NYSERDA Presents:

Battery Energy Storage Systems –
Key Considerations for Local Governments

Webinar #1:
Battery Energy Storage Systems 101

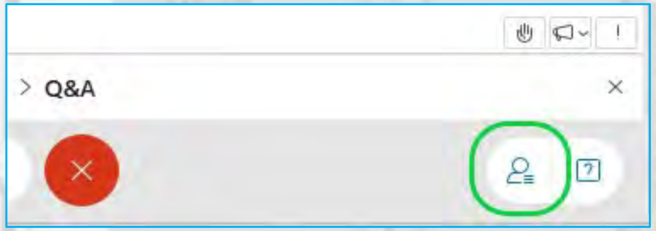
NEW YORK STATE OF OPPORTUNITY | NYSERDA

May 5, 2021

Meeting Procedures:

- Members of the public are muted upon entry
- Questions and comments may be submitted in writing through the Q&A feature at any time during the event
- The chat feature is disabled
- Today's materials, along with a recording of the webinar, will be posted to www.nyserda.ny.gov/StorageGuidebook
- If technical problems arise, please contact Sal.Graven@nyserda.ny.gov

You'll see when your microphone is muted



Coming Webinars:

Wednesday, May 19th: Fire Safety
Featured Speakers: NYS Office of Fire Prevention and Control; Energy Safety Response Group

Wednesday, June 2nd: Zoning and Permitting
Featured Speakers: NYSERDA's Clean Energy Siting Team

Wednesday, June 16th: Decommissioning and End-of-Life Considerations
Featured Speakers: DNV; Li-Cycle

Wednesday, June 30th: Taxation and Assessments
Featured Speakers: Hodgson Russ LLP

Agenda:

- Introduction to NYS Goals, Programs, and Resources
- Battery Energy Storage Systems 101
- BESS Fact vs. Fiction
- Q&A

Speakers:

- **Jason Doling**
  NYSERDA

- **Dr. Stanley Whittingham**
  Distinguished Professor of Chemistry,
  Binghamton University (SUNY);
  2019 Nobel Laureate for Chemistry

Introduction to NYS Goals, Programs, and Resources

The Climate Leadership and Community Protection Act (Climate Act)

Signed into law in 2019, the nation-leading Climate Act demonstrates New York's commitment to **fighting climate change**, **transforming our economy**, and **building resilient communities**.

The Climate Act:

- Most aggressive greenhouse gas reduction goals of any major economy: **40% by 2030, 85% by 2050**
- **70%** renewable energy **by 2030**; **100%** zero-emission electricity **by 2040**
- Established a path toward achieving carbon neutrality
- Created the Climate Action Council

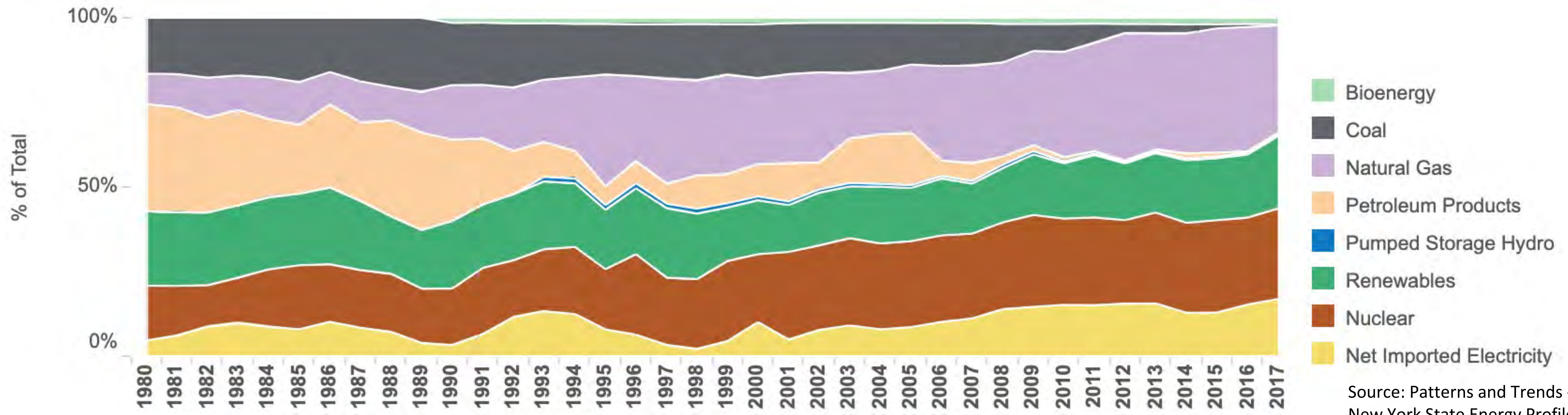
Climate Act: By the Numbers

At-Large Goals:

- 70% Renewable Electricity by 2030
- 100% Emissions-Free Grid by 2040

Technology-Specific Goals:

- 6,000 MW Distributed Solar by 2025
- 9,000 MW Offshore Wind by 2035
- 1,500 MW Energy Storage by 2025, and 3,000 MW by 2030



Source: Patterns and Trends - New York State Energy Profile (NYSERDA)

NYSERDA Energy Storage Initiative

Provides incentives & technical assistance to support deployment of advanced energy storage technologies

- **Retail Energy Storage Incentives:**
  - For residential through commercial-scale storage projects < 5 megawatts (MW)
  - Incentives vary based on region and megawatt-hour (MWh) block allocation
  - Over $161 million allocated; $16.4 million remaining for residential, commercial projects on Long Island and Con Edison

- **Bulk Energy Storage Incentives:**
  - For storage projects > 5 MW
  - Incentives vary based on project size and year of interconnection
  - Funding is fully allocated

www.nyserda.ny.gov/EnergyStorage

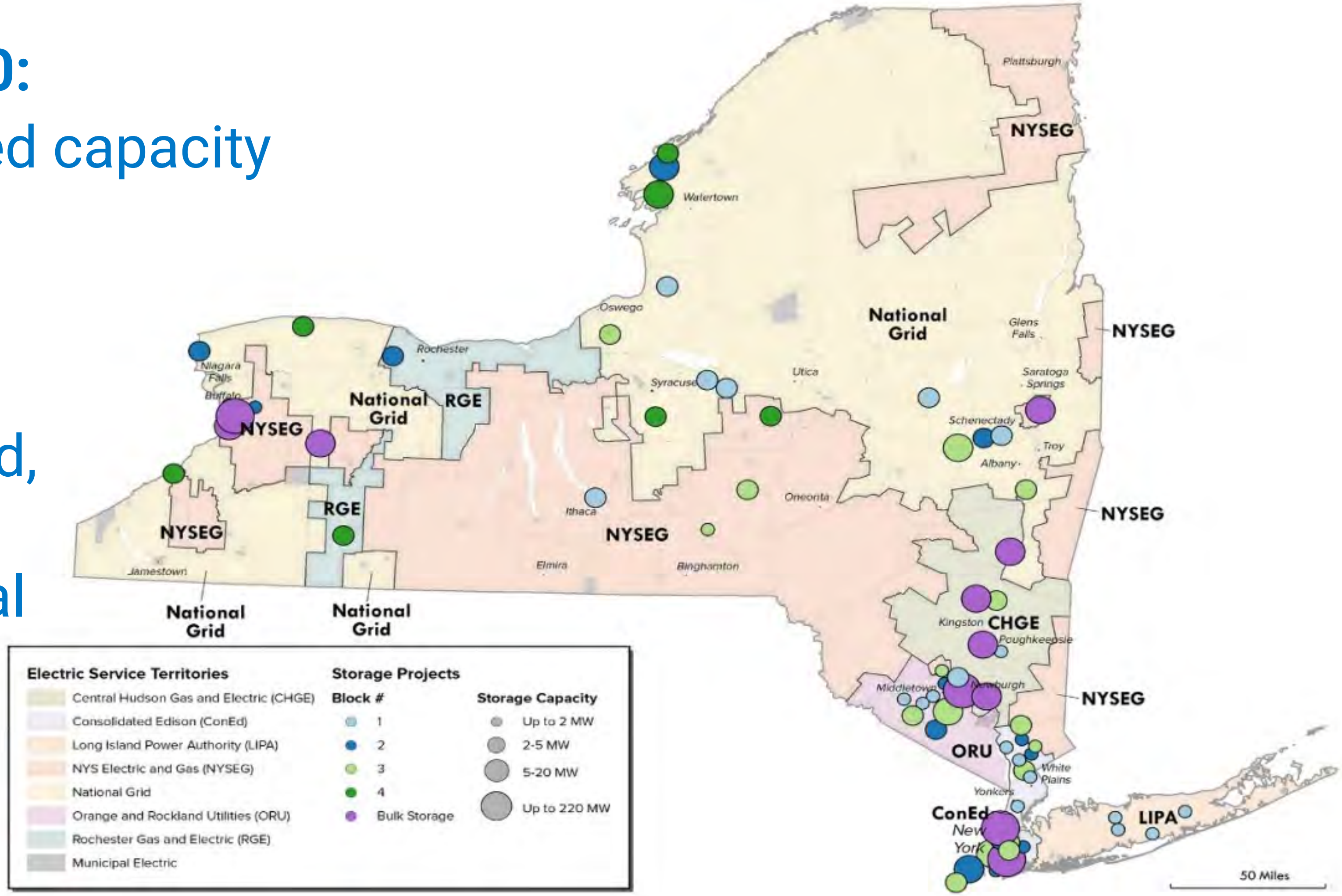
Energy Storage Deployment in NYS

As of October 31, 2020:

- 96.43 MW of installed capacity
- 561 projects

As of April 30, 2021:

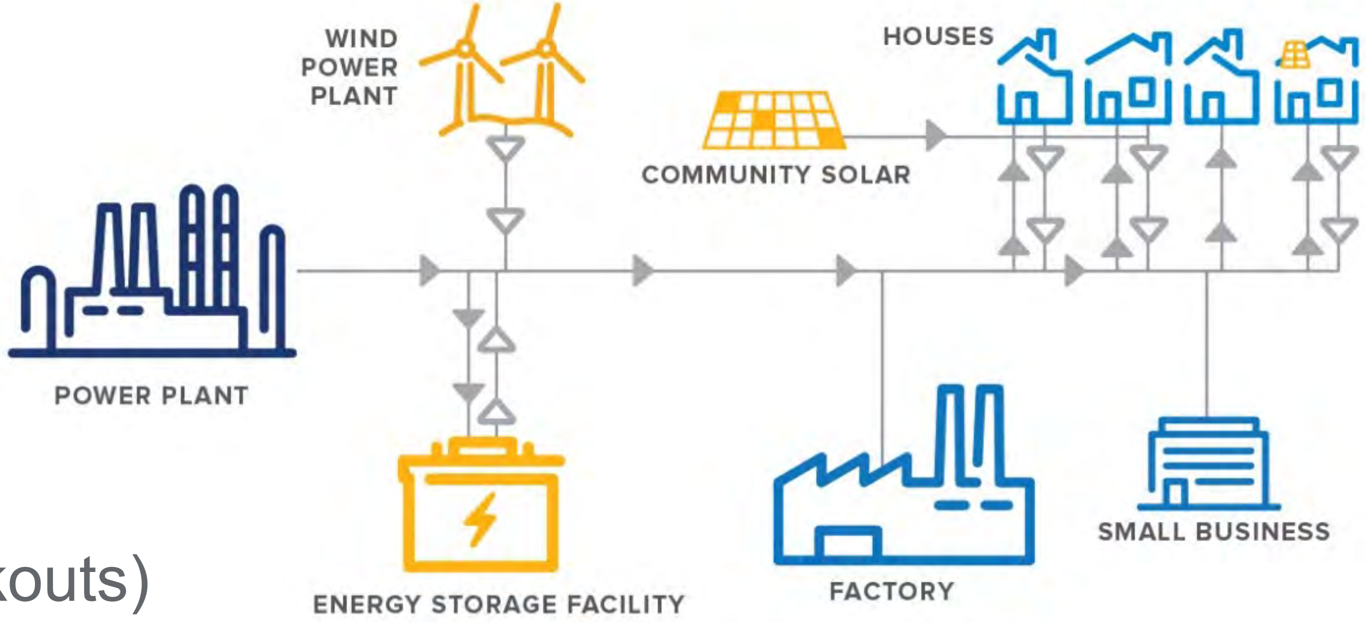
- 1,027 MW contracted, under development
- Over 100 commercial and bulk projects

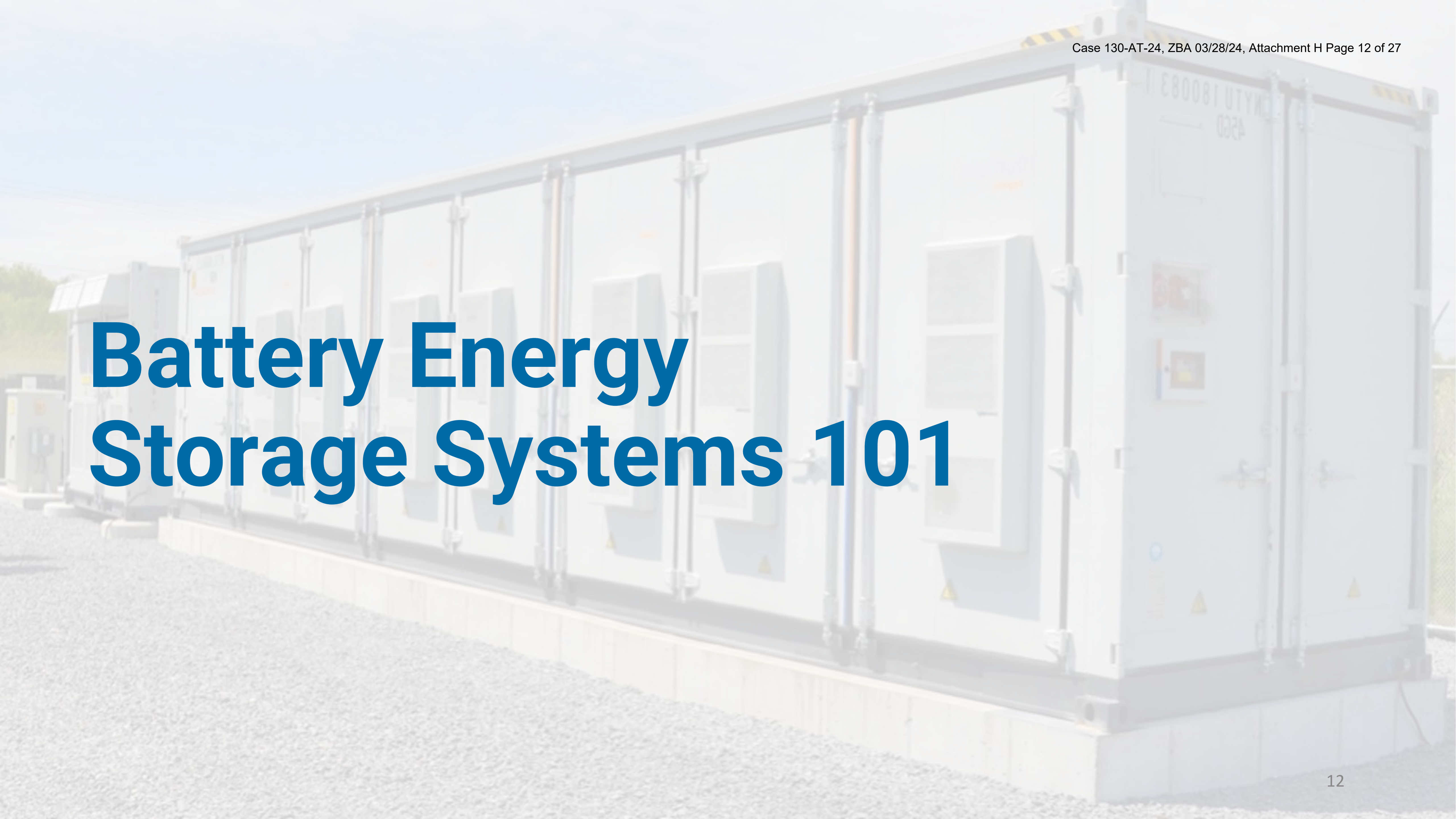


Use Cases for Energy Storage

Battery Energy Storage Systems can serve a variety of important roles, including these more common:

- Defer costly upgrades to transmission and distribution infrastructure
- Provide key ancillary grid services
- Support integration of renewable energy generators, including solar and wind
- Alleviate congestion in the grid (reducing brownouts and blackouts)
- Electric bill management, backup power for homes and businesses

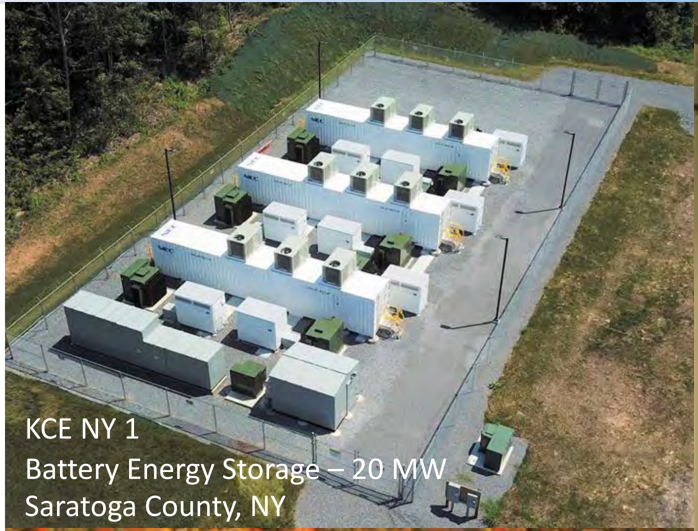




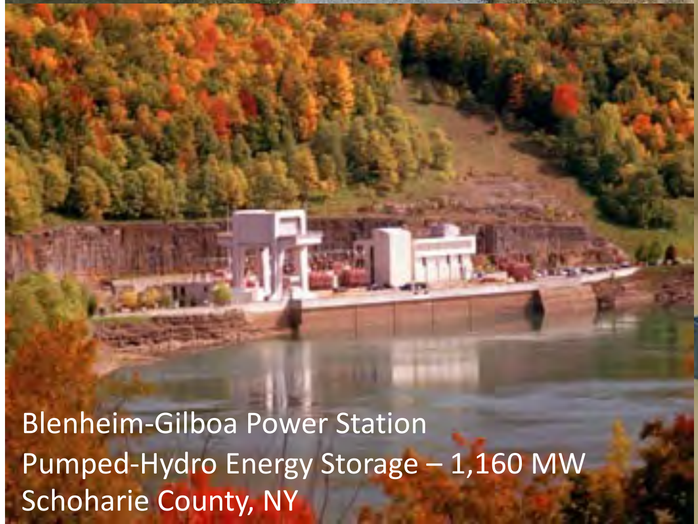
Battery Energy Storage Systems 101

Battery **Energy Storage** Systems (BESS)

- We want electrical energy
- Energy Storage = System that holds kinetic, potential, or other forms of energy that can be converted to another form (electrical energy).
- Examples of stored energy types: (naturally occurring examples in red/green)
  - Chemical (batteries, fuel cells; *fossil fuels*)
  - Potential (pumped hydro; *water*)
  - Kinetic (fly wheels; *wind, tides*)
  - Thermal (water, rocks; *geothermal, sun*)



KCE NY 1
Battery Energy Storage – 20 MW
Saratoga County, NY



Blenheim-Gilboa Power Station
Pumped-Hydro Energy Storage – 1,160 MW
Schoharie County, NY

Beacon Power Plant
Flywheel Energy Storage – 20 MW
Rensselaer County, NY

Battery Energy Storage Systems (BESS)

Two energy storage technologies dominate today in NYS and US:

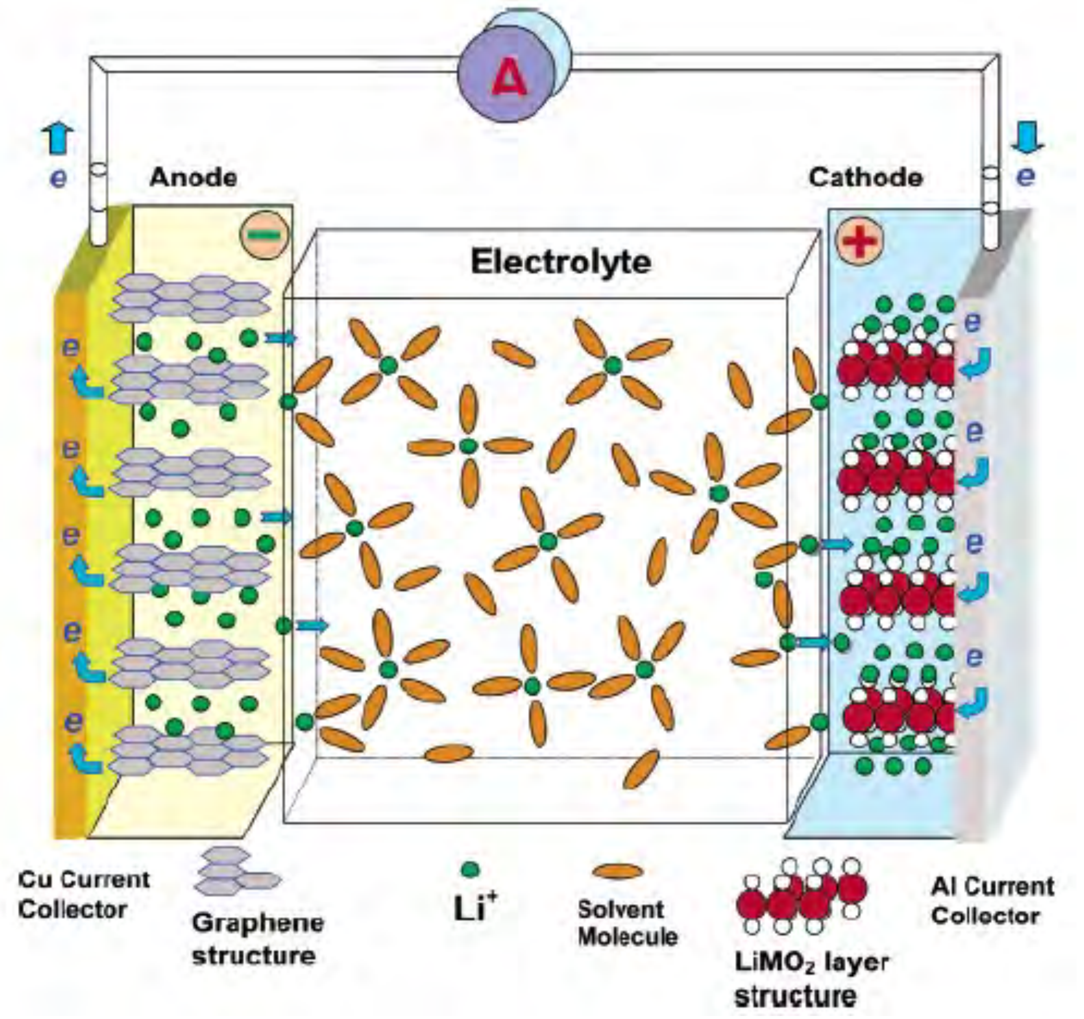
- **Pumped Hydro** (potential to electrical energy)
  - By far the largest in terms of storage capacity, gigawatt-hours
  - Highly efficient, 73%
  - Limited future development on new sites
- **Batteries** (chemical to electrical energy)
  - By far the most flexible and common
  - Portable or stationary
  - Milliwatts to Gigawatts
  - Very quick to switch on and off

1.2 GWh in Moss Landing, CA

Battery Energy Storage Systems (BESS)

Anatomy of a Battery:

- Anode
- Cathode
- Electrolyte
  - Liquid - organic



Battery Energy Storage Systems (BESS)

A Brief History of Batteries:

- Volta discovered the first battery in **1799**
- The lead acid battery first reported in **1859**
- The alkaline cell was first marketed in the **1960s**
  - Not rechargeable (primary cell)
- The rechargeable lithium-ion battery was invented in **1972**
  - Commercial success came in 1991 with SONY
  - Now dominates energy storage market, except for SLI in cars and UPS.

45 years old - still working

Battery Energy Storage Systems (BESS)

Why lithium-ion?

+ Stores the **most energy per unit weight or volume** of any battery
+ Essentially **minimal maintenance cost** (computer monitored)
+ **Readily available**; billions made per year
+ **Cost is dropping all the time** – lifetime cost probably lowest
+ "**Portable**" – Utilities can move them as desired (typically in containers)

- Need electronic protection from overcharge/discharge
  - If not, then thermal runaway can occur resulting in fires
- Need temperature control, just like humans
  - Large systems are in air-conditioned containers

Battery Energy Storage Systems (BESS)

Which lithium-ion?

There are two dominant lithium-ion battery types:

Phosphates (LFP)

- Lower cost, safer but store less energy
- Dominant in China
- Expect to dominate in US for BESS in future
- Will be made in NYS (IM3NY in Endicott)

Oxides (NMC)

- Dominant for portable devices as has highest energy per unit volume (EVs, phones, etc.)
- Today, dominant for BESS in US

Battery Energy Storage Systems (BESS)

System Components:

- Cells -> Modules -> Racks
- Battery Management System (BMS)
- Monitoring and safety components
- Balance of System (BOS) equipment

BESS Installation Types

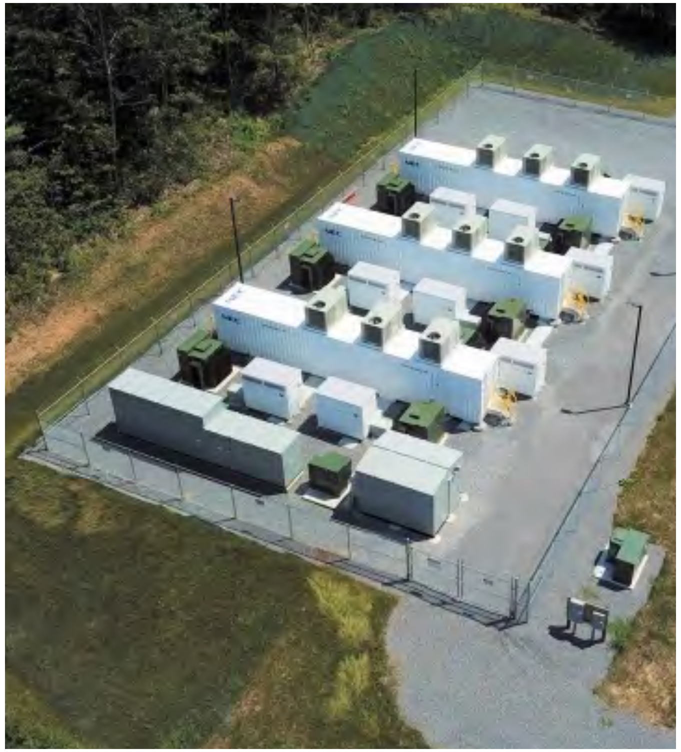
Residential

kWh

Commercial

kWh - MWh

Utility-Scale



MWh - GWh

BESS Fact vs. Fiction

Technology concerns:

- Lithium-ion batteries don't last long
  - FACT: Their lifetime can be up to 10-20 years
- Lithium-ion batteries won't work well in NY's climate
  - FACT: They will! But they need some of the same conditions we do (shelter, temperature regulation, etc.)
- These batteries can't be disposed of safely.
  - FACT: Recycling will be the normal and is already happening in NYS! BESS should not end in municipal waste streams.
- These systems are only needed or appropriate in dense population centers.
  - FACT: They are needed everywhere for resilience, grid stability, elimination of peaker plants, integration of renewable energy, etc.

