

*NYSERDA Presents:
Battery Energy Storage Systems –
Key Considerations for Local Governments*

***Webinar #2:
Fire Safety***



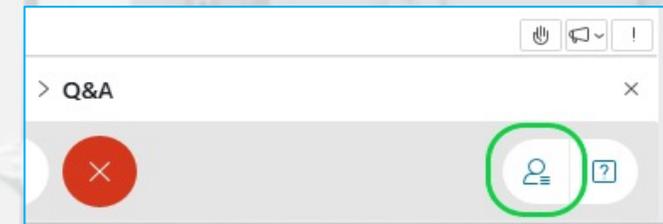
NYSERDA

May 19, 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, 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:

- **Recap: Energy Storage in NYS**
- **NYS Office of Fire Prevention and Control**
- **BESS: Fire Safety**
 - Context & Safety Considerations
 - Codes and Standards
 - Incident Response
- **Q&A**

Speakers:

- **Jason Ward**
NYS Office of Fire Prevention and Control
- **Paul Rogers**
Energy Safety Response Group (ESRG)



ESRG
ENERGY SAFETY
RESPONSE GROUP

A row of white energy storage containers, likely lithium-ion batteries, is shown in an outdoor setting. The containers are arranged in a line on a gravel pad. Each container has a control panel on its side. The background shows a clear blue sky and some greenery. The text "Recap: Energy Storage in NYS" is overlaid in the center of the image.

Recap: Energy Storage in NYS

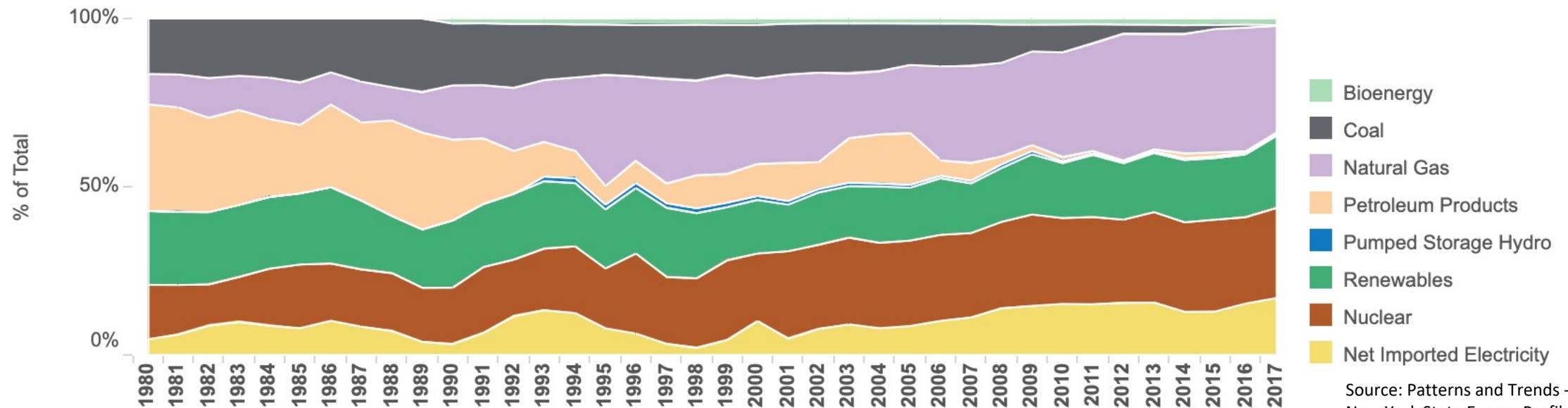
The Climate Leadership and Community Protection Act (Climate Act)

Electricity Sector 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;**
3,000 MW by 2030



Energy Storage Systems (ESS) 101

- ESS store energy for conversion to electrical energy
- Batteries (chemical → electrical energy) are the most common + flexible ESS
- Lithium-ion batteries are the prevailing chemistry for ESS
- ESS components include:
 - Cells → Modules → Racks
 - Battery Management System (BMS)
 - Monitoring, Safety, and Balance of System Equipment



Residential (kWh)



Commercial (kWh - MWh)

