly toxic gases released during fires will not reach concentrations in excess of Immediately Dangerous to Life or Health (IDLH) level in the building or adjacent means of egress routes during the time deemed necessary to evacuate occupants from any affected area
- Flammable gases will not exceed 25% of their LFL and will be controlled through ventilation of the gases preventing accumulation or by deflagration venting

Fire Remediation

- BESS owner shall mitigate the hazard or remove damaged equipment from the premises to a safe location
- BESS owner shall dispatch fire mitigation personnel 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 energy storage equipment is removed from the premises
- On-duty fire mitigation personnel shall have the following responsibilities:
  - Fire watch
  - Notify FD if a fire occurs
  - Maintain until decommissioning is finished
  - Evacuate building if needed

Battery Energy Storage Management System

- 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

Enclosures

- Must be of noncombustible construction

General Installation Requirements

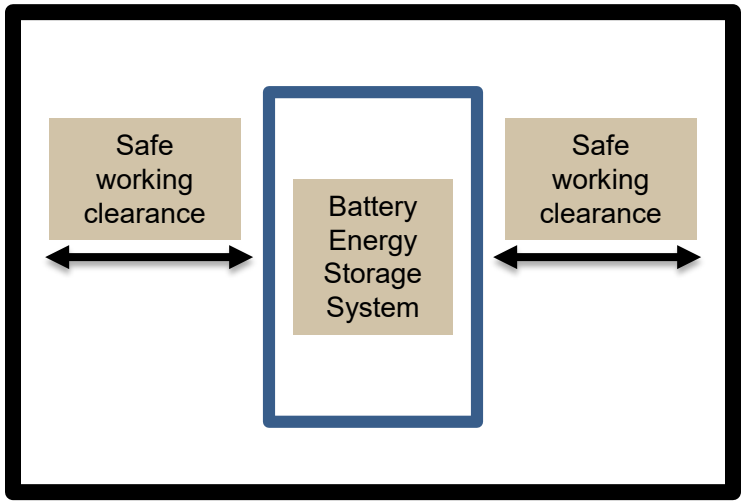
Electrical Disconnects

- 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.