BESS Fact vs. Fiction

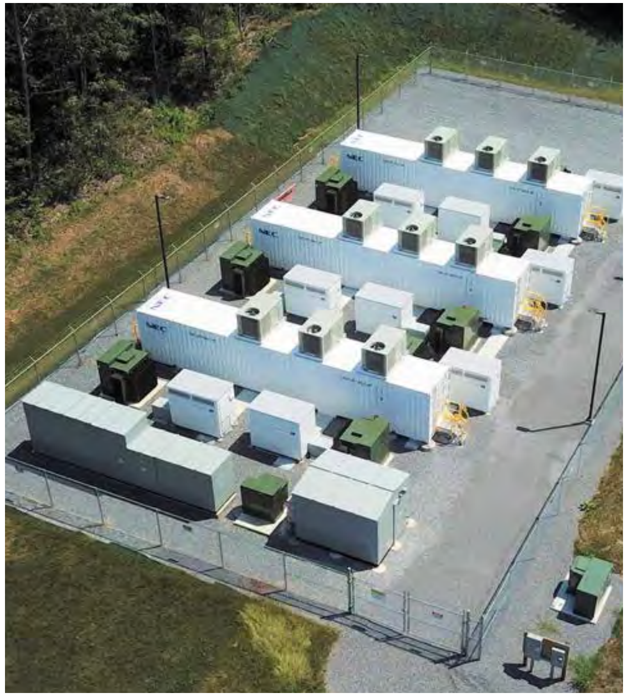
Fire safety concerns:

- These batteries are cheaply made and are likely to catch fire.
  - FACT: Energy storage system fires do happen, but are rare. Advances in technology, safety standards, and fire/building codes have and will continue to mitigate fire safety risks.
  - Important to buy from reliable sources, not just lowest cost.
  - Code compliance and listing to safety standards are primary concerns, not just Country of Origin.
- There are not adequate safety standards in place for these systems.
  - FACT: Safety standards have evolved to address BESS, and are already in place under the 2020 NYS Uniform Fire Prevention and Building Code.
- You can’t use water to extinguish a lithium-ion BESS fire.
  - FACT: Lithium-ion batteries *do not contain* metallic lithium, but rather lithium salts; as such, fire testing has demonstrated water to be an effective agent for cooling and extinguishing BESS fires and incidents.

BESS Fact vs. Fiction

Fire safety concerns (cont.):

- These systems are unmonitored; no one is paying attention if something were to happen.
  - FACT: The 2020 NYS Uniform Code ensures that BESS are equipped with sophisticated Battery Management Systems (BMS).
  - A BMS constantly monitors the system (down to the cell level) to ensure normal operating parameters. In the event of an incident, a BMS will notify key personnel and can even trigger HVAC or hazard mitigation systems.
- Local first responders/firefighters are unprepared to respond to an incident involving BESS.
  - FACT: Firefighters and responders are trained on a regular basis as to how to manage overheating, fires, and electrical hazards.
  - System-specific training and incident response plans should also be provided by project developers.



BESS Fact vs. Fiction

Environmental concerns:

- BESS will pollute the environment; even if firefighters use water on a system, that will produce toxic runoff.
  - FACT: Water is a suitable substance for cooling/extinguishing lithium-ion battery incidents, minimizing the need for spray foams and gels (some of which contain harmful "forever" chemicals).
  - Like many other fires, if water is used on a lithium-ion BESS fire, first responders *may* need to implement firewater collection strategies.
- These batteries produce toxic gases and will negatively affect air quality in communities.
  - FACT: Lithium-ion BESS do not offgas or produce emissions during operations.
- These batteries produce excess noise.
  - FACT: For larger installations, the only noise is from HVAC systems or inverters. Appropriate siting measures can ensure that noise will not be an issue for project neighbors.

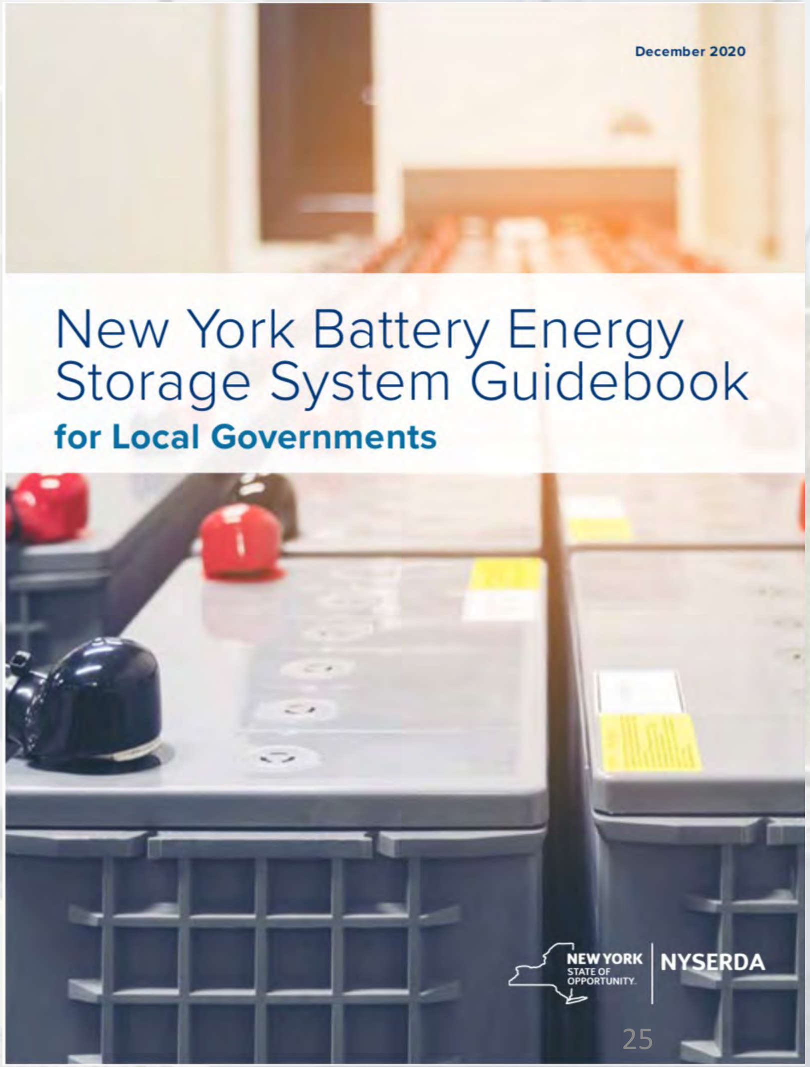
NYSERDA Resources for Local Governments

NY Battery Energy Storage System Guidebook:

- Model Zoning Law
- Model Permit + Inspection Checklist
- 2020 NYS Uniform Code References

NYSERDA Clean Energy Siting Team

- Work one-on-one with municipal boards & local officials to provide free technical assistance
- Offer free accredited trainings for code enforcement officials or planning/zoning board members



Q&A

Helpful links:

- Energy Storage Guidebook for Local Governments
- NYSERDA Energy Storage Program

For additional assistance, reach out to
cleanenergyhelp@nyserda.ny.gov

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Next Webinar in Series:

Fire Safety (Wednesday, May 19th)

NYSERDA Webinar Series

Battery Energy Storage Systems: Key Considerations for Local Governments

NYSERDA is pleased to host a series of webinars intended to equip local governments across New York State – including municipal board members, first responders, code enforcement officers, and other community stakeholders – with the knowledge and resources required to ensure responsible battery energy storage system development.

This webinar series, featuring presentations from NYSERDA staff as well as external subject matter experts, will cover a range of key topics related to battery energy storage systems which are particularly important for communities and local governments.

Events in this series will be held biweekly on Wednesdays from 5:30 p.m. to 6:45 p.m. ET.

Register for each session of interest using the registration links.

Questions? Email NYSERDA's Clean Energy Siting Team: cleanenergyhelp@nyserda.ny.gov

Battery Energy Storage Systems 101

Date: Wednesday, May 5, 2021

Featured Speakers: Dr. Stanley Whittingham, 2019 Nobel Laureate for Chemistry; Distinguished Professor of Chemistry, SUNY Binghamton

Gain an introduction to key concepts and technologies associated with battery energy storage systems, as well as an overview of relevant New York State (NYS) goals, policies and programs.

REGISTER HERE

Fire Safety

Date: Wednesday, May 19, 2021

Featured Speakers: NYS Office of Fire Prevention and Control (OFPC), Energy Safety Response Group (ESRG)

Learn about key fire safety considerations for battery energy storage systems, including a discussion of best practices for first responders, as well as a review of important regulations found in the 2020 NYS Uniform Fire Prevention and Building Code.

REGISTER HERE

Zoning and Permitting

Date: Wednesday, June 2, 2021

Featured Speakers: NYSERDA Clean Energy Siting Team

Dive into the valuable resources available to local governments in NYSERDA's Battery Energy Storage System Guidebook. These tools are designed to assist municipalities in implementing zoning, permitting, and inspection processes for battery energy storage installations.

REGISTER HERE

Decommissioning and End-of-Life Considerations

Date: Wednesday, June 16, 2021

Featured Speakers: DNV and Li-Cycle

Explore best practices for the treatment of battery energy storage systems at the end of their useful life – including system recycling and disposal – as well as an introduction to decommissioning plans for energy storage installations.

REGISTER HERE

Taxation and Assessments

Date: Wednesday, June 30, 2021

Featured Speaker: Hodgson Russ, LLP

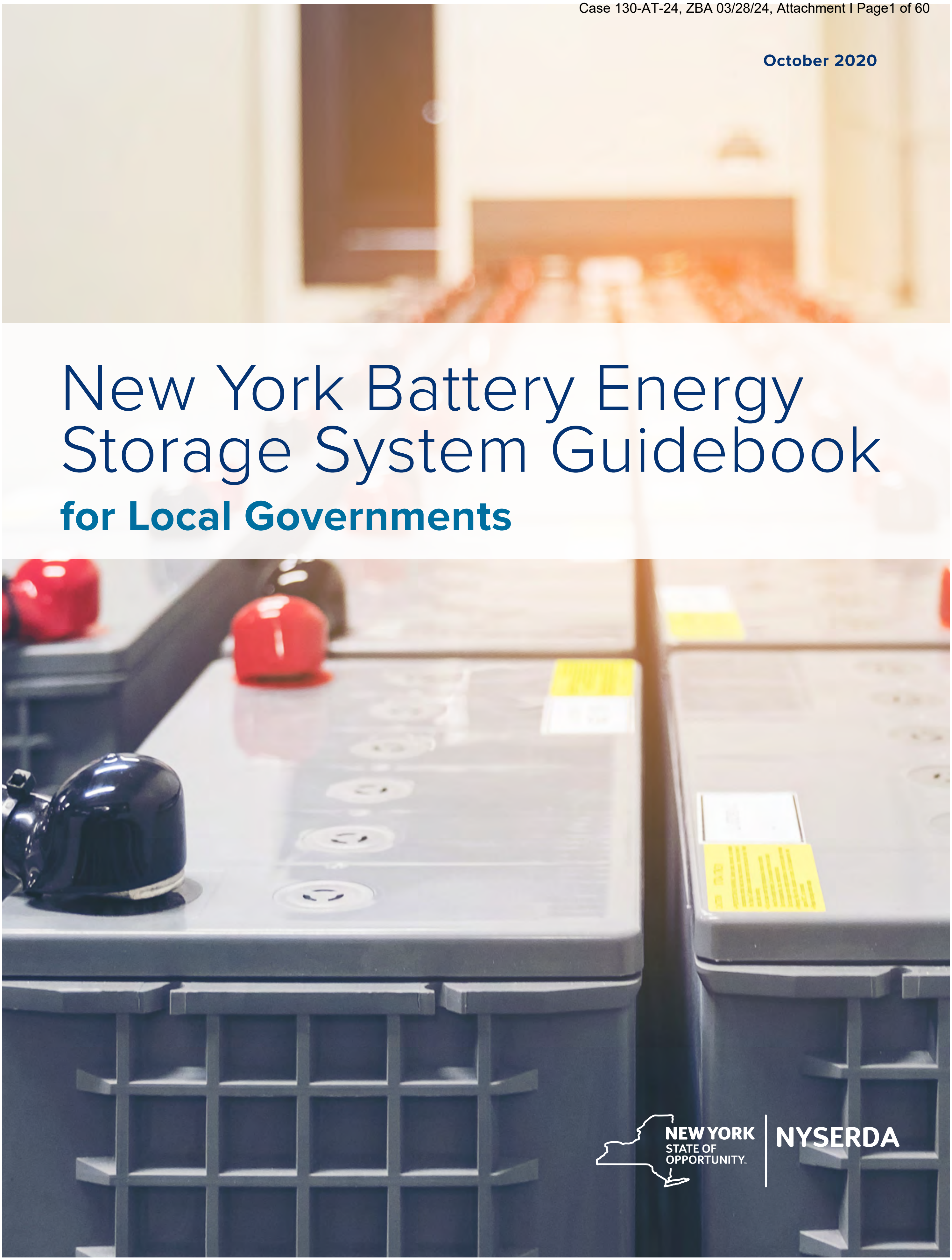
Learn about New York State and local tax treatment of battery energy storage systems, including information regarding assessments and payments-in-lieu-of-taxes (PILOT) agreements.

REGISTER HERE

October 2020

New York Battery Energy Storage System Guidebook

for Local Governments



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New York Battery Energy Storage System Guidebook

In December 2018, the New York Public Service Commission adopted Governor Cuomo's 1,500 MW energy storage target by 2025 and established a 3,000 MW target by 2030. Over $350 million in New York State incentives have been authorized to accelerate the adoption of energy storage systems in effort of building a self-sustaining industry. Energy storage systems will serve many critical roles to enable New York's clean energy future. As intermittent renewable power sources, such as wind and solar, provide a larger portion of New York's electricity, energy storage systems will be used to smooth and time-shift renewable generation, and minimize curtailment. As New York's grid becomes smarter and more decentralized, these systems will dispatch stored energy when and where it is needed the most. Further, energy storage systems will allow New York to meet its peak power needs without relying on its oldest and dirtiest peak generating plants, many of which are approaching the end of their useful lives.

As an important first step in protecting public and firefighter safety while promoting safe energy storage, the New York State Energy Research and Development Authority (NYSERDA) developed the first comprehensive set of guidelines for reviewing and evaluating battery energy storage systems. The Battery Energy Storage System Guidebook (Guidebook) helps local government officials, and Authorities Having Jurisdiction (AHJs), understand and develop a battery energy storage system permitting and inspection processes to ensure efficiency, transparency, and safety in their local communities. The Guidebook provides in-depth details about the permitting and inspection processes of battery energy systems that have (1) experienced the sharpest price declines, (2) are offered by a large number of manufacturers, and (3) are likely to comprise the largest number of battery energy storage system permits an AHJ may see.

The Guidebook contains the following chapters:

- **Battery Energy Storage System Model Law (Model Law):** The Model Law is intended to help local government officials and AHJs adopt legislation and regulations to responsibly accommodate battery energy storage systems in their communities. The Model Law lays out procedural frameworks and substantive requirements for residential, commercial, and utility-scale battery energy storage systems.
- **Battery Energy Storage System Model Permit (Model Permit):** 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.
- **Battery Energy Storage System Electrical Checklist (Checklist):** The Battery Energy Storage System Electrical Checklist is intended to be utilized as a guideline for field inspections of residential and small commercial battery energy storage systems. It can be used directly by local code enforcement officers or provided to a third-party inspection agency, where applicable.
- **2020 New York State Uniform Fire Prevention and Building Code:** The 2020 New York State Uniform Fire Prevention and Building Codes implement the latest safety considerations for energy storage systems.

When combined with all applicable provisions of the codes, regulations, and industry standards as referenced in the New York State Uniform Fire Prevention and Building Code, these resources create an all-encompassing process to safely permit all types of battery energy storage systems. The Guidebook is intended to create complementary review processes for battery energy storage systems separate from other technologies. For example, if a hybrid project contains both a battery energy storage system and solar photovoltaics, the proposed project would have to comply with both solar and battery energy storage system requirements.

This relatively new technology, and its subsequent variations, continues to face regulatory, policy and financial challenges. NYSERDA will continue to work with permitting authorities and the industry to test the processes outlined in the guide so they can be refined and updated as the codes and standards evolve.

The Guidebook is advisory only and not legally binding. These resources are not intended for adoption precisely as they are written, and each municipality should delete, modify, or add other provisions as appropriate to suit local conditions, comprehensive plans, and existing land use and zoning provisions. Neither NYSERDA, nor any of its employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information. AHJs and other entities are welcome to use and distribute the Guidebook.

NYSERDA offers free technical assistance, including educational workshops, to local governments to help further understand the issues addressed in the Battery Energy Storage Guidebook. Workshops provide municipal planning and zoning board members, code officials, first responders, and others with the knowledge and resources to ensure responsible battery storage development in their communities. The team helps municipalities:

- Develop appropriate zoning procedures
- Draft, amend, or adopt legislation for energy storage systems
- Update a comprehensive plan to include energy storage technologies
- Improve the permitting process
- Understand new fire safety requirements
- Answer questions regarding energy storage systems

If you have any questions regarding clean energy technologies, are interested in scheduling a free training in your region, or wish to access NYSERDA's full suite of clean energy siting resources, please email the team at **cleanenergyhelp@nyserda.ny.gov** or visit **nyserda.ny.gov/Siting**.

You can download specific chapters of the New York Battery Energy Storage System Guidebook at nyserda.ny.gov/Energy-Storage-Guidebook.

NYSERDA offers objective information and analysis, innovative programs, technical expertise, and support to help New Yorkers increase energy efficiency, save money, use renewable energy, and reduce reliance on fossil fuels. NYSERDA professionals work to protect the environment and create clean energy jobs. A public benefit corporation, NYSERDA has been advancing innovative energy solutions since 1975.

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Battery Energy Storage System Model Law

For local governments to utilize when drafting local laws and regulations for battery energy storage systems.

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Battery Energy Storage System Guidebook for Local Governments
NYSERDA 17 Columbia Circle Albany, NY 12203

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Overview

The Model Law is intended to help local government officials and AHJs adopt legislation and regulations to responsibly accommodate battery energy storage systems in their communities. The Model Law lays out procedural frameworks and substantive requirements for residential, commercial, and utility-scale battery energy storage systems.

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

1. Instructions

1. This Model Law can be adopted by the governing board of cities, towns, and villages (hereinafter "local governments" or "municipalities") to regulate the installation, operation, maintenance, and decommissioning of battery energy storage systems. The Model Law is intended to be an "all-inclusive" local law, regulating the subject of battery energy storage systems under typical zoning and land use regulations and it includes the process for compliance with the State Environmental Quality Review Act. Municipalities should review this Model Law, examine their local laws and regulations and the types, size range and number of battery energy storage system projects proposed, and adopt a local law addressing the aspects of battery energy storage system development that make the most sense for each municipality, deleting, modifying, or adding other provisions as appropriate.
2. This Model Law references a "Battery Energy Storage System Model Permit" that is available as part of NYSERDA's Battery Energy Storage Guidebook. 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.
3. In some cases, there may be multiple approaches to regulate a certain aspect of battery energy storage systems. The word "OR" has been placed in the text of the model law to indicate these options. Municipalities should choose the option that works best for their communities. The content provided in brackets and highlighted is optional. Depending on local circumstances, a municipality may want to include this content or choose to adopt a different standard.
4. The Model Law is not intended for adoption precisely as it is written. It is intended to be advisory only, and users should not rely upon it as legal advice. A municipality is not required to adopt this Model Law. Municipal officials are urged to seek legal advice from their attorneys before enacting a battery energy storage system law. Municipalities must carefully consider how the language in this Model Law may be modified to suit local conditions, comprehensive plans, and existing land use and zoning provisions.

5. Before enacting this Model Law, a comprehensive plan outlining the goals and policies for the installation, operation, maintenance, and decommissioning of battery energy storage systems must be adopted by the local governing board (city or common council, town board, village board of trustees). Some local governing boards can satisfy this requirement by updating an existing comprehensive plan while others must adopt a new comprehensive plan. Suggestions on how local governing boards can develop and adopt in their existing or new comprehensive plans battery energy storage system friendly policies and plans that provide local protection are listed below:

   A. Adopt a resolution or policy statement that outlines a strategy for municipal-wide battery energy storage system development. The chief executive officer of a local government (like a town supervisor or city or village mayor) may choose to issue in accordance with its local charter or other valid local law or regulations an executive order, proclamation or other declaration to advance battery energy storage system development.

   B. Appoint a Battery Energy Storage Task Force ("Task Force") that represents all interested stakeholders, including residents, businesses, interested non-profit organizations, the battery energy storage industry, utilities, and relevant municipal officials and staff to prepare an action plan, adopt or amend a comprehensive plan to include battery energy storage system planning goals and actions, and develop local laws and/or other regulations to ensure the orderly development of battery energy storage system projects.

   C. Charge the Task Force with conducting meetings on a communitywide basis to involve all key stakeholders, gather all available ideas, identify divergent groups and views, and secure support from the entire community. The Task Force should also conduct studies and determine whether existing policies, plans, and land use regulations require amendments to remove barriers to and facilitate battery energy storage system development goals.

   D. Establish a training program for local staff and land use boards. Municipalities are encouraged to utilize State and Federal technical assistance and grants for training programs when available.

   E. Partner with adjacent communities to adopt compatible policies, plan components, and zoning provisions for battery energy storage system projects. County or regional planning agencies may also advise participating local governments on locally addressing these issues.

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, welfare, and quality of life 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 ensure compatible land uses in the vicinity of the areas affected by battery energy storage systems;

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

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

3. Definitions

As used in this [Article/Chapter], the following terms shall have the meanings indicated:

ANSI: American National Standards Institute

BATTERY(IES): 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 energy storage systems from operating outside their safe operating parameters and disconnects electrical power to the energy storage system or places it in a safe condition if potentially hazardous temperatures or other conditions are detected.

BATTERY ENERGY STORAGE SYSTEM: One or more devices, assembled together, capable of storing energy in order to supply electrical energy at a future time, not to include a stand-alone 12-volt car battery or an electric motor vehicle. A battery energy storage system is classified as a Tier 1 or Tier 2 Battery Energy Storage System as follows:

A. Tier 1 Battery Energy Storage Systems have an aggregate energy capacity less than or equal to 600kWh and, if in a room or enclosed area, consist of only a single energy storage system technology.

B. Tier 2 Battery Energy Storage Systems have an aggregate energy capacity greater than 600kWh or are comprised of more than one storage battery technology in a room or enclosed area.

CELL: The basic electrochemical unit, characterized by an anode and a cathode, used to receive, store, and deliver electrical energy.

COMMISSIONING: A systematic process that provides documented confirmation that a battery energy storage system functions according to the intended design criteria and complies with applicable code requirements.

DEDICATED-USE BUILDING: A building that is built for the primary intention of housing battery energy storage system equipment, is classified as Group F-1 occupancy as defined in the International Building Code, and complies with the following:

1) The building's only use is battery energy storage, energy generation, and other electrical grid-related operations.
2) No other occupancy types are permitted in the building.
3) Occupants in the rooms and areas containing battery energy storage systems are limited to personnel that operate, maintain, service, test, and repair the battery energy storage system and other energy systems.
4) Administrative and support personnel are permitted in areas within the buildings that do not contain battery energy storage system, provided the following:
    a. The areas do not occupy more than 10 percent of the building area of the story in which they are located.
    b. A means of egress is provided from the administrative and support use areas to the public way that does not require occupants to traverse through areas containing battery energy storage systems or other energy system equipment.

ENERGY CODE: The New York State Energy Conservation Construction Code adopted pursuant to Article 11 of the Energy Law, as currently in effect and as hereafter amended from time to time.

FIRE CODE: The fire code section of the New York State Uniform Fire Prevention and Building Code adopted pursuant to Article 18 of the Executive Law, as currently in effect and as hereafter amended from time to time.

NATIONALLY RECOGNIZED TESTING LABORATORY (NRTL): A U.S. Department of Labor designation recognizing a private sector organization to perform certification for certain products to ensure that they meet the requirements of both the construction and general industry OSHA electrical standards.

NEC: National Electric Code.

NFPA: National Fire Protection Association.

NON-DEDICATED-USE BUILDING: All buildings that contain a battery energy storage system and do not comply with the dedicated-use building requirements.

NON-PARTICIPATING PROPERTY: Any property that is not a participating property.

NON-PARTICIPATING RESIDENCE: Any residence located on non-participating property.

OCCUPIED COMMUNITY BUILDING: Any building in Occupancy Group A, B, E, I, R, as defined in the International Building Code, including but not limited to schools, colleges, daycare facilities, hospitals, correctional facilities, public libraries, theaters, stadiums, apartments, hotels, and houses of worship.

PARTICIPATING PROPERTY: A battery energy storage system host property or any real property that is the subject of an agreement that provides for the payment of monetary compensation to the landowner from the battery energy storage system owner (or affiliate) regardless of whether any part of a battery energy storage system is constructed on the property.

UNIFORM CODE: the New York State Uniform Fire Prevention and Building Code adopted pursuant to Article 18 of the Executive Law, as currently in effect and as hereafter amended from time to time.

4. Applicability

A. The requirements of this Local Law shall apply to all battery energy storage systems permitted, installed, or modified in [Village/Town/City] after the effective date of this Local Law, excluding general maintenance and repair.

B. Battery energy storage systems constructed or installed prior to the effective date of this Local Law shall not be required to meet the requirements of this Local Law.

C. Modifications to, retrofits or replacements of an existing battery energy storage system that increase the total battery energy storage system designed discharge duration or power rating shall be subject to this Local Law.

5. General Requirements

A. A building permit and an electrical permit shall be required for installation of all battery energy storage systems.

B. Issuance of permits and approvals by the [Reviewing Board] shall include review pursuant to the State Environmental Quality Review Act [ECL Article 8 and its implementing regulations at 6 NYCRR Part 617 (“SEQRA”)].

C. 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 Uniform Code and/or the 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.

6. Permitting Requirements for Tier 1 Battery Energy Storage Systems

Tier 1 Battery Energy Storage Systems shall be permitted in all zoning districts, subject to the Uniform Code and the “Battery Energy Storage System Permit,” and exempt from site plan review.

7. Permitting Requirements for Tier 2 Battery Energy Storage Systems

Tier 2 Battery Energy Storage Systems are permitted through the issuance of a [special use permit] within the [XXXXXXXXXXXXX, XXXXXXXXXX, XXXXXXXXXX] zoning districts, and shall be subject to the Uniform Code and the site plan application requirements set forth in this Section.

A. Applications for the installation of Tier 2 Battery Energy Storage System shall be:

1) reviewed by the [Code Enforcement/Zoning Enforcement Officer or Reviewing Board] for completeness. An application shall be complete when it addresses all matters listed in this Local Law including, but not necessarily limited to, (i) compliance with all applicable provisions of the Uniform Code and all applicable provisions of the Energy Code and (ii) matters relating to the proposed battery energy storage system and Floodplain, Utility Lines and Electrical Circuitry, Signage, Lighting, Vegetation and Tree-cutting, Noise, Decommissioning, Site Plan and Development, Special Use and Development, Ownership Changes, Safety, and Permit Time Frame and Abandonment. Applicants shall be advised within [10] business days of the completeness of their application or any deficiencies that must be addressed prior to substantive review.

2) subject to a public hearing to hear all comments for and against the application. The [Reviewing Board] of the [Village/Town/City] shall have a notice printed in a newspaper of general circulation in the [Village/Town/City] at least [5] days in advance of such hearing. Applicants shall have delivered the notice by first class mail to adjoining landowners or landowners within [200] feet of the property at least [10] days prior to such a hearing. Proof of mailing shall be provided to the [Reviewing Board] at the public hearing.

3) referred to the [County Planning Department] pursuant to General Municipal Law § 239-m if required.

4) upon closing of the public hearing, the [Reviewing Board] shall take action on the application within 62 days of the public hearing, which can include approval, approval with conditions, or denial. The 62-day period may be extended upon consent by both the [Reviewing Board] and Applicant.