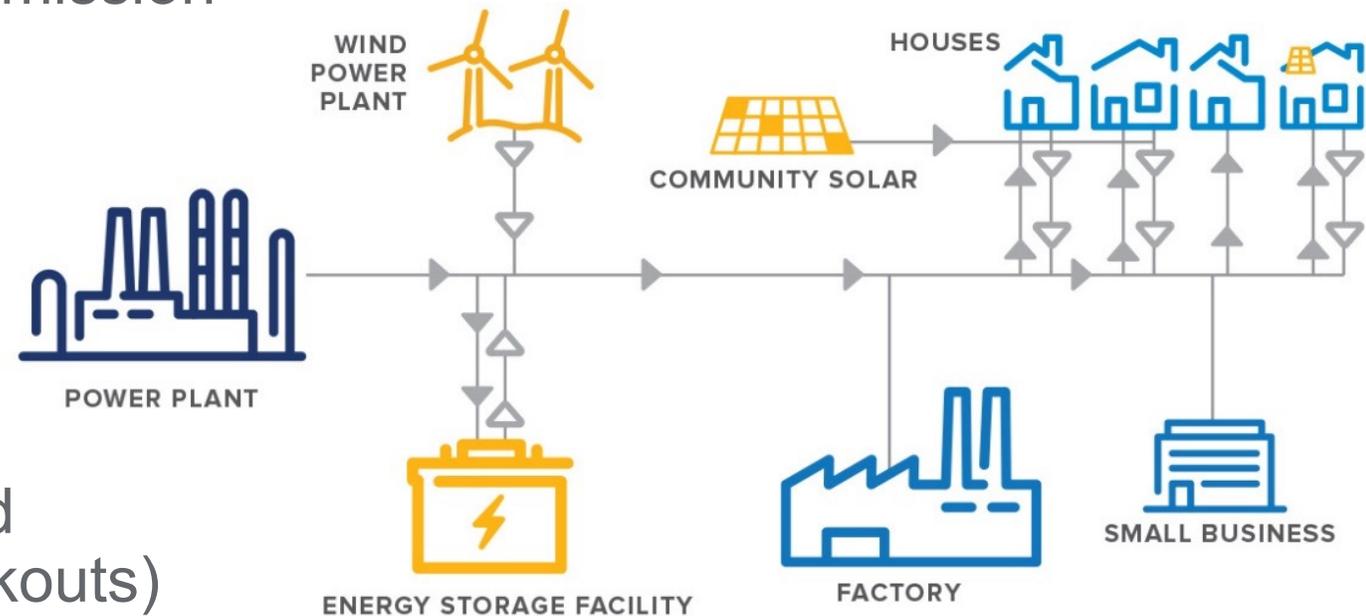


Utility-Scale (MWh – GWh)