General Installation Requirements

Working clearances

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

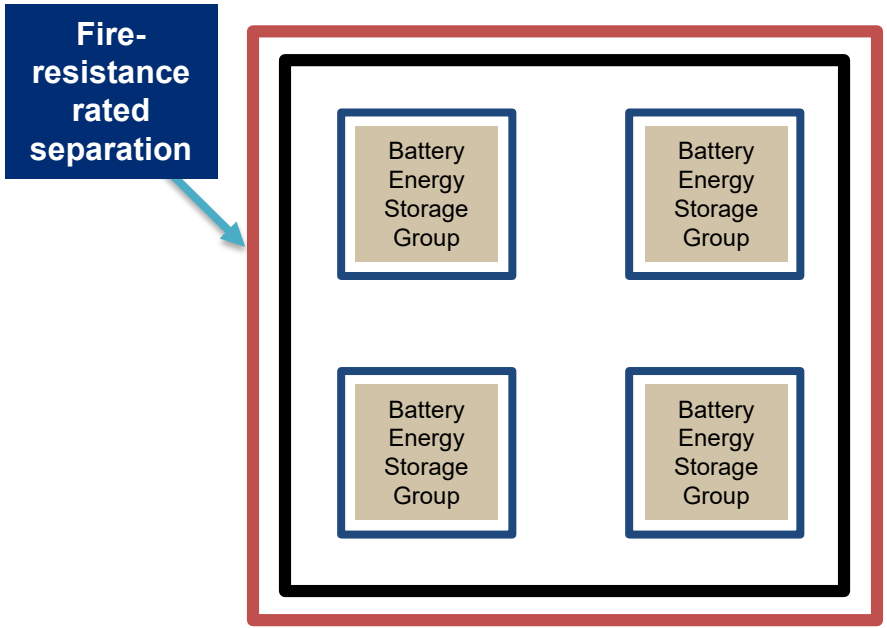


General Installation Requirements

Fire-resistance rated separations

- 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



General Installation Requirements

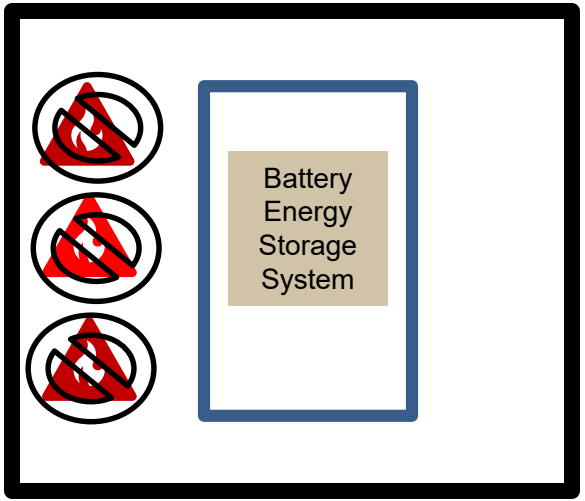
Vehicle impact protection

- Where BESS are subject to impact by motor vehicle, including fork lifts, vehicle impact protection must be provided

General Installation Requirements

Combustible storage

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

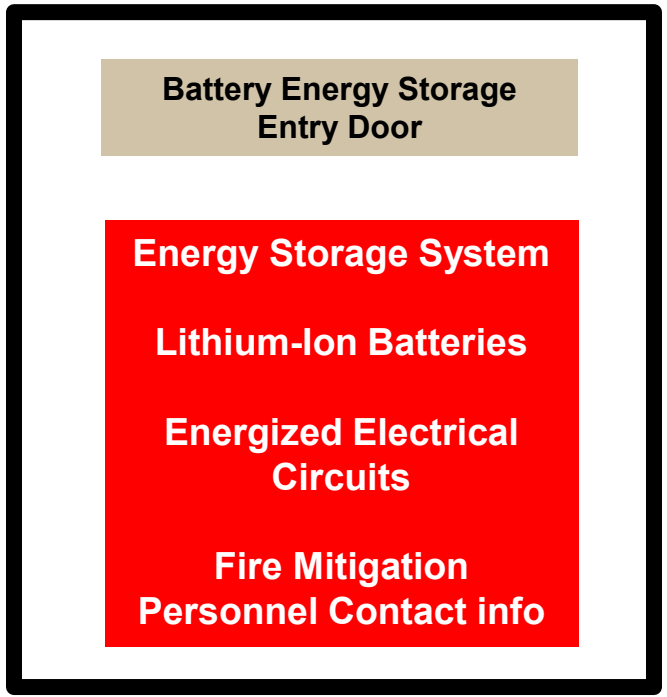


General Installation Requirements

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



General Installation Requirements

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

- Ensure that this does not inhibit the required air flow to or exhaust from the BESS

General Installation Requirements

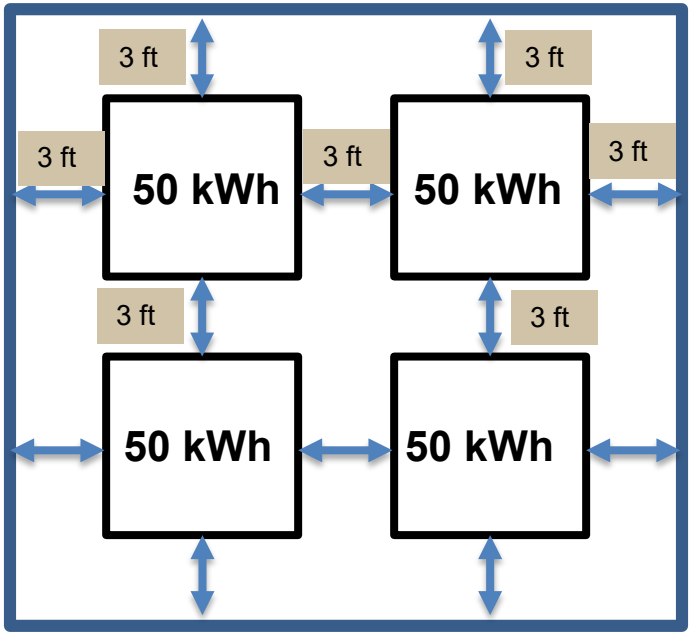
Walk-in units

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

Electrochemical BESS Protections

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



Fire Code Official is authorized to approve larger capacities or smaller separation distances based on large scale fire testing