B. Utility Lines and Electrical Circuitry. All on-site utility lines shall be placed underground to the extent feasible and as permitted by the serving utility, with the exception of the main service connection at the utility company right-of-way and any new interconnection equipment, including without limitation any poles, with new easements and right-of-way.

C. Signage.

1) The signage shall be in compliance with ANSI Z535 and shall include the type of technology associated with the battery energy storage systems, any special hazards associated, the type of suppression system installed in the area of battery energy storage systems, and 24-hour emergency contact information, including reach-back phone number.

2) As required by the NEC, disconnect and other emergency shutoff information shall be clearly displayed on a light reflective surface. A clearly visible warning sign concerning voltage shall be placed at the base of all pad-mounted transformers and substations.

D. Lighting. Lighting of the battery energy storage systems shall be limited to that minimally required for safety and operational purposes and shall be reasonably shielded and downcast from abutting properties.

E. Vegetation and tree-cutting. Areas within [10] feet on each side of Tier 2 Battery Energy Storage Systems shall be cleared of combustible vegetation and other combustible growth. Single specimens of trees, shrubbery, or cultivated ground cover such as green grass, ivy, succulents, or similar plants used as ground covers shall be permitted to be exempt provided that they do not form a means of readily transmitting fire. Removal of trees should be minimized to the extent possible.

F. Noise. The [1-hour] average noise generated from the battery energy storage systems, components, and associated ancillary equipment shall not exceed a noise level of [60] dBA as measured at the outside wall of any non-participating residence or occupied community building. Applicants may submit equipment and component manufacturers noise ratings to demonstrate compliance. The applicant may be required to provide Operating Sound Pressure Level measurements from a reasonable number of sampled locations at the perimeter of the battery energy storage system to demonstrate compliance with this standard.

G. Decommissioning.

1) Decommissioning Plan. The applicant shall submit a decommissioning plan, developed in accordance with the Uniform Code, to be implemented upon abandonment and/or in conjunction with removal from the facility. The decommissioning plan shall include:

a. A narrative description of the activities to be accomplished, including who will perform that activity and at what point in time, for complete physical removal of all battery energy storage system components, structures, equipment, security barriers, and transmission lines from the site;

b. Disposal of all solid and hazardous waste in accordance with local, state, and federal waste disposal regulations;

c. The anticipated life of the battery energy storage system;

d. The estimated decommissioning costs and how said estimate was determined;

e. The method of ensuring that funds will be available for decommissioning and restoration;

f. The method by which the decommissioning cost will be kept current;

g. The manner in which the site will be restored, including a description of how any changes to the surrounding areas and other systems adjacent to the battery energy storage system, such as, but not limited to, structural elements, building penetrations, means of egress, and required fire detection suppression systems, will be protected during decommissioning and confirmed as being acceptable after the system is removed; and

h. A listing of any contingencies for removing an intact operational energy storage system from service, and for removing an energy storage system from service that has been damaged by a fire or other event.

2) Decommissioning Fund. The owner and/or operator of the energy storage system, shall continuously maintain a fund or bond payable to the [Village/Town/City], in a form approved by the [Village/Town/City] for the removal of the battery energy storage system, in an amount to be determined by the [Village/Town/City], for the period of the life of the facility. This fund may consist of a letter of credit from a State of New York licensed-financial institution. All costs of the financial security shall be borne by the applicant.

H. Site plan application. For a Tier 2 Battery Energy Storage System requiring a Special Use Permit, site plan approval shall be required. Any site plan application shall include the following information:

1) Property lines and physical features, including roads, for the project site.

2) Proposed changes to the landscape of the site, grading, vegetation clearing and planting, exterior lighting, and screening vegetation or structures.

3) A [one- or three-line] electrical diagram detailing the battery energy storage system layout, associated components, and electrical interconnection methods, with all National Electrical Code compliant disconnects and over current devices.

4) A preliminary equipment specification sheet that documents the proposed battery energy storage system components, inverters and associated electrical equipment that are to be installed. A final equipment specification sheet shall be submitted prior to the issuance of building permit.

5) Name, address, and contact information of proposed or potential system installer and the owner and/or operator of the battery energy storage system. Such information of the final system installer shall be submitted prior to the issuance of building permit.

6) Name, address, phone number, and signature of the project Applicant, as well as all the property owners, demonstrating their consent to the application and the use of the property for the battery energy storage system.

7) Zoning district designation for the parcel(s) of land comprising the project site.

8) Commissioning Plan. Such plan shall document and verify that the system and its associated controls and safety systems are in proper working condition per requirements set forth in the Uniform Code. Where commissioning is required by the Uniform Code, Battery energy storage system commissioning shall be conducted by a New York State (NYS) Licensed Professional Engineer after the installation is complete but prior to final inspection and approval. A corrective action plan shall be developed for any open or continuing issues that are allowed to be continued after commissioning. A report describing the results of the system commissioning and including the results of the initial acceptance testing required in the Uniform Code shall be provided to [Code Enforcement/Zoning Enforcement Officer or Reviewing Board] prior to final inspection and approval and maintained at an approved on-site location.

9) Fire Safety Compliance Plan. Such plan shall document and verify that the system and its associated controls and safety systems are in compliance with the Uniform Code.

10) Operation and Maintenance Manual. Such plan shall describe continuing battery energy storage system maintenance and property upkeep, as well as design, construction, installation, testing and commissioning information and shall meet all requirements set forth in the Uniform Code.

11) Erosion and sediment control and storm water management plans prepared to New York State Department of Environmental Conservation standards, if applicable, and to such standards as may be established by the Planning Board.

12) Prior to the issuance of the building permit or final approval by the [Reviewing Board], but not required as part of the application, engineering documents must be signed and sealed by a NYS Licensed Professional Engineer.

13) Emergency Operations Plan. A copy of the approved Emergency Operations Plan shall be given to the system owner, the local fire department, and local fire code official. A permanent copy shall also be placed in an approved location to be accessible to facility personnel, fire code officials, and emergency responders. The 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, neighboring properties, and emergency responders.

h. Procedures and schedules for conducting drills of these procedures and for training local first responders on the contents of the plan and appropriate response procedures.

I. Special Use Permit Standards.

1) Setbacks. Tier 2 Battery Energy Storage Systems shall comply with the setback requirements of the underlying zoning district for principal structures.

2) Height. Tier 2 Battery Energy Storage Systems shall comply with the building height limitations for principal structures of the underlying zoning district.

3) Fencing Requirements. Tier 2 Battery Energy Storage Systems, including all mechanical equipment, shall be enclosed by a [7-foot-high] fence with a self-locking gate to prevent unauthorized access unless housed in a dedicated-use building and not interfering with ventilation or exhaust ports.

4) Screening and Visibility. Tier 2 Battery Energy Storage Systems shall have views minimized from adjacent properties to the extent reasonably practicable using architectural features, earth berms, landscaping, or other screening methods that will harmonize with the character of the property and surrounding area and not interfering with ventilation or exhaust ports.

J. Ownership Changes. If the owner of the battery energy storage system changes or the owner of the property changes, the special use permit shall remain in effect, provided that the successor owner or operator assumes in writing all of the obligations of the special use permit, site plan approval, and decommissioning plan. A new owner or operator of the battery energy storage system shall notify the [Code Enforcement/Zoning Enforcement Officer] of such change in ownership or operator within [30] days of the ownership change. A new owner or operator must provide such notification to the [Code Enforcement/Zoning Enforcement Officer] in writing. The special use permit and all other local approvals for the battery energy storage system would be void if a new owner or operator fails to provide written notification to the [Code Enforcement/Zoning Enforcement Officer] in the required timeframe. Reinstatement of a void special use permit will be subject to the same review and approval processes for new applications under this Local Law.

8. Safety

A. System Certification. Battery energy storage systems and equipment shall be listed by a Nationally Recognized Testing Laboratory to UL 9540 (Standard for battery energy storage systems and Equipment) with subcomponents meeting each of the following standards as applicable:

1) UL 1973 (Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail Applications),

2) UL 1642 (Standard for Lithium Batteries),

3) UL 1741 or UL 62109 (Inverters and Power Converters),

4) Certified under the applicable electrical, building, and fire prevention codes as required.

5) Alternatively, field evaluation by an approved testing laboratory for compliance with UL 9540 and applicable codes, regulations and safety standards may be used to meet system certification requirements.

B. Site Access. Battery energy storage systems shall be maintained in good working order and in accordance with industry standards. Site access shall be maintained, including snow removal at a level acceptable to the local fire department and, if the Tier 2 Battery Energy Storage System is located in an ambulance district, the local ambulance corps.

C. Battery energy storage systems, components, and associated ancillary equipment shall have required working space clearances, and electrical circuitry shall be within weatherproof enclosures marked with the environmental rating suitable for the type of exposure in compliance with NFPA 70.

9. Permit Time Frame and Abandonment

A. The Special Use Permit and site plan approval for a battery energy storage system shall be valid for a period of [24] months, provided that a building permit is issued for construction [and/or] construction is commenced. In the event construction is not completed in accordance with the final site plan, as may have been amended and approved, as required by the [Reviewing Board], within [24] months after approval, [Village/Town/City] may extend the time to complete construction for [180] days. If the owner and/or operator fails to perform substantial construction after [36] months, the approvals shall expire.

B. The battery energy storage system shall be considered abandoned when it ceases to operate consistently for [more than one year]. If the owner and/or operator fails to comply with decommissioning upon any abandonment, the [Village/Town/City] may, at its discretion, enter the property and utilize the available bond and/or security for the removal of a Tier 2 Battery Energy Storage System and restoration of the site in accordance with the decommissioning plan.

10. Enforcement

Any violation of this Battery Energy Storage System Law shall be subject to the same enforcement requirements, including the civil and criminal penalties, provided for in the zoning or land use regulations of [Village/Town/City].

11. Severability

The invalidity or unenforceability of any section, subsection, paragraph, sentence, clause, provision, or phrase of the aforementioned sections, as declared by the valid judgment of any court of competent jurisdiction to be unconstitutional, shall not affect the validity or enforceability of any other section, subsection, paragraph, sentence, clause, provision, or phrase, which shall remain in full force and effect.

Questions?

If you have any questions about the Battery Energy Storage System Model Law, please email questions to cleanenergyhelp@nyserda.ny.gov or request free technical assistance at nyserda.ny.gov/Energy-Storage-Guidebook. The NYSERDA team looks forward to partnering with communities across the State.

Battery Energy Storage System Model Permit

Understanding the permitting requirements of residential and small commercial battery energy storage systems.

NEW YORK STATE OF OPPORTUNITY. | NYSERDA

Battery Energy Storage System Guidebook for Local Governments
NYSERDA 17 Columbia Circle Albany, NY 12203

Section Contents

1. Battery Energy Storage System Model Permit 17

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.

SUBMITTAL INSTRUCTIONS

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].

APPLICATION REVIEW TIMELINE

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.

FOR FURTHER INFORMATION

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

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

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 less than or equal to 600kWh and, if in a room or indoor area, where only a single energy storage system technology is provided.

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.

b) Construction Documents, with listed attachments. Construction Documents must be stamped and signed by a 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.

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 building 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 Electrical Checklist. The Battery Energy Storage System Electrical Checklist provides an overview of common points of inspection for which the applicant should be prepared to show compliance.
- 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.

- Specifications and installation instructions
  - 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
  - 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

- All battery energy storage systems must be designed and installed in accordance with all applicable provisions of the New York State Uniform Code. Provide documentation on how this system will meet these requirements.
  - - Most one-to-two family residential systems will be subject to Section R327 (Energy Storage Systems) of the 2020 Residential Code of New York State. . All other systems are subject to Section 1206 (Electrical Energy Storage Systems) of the 2020 Fire Code of New York State.

PLAN REVIEW

Permit applications can be submitted to [DEPARTMENT NAME] in person at [ADDRESS] and electronically through: [WEBSITE/EMAIL/FAX CONTACT INFORMATION, IF APPLICABLE].

FEES

[PROVIDE CLEAR FEE SCHEDULE]

DEPARTMENTAL CONTACT INFORMATION

Once all permits to construct the battery energy storage system installation have been issued and the system has been installed, it must be inspected before final approval is granted for the battery energy storage system. On-site inspections can be scheduled by contacting [DEPARTMENT] by telephone at [PHONE NUMBER] or electronically at [WEBSITE OR EMAIL ADDRESS].

Inspection requests received within business hours are typically scheduled for the next business day. If next business day is not available, inspection should happen within a five-day window. [IF MUNICIPALITY ACCEPTS THIRD PARTY INSPECTIONS, INDICATE THIS AND PROVIDE A LIST OF APPROVED INSPECTORS].

In order to receive final approval, the following inspection is required:

[FINAL INSPECTION] The applicant must contact [INSERT CONTACT INFORMATION] when ready for a final inspection. During this inspection, the inspector will review the complete installation to ensure compliance with codes and standards, as well as confirming that the installation matches the records included with the permit application. The applicant must have ready, at the time of inspection, the following materials and make them available to the inspector:

- Copies of as-built drawings and equipment specifications, if different than the materials provided with the application.
- Photographs of key hard to access equipment.

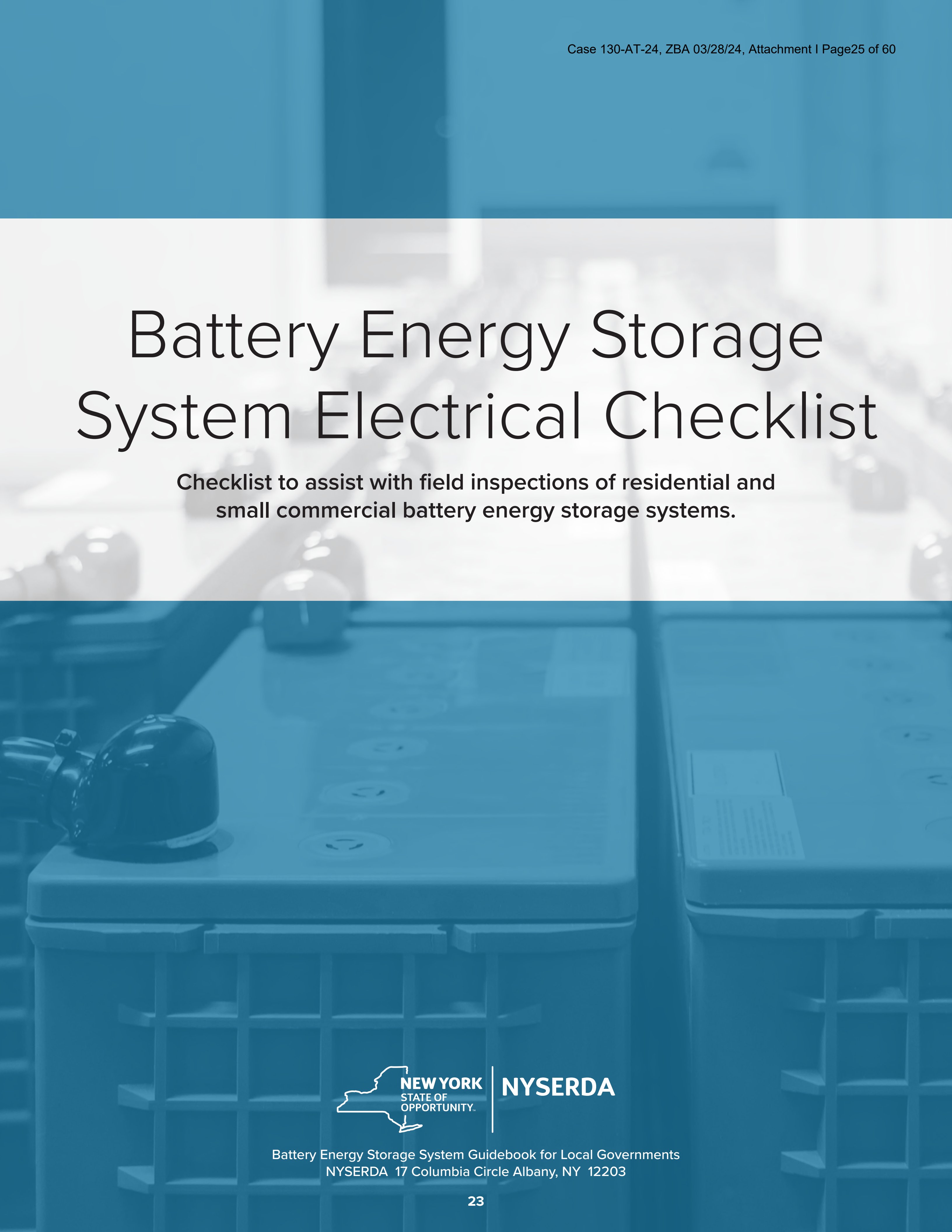
[MUNICIPALITY NAME] has adopted a standardized “Battery Energy Storage System Electrical Checklist”, which can be found here: [WEBSITE ADDRESS].

DEPARTMENTAL CONTACT INFORMATION

For additional information regarding this permit process, please consult our departmental website at [WEBSITE] or contact [DIVISION NAME] at [PHONE NUMBER].

Questions?

If you have any questions about the Battery Energy Storage System Model Permit, please email questions to cleanenergyhelp@nyserda.ny.gov or request free technical assistance at nyserda.ny.gov/Energy-Storage-Guidebook. The NYSERDA team looks forward to partnering with communities across the State.



Battery Energy Storage System Electrical Checklist

Checklist to assist with field inspections of residential and small commercial battery energy storage systems.

NEW YORK STATE OF OPPORTUNITY. | NYSERDA

Section Contents

1. Electrical Checklist 25

Overview

The Electrical Checklist is intended to be utilized as a guideline for field inspections of residential and small commercial battery energy storage systems. It can be used directly by local code enforcement officers or provided to a third-party inspection agency, where applicable.

The Battery Energy Storage System Electrical Checklist 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, Battery Energy Storage System Electrical Checklist tab.

1. Electrical Checklist

Applicable Codes: NEC 2017, [add any additional local codes required]

The information provided in this document is general and intended as a guide only. Each project is unique and additional requirements may be enforced as deemed appropriate.

Project Information

Permit Number	
Primary Contractor	
Project Address	
Date	

Pre-Inspection

	De-energize electrical panels prior to removing the dead-front. All equipment shall be open and ready for inspection
	The approved plans, permit, and installation instructions shall be on site at time of inspection
	Major changes, including revisions, to the installation shall be submitted to the AHJ for review and approval prior to inspection

Inspection

General

	Exact match of component product number and rating with plan
	All equipment shall bear the appropriate listing mark of a Nationally Recognized Testing Laboratory where such marking is required as part of the listing, and installed in accordance with its listing (NEC Article 110.3(B))
	Battery energy storage system includes a manual (system description, operating and safety instructions, maintenance requirements, safe battery handling requirements/recommendations)
	A personnel door(s) intended for entrance to and egress from rooms designed as BESS rooms shall open in the direction of egress and shall be equipped with listed panic hardware, (NEC 706.10(D))
	Provide sufficient working spaces and clearances for batteries. Working space shall be measured from the edge of the battery cabinet, racks, or trays, (NEC 480.9, 110.26)
	Spaces about the ESS shall comply with NEC 110.26. Working space shall be measured from the edge of the ESS modules, battery cabinets, racks, or trays, (NEC 706.10(C)) • For battery racks, there shall be a minimum clearance of 1 inch between a cell container and any wall or structure on the side not requiring access for maintenance. • ESS modules, battery cabinets, racks, or trays shall be permitted to contact adjacent walls or structures, provided that the battery shelf has a free air space for not less than 90% of its length. • Pre-engineered and self-contained ESSs shall be permitted to have working space between components within the system in accordance with the manufacturer's recommendations and listing of the system.

Equipment

	Flexible Battery DC conductors are listed as hard service use and/or moisture resistant, (NEC 690.74, 706.32)
	Fine stranded flexible cables (if used) terminated in accordance with NEC 110.14, (NEC 110.14, 690.74, 706.32)
	Ungrounded conductor is not marked using white, grey, or white striped conductors to avoid confusion with grounded conductor markings, (NEC 200.7)
	Electrochemically dissimilar metals are not in direct physical contact, (NEC 110.14)
	All connections shall be secure, (NEC 110.14, 706.31)
	All metallic raceways and equipment shall be bonded and electrically continuous, (NEC 110.3(B), 250.8)
	Unused opening shall be close with protection equivalent to the wall of enclosure, (NEC 110.3(B), 408.7)
	The selected wiring methods are appropriate for the location and installed in accordance with their intended use, (NEC 310, 706)
	All live parts of batteries must be guarded regardless of voltage or battery type, (NEC 706.10(B))
	Batteries' live parts shall be guarded in accordance with (NEC 110.27, 480.10(B))
	Verify that the attachment of the battery storage unit to the wall or floor is per the approved plans. If the wall or floor construction differs from the approved plans, a revision is required prior to inspection

Grounding

	Any conductive battery racks, cases or trays must be connected to an equipment grounding conductor. (NEC 250.110)
	Equipment grounding conductor is properly identified as either bare, green, or green with continuous yellow stripe(s), (NEC 250.119)
	If there is no existing AC grounding electrode, the ESS contractor shall install (2) ground rods at the main electrical service. If there Is only (1) ground rod, a second one shall be installed. Ground rods shall be a minimum of 6' apart, (NEC Exhibit 250.25, Article 250.53, 706)

Main Electric Service

	Circuit breakers shall be of the same manufacturer as the main service panel, (NEC 110.3)

Ventilation

	Provide adequate ventilation for batteries per manufacturer's requirements. (NEC 706.10(A))
	Batteries/enclosures contain ventilation equipment to prevent excessive accumulation of gas pressure and/or gas ignition, (NEC 706.10)

Connections and Terminations

	Cell terminations have measures taken to prevent corrosion
	Electrical connections do not put mechanical strain on battery terminals, (NEC 706.31, 110.14(A))
	Overcurrent protection of ungrounded conductors shall have overcurrent protection device(s) located as close as practicable to the battery terminals in an unclassified location, (NEC 480.5, 706.7)
	Battery circuit and equipment shall be protected by overcurrent protective devices as close as practicable to the storage battery terminals in accordance with the requirements of NEC Article 240, (NEC 240.21(H), 705.65(A))
	Unless the short-circuit currents from all sources do not exceed the ampacity of the conductors, storage battery inverters shall be protected by overcurrent protective devices from all other sources, (NEC 705.65(A))
	A listed current-limiting overcurrent protective device shall be installed adjacent to the ESS for each dc output circuit, (NEC 706.21(C))
	In an ac-coupled system, the plug-in type circuit breaker connected to the output of the storage battery or multimode inverter is required to be secured, (NEC 408.36(D), 710.15(E))
	Storage battery, multimode, and utility-interactive inverter output circuit breakers that are marked "Line" and "Load" are not permitted to be back-fed, (NEC 710.15(E), 110.3(B), 705.12(B)(4))
	Single 120-volt inverter in ac coupled systems should not supply back-up loads containing multiwire branch circuit or any 240 volt outlets. Such action can overload the common neutral in such a wiring method, (NEC 710.15(C))

Monitoring and Charge Control

	Charge controllers shall be compatible with the battery or ESS manufacturer's electrical ratings and charging specifications, (NEC110.3(B))
	Charge controller is properly installed to prevent overcharging or damaging batteries, (NEC 690.72, 706.23)
	Diversionary charge controllers with utility-interactive and multimode inverters shall have a second independent controller to prevent battery overcharge in the event the diversion loads are unavailable or the diversion charge controller fails, (NEC 706.23(B)(3)(b))

Disconnecting Means

	A disconnecting means is provided for all ungrounded conductors derived from a dc stationary battery system with a voltage of over 60 volts dc, (NEC 480.7)
	A disconnecting means shall be provided for all ungrounded conductors derived from an ESS. A disconnecting means shall be readily accessible and located within sight of the ESS, (NEC 706.7(A))
	Battery circuits subject to field servicing where exceeding 240 volts nominal between conductors or to ground, shall have provisions to disconnect the series-connected strings into segments not exceeding 240 volts nominal for maintenance by qualified persons. Non-load-break bolted, or plug-in disconnects shall be permitted, (NEC 706.30(B))
	ESS exceeding 100 volts between conductors or to ground shall have a disconnecting means, accessible only to qualified persons, that disconnects ungrounded and grounded circuit conductor(s) in the electrical storage system for maintenance. This disconnecting means shall not disconnect the grounded circuit conductor(s) for the remainder of any other electrical system. A non-load-break-rated switch shall be permitted to be used as a disconnecting means, (NEC 706.30(C))
	Where battery energy storage system input and output terminals are more than 5ft from the connected equipment, or where these terminals pass through a wall or partition must comply with all of NEC 706.7(E)) (1) A disconnecting means shall be provided at the energy storage system end of the circuit. Fused disconnecting means or circuit breakers shall be permitted to be used. (2) A second disconnecting means located at the connected equipment shall be installed where the disconnecting means required by 706.7(E)(1) is not within sight of the connected equipment. (3) Where fused disconnecting means are used, the line terminals of the disconnecting means shall be connected toward the energy storage system terminals. (4) Disconnecting means shall be permitted to be installed in energy storage system enclosures where explosive atmospheres can exist if listed for hazardous locations. (5) Where the disconnecting means in (1) is not within sight of the disconnecting means in (2), placards or directories shall be installed at the locations of all disconnecting means indicating the location of all other disconnecting means. (NEC 706.7(E))
	Where a disconnecting means, located in accordance with NEC 480.7(A) (out of sight of the battery storage system), is provided with remote controls to activate the disconnecting means and the controls for the disconnecting means are not located within sight of the stationary battery system, the disconnecting means shall be capable of being locked in the open position, (NEC 480.7(B))
	The equipment grounding lug shall be as specified by the manufacturer, (NEC 110.3(B))
	Remove any insulating finish, such as paint, under the equipment grounding lug prior to installation (NEC 250.8, 250.12)
	Maximum height requirements for disconnects applies to integrated disconnect (e.g., Tesla PowerWalls or similar applications)

Interconnection

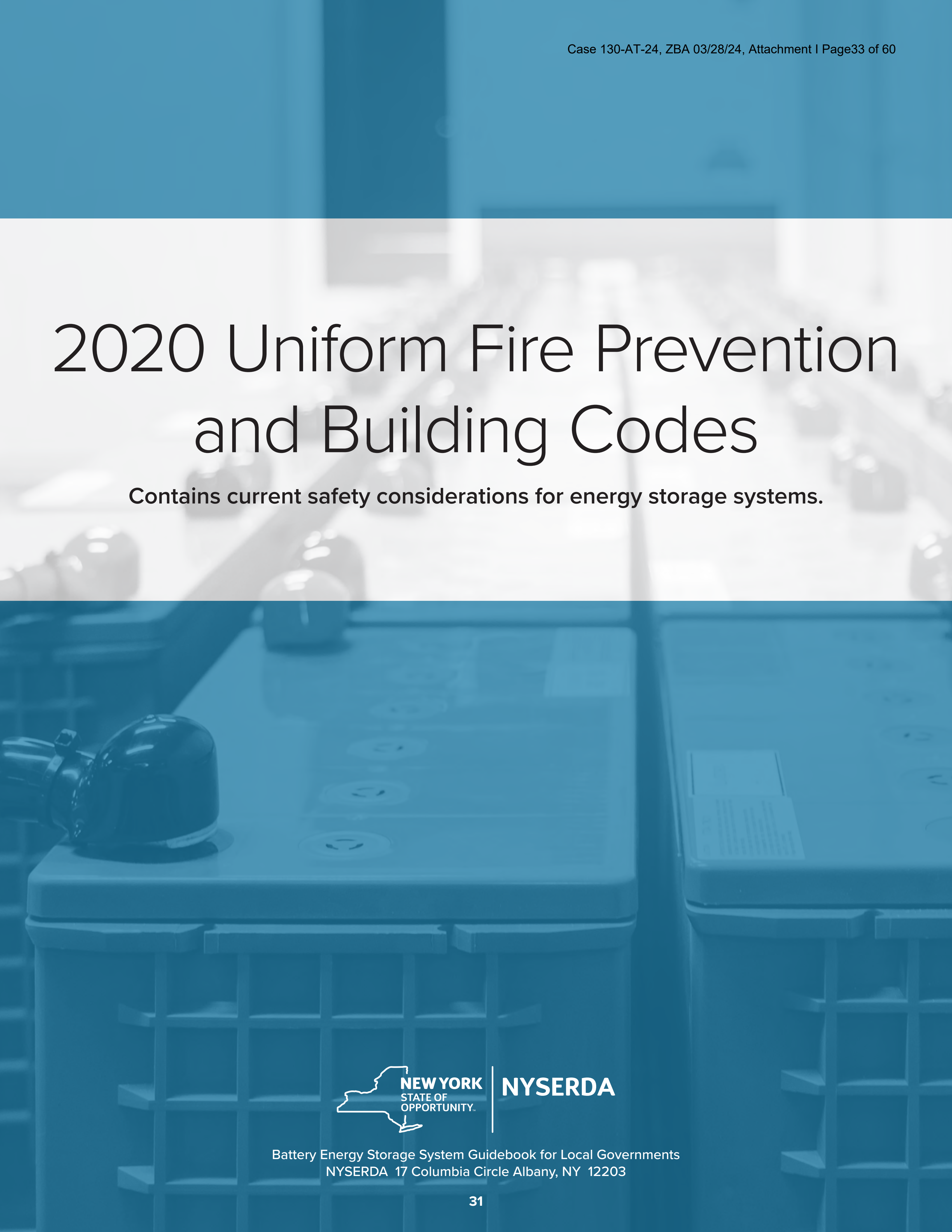
	The interconnection methods comply with NEC Article 705.12 (if connected to other energy sources)