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



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

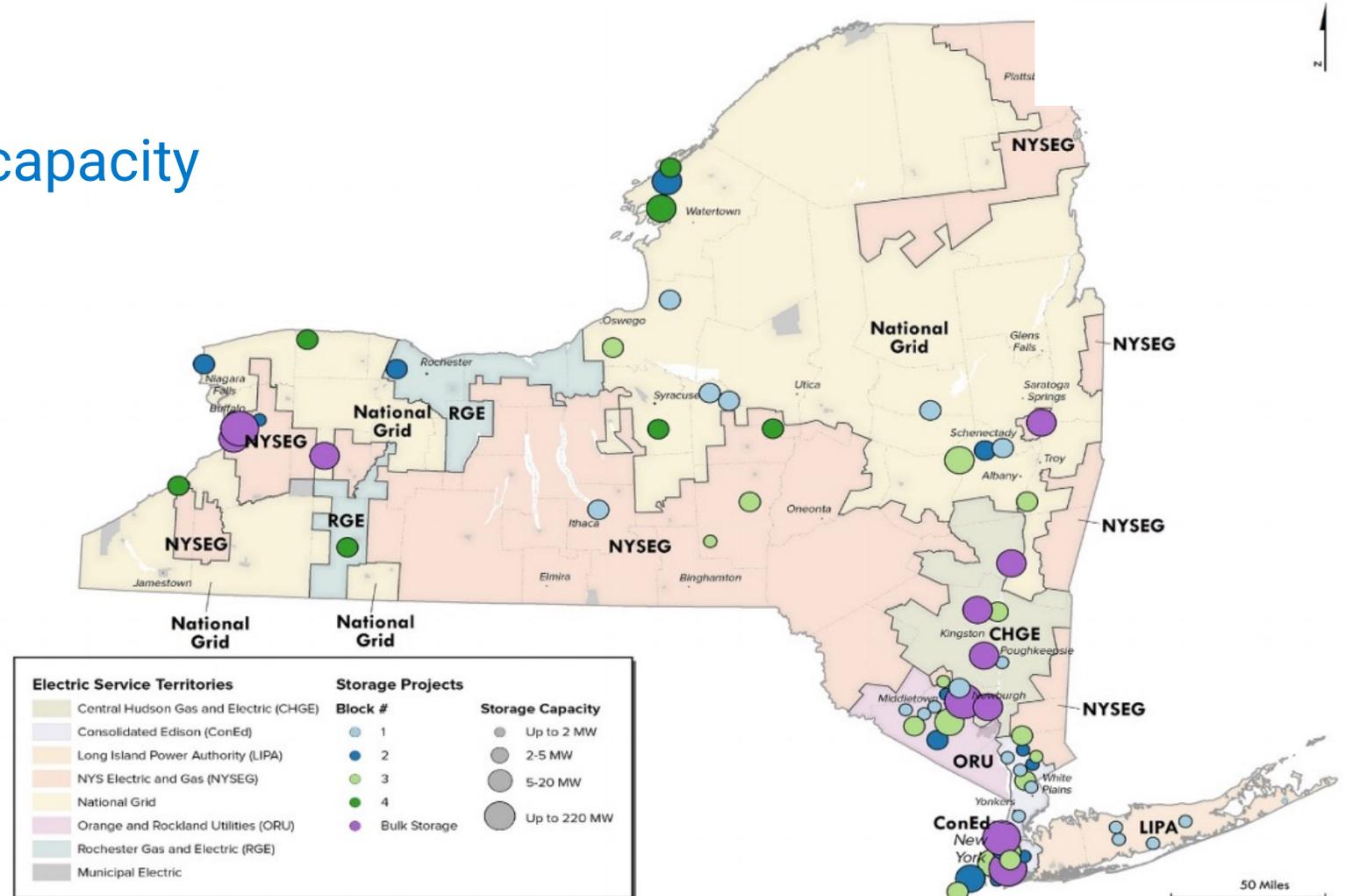
Energy Storage Deployment in NYS

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



A row of white electrical enclosures, likely for fire alarm or control systems, is shown in an outdoor setting. The enclosures are mounted on a gravel pad and feature various panels, switches, and warning labels. The background shows a clear sky and a fence.

NYS Office of Fire Prevention and Control (OFPC)

NYS Office of Fire Prevention and Control (OFPC)

OFPC's Mission:

The New York State Office of Fire Prevention and Control strives to be the **nationally recognized leader in fire services**, delivering the highest quality, state of the art, and most **comprehensive training, response, and technical assistance programs and services** to emergency responders, local entities, and the citizens of New York State.

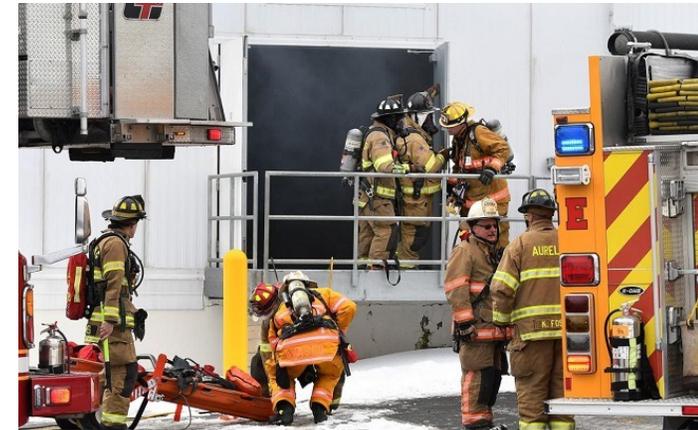
NYS Office of Fire Prevention and Control (OFPC)