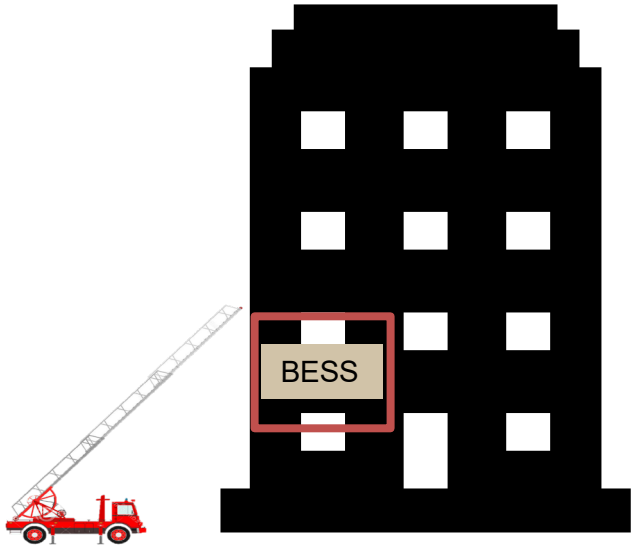
NEW YORK STATE OF OPPORTUNITY. NYSERDA

Electrochemical BESS Protections

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

NEW YORK STATE OF OPPORTUNITY. NYSERDA

Electrochemical BESS Protections

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

Electrochemical BESS Protections

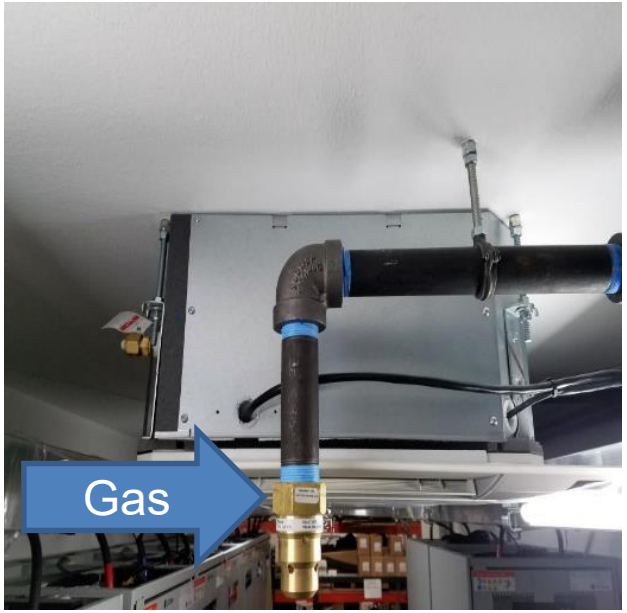
Fire suppression systems

1. Automatic sprinkler system with minimum density of 0.3gpm/ft^2 or determined based on large scale fire testing

or

2. 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

Fire Suppression



Dry Standpipe

Indoor Installations

Dwelling units and sleeping units

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

Indoor Installations

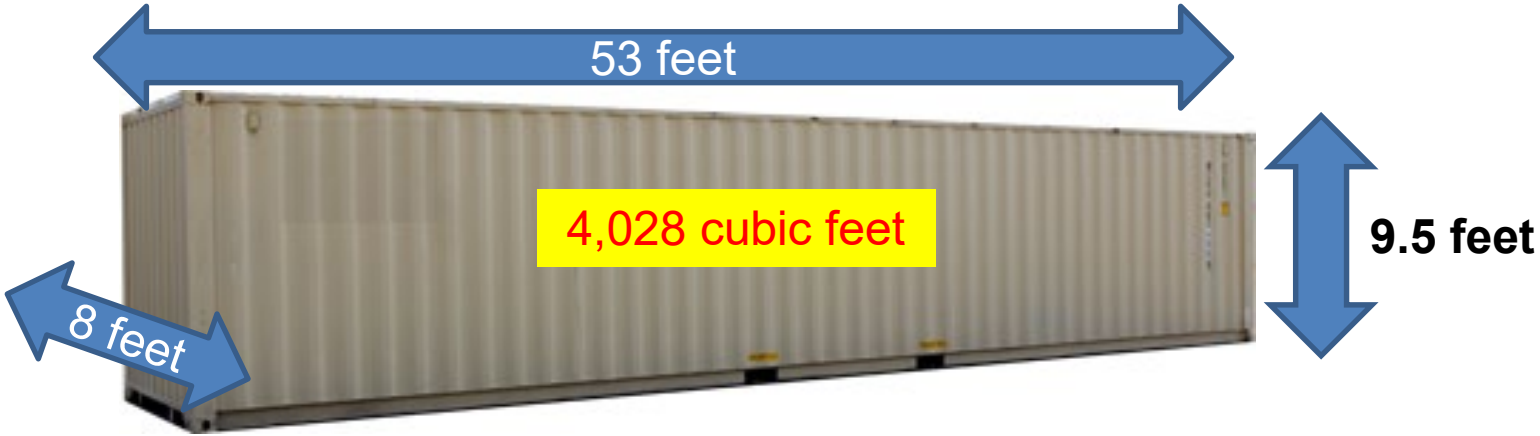
Fire-resistance rated separations

2-hour fire barriers (§707 IBC) and 2-hour fire rated horizontal assemblies (§711 IBC)