Signage

	The signage shall be in compliance with ANSI Z535 and shall include the following information 1. Labeled “Energy Storage Systems” with symbol of lightning bolt in a triangle 2. Type of technology associated with the ESS 3. Special hazards associated 4. Type of suppression system installed in the area of the ESS 5. Emergency contact information
	A permanent plaque or directory denoting the location of all electric power source disconnecting means on or in the premises shall be installed at each service equipment location and at the location(s) of the system disconnect(s) for all electric power production sources capable of being interconnected. The marking shall comply with NEC 110.21(B) (NEC 706.11)
	Equipment containing overcurrent devices in circuits supplying power to a busbar or conductors supplied from multiple sources shall be marked to indicate the presence of all sources. (NEC 705.12(B)(3))
	PV system output circuit conductors shall be marked to indicate the polarity where connected to battery energy storage systems. (NEC 690.55)
	DC system conductors of 4 AWG or larger shall be identified using colored marking tape, (NEC 210.5(C)(2))
	Where controls to activate the disconnecting means of a battery are not located within sight of a stationary battery system, the location of the controls shall be field marked on the disconnecting means. (NEC 480.7(B))
	Where controls to activate the disconnecting means of an ESS are not located within sight of the system, the disconnecting means shall be capable of being locked in the open position, in accordance with 110.25, and the location of the controls shall be field marked on the disconnecting means. (NEC 706.7(B))
	Where the sum of the ampere ratings of all overcurrent devices on panelboards, both load and supply devices, excluding the rating of the overcurrent device protecting the busbar, shall not exceed the ampacity of the busbar. The rating of the overcurrent device protecting the busbar shall not exceed the rating of the busbar. Permanent warning labels shall be applied to distribution equipment displaying the following or equivalent wording: (NEC 705.12(B)(2)(3)(c)): **WARNING:** **THIS EQUIPMENT FED BY MULTIPLE SOURCES.** **TOTAL RATING OF ALL OVERCURRENT DEVICES,** **EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE,** **SHALL NOT EXCEED AMPACITY OF BUSBAR**
	Where two sources, one a primary power source and the other another power source, are located at opposite ends of a busbar that contains loads, the sum of 125 percent of the power source(s) output circuit current and the rating of the overcurrent device protecting the busbar shall not exceed 120 percent of the ampacity of the busbar. The busbar shall be sized for the loads connected in accordance with Article 220. A permanent warning label shall be applied to the distribution equipment adjacent to the back-fed breaker from the power source that displays the following or equivalent wording: (NEC 705.12(B)(2)(3)(b)): **WARNING:** **INVERTER OUTPUT CONNECTION;** **DO NOT RELOCATE THIS OVERCURRENT DEVICE.**
	All battery and battery management equipment and associated switchgear are marked and labeled according to all applicable codes including arc flash incident calculations for the safety of operation and maintenance personnel required by the National Electrical Code and OSHA: (NEC 110.16)
	If a battery dc disconnecting means is not provided at the batteries, the disconnecting means shall be legibly marked in the field. The marking shall be of sufficient durability to withstand the environment involved and shall include the following (NEC 480.7(D)): • Nominal battery voltage • Maximum available short-circuit current derived from the stationary battery system • Date the calculation was performed for the value above • The battery disconnecting means shall be marked in accordance with 110.16

Questions?

If you have any questions about the Battery Energy Storage System Electrical Checklist, please email questions to cleanenergyhelp@nyserda.ny.gov or request free technical assistance at nyserda.ny.gov/Energy-Storage-Guidebook. The NYSERDA team looks forward to partnering with communities across the State.



2020 Uniform Fire Prevention and Building Codes

Contains current safety considerations for energy storage systems.

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Overview

The New York State Uniform Fire Prevention and Building Code (Uniform Code) prescribes mandatory statewide minimum standards for building construction and fire prevention. In 2020, the Uniform Code was amended to include the latest safety considerations for energy storage systems.

All energy storage systems must be designed and installed in accordance with all applicable provisions of the Uniform Code. Select excerpts from the 2020 Uniform Code that apply to Energy Storage Systems are included herein for ease of reference only.

For the latest code updates, please refer to the New York State Department of State website (www.dos.ny.gov). Should any conflicts exist between this section and the Uniform Code, the Uniform Code requirements shall prevail. This section of the Guidebook is adapted from excerpts from the 2020 Uniform Code, published by the NYS Department of State, available here.

The New York State Uniform Fire Prevention and Building Code (the "Uniform Code") is formulated by the State Fire Prevention and Building Code Council (the "Code Council") pursuant to Article 18 of the New York State Executive Law.

A downloadable version of the section can be found at nyserda.ny.gov/Energy-Storage-Guidebook

1. The 2020 Residential Code of New York State

1.1 2020 Residential Code of New York State Section R202 (Definitions) This is not an exhaustive list of definitions that may apply to energy storage systems

ENERGY STORAGE SYSTEM. One or more devices, assembled together, capable of storing energy in order to supply electrical energy at a future time, not to include a stand-alone 12- volt car battery or an electric motor vehicle.

(RB) BATTERY SYSTEM, STATIONARY STORAGE. A rechargeable energy storage system consisting of electrochemical storage batteries, battery chargers, controls 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.

1.2 2020 Residential Code of New York State Section R327 (Energy Storage Systems)

SECTION R327 ENERGY STORAGE SYSTEMS

R327.1 General. Energy storage systems installed in buildings or structures that are subject to the provisions of this code shall be installed and maintained in accordance with Sections R327.2 through R327.11. The temporary use of an owner's or occupant's electric powered vehicle as an energy storage system shall be in accordance with Section R327.12.

Energy storage system installations exceeding the permitted aggregate ratings in Section R327.5 shall be installed in accordance with Section 1206.2 through 1206.17.7.7 of the Fire Code of New York State.

R327.2 Equipment listings. Energy storage systems listed and labeled solely for utility or commercial use shall not be used for residential applications.

Exceptions:

1. 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.
2. Energy storage systems less than 1 kWh (3.6 megajoules). R327.3 Installation. Energy storage systems shall be installed in accordance with the manufacturer's instructions and their listing.

R327.3.1 Spacing. Individual units shall be separated from each other by at least 3 feet of spacing unless smaller separation distances are documented to be adequate based on large scale fire testing complying with Section 1206.6 of the Fire Code of New York State.

R327.4 Location. Energy storage systems shall only be installed in the following locations:

1. Detached garages and detached accessory structures.
2. Attached garages separated from the dwelling unit living space and sleeping units in accordance with Section R302 of this code.
3. Outdoors on exterior walls located a minimum 3 ft. from doors and windows.
4. Utility closets and storage or utility spaces within dwelling units and sleeping units

R327.5 Energy ratings. Individual energy storage system units shall have a maximum rating of 20 kWh. The aggregate rating 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

R327.6 Electrical installation. Energy storage systems shall be installed in accordance with NFPA 70. Inverters shall be listed and labeled in accordance with UL 1741 or provided as part of the UL 9540 listing. Systems connected to the utility grid shall use inverters listed for utility interaction.

R327.7 Fire detection. Rooms and areas in which energy storage systems are installed shall be protected by smoke alarms in accordance with Section R314. A heat detector or heat alarm listed and interconnected to the smoke alarms shall be installed in locations where smoke alarms cannot be installed based on their listing.

R327.8 Fire-resistance rating. 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.

R327.9 Protection from impact. Energy storage systems installed in a location subject to vehicle damage shall be protected by approved barriers.

R327.10 Ventilation. Indoor installations of energy storage systems that include batteries that produce hydrogen or other flammable gases during charging shall be provided with exhaust ventilation in accordance with Section 1206.13.1 of the Fire Code of New York State.

R327.11 Toxic and highly toxic gas. Energy storage systems that have the potential to release toxic or highly toxic gas during charging, discharging and normal use conditions shall not be installed within one- and two-family dwellings and townhouses.

R327.12 Electric vehicle use. The temporary use of an owner or occupant's electric powered vehicle to power a dwelling unit or sleeping unit while parked in an attached or detached garage or outside shall comply with the vehicle manufacturer's instructions and NFPA 70. The batteries on electric vehicles shall not contribute to the aggregate energy limitations in Section R327.

2. The 2020 Building Code of New York State

2.1 2020 Building Code of New York State Section 202 (Definitions) This is not an exhaustive list of definitions that may apply to energy storage systems

ENERGY STORAGE SYSTEM. One or more devices, assembled together, capable of storing energy in order to supply electrical energy at a future time.

GAS DETECTION SYSTEM. A system or portion of a combination system that utilizes one or more stationary sensors to detect the presence of a specified gas at a specified concentration and initiate one or more responses required by this code, such as notifying a responsible person, activating an alarm signal, or activating or deactivating equipment. A self-contained gas detection and alarm device is not classified as a gas detection system.

2.2 2020 Building Code of New York State Section 307.1.1 (Uses other than Group H)

9. Stationary storage battery systems in accordance with the Fire Code of New York State.

16. Capacitor energy storage systems in accordance with the Fire Code of New York State.

2.3 2020 Building Code of New York State Table 509 (Incidental Uses)

ROOM OR AREA	SEPARATION AND/OR PROTECTION
Energy storage systems having an energy capacity greater than the threshold quantity specified in Tabled 1206.1 of the Fire Code of New York State.	2 hours

2.4 2020 Building Code of New York State Section 907.2.23 (Fire Alarm and Detection Systems, Where required—new buildings and structures, Energy storage systems)

907.2.22 Battery rooms. An automatic smoke detection system shall be installed in areas containing stationary energy storage systems as required in section 1206 of the Fire Code of New York State.

907.2.23 Capacitor energy storage systems. An automatic smoke detection system shall be installed in areas containing capacitor energy storage systems as required in section 1206 of the Fire Code of New York State.

2.5 2020 Building Code of New York State Section 916 (Gas Detection Systems)

SECTION 916 GAS DETECTION SYSTEMS

916.1 Gas detection systems. Gas detection systems required by this code shall comply with Sections 916.2 through 916.11.

916.2 Permits. Permits shall be required as set forth in Section 105 of the Fire Code of New York State

916.2.1 Construction documents. Documentation of the gas detection system design and equipment to be used that demonstrates compliance with the requirements of this code and the Fire Code of New York State shall be provided with the application for permit.

916.3 Equipment. Gas detection system equipment shall be designed for use with the gases being detected and shall be installed in accordance with manufacturer's instructions.

916.4 Power connections. Gas detection systems shall be permanently connected to the building electrical power supply or shall be permitted to be cord connected to an unswitched receptacle using an approved restraining means that secures the plug to the receptacle.

916.5 Emergency and standby power. Standby or emergency power shall be provided, or the gas detection system shall initiate a trouble signal at an approved location if the power supply is interrupted.

916.6 Sensor locations. Sensors shall be installed in approved locations where leaking gases are expected to accumulate.

916.7 Gas sampling. Gas sampling shall be performed continuously. Sample analysis shall be processed immediately after sampling, except as follows:

1. For HPM gases, sample analysis shall be performed at intervals not exceeding 30 minutes.
2. For toxic gases, that are not HPM, sample analysis shall be performed at intervals not exceeding 5 minutes in accordance with Section 6004.2.2.7 of the Fire Code of New York State.
3. Where a less frequent or delayed sampling interval is approved.

916.8 System activation. A gas detection alarm shall be initiated where any sensor detects a concentration of gas exceeding the following thresholds:

1. For flammable gases, a gas concentration exceeding 25 percent of the lower flammability limit (LFL).
2. For nonflammable gases, a gas concentration exceeding one-half of the IDLH, unless a different threshold is specified by the section of this code requiring a gas detection system.

Upon activation of a gas detection alarm, alarm signals or other required responses shall be as specified by the section of this code requiring a gas detection system. Audible and visible alarm signals associated with a gas detection alarm shall be distinct from fire alarm and carbon monoxide alarm signals.

916.9 Signage. Signs shall be provided adjacent to gas detection system alarm signaling devices that advise occupants of the nature of the signals and actions to take in response to the signal.

916.10 Fire alarm system connections. Gas sensors and gas detection systems shall not be connected to fire alarm systems unless approved and connected in accordance with the fire alarm equipment manufacturer's instructions.

916.11 Inspection, testing and sensor calibration. Gas detection systems and sensors shall be inspected, tested and calibrated in accordance with the Fire Code of New York State.

2.6 2020 Building Code of New York State Section 2702.2 (Emergency and Standby Power Systems, Where required)

2702.2.7 Gas detection systems. Emergency or standby power shall be provided for gas detection systems in accordance with the Fire Code of the State of New York.

2702.2.19 Exhaust ventilation systems. Standby power shall be provided for mechanical exhaust ventilation systems as required in accordance with the Fire Code of the State of New York.

3. The 2020 Fire Code of New York State

3.1 2020 Fire Code of New York State Section 202 (Definitions) This is not an exhaustive list of definitions that may apply to energy storage systems

BATTERY SYSTEM, STATIONARY STORAGE. A rechargeable energy storage system consisting of electro-chemical storage batteries, battery chargers, controls, 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.

Flow battery. A type of storage battery that includes chemical components dissolved in two different liquids, ion exchange, which provides the flow of electrical current, occurs through the membrane while both liquids circulate in their respective spaces.

Lead-acid battery. A storage battery that is comprised of lead electrodes immersed in sulphuric acid electrolyte

Lithium ion battery. A storage battery with lithium ions serving as the charge carriers of the battery. The electrolyte is a polymer mixture of carbonates with an inorganic salt and can be in a liquid or a gelled polymer form. Lilhiated metal oxide is typically a cathode and forms of carbon or graphite typically form the anode.

Lithium metal polymer battery. A storage battery that is similar to the lithium ion battery except that it has a lithium metal anode in the place of the traditional carbon or graphite anode.

Nickel-cadmium (Ni-Cd) battery. An alkaline storage battery in which the positive active material is nickel oxide, the negative contains cadmium and the electrolyte is potassium hydroxide.

Pre-engineered stationary storage battery system. An energy storage system consisting of batteries, a battery management system, components and modules that are produced in a factory, designed lo comprise the system when assembled on the job site.

Prepackaged stationary storage battery system. An energy storage system consisting of batteries, a battery management system, components and modules that is factory assembled and shipped as a complete unit for installation at the job site.

Sodium-beta storage battery. A storage battery also referred to as a Na-beta battery or NBB, which uses a solid beta-alumina electrolyte membrane that selectively allows sodium ion transport between a positive electrode such as metal halide and a negative sodium electrode.

Stationary storage battery. A group of electrochemical cells interconnected lo supply a nominal voltage of DC power to a suitably connected electrical load, designed for service in a permanent location.

ENERGY STORAGE MANAGEMENT SYSTEM. An electronic system that protects energy storage systems from operating outside their safe operating parameters and disconnects electrical power to the energy storage system or places it in a safe condition if potentially hazardous temperatures or other conditions are detected.

CAPACITOR ENERGY STORAGE SYSTEM. A stationary, rechargeable energy storage system consisting of capacitors, chargers, controls and associated electrical equipment designed to provide electrical power to a building or facility. The system is typically used to provide standby or emergency power, an uninterruptable power supply, load shedding, load sharing or similar capabilities.

ENERGY STORAGE SYSTEM. One or more devices, assembled together, capable of storing energy in order to supply electrical energy at a future time, not to include a stand-alone 12- volt car battery or an electric motor vehicle.

ENERGY STORAGE SYSTEM CABINET. A cabinet containing components of the energy storage system that is included in the UL 9540 listing for the system. Personnel are not able to enter the enclosure, other than reaching in to access components for maintenance purposes.

ENERGY STORAGE SYSTEM COMMISSIONING. A systematic process that provides documented confirmation that an energy storage system functions according to the intended design criteria and complies with applicable code requirements.

ENERGY STORAGE SYSTEM DECOMMISSIONING. A systematic process that provides documentation and procedures that allow an energy storage system to be safely deenergized, disassembled, readied for shipment or storage, and removed from the premise in accordance with applicable code requirements.

ENERGY STORAGE SYSTEM, ELECTROCHEMICAL. An energy storage system that stores energy and produces electricity using chemical reactions. It includes, among others, battery energy storage systems and capacitor energy storage systems.

ENERGY STORAGE SYSTEM, MOBILE. An energy storage system capable of being moved and utilized for temporary energy storage applications, and not installed as fixed or stationary electrical equipment. The system can include integral wheels for transportation or be loaded on a trailer and unloaded for charging, storage and deployment.

ENERGY STORAGE SYSTEM, STATIONARY. An energy storage system installed as fixed or stationary electrical equipment in a permanent location.

GAS DETECTION SYSTEM. A system or portion of a combination system that utilizes one or more stationary sensors to detect the presence of a specified gas at a specified concentration and initiate one or more responses required by this code, such as notifying a responsible person, activating an alarm signal, or activating or deactivating equipment. A self- contained gas detection and alarm device is not classified as a gas detection system.

WALK-IN ENERGY STORAGE SYSTEM UNIT. A pre-fabricated building that contains energy storage systems. It includes doors that provide walk-in access for personnel to maintain, test and service the equipment, and is typically used in outdoor and mobile energy storage system applications.

3.2 2020 Fire Code of New York State Section 1203 Emergency and Standby Power Systems

1203.2.5 Exhaust ventilation systems. Standby power shall be provided for mechanical exhaust ventilation systems as required in Section 1206.6.1.2.1. The system shall be capable of powering the required load for a duration of not less than 2 hours.

1203.2.7 Gas detection systems. Emergency power shall be provided for gas detection systems where required by Sections 604.2.8 and 604.2.14. Standby power shall be provided for gas detection systems where required by Section 916.5 and 1206.13.1.2.4.

3.3 2020 Fire Code of New York State Section 1206 Electrical Energy Storage Systems

SECTION 1206 Electrical ENERGY STORAGE SYSTEMS

[NY] 1206.1 Scope. Energy storage systems having capacities exceeding the values shown in Table 1206.1 shall comply with Section 1206.2 through 1206.17.7.7. Energy storage systems in Group R·3 and R•4 occupancies shall comply with Section 1206.18.

TABLE 1206.1 — ENERGY STORAGE SYSTEM THRESHOLD QUANTITIES

TECHNOLOGY	ENERGY CAPACITY[a]
Lead-acid batteries, all types	70 kWh (252 Megajoules)[c]
Nickel-cadmium batteries (Ni-Cd)	70 kWh (252 Megajoules)
Nickel metal hydride (Ni-MH)	70 kWh (252 Megajoules)
Lithium-ion batteries	20 kWh (72 Megajoules)
Flow batteries[b]	20 kWh (72 Megajoules)
Other battery technologies	10 kWh (36 Megajoules)
Capacitor energy storage systems	3 kWh (10.8 Megajoules)
Other electrochemical energy storage systems technologies	3 kWh (10.8 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 1000.
b. Shall include vanadium, zinc-bromine, polysulfde-bromide, and other flowing electrolyte type technologies.
c. An installation that exceeds 50 gallons of lead-acid battery electrolyte shall be considered to have exceeded the threshold quantities of this Table.

1206.2 Applicability. The provisions of Section 1206 shall apply to the installation, operation, maintenance, repair, retrofitting, testing, commissioning and decommissioning of both stationary energy storage systems and mobile energy storage systems.

Exceptions:

1. Equipment associated with the generation, control, transformation, transmission, or distribution of energy installations that is under the exclusive control of an electric utility.
2. Outdoor stationary vehicle charging stations with a capacity of 250 kWh or less. Electrical connections between the charging station and buildings shall meet the requirements of NFPA 70.

1206.2.1 Electrical wiring and equipment. Electrical wiring and equipment used in connection with energy storage systems shall be installed and maintained in accordance with this Chapter and NFPA 70.

1206.2.2 Mixed system installation. Where approved by the fire code official, the aggregate nameplate kWh energy capacity of all energy storage systems in a fire area shall not exceed the maximum quantity specified for any of the energy storage systems in this chapter. Where required by the Authority Having Jurisdiction, a hazard mitigation analysis shall be provided and approved to evaluate any potential adverse interaction between the various energy storage systems and technologies.

1206.3 Permits. Building permits and operating permits shall be provided in accordance with Section 108 of the 2017 Uniform Code Supplement.

1206.4 Construction documents. The following information shall be provided with the permit application:

1. Location and layout diagram of the room or area in which the energy storage system is to be installed.
2. Details on the fire-resistance rating of assemblies enclosing the energy storage system.
3. The quantities and types of energy storage system to be installed.
4. Manufacturer's specifications, ratings and listings of each energy storage system.
5. Description of energy storage management systems and their operation.
6. Location and content of required signage.
7. Details on fire suppression, smoke or fire detection, thermal management, ventilation, exhaust and deflagration venting systems, if provided.
8. Support arrangement associated with the installation, including any required seismic restraint.
9. A commissioning plan complying with 1206.9.1.
10. A decommissioning plan complying with 1206.9.3.
11. Peer reviewer identification and qualifications, where required by the Authority Having Jurisdiction.

1206.5 Hazard mitigation analysis. A failure modes and effects analysis (FMEA) or other approved hazard mitigation analysis shall be provided under any of the following conditions:

1. Where energy storage system technologies not specifically identified in Table 1206.1 are provided.
2. More than one energy storage system technology is provided in a room or enclosed area.
3. Where allowed as a basis for increasing maximum allowable quantities. See Section 1206.12.2.

1206.5.1 Fault condition. The hazard mitigation analysis shall evaluate the consequences of the following failure modes. Only single failure modes shall be considered.

1. A thermal runaway condition in a single energy storage system rack, module or unit.
2. Failure of any energy storage management system.
3. Failure of any required ventilation or exhaust system.
4. Voltage surges on the primary electric supply.
5. Short circuits on the load side of the energy storage system.
6. Failure of the smoke detection, fire detection, fire suppression, or gas detection system.
7. Required spill neutralization not being provided or failure of a required secondary containment system.

1206.5.2 Analysis approval. The fire code official may approve the hazardous mitigation analysis provided the consequences of the hazard mitigation analysis demonstrate:

1. Fires will be contained within unoccupied energy storage system rooms or areas for the minimum duration of the fire-resistance rated assemblies identified in Section 1206.14.4.
2. Fires in occupied work centers will be detected in time to allow occupants within the room or area to safely evacuate.
3. Toxic and highly toxic gases released during fires will not reach concentrations in excess of OSHA-regulated IDLH levels in the building or in adjacent means of egress routes during the time deemed necessary to evacuate occupants from any affected area.
4. Flammable gases released from energy storage systems during charging, discharging and normal operation will not exceed 25 percent of their lower flammability limit (LFL).
5. Flammable gases released from energy storage systems during fire, overcharging and other abnormal conditions will be controlled through the use of ventilation of the gases preventing accumulation or by deflagration venting.

1206.5.3 Additional protection measures. Construction, equipment and systems that are required for the energy storage system to comply with the hazardous mitigation analysis, including but not limited to those specifically described in Section 1206 shall be installed, maintained and tested in accordance with nationally recognized standards and specified design parameters.

1206.6 Large scale fire test. Where required elsewhere in Section 1206, large scale fire testing shall be conducted on a representative energy storage system in accordance with UL 9540A or approved equivalent. The testing shall be conducted or witnessed and reported by an approved testing laboratory and show that a fire involving one energy storage system will not propagate to an adjacent energy storage system. In addition, the testing shall demonstrate that, where the energy storage system is installed within a room, enclosed area or walk-in energy storage system unit, a fire will be contained within the room, enclosed area or walk-in energy storage system unit for a duration equal to the fire-resistance rating of the room assemblies as specified in Section 1206.14.4. The test report shall be provided to the fire code official for review and approval.

1206.7 Fire remediation. Where a fire or other event has damaged the energy storage system, the system owner, agent, or lessee shall, at their expense, comply with Sections 1206.7.1 and 1206.7.2, or remove damaged equipment from the premises to a safe location.

1206.7.1 Fire mitigation personnel. Where, required by the fire code official, the system owner, agent or lessee shall, at their expense, immediately dispatch one or more fire mitigation personnel to the premises. The personnel shall remain on duty continuously after the fire department leaves the premises and until the damaged energy storage system equipment is removed from the premises, or earlier if the fire code official indicates the public safety hazard has been abated.

1206.7.2 Duties. On-duty fire mitigation personnel shall have the following responsibilities:

1. Keep diligent watch for fires, obstructions to means of egress, and other hazards.
2. Immediately contact the fire department if their assistance is needed to mitigate any hazards or extinguish fires.
3. Take prompt measures for remediation of hazards in accordance with the decommissioning plan in Section 1206.9.3.
4. Take prompt measures to assist in evacuation from the structures.

1206.8 Peer review. Where required by the Authority Having Jurisdiction, the owner or the owner's authorized agent shall be responsible for retaining and furnishing the services of a registered design professional or special expert, who will perform as a peer reviewer, subject to the approval of the fire code official.

1206.8.1 Costs. The costs of special services, where required by the Authority Having Jurisdiction, shall be borne by the owner or the owner's authorized agent.

1206.8.2 Special expert. Where the scope of work is limited or focused in an area that does not require the services of a registered design professional or the special knowledge and skills associated with the practice of architecture or engineering, an approved special expert may be employed by the owner or the owner's authorized agent as the person in responsible charge of the limited or focused activity.

1. **Scope of work.** The scope of work of a special expert shall be limited to the area of expertise as demonstrated in the documentation submitted to the fire code official for review and approval.
2. **Special expert qualifications.** Special experts are those individuals who possess the following qualifications:
   1. Has credentials of education and experience in an area of practice that is needed to evaluate risks and safe operations associated with the design, operation and special hazards of energy storage systems.
   2. Licensing or registration, when required by any other applicable statute, regulation, or local law or ordinance.

1206.9 Commissioning, decommissioning, operation and maintenance. Energy storage system commissioning, energy storage system decommissioning, operation, and maintenance shall be conducted in accordance with this section.

1206.9.1 Commissioning. Energy storage system commissioning of newly installed energy storage systems, and existing energy storage systems that have been retrofitted, replaced or previously decommissioned and are returning to service, shall be conducted prior to the energy storage system being placed in service, in accordance with a commissioning plan that has been approved prior to initiating commissioning. The commissioning plan shall include the following:

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 energy storage system 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 understand the installation and operation of the energy storage system.
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 energy storage system 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 energy storage system, and respond to incidents involving the energy storage system, including documentation that such service has been contracted for.
12. A decommissioning plan in accordance with Section 1206.9.3.