- One of 4 offices which make up the **NYS Division of Homeland Security and Emergency Services**
- Managed by the State Fire Administrator
- OFPC comprises 6 branches:
 - Special Operations
 - Fire and Arson Investigation
 - Fire and Life Safety
 - Professional Leadership Development
 - Educational and Operations Support
 - Fire Operations and Training

NYS Office of Fire Prevention and Control (OFPC)

Branch Spotlights:

- **Special Operations**
 - Technical Rescue Response & Instruction
 - Hazardous Materials Response & Instruction
- **Fire and Life Safety**
 - Inspections & NYS Uniform Code administration
- **Fire Operations and Training**
 - Operate the NYS Academy of Fire Science (Montour Falls, NY)
 - Administers the Outreach Training Program, covering a variety of training courses/modules
 - Act as a liaison between local, county, and state officials



NYS Office of Fire Prevention and Control (OFPC)

OFPC & Energy Storage:

- ESS have been on OFPC's radar for some time
 - OFPC has previously issued or amplified alerts for batteries and/or products containing batteries.
- Looking to apply lessons learned from EVs to other battery applications in clean energy
- Developing trainings to ensure first responder safety and NYS Uniform Code compliance
- Partnering with NYSERDA, Subject Matter Experts to reach a broader audience
- More to come!

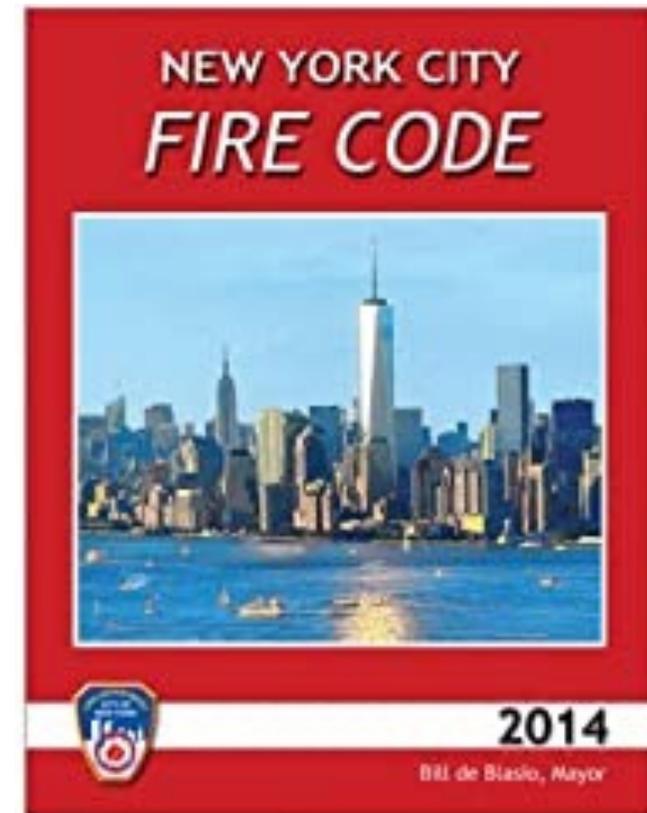


A row of white BESS containers with electrical panels on a gravel site. The containers are arranged in a line, and each has a large electrical panel on its side. The background shows a clear blue sky and some greenery in the distance.