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

Electrochemical BESS Protections

Maximum enclosure size

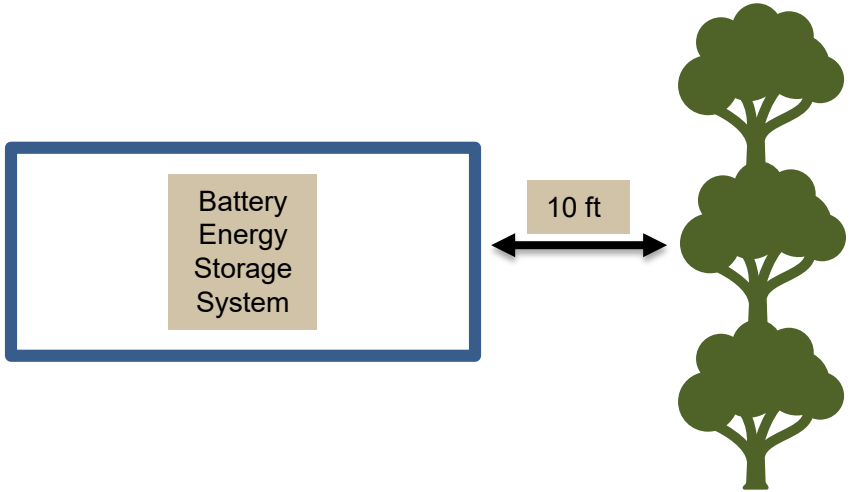


Outdoor walk-in units exceeding these limitations shall be consider indoor installations

Electrochemical BESS Protections

Vegetation control

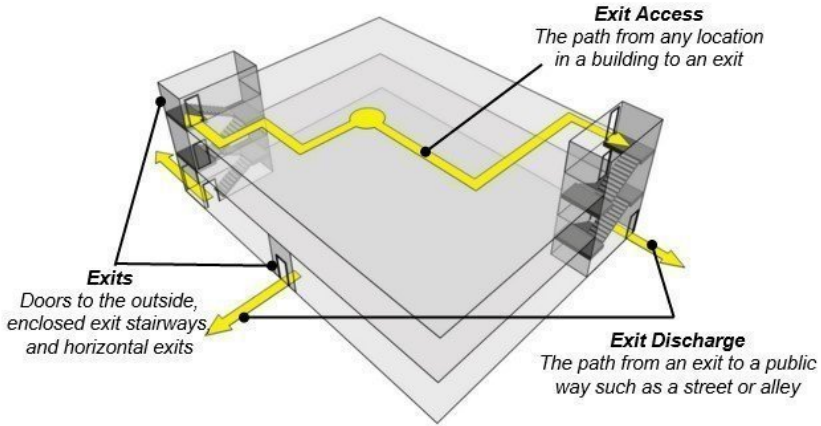
- Areas within 10 feet of each side of outdoor BESS shall be cleared of combustible vegetation.



Electrochemical BESS Protections

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 10ft

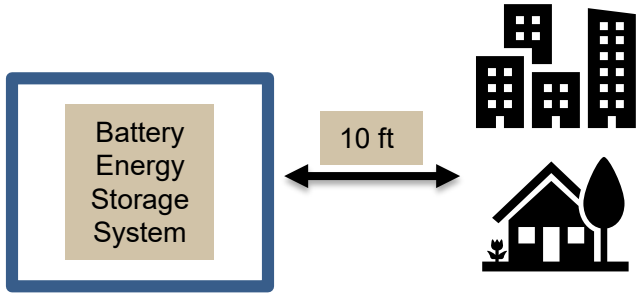


"Means of Egress" Upside Innovations, 2019.

Outdoor Installations

Clearance to exposures

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



Exceptions to reduce clearance to 3ft:

- All exposures:
  - 1-hour fire barrier 5ft 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

Questions?

Thank you, For additional questions, please contact me at:

CleanEnergyHelp@nyserda.ny.gov