Exception: Energy storage system commissioning shall not be required for lead-acid and nickel-cadmium battery systems at facilities under the exclusive control of communications utilities that comply with NFPA 76 and operate at less than 50 VAC and 60 VDC. However, a decommissioning plan shall be provided and maintained where required by the Authority Having Jurisdiction.

1206.9.1.1 Initial acceptance testing. During the commissioning process an energy storage system shall be evaluated for proper operation in accordance with the manufacturer's instructions and the commissioning plan prior to final approval.

1206.9.1.2 Commissioning report. A report describing the results of the energy storage system commissioning and including the results of the initial acceptance testing required in Section 1206.9.1.1 shall be provided to the fire code official prior to final inspection and approval and maintained at an approved on-site location.

1206.9.2 Operation and Maintenance Manual. An Operation and Maintenance Manual (O&M) shall be provided to both the energy storage system owner or their authorized agent and to the energy storage system operator before the 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 manual shall be retained at an approved onsite location and be available to the fire code official. The O&M shall include the following:

1. Manufacturer's O&M for the entire energy storage system or for each component of the system requiring maintenance, that clearly identifies the required routine maintenance actions.
2. Name, address and phone number of a service agency that has been contracted to service the energy storage system 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 systems controls.
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 energy storage system 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 shall be maintained in the O&M.

1206.9.2.1 Systems monitoring. Systems that monitor and protect the energy storage system installation shall also be inspected and tested in accordance with the manufacturer's instructions and Section 1206.9.2.

1206.9.3 Decommissioning. The Authority Having Jurisdiction shall be notified prior to energy storage system decommissioning. Decommissioning or removal of the energy storage system from service, and from the facility in which it is located, shall be performed in accordance with the decommissioning plan. The plan shall include details on providing a safe and orderly shutdown of the energy storage system that includes the following:

1. A narrative description of the activities to be accomplished for removing the energy storage system from service, and from the facility in which it is located.
2. A listing of any contingencies for removing an intact operational energy storage system from service, and for removing an energy storage system from service that has been damaged by a fire or other event.

1206.10 Equipment. Energy storage systems and equipment shall comply with Sections 1206.10.1 through 1206.10.9.

1206.10.1 Energy storage system listings. Energy storage systems shall be listed in accordance with UL 9540 or approved equivalent.

Exception: Lead-acid and nickel-cadmium battery systems installed 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 not required to be listed.

1206.10.2 Equipment listing. Chargers, inverters, energy storage management systems shall be covered as part of the UL 9540 listing or shall be listed separately.

1206.10.3 Utility interactive systems. Only inverters listed and labeled for utility interactive system use and identified as interactive shall be allowed to operate in parallel with the electric utility power system to supply power to common loads. Inverters shall be listed and labeled in accordance with UL 1741.

1206.10.4 Energy storage management system. Where required by the energy storage system listing an approved energy storage management system shall be provided that monitors and balances cell voltages, currents and temperatures within the manufacturer's specifications. The system shall disconnect electrical connections to the energy storage system or otherwise place it in a safe condition if potentially hazardous temperatures or other conditions such as short circuits, over voltage or under voltage are detected.

1206.10.5 Enclosures. Enclosures of energy storage systems shall be of noncombustible construction.

1206.10.6 Repairs. Repairs of energy storage systems shall only be done by qualified personnel. Repairs with other than identical parts shall be considered a retrofit and comply with Section 1206.10.7. Repairs shall be documented in the service records log.

1206.10.7 Retrofits. Retrofitting of an existing energy storage system shall comply with the following:

1. A building permit shall be obtained in accordance with Section 105.
2. New batteries, battery modules, capacitors and similar energy storage system components shall be listed.
3. Energy storage management systems and other monitoring systems shall be connected and installed in accordance with the manufacturer's instructions.
4. The overall installation shall continue to comply with UL 9540 listing requirements, where applicable.
5. Systems that have been retrofitted shall be commissioned in accordance with Section 1206.9.1.
6. Retrofits shall be documented in the service records log.

Exception: Retrofitting of lead-acid and nickel-cadmium batteries with other 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.

1206.10.8 Replacements. Replacements of energy storage systems shall be considered new energy storage system installations and shall comply with the provisions of Section 1206 as applicable to new energy storage systems. The energy storage system being replaced shall be decommissioned in accordance with Section 1206.9.3.

1206.10.9 Reused and repurposed equipment. Equipment and materials shall only be reused or reinstalled as approved by the fire code official. Storage batteries previously used in other applications, such as electric vehicle propulsion, shall not be reused in applications regulated by this Chapter, unless (1) approved by the fire code official and (2) the equipment is refurbished by a battery refurbishing company approved in accordance with UL 1974.

1206.11 General installations requirements. Energy storage systems shall comply with the requirements of Sections 1206.11.1 through 1206.11.12.

1206.11.1 Electrical disconnects. Where the energy storage system disconnecting means is not within sight of the main electrical service disconnecting means, placards or directories shall be installed at the location of the main electrical service disconnecting means indicating the location of stationary storage battery system disconnecting means, in accordance with NFPA 70.

Exception: Electrical disconnects for lead-acid and nickel-cadmium battery systems at facilities under the exclusive control of communications utilities and operating at less than 50 VAC and 60 VDC shall be permitted to have electrical disconnects signage in accordance with NFPA 76.

1206.11.2 Working clearances. Access and working space shall be provided and maintained about all electrical equipment to permit ready and safe operation and maintenance of such equipment, in accordance with NFPA 70 and the manufacturer's instructions.

1206.11.3 Fire-resistance rated construction. Rooms and other indoor areas containing energy storage systems shall be separated from other areas of the building in accordance with Section 1206.14.4 and Chapter 7 of this code. Energy storage systems shall be permitted to be in the same room as the equipment they support.

1206.11.4 Seismic and structural design. Stationary energy storage systems shall comply with the seismic design requirements in Chapter 16 of the International Building Code and shall not exceed the floor loading limitation of the building.

1206.11.5 Vehicle impact protection. Where energy storage systems are subject to impact by a motor vehicle, including fork lifts, vehicle impact protection shall be provided in accordance with Section 312 of this code.

1206.11.6 Combustible storage. Combustible materials shall not be stored in energy storage system rooms, areas, or walk-in energy storage system units. Combustible materials in occupied work centers covered by Section 1206.11.10 shall be stored at least 3 feet (914 mm) from energy storage system cabinets.

1206.11.7 Toxic and highly toxic gases. Energy storage systems installed indoors and that have the potential to release toxic and highly toxic gas during charging, discharging and normal use conditions shall be provided with a hazardous exhaust system in accordance with Section 502.8 of the Mechanical Code of New York State.

1206.11.8 Signage. Approved signs shall be provided on or adjacent to all entry doors to energy storage system rooms or areas, to walk-in energy storage system units located outdoors, on rooftops, or in open parking garages, and on enclosures of energy storage system cabinets. Signs shall be designed to meet both the requirements of this section and of NFPA 70. The signage shall include the following or equivalent.

1. "Energy Storage System", "Battery Storage System", "Capacitor Energy Storage System", or the equivalent.
2. The identification of the electrochemical energy storage system technology present and its rated capacity.
3. "Energized electrical circuits"
4. If water reactive electrochemical energy storage systems are present the signage shall include "APPLY NO WATER"
5. Current contact information, including phone number, for personnel with the technical knowledge of the system who is authorized to service the equipment and for fire mitigation personnel required by Section 1206.7.1.

1206.11.9 Security of installations. Rooms, areas and walk-in energy storage system units in which electrochemical energy storage systems are located shall be secured against unauthorized entry and safeguarded in an approved manner. Security barriers, fences, landscaping, and other enclosures shall not inhibit the required air flow to or exhaust from the electrochemical energy storage system and its components.

1206.11.10 Occupied work centers. Electrochemical energy storage systems located in rooms or areas occupied by personnel not directly involved with maintenance, service and testing of the systems shall comply with the following:

1. Electrochemical energy storage systems located in occupied work centers shall be housed in locked noncombustible cabinets or other enclosures to prevent access by unauthorized personnel.
2. Where electrochemical energy storage systems are contained in cabinets in occupied work centers, the cabinets shall be located within 10 feet (3048 mm) of the equipment that they support.
3. Cabinets shall include signage complying with Section 1206.11.8.

1206.11.11 Open rack installations. Where electrochemical energy storage systems are installed in a separate equipment room and only authorized personnel have access to the room, they shall be permitted to be installed on an open rack.

1206.11.12 Walk-in units. Walk-in energy storage system units shall only be entered for inspection, maintenance and repair of energy storage system units and ancillary equipment and shall not be occupied for other purposes.

1206.12 Electrochemical Energy Storage System Protection. Where required by Section 1206.14 through 1206.17, he protection of electrochemical energy storage systems shall be in accordance with Sections 1206.12.1 through 1206.12.8.

1206.12.1 Size and separation. Electrochemical energy storage systems shall be segregated into groups not exceeding 50 kWh (180 Mega joules). Each group shall be separated a minimum 3 feet (914 mm) from other groups and from walls in the storage room or area. The storage arrangements shall comply with Chapter 10 of this code.

Exceptions:

1. 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.
2. Larger capacities or smaller separation distances shall be permitted based on large scale fire testing complying with Section 1206.6.

1206.12.2 Maximum allowable quantities. Fire areas within rooms, areas and walk-in energy storage system units containing electrochemical energy storage systems shall not exceed the maximum allowable quantities in Table 1206.12.

Exceptions:

1. Where approved by the fire code official, rooms, areas and walk-in energy storage system units containing electrochemical energy storage systems that exceed the amounts in Table 1206.12 shall be permitted based on a hazard mitigation analysis in accordance with Section 1206.5 and large-scale fire testing complying with Section 1206.6.
2. Lead-acid and nickel-cadmium battery systems installed in facilities under the exclusive control of communications utilities and operating at less than 50 VAC and 60 VDC in accordance with NFPA 76.
3. Dedicated use buildings in compliance with Section 1206.14.1.

1206.12.2.1 Mixed electrochemical energy systems. Where rooms, areas and walk-in energy storage system units contain different types of electrochemical energy technologies, the total aggregate quantities of the systems shall be determined based on the sum of percentages of each technology type quantity divided by the maximum allowable quantity of each technology type. The sum of the percentages shall not exceed 100 percent of the maximum allowable quantity.

1206.12.3 Elevation. Electrochemical energy storage systems shall not be located in the following areas:

1. Where the floor is located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access, or
2. Where the floor is located below the lowest level of exit discharge.

Exceptions:

1. 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.
2. Where approved by the fire code official, installations shall be permitted in underground vaults complying with NFPA 70, Article 450, Part III.
3. Where approved by the fire code official, installations shall be permitted on higher and lower floors, based on large scale fire testing complying with Section 1206.6 or on hazard mitigation analysis complying with Section 1206.5.

TABLE 1206.12 - MAXIMUM ALLOWABLE QUANTITIES OF ELECTROCHEMICAL ENERGY STORAGE SYSTEMS

TECHNOLOGY	MAXIMUM ALLOWABLE QUANTITIES [a]
STORAGE BATTERIES	
Lead-acid, all types	Unlimited
Nickel-cadmium (Ni-Cd)	Unlimited
Nickel metal hydride (Ni-MH)	Unlimited
Lithium-ion	600 kWh
Flow batteries [b]	600 kWh
Other battery technologies	200 kWh
CAPACITORS	
All types	20 kWh
OTHER ELECTROCHEMICAL ENERGY STORAGE SYSTEM	
All types	20 kWh

a. For electrochemical energy storage system units rated in Amp-Hours, kWh shall equal rated voltage times the Amp-hour rating divided by 1000
b. Shall include vanadium, zinc-bromine, polysulfide-bromide, and other flowing electrolyte type technologies

1206.12.4 Fire detection. An approved automatic smoke detection system or radiant energy– sensing fire detection system complying with Section 907 shall be installed in rooms, indoor areas, and walk-in energy storage system units containing electrochemical energy storage systems. An approved radiant energy–sensing fire detection system shall be installed to protect open parking garage and rooftop installations. Alarm signals from detection systems shall be monitored by an approved supervising station in accordance with NFPA 72.

1206.12.4.1 System status. Where required by the Authority Having Jurisdiction, visible annunciation shall be provided on cabinet exteriors or in other approved locations to indicate that potentially hazardous conditions associated with the energy storage system exist.

1206.12.5 Fire suppression systems. Rooms and areas within buildings and walk-in energy storage system units containing electrochemical energy storage systems shall be protected by an automatic fire suppression system designed and installed in accordance with one of the following:

1. An automatic sprinkler system designed and installed in accordance with Section 903.3.1.1 with a minimum density of 0.3 gpm/ft2 based on the fire area or on a 2,500 ft2 design area, whichever is smaller.
2. Where approved, based on large scale fire testing complying with Section 1206.6, an automatic sprinkler system designed and installed in accordance with Section 903.3.1.1 with a sprinkler hazard classification.
3. Where approved, based on large scale fire testing complying with Section 1206.6, the following alternate automatic fire extinguishing systems designed and installed in accordance with Section 904:
   - 3.1 NFPA 12, Standard on Carbon Dioxide Extinguishing Systems
   - 3.2 NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection
   - 3.3 NFPA 750, Standard on Water Mist Fire Protection Systems
   - 3.4 NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems
   - 3.5 NFPA 2010, Standard for Fixed Aerosol Fire Extinguishing Systems

Exception: Fire suppression systems for lead-acid and nickel-cadmium battery systems at facilities under the exclusive control of communications utilities that operate at less than 50 VAC and 60 VDC shall be provided where required by NFPA 76.

1206.12.5.1 Water reactive systems. Where an electrochemical energy storage system that utilizes water reactive materials is approved based on large-scale fire testing complying with Section 1206.6, it shall be protected by an approved alternative automatic fire extinguishing system in accordance with Section 904.

1206.12.6 Maximum enclosure size. Outdoor walk-in energy storage system units housing energy storage systems shall not exceed 4,028 cubic feet, not including bolt-on HVAC and related equipment, as approved. Outdoor walk-in energy storage system units exceeding these limitations shall be considered indoor installations and comply with the requirements in Section 1206.14.

1206.12.7 Vegetation control. Areas within 10 feet (3 m) on each side of outdoor energy storage system shall be cleared of combustible vegetation and other combustible growth. Single specimens of trees, shrubbery, or cultivated ground cover such as green grass, ivy, succulents, or similar plants used as ground covers shall be permitted, provided that they do not form a means of readily transmitting fire.

Exception: A reduced clearance to combustible vegetation shall be permitted based on large scale fire testing complying with Section 1206.6.

1206.12.8 Means of egress separation. Energy storage systems located outdoors and in open parking garages shall be separated from any means of egress to ensure safe egress under fire conditions by no less than 10 feet (3048 mm).

Exception: The fire code official may approve a reduced separation distance if large scale fire testing complying with Section 1206.6 is provided that shows that a fire involving the energy storage system will not adversely impact occupant egress.

1206.13 Electrochemical energy storage system technology specific protection. Electrochemical energy storage system installations shall comply with the requirements of this section in accordance with the applicable requirements of Table 1206.13.

TABLE 1206.13 - ELECTROCHEMICAL ENERGY STORAGE SYSTEM TECHNOLOGY SPECIFIC REQUIREMENTS

COMPLIANCE REQUIRED [b]	BATTERY TECHNOLOGY				OTHER ENERGY STORAGE SYSTEM AND BATTERY TECHNOLOGIES [b]	CAPACITOR ENERGY STORAGE SYSTEM [b]
	Leadacid	Ni-Cad and Ni-MH	Lithiumion	Flow		
1206.13.1 Exhaust ventilation	Yes	Yes	No	Yes	Yes	Yes
1206.13.2 Spill control and neutralization	Yes [c]	Yes [c]	No	Yes	Yes	Yes
1206.13.3 Explosion control	Yes [a]	Yes [a]	Yes	No	Yes	Yes
1206.13.4 Safety caps	Yes	Yes	No	No	Yes	Yes
1206.13.5 Thermal runaway	Yes [d]	Yes	Yes [e]	No	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 (i.e. flooded) type nickel-cadmium and lead-acid batteries.
d. Not required for vented (i.e. flooded) type lead-acid batteries.
e. The thermal runaway protection is permitted to be part of an energy storage management system that has been evaluated with the battery as part of the evaluation to UL 1973.

1206.13.1 Exhaust ventilation. Where required by Table 1206.13 or elsewhere in this code, exhaust ventilation shall be provided for rooms, areas, and walk-in energy storage system units containing electrochemical energy storage systems in accordance with the International Mechanical Code and Section 1206.13.1.1 or 1206.13.1.2

1206.13.1.1 Ventilation based upon LFL. The exhaust ventilation system shall be designed to limit the maximum concentration of flammable gas to 25 percent of the lower flammable limit (LFL) of the total volume of the room, area, or walk-in energy storage system unit during the worst-case event of simultaneous charging of batteries at the maximum charge rate, in accordance with nationally recognized standards.

1206.13.1.2 Ventilation based upon exhaust rate. Mechanical exhaust ventilation shall be provided at a rate of not less than 1 ft3/min/ft2(5.1 L/sec/m2) of floor area of the room, area, or walk-in energy storage system unit. The ventilation shall be either continuous or shall be activated by a gas detection system in accordance with Section 1206.13.1.2.4.

1206.13.1.2.1 Standby power. Mechanical exhaust ventilation shall be provided with a minimum of two hours of standby power in accordance with Section 604.2.17.

1206.13.1.2.2 Installation instructions. Required mechanical exhaust ventilation systems shall be installed in accordance with the manufacturer's installation instructions and the International Mechanical Code.

1206.13.1.2.3 Supervision. Required mechanical exhaust ventilation systems shall be supervised by an approved supervising station in accordance with NFPA 72.

1206.13.1.2.4 Gas detection system. Where required by Section 1206.13.1.2, rooms, areas, and walk-in energy storage system units containing energy storage systems shall be protected by an approved continuous gas detection system that complies with Section 916 of this code and with the following:

1. The gas detection system shall be designed to activate the mechanical ventilation system when the level of flammable gas in the room, area, or walk-in energy storage system unit exceeds 25 percent of the LFL.
2. The mechanical ventilation system shall remain on until the flammable gas detected is less than 25 percent of the LFL.
3. The gas detection system shall be provided with a minimum of 2 hours of standby power in accordance with requirements for emergency and standby power systems for gas detection systems in Section 916 of this code.
4. Failure of the gas detection system shall annunciate a trouble signal at an approved supervising station in accordance with NFPA 72.

1206.13.2 Spill control and neutralization. Where required by Table 1206.13 or elsewhere in this code, areas containing free-flowing liquid electrolyte or hazardous materials shall be provided with spill control and neutralization in accordance with this section.

1206.13.2.1 Spill control. Spill control shall be provided to prevent the flow of liquid electrolyte or hazardous materials to adjoining rooms or areas. The method shall be capable of containing a spill from the single largest battery or vessel.

1206.13.2.2 Neutralization. An approved method to neutralize spilled liquid electrolyte shall be provided that is capable of neutralizing a spill from the largest battery or vessel to a pH between 5.0 and 9.0.

1206.13.2.3 Communication Utilities. The requirements of Section 1206.13.2 only apply where the aggregate capacity of multiple vessels exceeds 1,000 gallons (3785 L) for lead acid and nickel-cadmium battery systems operating at less than 50 VAC and 60 VDC that are located at facilities under the exclusive control of communications utilities and those facilities comply with NFPA 76 in addition to applicable requirements of this code.

1206.13.3 Explosion control. Where required by Table 1206.13 or elsewhere in this code, explosion control complying with Section 911 shall be provided for rooms, areas or walk-in energy storage system units containing electrochemical energy storage system technologies.

Exceptions:

1. Where approved by the fire code official, explosion control may be waived based on large scale fire testing complying with Section 1206.6 which demonstrates that flammable gases are not liberated from electrochemical energy storage system cells or modules.
2. Where approved by the fire code official, explosion control may be waived based on documentation provided that demonstrates that the electrochemical energy storage system technology to be used does not have the potential to release flammable gas concentrations in excess of 25 percent of the LFL anywhere in the room, area, walk-in energy storage system unit or structure under thermal runaway or other fault conditions.

1206.13.4 Safety caps. Where required by Table 1206.13 or elsewhere in this code, vented batteries and other energy storage systems shall be provided with fame arresting safety caps.

1206.13.5 Thermal runaway. Where required by Table 1206.13 or elsewhere in this code, batteries and other energy storage systems shall be provided with a listed device or other approved method to prevent, detect and minimize the impact of thermal runaway.

1206.14 Indoor installations. Indoor energy storage system installations shall be in accordance with Sections 1206.14.1 through 1206.14.4.

1206.14.1 Dedicated use buildings. Dedicated use buildings in compliance with this section shall be classified as Group F-1 occupancies. For the purpose of Table 1206.14, dedicated use energy storage system buildings shall comply with all the following:

1. The building shall only be used for energy storage systems, electrical energy generation, and other electrical grid related operations.
2. Other occupancy types shall not be permitted in the building.
3. Occupants in the rooms and areas containing energy storage systems are limited to personnel that operate, maintain, service, test and repair the energy storage system and other energy systems.
4. Administrative and support personnel shall be permitted in areas within the buildings that do not contain energy storage systems provided:
    - 4.1 The areas do not occupy more than 10 percent of the building area of the story in which they are located.
    - 4.2 A means of egress is provided from the administrative and support use areas to the public way that does not require occupants to traverse through areas containing energy storage systems or other energy system equipment.

TABLE 1206.14 — INDOOR ENERGY STORAGE SYSTEM INSTALLATIONS

COMPLIANCE REQUIRED	DEDICATED USE BUILDINGS [a]	NON-DEDICATED USE BUILDINGS [b]
1206.11 General installation requirements	Yes	Yes
1206.12.1 Size and separation	Yes	Yes
1206.12.2 Maximum allowable quantities	No	Yes
1206.12.3 Elevation	Yes	Yes
1206.12.4 Smoke and automatic fire detection [e]	Yes [c]	Yes
1206.12.5 Fire suppression systems	Yes [d]	Yes
1206.14.3 Dwelling units and sleeping units	NA	Yes
1206.14.4 Fire-resistance rating	Yes	Yes
1206.13 Technology specific protection	Yes	Yes

NA = Not allowed.
a. See Section 1206.14.1.
b. See Section 1206.14.2.
c. Where approved by the fire code official, alarm signals are not required to be monitored by an approved supervising station in accordance with NFPA 72.
d. 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.
e. Lead-acid and nickel-cadmium battery systems installed in Group U buildings and structures less than 1500 ft^2 (140 m^2) 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.

1206.14.2 Non-dedicated use buildings. For the purpose of Table 1206.14, non-dedicated use buildings include all buildings that contain energy storage systems and do not comply with the Section 1206.14.1 dedicated use building requirements.

1206.14.3 Dwelling units and sleeping units. Energy storage systems shall not be installed in sleeping units or in habitable spaces of dwelling units.

1206.14.4 Fire-resistance rating. Separation shall be provided by 2 hour rated fire barriers constructed in accordance with Section 707 of the International Building Code and 2 hour rated horizontal assemblies constructed in accordance with Section 711 of the International Building Code, as appropriate. Rooms and areas containing energy storage systems shall be protected on the system side as follows:

1. In dedicated use buildings, fire-resistance rated assemblies shall be provided between rooms and areas containing energy storage systems and areas in which administrative and support personnel are located.
2. In non-dedicated use buildings, fire-resistance rated assemblies shall be provided between rooms and areas containing energy storage systems and other areas in the building.

1206.15 Outdoor installations. Outdoor installations shall be in accordance with Sections 1206.15.1 through 1206.15.3. Exterior wall installations for individual energy storage system units not exceeding 20 kWh shall be in accordance with Sections 1206.15.3 and 1206.15.4.

1206.15.1 Remote outdoor installations. For the purpose of Table 1206.15, remote outdoor installations include energy storage systems 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.

1206.15.2 Installations near exposures. For the purpose of Table 1206.15, installations near exposures include all outdoor energy storage system installations that do not comply with Section 1206.15.1 remote outdoor location requirements.

TABLE 1206.15 — OUTDOOR ENERGY STORAGE SYSTEM INSTALLATIONS[a]

COMPLIANCE REQUIRED	REMOTE INSTALLATIONS[a]	INSTALLATIONS NEAR EXPOSURES[b]
1206.11 General installation requirements	Yes	Yes
1206.12.1 Size and separation	No	Yes[c]
1206.12.2 Maximum allowable quantities	No	Yes
1206.12.4 Smoke and automatic fire detection	Yes	Yes
1206.12.5 Fire suppression systems	Yes[d]	Yes
1206.12.6 Maximum enclosure size	Yes	Yes
1206.12.7 Vegetation control	Yes	Yes
1206.12.8 Means of egress separation	Yes	Yes
1206.15.3 Clearance to exposures	Yes	Yes
1206.13 Technology specific protection	Yes	Yes

a. See Section 1206.15.1.
b. See Section 1206.15.2.
c. In outdoor walk-in energy storage system units, spacing is not required between energy storage system units and the walls of the enclosure.
d. Where approved by the fire code official, fire suppression systems are permitted to be omitted.

1206.15.3 Clearance to exposures. Energy storage systems located outdoors shall be separated by a minimum 10 feet (3048 mm) from the following exposures:

1. 1 Lot lines
2. Public ways
3. Buildings
4. Stored combustible materials
5. Hazardous materials
6. High-piled storage
7. Other exposure hazards

Exceptions:

1. Clearances from exposures are permitted to be reduced to 3 feet (914 mm) where a 1-hour firee standing fire barrier, suitable for exterior use, and extending 5 feet (1.5 m) above and 5 feet (1.5 m) horizontally beyond the physical boundary of the energy storage system installation is provided to protect the exposure.
2. Clearances to buildings are permitted to be reduced to 3 feet (914 mm) where noncombustible exterior walls without openings or combustible overhangs are provided on the wall adjacent to the energy storage system and the fire-resistance rating of the exterior wall is no less than 2 hours.
3. Clearances to buildings are permitted to be reduced to 3 feet (914.4 mm) where a weatherproof enclosure constructed of noncombustible materials is provided over the energy storage system, and it has been demonstrated that a fire within the enclosure will not ignite combustible materials outside the enclosure based on large scale fire testing complying with Section 1206.6.
4. Where exterior wall installations in accordance with Section 1206.15.4 are provided, the clearance between the energy storage system and the wall in which it is mounted, is permitted to be reduced to zero.

1206.15.4 Exterior wall installations. Energy storage systems shall be permitted to be installed outdoors on exterior walls of buildings when all of the following conditions are met:

1. The maximum energy capacity of individual energy storage system units shall not exceed 20 kWh.
2. The energy storage system shall comply with applicable requirements in Section 1206.15.
3. The energy storage system shall be installed in accordance with the manufacturer's instructions and their listing.
4. Individual energy storage system units shall be separated from each other by at least 3 feet (914 mm).
5. The energy storage system shall be separated from doors, windows, operable openings into buildings, or HVAC inlets by at least 5 feet (1524 mm)

Exception: Smaller separation distances in items 4 and 5 shall be permitted based on large scale fire testing complying with Section 1206.6.

1206.16 Special installations. Rooftop and open parking garage energy storage system installations shall comply with Sections 1206.16.1 through 1206.16.6.