BESS: Fire Safety Context & Safety Considerations

Context & Safety Considerations

Energy Storage in NYC



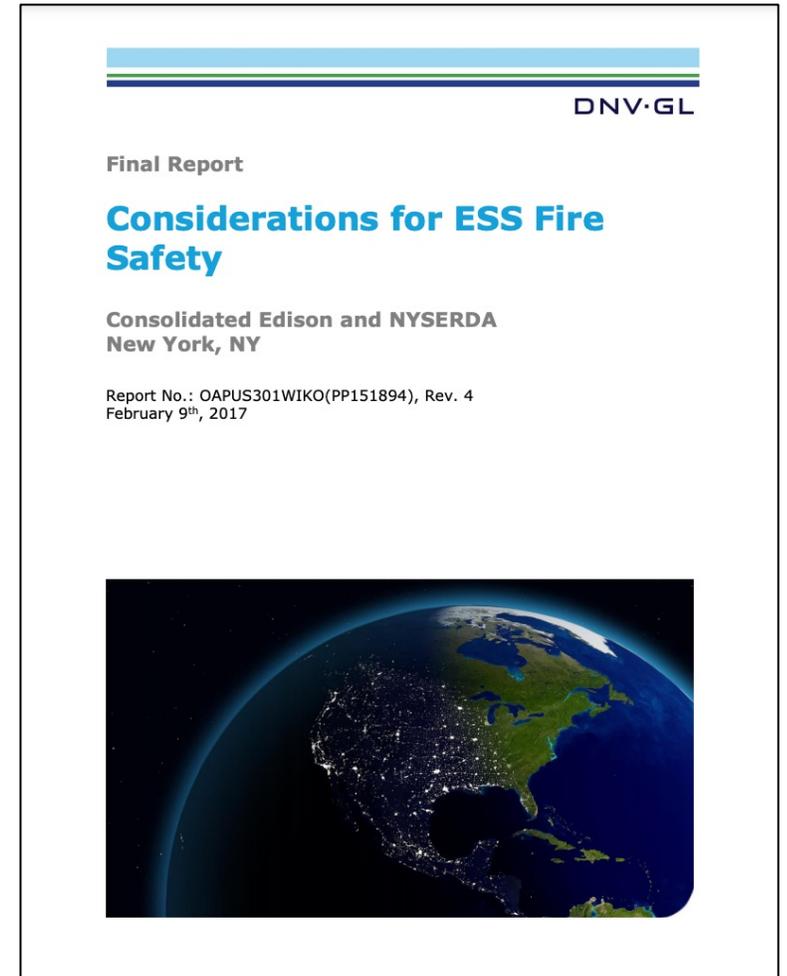
Context & Safety Considerations

Primary Failure Modes for Lithium-Ion BESS:

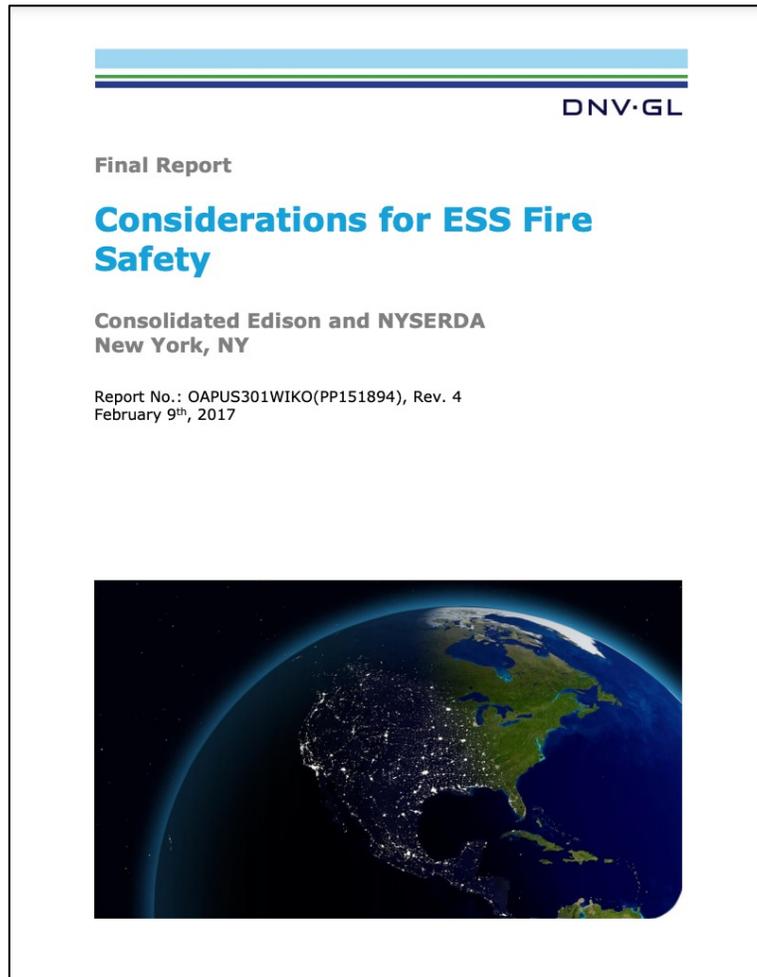
- Thermal abuse (overheating, external heating)
- Electric abuse (over-charging, over-discharging)
- Mechanical abuse (impact, puncture, crushing)
- Factory defects (dendrites)
- Component failure