TABLE 1206.16 — SPECIAL ENERGY STORAGE SYSTEM INSTALLATIONS

COMPLIANCE REQUIRED	ROOFTOPS [a]	OPEN PARKING GARAGES [b]
1206.11 General installation requirements	Yes	Yes
1206.12.1 Size and separation	Yes	Yes
1206.12.2 Maximum allowable quantities	Yes	Yes
1206.12.4 Smoke and automatic fire detection	Yes	Yes
1206.12.6 Maximum enclosure size	Yes	Yes
1206.12.8 Means of egress separation	Yes	Yes
1206.16.3 Clearance to exposures	Yes	Yes
1206.16.4 Fire suppression systems	Yes	Yes
1206.16.5 Rooftop installations	Yes	No
1206.16.6 Open parking garage installations	No	Yes
1206.13 Technology specific protection	Yes	Yes

a. See Section 1206.16.1.
b. See Section 1206.16.2.

1206.16.1 Rooftop installations. For the purpose of Table 1206.16, rooftop energy storage system installations are those located on the roofs of buildings.

1206.16.2 Open parking garage installations. For the purpose of Table 1206.16, open parking garage energy storage system installations are those located in a structure or portion of a structure that complies with Section 406.5 of the International Building Code.

1206.16.3 Clearance to exposures. Energy storage systems located on rooftops and in open parking garages shall be separated by a minimum 10 feet (3048 mm) from the following exposures:

1. Buildings, except the building on which a rooftop energy storage system is mounted
2. Any portion of the building on which a rooftop system is mounted that is elevated above the rooftop on which the system is installed
3. Lot lines
4. Public ways
5. Stored combustible materials
6. Locations where motor vehicles can be parked
7. Hazardous materials
8. Other exposure hazards

Exceptions:

1. Clearances from exposures are permitted to be reduced to 3 feet (914 mm) where a 1-hour free standing fire barrier, suitable for exterior use, and extending 5 feet (1.5 m) above and extending 5 feet (1.5 m) beyond the physical boundary of the energy storage system installation is provided to protect the exposure.
2. Clearances are permitted to be reduced to 3 feet (914.4 mm) where a weatherproof enclosure constructed of noncombustible materials is provided over the energy storage system and it has been demonstrated that a fire within the enclosure will not ignite combustible materials outside the enclosure based on large scale fire testing complying with Section 1206.6.

1206.16.4 Fire suppression systems. Energy storage systems located in walk-in energy storage system units on rooftops or in walk-in energy storage system units in open parking garages shall be provided with automatic fire suppression systems within the energy storage system enclosure in accordance with Section 1206.12.5. Areas containing energy storage systems other than walk-in energy storage system units in open parking structures on levels not open above to the sky shall be provided with an automatic fire suppression system complying with Section 1206.12.5.

Exception: A fire suppression system is not required in open parking garages if large scale fire testing complying with Section 1206.6 is provided that shows that a fire will not impact the exposures in Section 1206.16.3.

1206.16.5 Rooftop. Energy storage systems and associated equipment that are located on rooftops and not enclosed by building construction shall comply with the following:

1. Stairway access to the roof for emergency response and fire department personnel shall be provided either through a bulkhead from the interior of the building or a stairway on the exterior of the building.
2. Service walkways at least 5 feet (1524 mm) in width shall be provided for service and emergency personnel from the point of access to the roof to the system.
3. Energy storage systems and associated equipment shall be located from the edge of the roof a distance equal to at least the height of the system, equipment, or component but not less than 5 feet (1.5 m).
4. The roofing materials under and within 5 feet (1524 mm) horizontally from an energy storage system or associated equipment shall be noncombustible or shall have a Class A rating when tested in accordance with ASTM E108 or UL 790.
5. A Class I standpipe outlet shall be installed at an approved location on the roof level of the building or in the stairway bulkhead at the top level.
6. The energy storage system shall be the minimum of 10 feet from the fire service access point on the roof top.
7. Energy storage systems shall not be located within 50 feet (15,240 mm) of air inlets for building HVAC systems.

Exception: This distance shall be permitted to be reduced to 25 feet (7.620 mm) if the automatic fire alarm system monitoring the radiant-energy sensing detectors deenergizes the ventilation system connected to the air intakes upon detection of fire.

1206.16.6 Open parking garages. Energy storage systems and associated equipment that are located in open parking garages shall comply with all of the following:

1. Energy storage systems shall not be located within 50 feet (15,240 mm) of air inlets for building HVAC systems.

   Exception: This distance shall be permitted to be reduced to 25 feet (7.620 mm) if the automatic fire alarm system monitoring the radiant-energy sensing detectors deenergizes the ventilation system connected to the air intakes upon detection of fire.

2. Energy storage systems shall not be located within 25 feet (7620 mm) of exits where located on a covered level of the parking structure not directly open to the sky above.
3. An approved fence with a locked gate or other approved barrier shall be provided to keep the general public at least 5 feet (1024 mm) from the outer enclosure of the energy storage system.

1206.17 Mobile energy storage system equipment and operations. Mobile energy storage system equipment and operations shall comply with Sections 1206.17.1 through 1206.17.7.7

1206.17.1 Charging and storage. For the purpose of Section 1206.17, charging and storage covers the operation where mobile energy storage systems are charged and stored so they are ready for deployment to another site, and where they are charged and stored after a deployment.

1206.17.2 Deployment. For the purpose of Section 1206.17, deployment covers operations where mobile energy storage systems are located at a site other than the charging and storage site and are being used to provide power.

1206.17.3 Permits. Building permits and operating permits shall be provided as required by Section 108 of the 2017 Uniform Code Supplement.

1206.17.4 Construction documents. Construction documents complying with Section 1206.4 shall be provided with the building permit application for mobile energy storage system charging and storage locations.

1206.17.4.1 Deployment documents. The following information shall be provided with the operating permit applications for mobile energy storage system deployments:

1. Relevant information for the mobile energy storage system equipment and protection measures in the construction documents required by Section 1206.4.
2. Location(s) and layout diagram(s) of the area(s) in which the mobile energy storage system is to be deployed, including a scale diagram of all nearby exposures.
3. Location and content of signage, including no smoking signs and signage complying with Section 1206.11.8.
4. Description of fencing to be provided around the energy storage system, including locking methods.
5. Details on fire suppression, smoke and automatic fire detection, system monitoring, thermal management, exhaust ventilation, and explosion control, if provided.
6. The intended duration of the deployment operation, including anticipated connection and disconnection times and dates.
7. Location and description of local staging stops during transit to the deployment site. See Section 1206.17.7.5.
8. Description of the temporary wiring, including connection methods, conductor type and size, and circuit overcurrent protection to be provided.
9. Description of how fire suppression system connections to water supplies or extinguishing agents are to be provided.
10. Contact information for personnel who are responsible for maintaining and servicing the equipment and responding to emergencies as required by Section 1206.7.1.

1206.17.5 Approved locations. Locations where mobile energy storage systems are charged, stored and deployed shall be restricted to the locations established on the building permits and operating permits.

1206.17.5.1 Local staging. Mobile energy storage systems in transit from the charging and storage location to the deployment location and back shall not be parked within 100 feet (30,480 mm) of an occupied building for more than one hour during transit, unless specifically permitted by Section 1206.17.3.

1206.17.6 Charging and storage. Installations where mobile energy storage systems are charged and stored shall be treated as permanent indoor or outdoor energy storage system installations, and shall comply with the following sections, as applicable:

1. Indoor charging and storage shall comply with Section 1206.14.
2. Outdoor charging and storage shall comply with Section 1206.15.
3. Charging and storage on rooftops and in open parking garages shall comply with Section 1206.16.

Exceptions:

1. Electrical connections shall be permitted to be made using temporary wiring complying with the manufacturer's instructions, the UL 9540 listing, and NFPA 70.
2. Fire suppression system connections to the water supply shall be permitted to use approved temporary connections.

1206.17.7 Deployed mobile energy storage system requirements. Deployed mobile energy storage system equipment and operations shall comply with this section and Table 1206.17.

1206.17.1 Duration. The duration of a mobile energy storage system deployment shall not exceed 30 days.

Exceptions:

1. Mobile energy storage system deployments that provide power for durations longer than 30 days shall comply with Section 1206.17.6.
2. Mobile energy storage system deployments shall not exceed 180 days unless additional operating permits are obtained.

1206.17.7.2 Restricted locations. Deployed mobile energy storage system operations shall not be located indoors, in covered parking garages, on rooftops, below grade, or under building overhangs.

1206.17.7.3 Clearance to exposures. Deployed mobile energy storage systems shall be separated by a minimum 50 feet (15.3 M) from public seating areas and from tents, canopies and membrane structures with an occupant load of 30 or more. Deployed mobile energy storage systems shall be separated by a minimum 10 feet (3048 mm) from the following exposures:

1. Public ways
2. Buildings
3. Stored combustible materials
4. Hazardous materials
5. High-piled stock
6. Other exposure hazards

1206.17.7.4 Electrical connections. Electrical connections shall be made in accordance with the manufacturer's instructions and the UL 9540 listing. Temporary wiring for electrical power connections shall comply with NFPA 70. Fixed electrical wiring shall not be provided.

1206.17.7.5 Fencing. An approved fence with a locked gate or other approved barrier shall be provided to keep the general public at least 5 feet (1024 mm) from the outer enclosure of a deployed mobile energy storage system.

1206.17.7.6 Smoking. Smoking shall be prohibited within 10 feet (3048 mm) of mobile energy storage systems. Signs shall be posted in accordance with Section 310.

TABLE 1206.17 — MOBILE ENERGY STORAGE SYSTEMS

COMPLIANCE REQUIRED	DEPLOYMENT [a]
1206.11 General installation requirements	Yes [b]
1206.12.1 Size and separation	Yes [c]
1206.12.2 Maximum allowable quantities	Yes
1206.12.4 Smoke and automatic fire detection	Yes [e]
1206.12.5 Fire suppression systems	Yes [d]
1206.12.6 Maximum enclosure size	Yes
1206.12.7 Vegetation control	Yes
1206.12.8 Means of egress separation	Yes
1206.13 Technology specific protection	Yes

a. See Section 1206.17.2.
b. Mobile operations on wheeled vehicle or trailers shall not be required to comply with the seismic and structural load requirements of Section 1206.11.4.
c. In walk-in energy storage system units, spacing is not required between energy storage system units and the walls of the enclosure.
d. Fire suppression system connections to the water supply shall be permitted to use approved temporary connections.
e. Alarm signals are not required to be transmitted to an approved location for mobile energy storage systems deployed 30 days or less.

1206.18 Energy storage systems in Group R-3, and R-4 Occupancies. Energy storage systems in Group R-3 and R-4 occupancies shall be installed and maintained in accordance with Sections 1206.18.1 through 1206.18.9. The temporary use of an owner or occupant's electric powered vehicle as an energy storage system shall be in accordance with Section 1206.18.11. Energy storage system installations exceeding the permitted aggregate ratings in Section 1206.18.4 shall be installed in accordance with Section 1206.2 through 1206.17.7.7.

1206.18.1 Equipment listings. Energy storage systems listed and labeled solely for utility or commercial use shall not be used for residential applications.

Exceptions:

1. Where approved by the fire code official, 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.
2. Energy storage systems less than 1 kWh (3.6 megajoules).

1206.18.2 Installation. Energy storage systems shall be installed in accordance with the manufacturer's instructions and their listing.

1206.18.2.1 Spacing. Individual units shall be separated from each other by at least 3 feet of spacing unless smaller separation distances are documented to be adequate based on large scale fire testing complying with Section 1206.6.

1206.18.3 Location. Energy storage systems shall only be installed in the following locations:

1. Detached garages and detached accessory structures.
2. Attached garages separated from the dwelling unit living space and sleeping units in accordance with Section 406.3.4 of the International Building Code.
3. Outdoors on exterior walls located a minimum 3 ft. from doors and windows.
4. Utility closets and storage or utility spaces within dwelling units and sleeping units

1206.18.4 Energy ratings. Individual energy storage system units shall have a maximum rating of 20 kWh. The aggregate rating 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

1206.18.5 Electrical installation. Energy storage systems shall be installed in accordance with NFPA 70. Inverters shall be listed and labeled in accordance with UL 1741 or provided as part of the UL 9540 listing. Systems connected to the utility grid shall use inverters listed for utility interaction.

1206.18.6 Fire detection. Rooms and areas within dwellings units, sleeping units and attached garages in which energy storage systems are installed shall be protected by smoke alarms in accordance with Section 907. A heat detector or heat alarm listed and interconnected to the smoke alarms shall be installed in locations within dwelling units, sleeping units and attached garages where smoke alarms cannot be installed based on their listing.

1206.18.7 Fire-resistance rating. Rooms and areas containing energy storage systems shall be protected on the system side by 2-hour rated fire barriers constructed in accordance with Section 707 of the Building Code of New York State and 2 hour rated horizontal assemblies constructed in accordance with Section 711 of the Building Code of New York State, as applicable.

1206.18.8 Protection from impact. Energy storage systems installed in a location subject to vehicle damage shall be protected by approved barriers.

1206.18.9 Ventilation. Indoor installations of energy storage systems that include batteries that produce hydrogen or other flammable gases during charging shall be provided with exhaust ventilation in accordance with Section 1206.13.1.

1206.18.10 Toxic and highly toxic gas. Energy storage systems that have the potential to release toxic or highly toxic gas during charging, discharging and normal use conditions shall not be installed within Group R-3 and R-4 occupancies.

1206.18.11 Electric vehicle use. The temporary use of an owner or occupant's electric powered vehicle to power a dwelling unit or sleeping unit while parked in an attached or detached garage or outside, shall comply with the vehicle manufacturer's instructions and NFPA 70. The batteries on electric vehicles shall not contribute to the aggregate energy limitations in Section 1206.18.4.

3.4 2020 FIRE CODE OF THE STATE OF NEW YORK Section 907.2.22 (Fire Alarm and Detection Systems)

907.2.22 Battery Rooms. An automatic smoke detection system shall be installed in areas containing energy storage systems as required in Section 1206.

907.2.23 Capacitor Energy Storage System. An automatic smoke detection system shall be installed in areas containing capacitor energy storage systems as required in Section 1206.

3.5 2020 FIRE CODE OF THE STATE OF NEW YORK Section 916 (Gas Detection Systems)

SECTION 916 GAS DETECTION SYSTEMS

916.1 Gas detection systems. Gas detection systems required by this code shall comply with Sections 916.2 through 916.11.

916.2 Permits. Permits shall be provided in accordance with Section 105.2.

916.2.1 Construction documents. Documentation of the gas detection system design and equipment to be used that demonstrates compliance with the requirements of this code shall be provided with the application for permit.

916.3 Equipment. Gas detection system equipment shall be designed for use with the gases being detected and shall be installed in accordance with manufacturer's instructions.

916.4 Power connections. Gas detection systems shall be permanently connected to the building electrical power supply or shall be permitted to be cord connected to an unswitched receptacle using an approved restraining means that secures the plug to the receptacle.

916.5 Emergency and standby power. Standby or emergency power shall be provided, or the gas detection system shall initiate a trouble signal at an approved location if the power supply is interrupted.

916.6 Sensor locations. Sensors shall be installed in approved locations where leaking gases are expected to accumulate.

916.7 Gas sampling. Gas sampling shall be performed continuously. Sample analysis shall be processed immediately after sampling, except as follows:

1. For HPM gases, sample analysis shall be performed at intervals not exceeding 30 minutes.
2. For toxic gases that are not HPM, sample analysis shall be performed at intervals not exceeding 5 minutes, in accordance with Section 6004.2.2.7.
3. Where a less frequent or delayed sampling interval is approved. 916.8 System activation. A gas detection alarm shall be initiated where any sensor detects a concentration of gas exceeding the following thresholds:
    1. For flammable gases, a gas concentration exceeding 25 percent of the lower flammability limit (LFL).
    2. For nonflammable gases, a gas concentration exceeding one-half of the IDLH, unless a different threshold is specified by the section of this code requiring a gas detection system.

Upon activation of a gas detection alarm, alarm signals or other required responses shall be as specified by the section of this code requiring a gas detection system. Audible and visible alarm signals associated with a gas detection alarm shall be distinct from fire alarm and carbon monoxide alarm signals.

916.9 Signage. Signs shall be provided adjacent to gas detection system alarm signaling devices that advise occupants of the nature of the signals and actions to take in response to the signal.

916.10 Fire alarm system connections. Gas sensors and gas detection systems shall not be connected to fire alarm systems unless approved and connected in accordance with the fire alarm equipment manufacturer's instructions.

916.11 Inspection, testing and sensor calibration. Inspection and testing of gas detection systems shall be conducted not less than annually. Sensor calibration shall be confirmed at the time of sensor installation and calibration shall be performed at the frequency specified by the sensor manufacturer.

4. The 2020 Existing Building Code of New York State

4.1 2020 Existing Building Code of New York State Section 202 (Definitions) This is not an exhaustive list of definitions that may apply to energy storage systems

ENERGY STORAGE SYSTEM. One or more devices, assembled together, capable of storing energy in order to supply electrical energy at a future time, not to include a stand-alone 12- volt car battery or an electric motor vehicle.

4.2 2020 Existing Building Code of New York State Section 306 (Energy Storage Systems)

SECTION 306 ENERGY STORAGE SYSTEMS

306.1 Energy storage systems. The installation, operation, maintenance, repair, and retrofitting of energy storage systems shall be in accordance with Section 1206 of the Fire Code of New York State.

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Morris Lithium Battery Fire Highlights Emergency Planning, Hazardous Chemical Management - VelocityEHS

07/16/2021

On July 11, Morris Fire Chief Tracey Steffes announced that after nearly two weeks, the lithium battery fire which erupted on June 29 at a 70,000-square-foot warehouse in Morris, Illinois has been extinguished and is under control.

The incident site is still being secured and no formal investigation has yet been completed, but several clues have emerged as to the causes of the fire. Here, we'll take a look at what facts are currently known, what emergency planning and safety system failures may have contributed to the fire, and what risk controls can help us ensure similar incidents are prevented in the future.

What Happened?

The incident was first reported around 11:45 AM CT at the old Federal Paper Board facility in Morris, about 70 miles southwest of Chicago. According to authorities, an estimated **180,000 to 200,000 pounds of lithium ion batteries** stored in the warehouse caught fire, ultimately setting off a series of explosions that destroyed the warehouse and sent thick plumes of "highly poisonous" and "very deadly" fumes into the surrounding community.

Area firefighters responded to the fire shortly after 11:45 AM. Alarmingly, Morris Mayor Chris Brown stated that officials and first responders were unaware that the building, believed to have been unoccupied since the Federal Paper Board facility closed almost 35 years ago, was housing approximately 100 tons of lithium ion batteries. Chief Steffes indicated that firefighters initially attempted to suppress the blaze with water, unaware of the lithium ion batteries inside which explode when exposed to water. Firefighters' initial attempts to extinguish the fire tragically caused it to intensify, and rain showers Tuesday night contributed to an already uncontrollable situation.

It was soon determined that alternate firefighting tactics and materials were required. By late Tuesday, a large portion of batteries contained in the warehouse were likely consumed, allowing first responders to remove parts of a wall to see inside. With the volume of the fire reduced, firefighters attempted to extinguish the flames using a fire suppressant called Purple-K.

Purple-K is a dry chemical fire retardant that is considered highly effective against Class B fires. It was likely chosen due to its water repellent, non-abrasive and non-toxic chemical properties, and that post-fire cleanup of Purple-K agent can be easily accomplished using a vacuum cleaner.

However, a lithium ion battery fire is more appropriately classified as a Class C or D fire, and the Purple-K was ineffective at suppressing the flames. Chief Steffes commented, "We brought over 1,000 pounds of Purple-K and we introduced that to the fire hoping we could kill it and choke it out. The lithium ion fire laughed at the Purple-K. Didn't put a dent in it." Officials soon determined that the best course of action would be to allow the fire to burn itself out until it could be managed.

By Wednesday morning, local officials had ordered the evacuation of approximately 1,000 homes and businesses in the surrounding vicinity, displacing anywhere between 3,000 to 5,000 area residents for more than 3 days until the evacuation order was eventually lifted late Friday, July 2.

Once the fire had diminished to a controllable level, firefighters applied high-flow water in an attempt to cool the batteries while applying approximately 28 tons of dry Portland cement to smother the burning lithium ion batteries until there was no longer any active fires at the site.

At the time of this article, Morris officials continue to monitor the site for potential hotspots and to control any flare ups, while Illinois EPA continues to monitor air quality and other potential environmental risks resulting from the fire, as well as soil and water sampling to determine if any contaminants from the fire had impacted surrounding communities or municipal water sources.

What Went Wrong & How it Could Have Been Prevented

Several factors have been revealed in the days following the incident that may have contributed to not only the fire itself, but also first responders' difficulty in controlling the blaze. To be clear, no formal investigation has been completed at this point, but as safety professionals we can begin to draw potential conclusions about how these failures occurred based on what we already know. From there, we can start to determine what systems and precautions need to be in place to prevent such incidents in the future.

Hazard Awareness

Lithium ion batteries are so commonplace in our daily lives, it's easy to forget that they are, in fact, *highly* hazardous materials. They contain highly reactive toxic chemicals that, if released, pose severe hazards. The primary concern is the potential for an irreversible reaction known as "thermal runaway" in which spontaneous internal or external short-circuit, overcharging, external heating/fire or mechanical abuse (puncture) causes a chain reaction that essentially cannot be stopped until the entire battery has combusted. This is precisely what happened in the Morris fire, but on a massive scale.

A common point of confusion is the hazard communication requirements for lithium ion batteries. OSHA's Hazard Communication Standard (HazCom) does not typically apply to items or materials that are considered "articles" under the definitions of the Standard, which is:

Article *- a manufactured item: (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which does not release, or otherwise result in exposure to, a hazardous chemical under normal conditions of use.*

However, OSHA and EPA have clarified that the article exemption does **NOT** apply to lithium ion batteries and that they are subject to OSHA HazCom regulations. This is because although these batteries are sealed, they have the potential to leak, spill or break during normal conditions of use and in foreseeable emergencies, causing exposure to chemicals. Therefore, lithium ion batteries must be accompanied by an SDS that provides full information on their potential hazards including proper storage, handling and emergency response measures. It is uncertain whether the owner/operator of the Morris warehouse or its workers were aware of the HazCom requirements for the batteries on-site, or whether SDS were available.

Emergency Planning & Preparedness

As a hazardous substance covered under OSHA's HazCom Standard, lithium ion batteries are also subject to reporting requirements under Sections 311 and 312 of EPA's Emergency Planning and Community Right-to-Know Act (EPCRA) Hazardous Chemical Inventory Reporting Requirements, which state:

40 CFR §370.10

(a) You must comply with the reporting requirements of this part if the Occupational Safety and Health Administration's (OSHA) Hazard Communication Standard (HCS) require your facility to prepare or have available a Material Safety Data Sheet (MSDS) (or Safety Data Sheet (SDS)) for a hazardous chemical and if either of the following conditions is met:

(1) A hazardous chemical that is an Extremely Hazardous Substance (EHS) is present at your facility at any one time in an amount equal to or greater than 500 pounds (227 kg—approximately 55 gallons) or the Threshold Planning Quantity (TPQ), whichever is lower. EHSs and their TPQs are listed in Appendices A and B of 40 CFR part 355.

(2) A hazardous chemical that is not an EHS is present at your facility at any one time in an amount equal to or greater than the threshold level for that hazardous chemical. Threshold levels for such hazardous chemicals are:

(i) For any hazardous chemical that does not meet the criteria in paragraph (a)(2)(ii) or (iii) of this section, the threshold level is 10,000 pounds (or 4,540 kg).

In more basic terms, EPA requires facilities that store or use *any hazardous chemical covered under HazCom* in an amount greater than 10,000 pounds to:

- Submit the SDS for that hazardous chemical to their State Emergency Response Commission (SERC), Local Emergency Planning Committee (LEPC) and *local fire department*. New facilities have three months after becoming subject to the OSHA regulations to submit their SDS or list of the hazardous chemicals to their SERC, LEPC, and the fire department.

- Submit an annual inventory report (Tier I or Tier II) for the same chemicals to the SERC, LEPC and local fire department by March 1 of each year.

In the case of the Morris lithium battery fire, what we can reasonably determine is that this requirement **WAS NOT** met in even the most limited sense. According to officials' statements, they had no prior indication that the warehouse was occupied, let alone that it contained nearly 20 times the TPQ for hazardous chemicals (i.e. lithium batteries). If local officials and fire fighters had this information available upon responding to the fire initially, the severity and impact of the fire could certainly have been more effectively mitigated.

What's also evident is that the warehouse owner/operator failed to develop and implement an emergency response plan including details such as:

- Emergency contact information to obtain critical information in the event of an incident involving battery shipment and storage
- Rapid access to SDSs and other hazard information including first aid, medical exposure support and emergency response assistance
- Reporting procedures to comply with chemical spill/release reporting requirements (e.g. EPCRA 313, CERCLA)
- Notification procedures for local emergency first responders and officials as to the contents and potential hazards of the facility's hazardous chemical inventory
- Dispatch of HAZMAT Response and remediation teams

Improper Handling & Storage

Like any other hazardous chemical, lithium batteries must be stored according to the precautions listed in **Section 7 of the SDS**. Once the safe storage conditions are identified it is necessary to inspect storage locations to ensure they are free of hazards, and conditions are consistent with SDS storage precautions. For lithium ion batteries, an example SDS provides the following storage precautions:

- Avoid excessive physical shock or vibration
- Store in a cool, dry, well-ventilated area (25°C+/-5°C), (<85% humidity)
- Keep battery packs in packaging material to prevent exposure to elements and conductive material
- Do not store battery packs near heat, high humidity, open flame, sunlight, water, seawater, strong acids, strong oxidizers, strong reducing agents, strong alkalis or metal wire

As we've already mentioned, the primary hazard of lithium ion batteries is the potential for thermal runaway, which can occur due to short-circuit, overcharging, external heating/fire or mechanical abuse (puncture/rupture). Any number of improper storage conditions may have been present that contributed the Morris fire. Again, the warehouse where the batteries were stored was part of a facility that had been presumably unoccupied since 1980, and in all probability, was not properly maintained. It is likely that the building was not equipped with sufficient ventilation or cooling systems to keep batteries at a safe storage temperature and humidity. The building may have had roof leaks that allowed water to infiltrate the storage areas and cause short-circuiting of batteries. Workers inside the building may not have stored batteries in locations that were free from risk of physical damage to the batteries. It may have been something as simple as a package of batteries being dropped on the floor, causing one or more to rupture and catch fire.

In any event, training and awareness of proper handling and storage precautions, as well as regular inspection and corrective maintenance to ensure storage conditions were acceptable could have significantly reduced both the likelihood and severity of this incident.

Lessons learned

As with so many other devastating chemical-related incidents, it appears the Morris battery fire was caused by a cascade of failures that not only initiated the fire, but created the perfect conditions for it to quickly get out of control. Seemingly simple oversights of regulations and hazard controls compounded to cause an event that led to the complete destruction of the facility, the evacuation of more than 3,000 Morris residents, and potential long term health and environmental impacts that have yet to be fully quantified. In all likelihood, the owner and operator of the warehouse will face multiple violations of environmental health and safety regulations, years of litigation and civil liabilities, and suffer potentially irreversible damage to the company's reputation that could ultimately cost them their business.

If they had only taken the required steps to ensure proper storage and handling of their hazardous chemical inventory, provided their workers with knowledge and training in those safety precautions, and developed an emergency plan that included a means of sharing of critical chemical inventory and hazard information with local officials and first responders, all of this might have been avoided.

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No evacuations for battery fire at energy storage facility east of Grand Ridge

Michael Urbanec

A battery fire Monday, July 19, 2021, at an Invenergy storage facility is under control and the La Salle County Emergency Management Agency says it doesn't pose an immediate threat to the public. (Photo provided)

July 19, 2021 at 1:26 pm CDT

A battery fire Monday at an Invenergy storage facility on 25th Road, just west of the La Salle Generation Station nuclear power plant, is contained, but the scene will remain active for awhile.

No evacuations have been made.

There is no immediate threat to the surrounding area, reported the La Salle County Emergency Management Agency. Officials there say this is a different type of battery fire than what occurred recently in Morris, causing evacuations.

To be safe, Illinois EPA is conducting air sampling, the La Salle County agency said.

Firefighters, including those from Marseilles, were on the scene trying to extinguish the fire and smoke was visible as of 1 p.m. The driveway toward the facility is closed and media was not allowed past that point.

Invenergy's Grand Ridge Energy Storage is the second-largest operating lithium ion battery project in the world based on it's power rating according to the Energy Storage North America website.

The area around the fire is rural.

An Invenergy truck blocks the driveway Monday, July 19, 2021, while firefighters work on extinguish a fire at an energy storage facility. (Michael Urbanec)

What Sparked the Arizona Battery Fire? LG Chem Has a Different Version

Julian Spector

The grid battery fire in Arizona last year ended with an explosion, but disagreement has emerged on how exactly it began.

Owner Arizona Public Service recently concluded that a defect in a single lithium-ion battery cell caused it to heat up, triggering a chain reaction that destroyed a whole rack and released gases that later exploded. But LG Chem, the manufacturer responsible for the battery cells and modules, published its own report with a different conclusion.

According to LG Chem’s "progress report," compiled by scientific investigation firm Exponent, the physical evidence does not support the battery defect theory. The report, filed with Arizona's utility regulators last month, instead theorizes that external causes heated up the battery.

At stake is the reputation of a long-time leader in the lithium-ion manufacturing space. Batteries are known to degrade over time, sometimes forming spindly metal deposits called dendrites, which can eventually reach across a cell and cause a short. When a short circuit heats up, it can trigger thermal runaway. But for LG Chem's cells to exhibit such behavior in just two years — the age of the battery system in Arizona when the incident occurred — would constitute a manufacturing failure.

“The APS event is well known, so when a report gets published as the final report, that does generate a lot of questions,” said Peter Gibson, vice president of energy storage at LG Chem, in a recent interview. “We felt a need to make it clear that the report was not consistent with our perspectives.”

APS declined to comment on LG Chem's methods or findings.

"We stand by the investigation we led into the April 2019 McMicken event and the independent report we commissioned to compile expert analysis into our final findings," spokesperson Jenna Rowell said in an email. "The report we released reflects the lessons we learned and will guide APS’ future actions with battery energy storage."

The utility's new requirements should rule out the explosive outcome, even if another battery cell heats up. In that sense, whether or not a particular cell kicked off the McMicken disaster has little bearing on the safety of future projects.

The stakes of the conflicting report have more to do with LG Chem's reputation as a responsible battery manufacturer, and the industry's understanding of the risks of lithium-ion battery technology.

Conflicting explanations of the root cause

APS brought in energy consultancy DNV GL to write its report; that firm reviewed the forensic investigation findings to compile its conclusions. Exponent, a firm that specializes in investigating battery failures, conducted its own testing.

The wreckage posed an epistemological problem for investigators because the cell at ground zero for thermal runaway and those around it burned up in the process. Without conclusive evidence from the source, investigators had to look to fragmentary clues to piece together what happened.

Cells taken at random from elsewhere in the battery system, and from its twin system at Festival Ranch, showed “lithium metal deposition and abnormal dendritic growth,” DNV GL notes.

"Because the evidence of Lithium metal deposition and abnormal dendritic growth was sufficiently present in the random samples that were analyzed, it was determined to a reasonable degree of scientific certainty to be the anomaly that caused the initial cell failure and ensuing thermal runaway," battery safety expert Davion Hill wrote in the APS report.

But LG Chem asserts that the investigation needed to consider other explanations. “A cell failure can be caused by either a short circuit or heating from an external source,” Gibson said. “Any serious analysis needs to consider both.”

LG Chem tested one of those cycled cells with deposits similar to those DNV GL examined and found that it did not conduct electricity and thus was unlikely to be pure lithium metal.

“It is impossible for a non-conductive deposit to establish an internal cell short circuit, carry current, resistively heat and cause thermal runaway,” Exponent's report says.

However, Exponent also notes that some of the deposit samples reacted in air in manners consistent with lithium metal. "It is difficult to reconcile the facts that the deposits have been shown to be non-conductive and that they have reactivity in air that is similar to that of conductive lithium metal," the report explains.

Extreme lithium plating, of the sort that could cause a short circuit, necessarily reduces the cell’s ability to store energy, which would lead to a decline in performance. But it's not clear if a reduction in one cell's performance could show up in the data logs. The Exponent report includes a section on "Failure Data Limitations" that shows how McMicken's data logging did not capture a granular picture of what transpired at the cell level.

Exponent also found physical signs of electrical arcing in the battery rack, which could have provided an external heat source to initiate thermal runaway. It found that the damage on the batteries indicates an "attack" by an external heat source.

These observations raise questions about the timeline that may be impossible to resolve. If a metallic deposit appeared non-conductive when LG Chem examined it, were all similar deposits also non-conductive when they first formed or when the thermal runaway began? Did the electrical arcing that left marks on the rack happen right before the thermal runaway or in the chaos that ensued?

Reputational damage control

Even if observers did blame LG Chem’s cell for starting the fire, it’s not clear that this would seriously affect the company’s prospects.

Both reports agree that the real damage came from other factors, namely, the propagation of thermal runaway and the accumulation of unvented explosive gas. Battery developers recognize that individual cells sometimes fail; the industry since has made headway in designing systems to limit the damage of a single cell failure.

LG Chem has dealt with fires at facilities it supplied before. After South Korea paid out a generous subsidy for battery projects, business boomed, and then a spate of battery fires broke out. Around a dozen of them occurred at projects supplied by LG Chem, Gibson said.

“In Korea, there were an awful lot of systems developed by relatively inexperienced system integrators,” he said.

Some projects revealed fundamental design problems, evidenced by things like rust and water leakage. After investigating the problem, the Korean government recommended limiting the maximum state of charge. At that point, LG Chem proactively exchanged battery modules from that era as an additional safety precaution, Gibson said.

“If we see something where there’s really a need to do a retrofit to enhance safety...we are very proactive,” Gibson said. "It happens very rarely."

That episode did not dislodge LG Chem from its Tier 1 cell supplier status, nor did it jeopardize the business of supplying electric vehicle batteries to automakers like GM. LG Chem's automotive battery business is roughly 10 times larger than its stationary grid storage business, Gibson said.

Whatever happened at McMicken, it hasn’t shaken the trust of Fluence, which bought the cells from LG Chem and integrated them into the system for APS.

When asked if Fluence still buys from LG Chem, COO John Zahurancik said, “We work closely with multiple top-tier battery providers, including LG, to ensure the safety and quality of battery cells used in our systems. Under no circumstances would we ever consider using battery technology we did not believe could be deployed and operated safely.”

Even after the McMicken fire, LG Chem cells found a home in LS Power's Gateway storage facility, the largest lithium-ion battery in the world. LG Chem's safety standards convinced LS Power that it was a good choice to supply 250 megawatts for the Southern California plant, which began operations this summer.

Other chemistries rising

A broader shift in customer preference is underway in the grid battery sector, however.

The stationary storage industry got an early boost from piggybacking on the supply chains for the electric vehicle industry. The energy-dense nickel-manganese-cobalt-oxide (NMC) batteries designed for cars doubled as powerful batteries for the grid.

But the APS fire strikingly illustrated the explosive potential of those NMC batteries. Another chemistry, lithium-ferrous-phosphate or LFP, has gained ground due to a reputation for safety and lower costs, although it packs less energy density.

“The safety question has been one of several reasons why the energy storage market has given the Chinese LFP vendors a harder look,” said Daniel Finn-Foley, energy storage director at Wood Mackenzie. “As they’ve given them a second look, they’re liking what they see, and it’s moving LFP vendors toward a market-leading position.”

Indeed, NMC’s market share for grid storage has already peaked and will continue to decline as LFP gains ground, according to new research from Wood Mackenzie. LFP supplied just 10 percent of the market in 2015, but its share will reach 30 percent by 2030.

That shift elevates manufacturers in China that weren’t considered Tier 1 in the early days of U.S. grid battery development. But the trend does not necessarily mean LG Chem will be left behind.

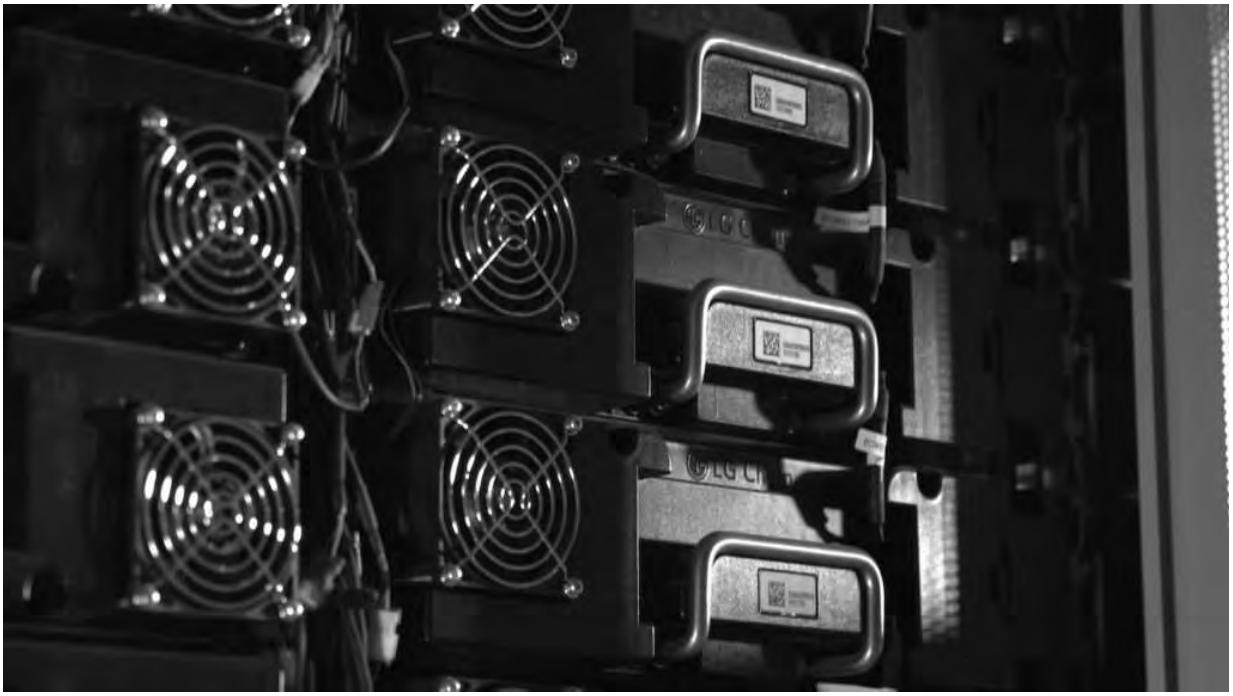
The South Korean company maintains a sizable roster of technical talent to develop and commercialize new chemistries as the market demands. LG Chem has produced LFP in the past, Gibson noted, but he says he is "still very much of the opinion that NMC is preferred" due to its power density and performance characteristics.

If the market shifts as the analysts predict, it will coincide with meteoric growth in storage deployments. That means NMC would serve a smaller slice of a much larger pie than today's grid storage market.

This is the second in a series of exploring the repercussions of the most prominent battery fire in recent U.S. history. The first installment, on how the storage industry has already improved its safety procedures, is available here.

World's biggest lithium battery storage facility now completely offline after weekend incident

By Andy Colthorpe



Closeup of battery modules at Moss Landing Energy Storage Facility. Image: Vistra Energy.

An incident which caused batteries to short has taken offline Phase II of Moss Landing Energy Storage Facility in Monterey County, California, the world's biggest lithium-ion battery energy storage system (BESS) project.

Project owner Vistra Energy said yesterday that the 100MW/400MWh expansion phase of the facility now joins the 300MW/1,200MWh Phase I in being out of action, after the incident late on Sunday (13 February).

In what appears to be a repeat of what happened in September to Phase I, a sprinkler system released water onto battery racks.

As before, no one was harmed, but after Phase II's early detection safety system kicked in, local fire crews were called to the scene, in line with protocols and out of what Vistra described in a brief statement as an abundance of caution.

The latest incident comes only a couple of weeks after integrated utility and power generation company Vistra issued a report into the situation at Phase I and said it was preparing to bring it back online soon. Vistra has now decided to pause those restart activities.

In the January report, the cause of overheating of batteries was attributed to a sprinkler system that became active in response to smoke coming from an air handling unit in which a bearing had failed, rather than battery cells going into a thermal incident through internal faults or damage.

The onsite smoke detection apparatus had triggered water to be sprayed at a threshold below what it should have, leading Vistra to conclude there had been an error made in the equipment's programming.

A course of corrective actions was being implemented at Phase I, including sealing gaps between the floor levels containing battery racks to prevent water leaking from one down onto the other, testing all the heat suppression equipment thoroughly and reviewing the programming of the Very Early Smoke Detection Apparatus (VESDA).

The early signs are that something similar happened again at Phase II, with leaking hoses having caused the suppression system to release water onto battery racks, which then produced smoke as damage was done to batteries. The suppression system did however contain the event.

Another investigation is now underway to find out what caused the detection system to activate and trigger the chain of events at Phase II, which came online in August 2021.

Vistra Energy is preparing to expand the facility even further to 750MW/3,000MWh, after signing off-take agreement contracts with California investor-owned utility (IOU) Pacific Gas & Electric (PG&E) for the next 350MW/1,400MWh phase which should come online by June next year if the agreement is approved by the California Public Utilities Commission (CPUC).

In a recent interview for our quarterly journal *PV Tech Power*, Paul Rogers, a former firefighter-turned-subject matter expert in battery energy storage said that for fire crews, fire and explosion incidents will be extremely rare, but could be high risk events when they do occur.

Pacific Northwest
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PNNL-34462

Energy Storage in Local Zoning Ordinances

October 2023

Jeremy B Twitchell
Devyn W Powell
Matthew D Paiss

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under Contract DE-AC05-76RL01830

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Executive Summary

Increasing policy support and declining prices for battery energy storage systems (BESS) are driving rapid growth in the installation of these systems in the United States and around the world. Because a BESS is modular in nature and has limited infrastructure requirements, it has the potential to placed on infill developments in close proximity to existing uses, which creates the potential for conflict. As the use of BESS grows, local planning and zoning staff are increasingly being asked to determine where the systems can be built and how their impacts on surrounding uses can be mitigated. While a large-scale BESS offers significant electric grid and societal benefits, it can also pose safety, visual, auditory, and environmental impacts on the community in which it is located. While these are material impacts, current safety codes for energy storage systems and land use frameworks provide planners with the necessary tools and processes to mitigate those impacts and ensure that their communities safely receive the benefits of energy storage systems. This report provides an overview of BESS from a land use perspective and describes their implications for zoning and project permitting. It concludes with an analysis of current energy storage zoning standards adopted by local jurisdictions in the U.S. Its intent is to objectively inform land use decisions for energy storage projects by equipping planning officials with relevant information about these technologies and knowledge of what questions to ask during review processes, so that energy storage projects can move forward in ways that will benefit electric systems while not unduly affecting host communities.

Acknowledgments

This work was funded by the U.S. Department of Energy—Office of Electricity, through the Energy Storage Program under the direction of Dr. Imre Gyuk.

Acronyms and Abbreviations

BESS	Battery Energy Storage System
dB	Decibel
EIA	Energy Information Administration
IFC	International Fire Code
IRA	Inflation Reduction Act
MW	Megawatt
NFPA	National Fire Protection Association
SDO	Standards-developing Organization

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1.0 Introduction and Background

Numerous U.S. states have adopted aggressive energy decarbonization targets in recent years; 16 states and territories have enacted binding legislation requiring all of their electricity to either be 100 percent clean or fully offset by clean energy, while another seven states have aspirational, non-binding goals for an electric supply that is either fully decarbonized or fully offset by clean energy. Another 25 states and territories have clean energy requirements of varying levels, including some of those that have aspirational goals for a fully decarbonized grid (Clean Energy States Alliance 2023; National Conference of State Legislators 2023).

Because the output of non-emitting energy resources like wind and solar is variable, integrating them into the electric grid while maintaining reliable service presents a challenge. In response, many states have also implemented policies to encourage or require energy storage investments as a means of harnessing renewable energy and matching it to customer demands. To date, 10 states have adopted legislation or executive actions requiring electric utilities to install certain amounts of energy storage, and many states have also established financial incentives and other policies designed to encourage the use of energy storage to make the electric grid more flexible (PNNL 2022).

Electric utilities have also increased their investments in energy storage in recent years, in many cases independently of any state policy. For example, about 24 percent of all battery energy storage in the U.S. has been installed in Texas, which has no energy storage incentives or policies in place (EIA 2023).

These state and utility efforts have been reinforced by recent federal legislation that provided incentives to reduce the costs of manufacturing and purchasing energy storage. The Infrastructure Investment and Jobs Act of 2021 provided $200 million in federal funding for battery manufacturing facilities in the U.S., while the Inflation Reduction Act (IRA) of 2022 created tax incentives for both battery manufacturers and battery purchasers. The credits for the purchase of energy storage depend on the size and characteristics of the system, and can range from 6 to 70 percent.

While the intent of the IRA is to reduce the cost of manufacturing, purchasing and installing a BESS, the increased demand coupled with lingering supply chain challenges from the pandemic caused a temporary increase in BESS costs in recent years. However, analysts project that the pending increases in U.S. battery manufacturing capacity will cause BESS costs to stabilize by 2024 (BloombergNEF 2022).

The confluence of these factors—changing grid needs, supportive policies, and declining costs—has dramatically accelerated the growth of the battery energy storage industry in recent years. Figure 1 illustrates the cumulative amount of battery energy storage added to the U.S. electric grid since 2020 and projected installation rates for the near future.

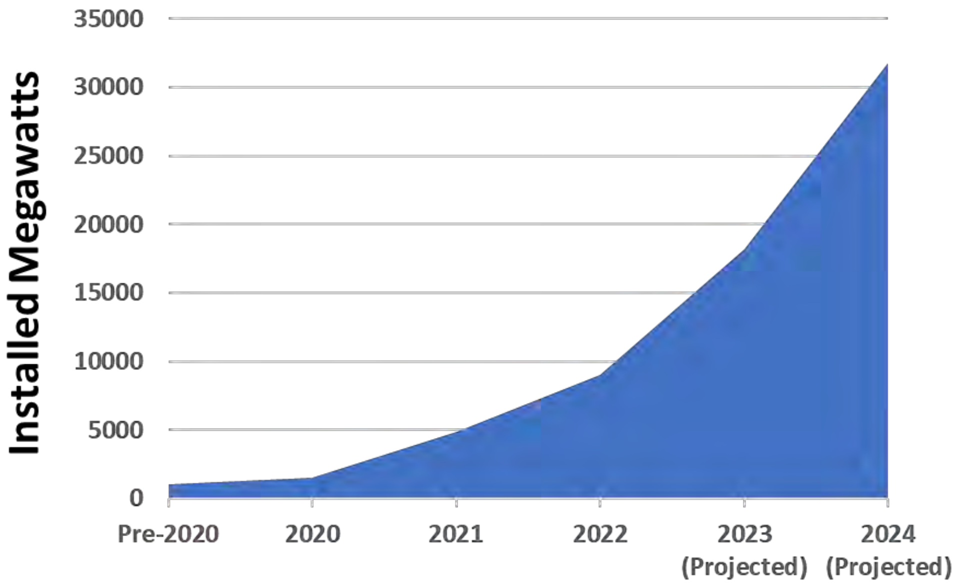

Figure 1: Existing and Projected U.S. Battery Energy Storage System Installations, 2016-2023

As Figure 1 illustrates, battery energy storage is in a period of rapid growth. At the end of 2020, there were about 1,500 megawatts (MW) of battery energy storage installed on the U.S. grid. That number more than tripled in 2021, nearly doubled in 2022, and is expected to double again in 2023 (EIA). Based on contracts expected to be completed by the end of the year, there will be more than 18,000 MW of battery storage on the grid—an 18-fold increase in four years. And contracts are already in place for more than 13,000 more MW in 2024 (EIA).

As a point of reference, the average residential utility customer uses an average of 1.2 kilowatts (kW) at any given point in time, so 1 MW of energy storage would support about 833 residential customers. How long a battery will support those customers depends on their exact usage and the total amount of energy in the battery. Most systems being installed today are rated for 4 hours, so a 1 MW BESS would support 833 customers for about 4 hours under normal usage.

Batteries are a unique class of energy system infrastructure. Because the basic unit is a small cell or pouch, a BESS is modular in nature and can be configured in virtually any size. Additionally, a BESS has relatively limited infrastructure requirements, needing just a concrete pad to sit on and a connection to the electric grid. These two factors—modularity and limited infrastructure needs—mean that a BESS can be built virtually anywhere, including in close proximity to existing commercial and residential uses.

These factors create a unique challenge for planning and zoning officials at local jurisdictional levels, who are frequently tasked with deciding where energy storage assets may be sited and how their impacts on the community may be mitigated. And because BESS is a new technology with a unique risk profile, planners may lack the necessary information and familiarity to respond to proposed battery systems in their jurisdiction. In some places, the resulting uncertainty and extensive review processes are resulting in developers withdrawing projects (Smith 2022). In other places, it has led local planners to ban energy storage projects outright (Colthorpe 2022; Merzbach 2022; Ryan 2022).

Energy storage technologies hold significant value for the electric grid and are a critical factor in decarbonization efforts. But the interactions between a BESS and its host community are complex and require local planning and zoning officials to consider unique operational and safety needs when evaluating a proposed energy storage project (Gerow, Gerrard and Dernbach 2021). This report defines the potential community impacts of an energy storage project in terms relevant to a local planner and provides real-world examples of how communities have addressed those impacts. Its intention is to objectively inform planners as they develop the conditions and ordinances necessary to ensure the safe and acceptable operation of energy storage projects within their communities.

Section 2 describes the safety standards that govern energy storage systems, Section 3 provides an overview of other potential community impacts of a BESS, and Section 4 summarizes existing local zoning ordinances in the U.S. for energy storage systems.

2.0 Safety Considerations

While there are many energy storage technologies, virtually all energy storage systems installed on the electric grid in the last few years and most of those expected to be installed in coming years are lithium-ion batteries. Lithium-ion batteries have become the dominant technology because they offer high energy density at a cost competitive price. This makes them the ideal solution for electric vehicles and consumer electronics, where space and weight are constrained. It also facilitated the development of a global supply chain that has driven down costs and made lithium-ion batteries the most readily available and affordable source of energy storage for electric grid applications as well.

Lithium-ion systems are also modular in nature, in that they are based on a single cell or a small pouch, which can be aggregated and configured in many different ways and system sizes. Therefore, a lithium-ion battery installation may be a large, utility-scale investment consisting of many interlinked systems covering several acres, or a small system hanging in the garage of a home, or anything in between. Planning and zoning officials may see applications for projects that vary widely in their size and potential impacts. Because electrical substations are the hubs of a utility's system, many energy storage developers may seek to build near a substation so that they can provide support and benefits across a wider area of the utility's system. But planners may also see applications for battery systems sited near or on the premises of a large customer or for distributed networks of smaller batteries spread throughout a utility's system, in addition to the growth of small residential and commercial systems installed by individual utility customers.

And while the energy density of lithium-ion batteries is one of the technology's key benefits, it is also its greatest risk. Because lithium-ion batteries store large amounts of energy within a relatively small space coupled with having a flammable electrolyte, they have the potential to become unstable and enter thermal runaway—a state in which the chemical reactions within the battery release excess energy and gases that cause battery failure and fires.

While battery fires tend to be high-profile events, they are relatively rare when compared to the number of installations. The Electric Power Research Institute (EPRI) maintains a database of fires involving grid-connected BESS from media reporting sources. It does not include battery fires in vehicles or consumer mobility products and contains an incomplete record of fires in systems that were owned and installed by individual customers. But the database does contain a thorough accounting of fires involving the type of large, grid-connected BESS that would be subject to review and approval by local planners.

EPRI's database identifies 14 such incidents in the U.S. (EPRI 2023).[1] To place that number in context, there were 491 large, utility-scale projects in the U.S. as of April 2023, for a fire incidence rate of about 2.9 percent. No BESS fire in the U.S. has resulted in loss of life, and many of the affected facilities were able to resume operation.

---

[1] The EPRI database identifies 12 total battery fires in the U.S. The other four involved smaller, privately owned and installed BESS. Eleven of the fires involved lithium-ion batteries and one involved a lead acid battery.

For further context, the average age of the BESS that caught fire was about 18 months, and as indicated in Figure 1, more than 80 percent of the large-scale batteries on the U.S. grid have been installed within the last two years. It is therefore possible that the rate of BESS fires could increase in the coming years. But as discussed in the box to the right and will be further discussed below, lessons learned from BESS fires have guided changes in safety codes that are intended to reduce the impact from future incidence of fires.

Battery fires release toxic gases and may potentially spread to other community infrastructure. And because batteries contain both chemicals and electrical energy, traditional firefighting techniques such as dousing the fire with water may have limited success. Battery failures represent a material risk that planners must address when considering a proposed battery project, but there is a significant body of work in battery safety on which they may rely. A full review of the numerous codes and standards governing energy storage systems is beyond the scope of this report, but has been done elsewhere (Vartanian, Paiss, Viswanathan, Kolln, and Reed 2021).

Case Study: Surprise, AZ

The most prominent BESS fire in the U.S. happened in April 2019 in Surprise, AZ, when a 2-MW BESS housed within a structure caught fire and exploded.

The explosion occurred several hours after the fire was reported, when firefighters opened the door to inspect the facility and the introduction of oxygen caused the flammable gases trapped in the container to ignite. Several firefighters were severely injured.

In response to this event, current codes require explosion control systems for BESS. Many BESS developers have also moved to cabinet-based systems, which have limited internal spaces where gases may accumulate and do not allow entrance by first responders.

Adoption and enforcement of these codes and standards is generally done at the state level, which means that many local planners may have limited or no authority to enforce them. However, a working knowledge of these codes and standards can serve planners in developing an understanding of industry best practices for the safe installation and operation of energy storage systems. The objective of this section is to equip local planning and zoning officials with a knowledge of key codes and standards affecting energy storage safety so that they know what questions to ask and what conditions to impose or negotiate to mitigate the risks.

2.1 Safety Codes and Standards

This section provides an overview of the safety criteria applicable in the procurement, design, commissioning and emergency response to a BESS incident. There are well-defined codes and standards governing stationary energy storage systems to guide these steps. Figure 2 illustrates how various codes & standards apply to specific components of a battery storage system and how they all relate to one another.

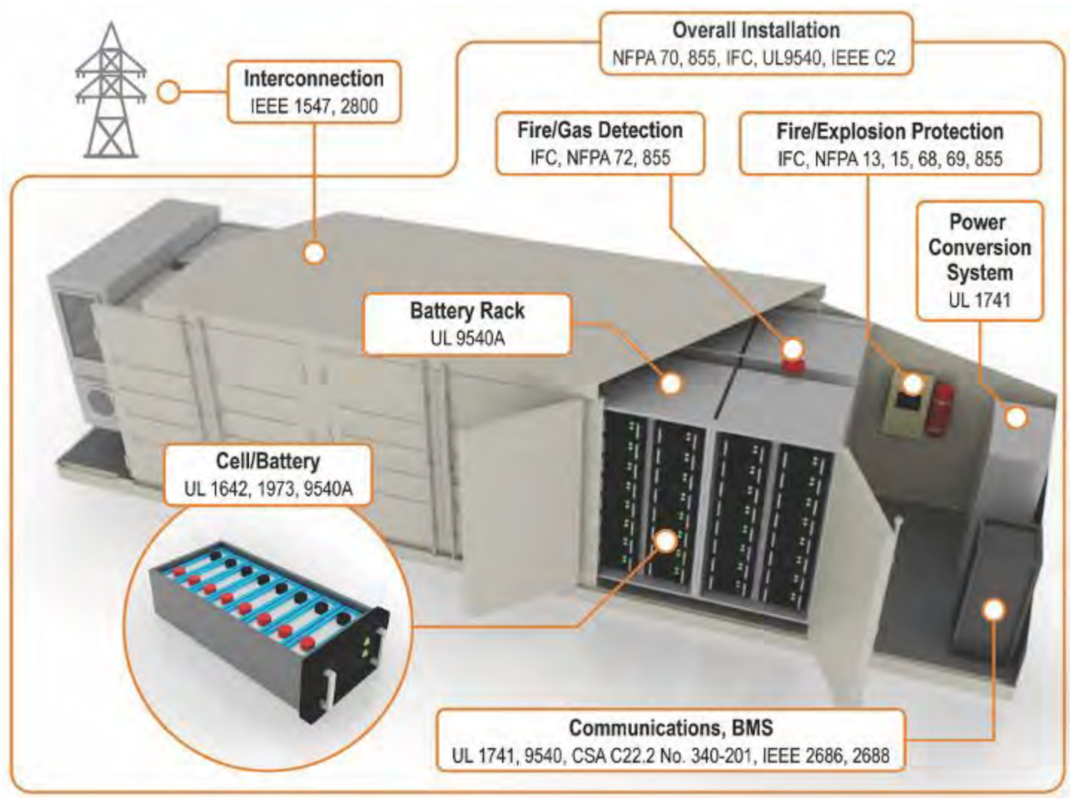

Figure 2: Overview of Codes and Standards for Battery Energy Storage Systems

In the United States, codes and standards are primarily written by standards-developing organizations (SDOs). Examples of SDOs include UL and IEEE for standards and the National Fire Protection Association (NFPA) and the International Fire Code (IFC) for codes. The Infrastructure Investment and Jobs Act (H.R. 3684, 2021) directed the Secretary of Energy to prepare a report identifying the existing codes and standards for energy storage technologies; that report is publicly available (Paiss et al 2022).

Typically, a code is a document that guides installation requirements, while a standard is a document that describes the safety requirements of a product and how to perform certification testing. In the energy storage industry, an example of this code and standard relationship is the NFPA 1 Fire Code requiring that energy storage systems of certain sizes and in certain environments be “tested and listed.” This code then references standard UL 9540, “Standard for Safety of Energy Storage Systems and Equipment.” UL 9540 is the key product safety standard for energy storage systems, and ESS listed to this standard is a requirement in both the IFC and NFPA 855. This standard addresses the compatibility of all components and systems, functional safety, enclosures, ventilation and cooling, communications, and fire safety. In addition to the requirement for listing to UL 9540, there are requirements for fire testing to UL 9540A. In a UL

9540A test, thermal runaway is intentionally created so that test administrators can understand how the cell performs under failure and observe how fires spread through the unit. This is used to help design fire safety features and establish safe distances between units to limit propagation should a failure occur. A system that is UL 9540 certified, therefore, is a system designed to contain battery failures and prevent them from spreading to adjacent units while ensuring against explosions.

The high-profile fire of a grid-scale battery at a Tesla facility in Australia in July 2021 illustrates the importance of UL 9540 compliance. When one of the project's 212 units caught fire, proper spacing largely contained the failure to the unit where it originated. Even though winds were high that day—nearly three times the wind speed assumed in the 9540A test—the fire only caused minor damage to one neighboring unit, and the rest of the large project was unaffected (Blum et al 2022). This was further demonstrated during a failure in a similar system in Monterey County, CA in Sept 2022, where damage was contained to the unit of origin. Two other fire incidents at outdoor energy storage systems in 2023 followed this pattern as well.

This point of failures being contained to the unit of origin is critical in both system design and assessing the project's overall risk profile. The risk of a fire incident at a battery storage project does not increase with project size; the two are decoupled in a well-designed system that prevents a fire in one unit from spreading to neighboring units. Regardless of project size, the fundamental question in assessing a project's risk is what happens if a single unit fails, rather than what happens if every unit fails at once. In determining the risk to neighboring properties, it is recommended that siting consider prevailing winds where projects are located less than 150 feet from occupied structures, with the knowledge that weather conditions and incident specifics will guide any emergency response by the fire service. In general, it is the distance to the closest BESS enclosure more than the total number of BESS on a site that should guide the siting considerations from a fire safety perspective.

In addition to the requirements in the National Electrical Code (NFPA 70) addressing installation requirements, the adopted fire code in a local jurisdiction provides additional guidance for safe installations. For federally owned facilities, the NFPA codes are often enforced, with NFPA 855 as the guiding document for stationary energy storage systems. For states that follow the International Fire Code (IFC), there is language similar to NFPA 855. NFPA 855 includes criteria for the system design, installation, commissioning, repair/replacements, explosion control, and decommissioning. While the standard has technology-specific sections, it was initially created to address the unique risks that lithium-ion chemistries represent. It is expected that future editions of the IFC will reference NFPA 855 for ESS requirements.

Much of NFPA 855 deals with technical details that are beyond the scope of planning and zoning, and direct enforcement of the standard is beyond the jurisdiction of many local planning agencies. However, many of NFPA 855's requirements are relevant to zoning considerations, and familiarity with the standard can provide a blueprint for knowing what questions to ask about a project and what conditions to impose or negotiate. Some of the requirements in NFPA that have direct relevance to local zoning officials include:

- An emergency response plan and training for local emergency responders (Section 4.3)
- Use of UL 9540-listed equipment (Section 4.6)
- Fire control and suppression systems (Section 4.9)

- A decommissioning plan for removing and disposing of the system at the end of its useful life (Section 8.1)
- Detailed site/facility construction requirements (Sections 9.3 through 9.5)
- Explosion control (Section 9.6)

NFPA 855 can be accessed and reviewed for free by anyone who registers on the NFPA's website (www.nfpa.org/855). In addition to the standards identified above, NFPA 855 also contains Appendix B: Battery Energy Storage System Hazards. While not a part of the standard, Appendix B can be a valuable reference for local planners and first responders to understand the safety risks associated with battery storage and strategies for addressing them.

2.2 First Responder Training and Protection

Outreach to local fire officials is an important phase of project development and should begin early in project planning. This will identify local amendments to adopted codes as well as determine training requirements for the responding agencies. Early inclusion of local fire officials can also help identify any potential barriers to permitting of projects.

On the training side, NFPA 855 has requirements that training of operations staff as well as emergency responders be provided by the system owner or operator. Typically, this training will include high-level awareness training of battery safety, operations, and response guidance that will be used to create guidelines often known as Standard Operation Procedures or SOP's.

Common recommendations for Lithium-ion ESS are increasingly including allowing a battery located outdoors to be allowed to burn if on fire, with attention paid to protecting nearby exposure structures or other ESS. These recommendations inform the siting of ESS as well as emergency response training.

2.3 Implications for Local Planners

NFPA and IFC codes are updated on a 3-year cycle to include new information and requirements. In the case of energy storage codes, this is particularly relevant as lessons learned from system failures and technological innovations are integrated into new versions of the code. But because adoption of code updates is a state-level process in most states, and because a code update can be costly and time-consuming, it may take years for a state to complete one.

Some states allow local jurisdictions to adopt codes that exceed those adopted at the state levels, while others prohibit it. In either case, understanding these standards and knowing what questions to ask can ensure safe installation and operation of BESS projects in their jurisdiction, regardless of what version of the code is in force. Many developers will likely be willing to voluntarily abide by industry best practices, even if not legally required in the jurisdiction; asking the right questions can increase local comfort with the project and facilitate voluntary agreements. Example questions that planners can ask include:

- Is this system listed to UL 9540?
- Have local fire officials been briefed on the project?

- What training would be necessary for first responders?
- What explosion control equipment will the project employ?
- What maintenance and repair plans are in place?

3.0 Other Zoning Implications

Safety is frequently the most pressing concern expressed in local zoning proceedings for energy storage projects, and justifiably so. But there are several other potential community impacts that local planners may be asked by their constituents to address. This section will briefly discuss four other types of community impacts: sound, odor and emissions, visual, and environmental. It will also illustrate how planners are mitigating these impacts, drawing on case studies from various jurisdictions that have dealt with siting large energy storage projects.

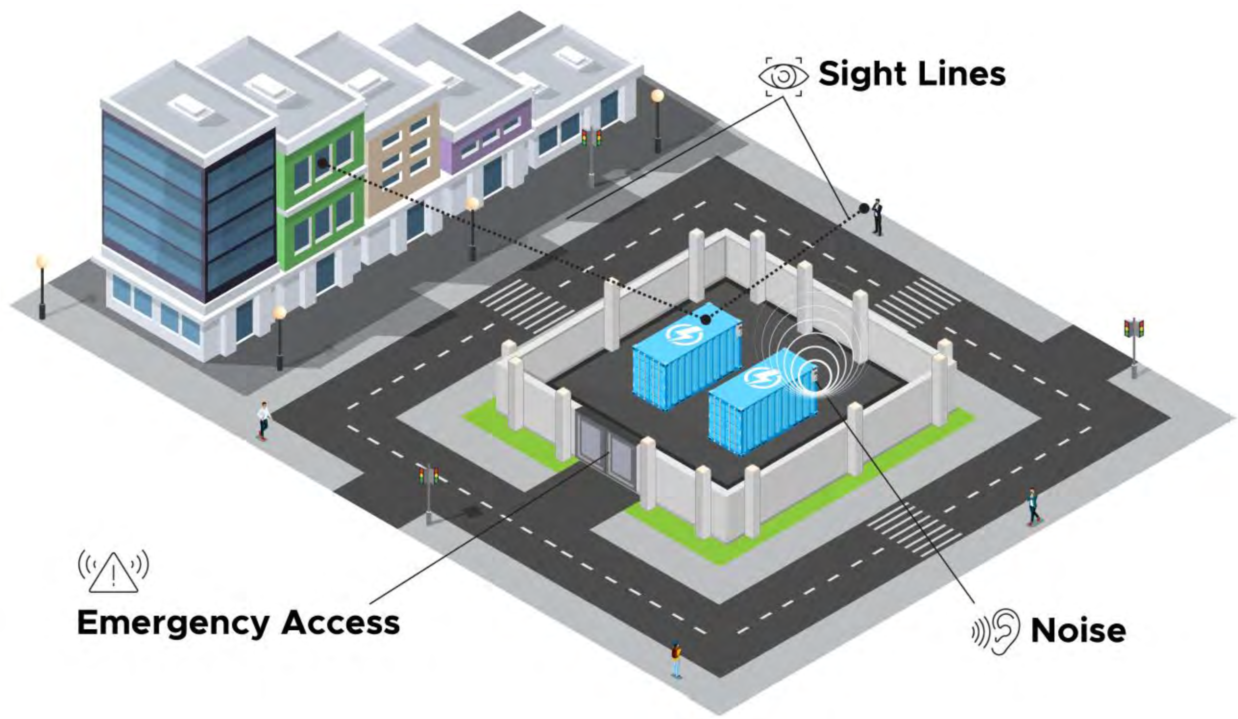

Figure 3: Potential Community Impacts of Energy Storage Projects

Before proceeding, it is important to note that every project will be different. Due to the wide range of battery providers, component manufacturers, and project configurations, no two projects will have the same impacts profile. Each project will need to be considered based on its specific components and configuration to properly identify and mitigate its impacts. This section is meant as a guide to help planners identify the specific aspects of an energy storage project that could cause community impacts, give some indication of the potential size of those impacts, and document how different jurisdictions have addressed those impacts. The case studies in this section are presented for illustrative purposes and are not intended as an endorsement or recommendation of any particular approach.

3.1 Visual Impacts

Because a lithium-ion battery project is ultimately an aggregation of many individual cells and racks, there is flexibility in how that project is packaged. Many energy storage developers have settled on a containerized solution, in which systems are built on a modular basis in a shipping container or other container manufactured by the developer. These systems generally range between about 8 and 12 feet in height.

Alternatively, some battery storage projects have been assembled within a structure, in some cases a repurposed industrial facility and in others in a building constructed specifically for the storage project. The Moss Landing Energy Storage Facility in California is an example of a storage project housed in a repurposed industrial building, while the Salem Smart Power Center in Oregon is an example of a storage project housed in a newly constructed building.

While housing energy storage within a structure can serve to screen the project from surrounding uses, it generally increases project costs because of the expenses of constructing the building, engineering the project to fit within the building, and the increased cooling requirements for the larger interior space. Due to the cost reductions and engineering efficiencies that can be achieved through standardized containers, most projects will likely opt for a containerized approach and local planners may find it appropriate to screen those containers from surrounding uses.

Section 70 of the NFPA requires all large electrical installations, like energy storage systems, to have a perimeter fence of at least 7 feet to prevent unauthorized access to the facility. This requirement creates an inherent screen for all large energy storage systems, though some jurisdictions have increased the perimeter fence requirements to 8 feet or more, depending on the site characteristics.

Some jurisdictions, however, have determined that large perimeter walls may be an eyesore of their own, and have added more layers of screening. When planners in Ripley, NY raised concerns about the large perimeter fence around a solar and storage facility, the developer proposed to meet the town's objectives by strategically siting trees at certain points around the perimeter to provide an additional, natural layer of screening from certain angles (ConnectGen 2021). In St. James County, VA, planners required vegetated buffers ranging from 20 feet to 60 feet wide when issuing a use permit for a battery storage system in their jurisdiction (St. James County Community Development 2022).

In more heavily urbanized areas where options for setbacks and screening may be more limited, some utilities and local jurisdictions have opted for more creative approaches like commissioning murals to be painted on the exterior of energy storage projects to help them blend in with the community. In Chicago, utility Commonwealth Edison hired local artists to paint the history of their neighborhood on the side of energy storage systems that are part of the Bronzeville Microgrid (Commonwealth Edison 2020).

3.2 Auditory Impacts

A battery storage system has three sources of noise:

- The inverter, which converts the direct current electricity stored in the battery to the alternating current electricity used on the electric grid (and vice versa);
- The transformer, which increases the voltage of the electricity stored in the batteries to the level used on the utility's transmission or distribution system; and
- The ventilation and cooling system, which maintains a safe operational temperature for the batteries.

Several jurisdictions that have permitted a large energy storage system have required an impact study that included, among other things, sound impacts. Those studies have generally concluded that individual inverters, transformers, and ventilation systems generally have sound levels between 60 and 80 decibels (dB) when measured at close distance (Burns & McDonnell 2019; Louden 2015; Hodgson 2022; Plus Power 2019). 60 dB corresponds to a normal conversation and 80 dB corresponds to the noise level inside a car (Britannica 2022).

The ultimate noise level experienced by neighboring property owners will depend on three factors: the number of noise-producing components in the project (which increases the noise level), the distance between those components and the property line, and physical screening (which both decrease the noise level). One study found that when the collective impact of all inverters, transformers, and ventilation systems in a project is studied, the noise level would be 101 dB at the source, but an unscreened buffer of 400 feet between the nearest component and the property line reduced that level to 59 dB at the property line (Burns & McDonnell 2019). In another analysis for a similarly sized battery storage project, the analysis determined that a buffer of 125 feet coupled with an 8-foot perimeter fence and natural screening provided by large trees would reduce the noise level at the property line to about 55 dB (Plus power 2019).

Noise standards will vary by jurisdiction and the specific zone in which a storage project is located. Where a project has the potential to cause noise pollution for surrounding property owners, local planning and zoning officials may consider requiring a noise study to identify the noise impacts and then requiring setbacks and/or screening to mitigate those impacts.

3.3 Odor Impacts

During normal operations, a lithium-ion system does not emit gases and has no odor impacts on neighboring property owners. During a battery fire, the system will emit hydrogen, carbon monoxide, carbon dioxide, and various hydrocarbon gases such as methane and propane (Baird, Archibald, Marr, and Ezekoye 2019). While they are all odorless, these gases can create risk of fire and explosion if allowed to accumulate in an enclosed space. As the fire spreads, toxic fluorine-based gases may be released as plastics and other incidental equipment burn (Larsson, Andersson, Blomqvist, and Mellander 2017). As explained in Section 2, it was the buildup of flammable gases in a sealed battery room that caused an explosive deflagration event in Surprise, AZ in 2019 that injured several fighters (Hill 2020).

The implication for planning and zoning officials is to be aware of the risk for off-gassing and to ask storage developers about what systems will be in place to limit the buildup of flammable gases. It may also be appropriate to have a plan for directing neighboring property owners to evacuate or shelter in place in the event of a fire to avoid exposure to the gas.

In some instances of BESS fires, evacuation or shelter-in-place orders have been issued to nearby property owners as a precautionary measure. Where air quality monitoring has been performed after a battery fire, no harmful levels of emissions have been detected (Percha 2021; Copitch 2022).

3.4 Environmental Impacts

The global environmental impacts of energy storage systems associated with their manufacture, operation and decommissioning are an active area of research, with dozens of reports and papers addressing the topic in recent years (Hiremath, Derendorf, and Vogt 2015; Pellow et al 2020). Planners and zoning officials, however, are more likely to be concerned with the local environmental impacts arising from the construction and operation of battery storage projects, which is a much less active area of inquiry. Impacts on watersheds have been a particular topic of discussion in local storage proceedings around the country.

Because lithium-ion battery cells and pouches are designed to be self-contained, a lithium-ion BESS will only leak in a failure state. In fact, battery leakage is an early indicator of failure (Lu et al 2020). During normal operations, therefore, a lithium-ion BESS will not leak chemicals that could contaminate local watersheds.. Another emerging energy storage technology, flow batteries, use large tanks of liquid to store energy that pose a different risk profile for leaks. Several early projects using this technology had leakage issues, so local planners may want to ensure that flow battery projects are designed to manage this risk. A flow battery will also be engineered with primary and secondary containment systems to ensure that any leaks do not escape the system’s envelope.

The primary risk of local environmental contamination associated with battery storage systems is the use of water in fire suppression. The water will bind with the chemicals released during the fire and carry them into drainage systems, where they could contaminate watersheds. This risk supports an emerging consensus in the firefighting community, outlined above, that water suppression should be used sparingly on battery fires for exposure protection. If the local fire department prefers to use water in its response plan, then planners may want to require a severable storm drain connection to ensure that contaminated water cannot leave the site.

4.0 Survey of Energy Storage in Local Zoning Ordinances

Local planning and zoning officials can benefit from seeing how other jurisdictions have addressed the unique question of battery energy storage siting, as this both illustrates available alternatives and demonstrates their viability.

To identify where battery storage zoning ordinances have been developed, the research team reviewed data from EIA Form 860M, which provides an inventory of all utility-scale electric generation and storage resources in the U.S. and is updated on a monthly basis. Data from the July 2021 report were used for this analysis, which listed energy storage systems of 4.9 MW or more in 97 cities and counties whose zoning ordinances are publicly searchable in the Municode database. Those ordinances were searched for any reference to batteries or energy storage, yielding 28 results. The search was then repeated for all local codes in the Municode database, which contained local ordinances for more than 3,300 other jurisdictions at the time, yielding another 31 results.

In all, the survey identified 42 municipalities and 17 counties with zoning, building code, fire code, permitting, local tax, or sustainability ordinances regulating energy storage to some degree. In addition, 55 municipal or county codes also include local adoption of updated standard fire or building codes that include standards for energy storage. This is not a mutually exclusive count; some areas that have specific storage considerations in their ordinances have also adopted a storage-inclusive code. Overall, relatively few cities and counties appear to currently have zoning ordinances that directly govern energy storage, underscoring the value of guidance for local planners.

4.1 State-level Variations in Local Siting and Zoning Authority

Rules determining which level of government holds overall zoning authority varies by state. Most states follow a similar general framework: municipal governments have the authority to zone land within their incorporated boundaries, and county governments may develop zoning ordinances for unincorporated county land. In the six New England states, New Jersey, and Pennsylvania, no land is unincorporated, and municipalities or townships have zoning authority over all land within their boundaries. Three states – Texas, Oklahoma, and Alabama – restrict counties' ability to zone unincorporated land, meaning that unincorporated county land in those states is largely not zoned (Lo 2019).

In Texas, the Texas Local Government Code prohibits counties from regulating, among other stipulations, the use of any building or property, or the size and number of buildings on any property. Certain counties have been granted permission from the state to enact ordinances in response to specific issues, but counties in general may not enact zoning ordinances (Phillips 2002). Oklahoma grants some ability to counties to zone unincorporated land and enables county boards to form collaborative planning commissions alongside governments of incorporated municipalities. However, most counties in Oklahoma do not have zoning ordinances for unincorporated land (Sweeney 2018). Alabama similarly does not grant counties broad powers to zone unincorporated land.

While Oklahoma and Alabama only have one utility-scale battery storage system each, Texas was home to 62 utility-scale battery projects totaling 2,306 MW as of April 2023, including several of the country's largest utility-scale battery storage systems (EIA 2023). Eight of the state's nine largest storage projects are located on unincorporated county land. There are several likely reasons why Texas has attracted recent investment in so many large-scale storage projects, including ERCOT commitments to encourage and remove barriers to energy storage integration following the Texas freeze of 2021 (Jones 2022). The lack of zoning and permitting requirements and abundant space on unincorporated county land in Texas may also offer incentives for project developers.

4.2 Overview and Categorization of Storage in Local Zoning Ordinances

The presence of energy storage language in local zoning ordinances can be divided into four categories: ordinances written to regulate solar generation that also include energy storage; local adoption of fire or building codes that include standards for energy storage systems; ordinances that are specifically targeted at energy storage technologies; and ordinances that encourage or incent storage adoption.

Table 1 summarizes these different categories, how widely they have been adopted by municipalities across the country, and specific examples of each category.

Table 1: Energy Storage in Local Zoning Ordinances

Description	Number of ordinances found	Examples
Ordinances written to regulate solar installations that also include storage. These ordinances generally only regulate storage systems when co-located with solar generation, and generally apply all solar PV regulations to storage components.	37	• *Plumsted, New Jersey* requires all equipment for a solar energy system, "including ... structures for batteries or storage cells" to "be completely enclosed by a minimum 12 foot high fence," and prohibits all systems from being located in a "front, side, or rear yard setback." *(Township of Plumsted, NJ Code § 15-5.21)* • *Boulder, Colorado*'s zoning ordinances define a "solar energy system" as "a system ... which may include an energy storage facility," and then defines permitting requirements and zoning districts eligible for installation of these systems. *(Boulder County Land Use Code Article 18, 18-199)*
Local adoption of fire or building codes that include standards for energy storage systems. County and municipalities have adopted fire and/or building codes that include explicit safety, labeling, and siting guidance for energy storage, such as the 2018 IFC, 2020 NEC, or NFPA 855.	12	• *Yarmouth, Maine* has locally adopted NFPA 855, "Standard for the Installation of Stationary Energy Storage," into its municipal fire and safety code. *(Town of Yarmouth, Maine Code Chapter 319: Fire Prevention and Life Safety Ordinance, 2021)* • *Daly City, California* amended the California Fire Code, which already includes some regulations for energy storage, to specify that means for disconnection must be included with ungrounded conductors connected to energy storage systems. *(City of Daly City, Municipal Code 15.24.130 - Article 706.7)*
Ordinances specifically targeted at energy storage technologies. These regulations include labeling standards, permitting requirements, setbacks, height standards, and visibility requirements. These ordinances may contain standards like those in standard fire or building codes and may be adopted in addition to these codes to add additional guidance. Alternatively, they may be adopted by local governments unable to exceed state code requirements.	12	• *King George County, Virginia* requires battery energy storage facilities to have access to water, provide access to the county fire department, have decommissioning plans, be labeled with NFPA 704 placards, and to not be visible from “any adjacent street, use or building.” *(King George County, Virginia Code of Ordinances § 4.19)* • *Madison, Maine* requires battery storage systems to be enclosed by a minimum eight-foot fence with a locking gate and feature a visible sign to warn of potential voltage hazards. *(Town of Madison, Maine Code of Ordinances § 484-41)*
Ordinances that incent or encourage energy storage development. Some municipal ordinances protect the right to install energy storage systems or use local building codes to add incentives for storage.	5	• *Lancaster, California* ensures that all residents and businesses are “permitted to construct and operate stand-alone electric energy systems,” including “fuel cell systems [and] battery systems.” *(City of Lancaster, California, Ordinance No. 1067)* • *Wilton Manors, Florida*’s “Green Building Design Option” system, written into its code of ordinances, requires new buildings to earn a minimum number of green building “points,” and allows on-site solar and storage systems to contribute to their total. *(Wilton Manors, Florida Code of Ordinances § 170-050).*

Each of these approaches has advantages and disadvantages. As Table 1 shows, the most commonly utilized approach to storage in local zoning ordinances has been to add energy storage to ordinances that were primarily crafted to regulate solar installations. Including energy storage in a new or existing zoning ordinance targeted at solar may be the fastest, least-resistance approach to placing some form of local oversight for energy storage projects on the book. These ordinances may also provide a means of addressing some of the community impacts of energy storage, such as sound and visual impacts.

However, as described above, energy storage technologies have unique risks that will likely fall outside of the scope of a solar-focused ordinance. Ensuring that storage systems installed in a jurisdiction have met applicable technical standards and that first responders are prepared to deal with an emergency are objectives that are unlikely to be satisfied by inserting energy storage into solar zoning ordinances.

Some local jurisdictions may have the authority to adopt national and international codes at the local level; this study identified 12 localities that have done so. While this approach provides the security of applying best industry safety practices to local energy storage projects, it is likely not viable for most jurisdictions. Fire and electrical code adoption are state-driven processes, and many states prohibit county and municipal bodies from exceeding state-adopted codes. Even where local officials have the authority to exceed state standards, their jurisdictions may become financially liable for any incremental requirements. This may present a significant financial risk, particularly for smaller localities.

Another 12 jurisdictions identified in this study have adopted ordinances that are specifically targeted at energy storage technologies, but do not include formal adoption of national or international fire or electrical codes. This approach presents a middle ground for local officials to address many of the potential impacts of energy storage developments, particularly for those that cannot implement current fire and electric codes. As the examples in the table show, these ordinances may address emergency response by requiring access to water at the facility, or may focus on visual and sound impacts by requiring projects to be screened from neighboring properties.

Finally, the study identified five jurisdictions that have taken some form of proactive step to encourage or incent local energy storage development, such as establishing a right for property owners to install it. While these policies may be a vehicle for aligning local zoning decisions with local, regional, or state energy policies and goals, they must be paired with more detailed ordinances if the potential community impacts of the desired energy storage investments are to be mitigated.

5.0 Summary

Energy storage technologies offer significant potential to make the electric grid more clean, flexible, and reliable. The rapidly accelerating investment in storage technologies by utilities, independent developers, and individual customers can deliver far-reaching benefits to all electric customers, and the development of a lithium-ion battery supply chain has rapidly driven down the cost of those investments. However, those same customers face unique risks when battery energy storage technologies are installed in their communities, and local planning and zoning officials face the momentous challenge of understanding and mitigating those risks in a rapidly developing and changing environment. As with any electrical device, batteries can and will occasionally fail. The goal for BESS is to isolate failures to the unit of origin with as minimal negative impact to the environment and population as possible.

Fortunately, local officials have tools at their disposal. Multiple codes and standards have been adopted at the national and international levels to guide safe installation and operation of battery energy storage technologies, and those codes are regularly updated as lessons are learned from a growing operational history for the technology. While implementation of those codes and standards will be beyond the authority of many local planning and zoning officials, a working knowledge of those codes and standards can help planners know what questions to ask during the review process to ensure peaceful coexistence between energy storage projects and the communities that host them.

By identifying the potential risks of battery energy storage and how those risks have been addressed in fire and electric codes as well as local zoning ordinances from around the country, this work may be useful to local planning and zoning officials who are tasked with responding to a proposed battery storage project in their jurisdiction in crafting project conditions and zoning ordinances that will enable the growth of these beneficial technologies while mitigating their risks to local residents.

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