Primary Hazards:

- Fire
- Toxicity
- High Heat Release
- Flammable Gases
- Stranded Energy



Context & Safety Considerations



Key Takeaways:

- Importance of ventilation (during and after incident)
 - Precedent exists in terms of toxicity & ventilation requirements, akin to plastics fires
- Confirmed effectiveness of water for cooling ESS
 - Requires fire rating adherence, strategic system design to allow direct water contact

A row of white BESS containers with electrical panels on a gravel site. The containers are arranged in a line, and each has a large electrical panel on its side. The panels are white with some yellow warning symbols. The containers are mounted on a concrete base. The background shows a clear blue sky and some greenery in the distance.

BESS: Fire Safety Codes & Standards

Codes and Standards

Evolution of ESS Codes and Standards:

- **2016:** Underwriters Laboratory (UL) publishes 1st ed. of UL 9540 (listing standard for ESS)
- **2017:** UL publishes 1st ed. of UL 9540A (test method to evaluate system safety and inform installations)
- **2018:**
 - International Code Council (ICC) introduces Chapter 12, Energy Storage Systems to International Fire Code (IFC)
- **2019:**
 - National Fire Protection Association (NFPA) releases *NFPA 855*
 - UL publishes 4th ed. of UL 9540A
 - ICC introduces draft 2021 IFC & IRC



UL 9540A Testing

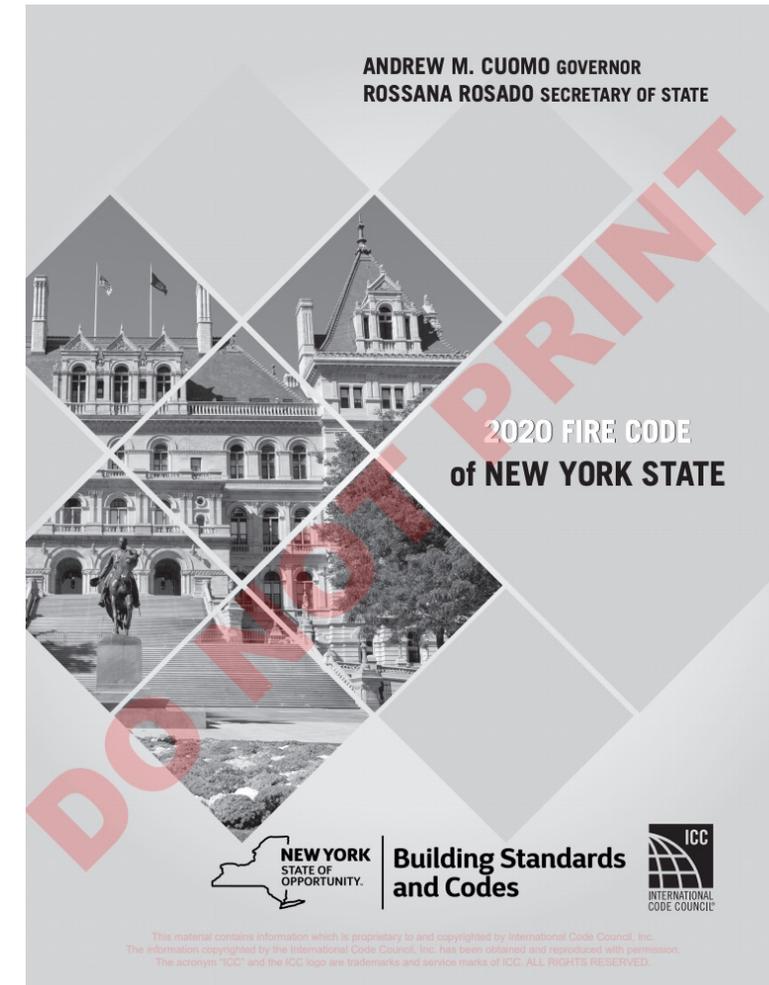
- Developed to better understand safety risks, demonstrate compliance with codes & standards
- Testing performed at multiple levels of BESS
- Test results will inform system design + installation requirements:
 - Fire mitigation & protection
 - Ventilation
 - Incident management

Level	Testing Hierarchy
Cell 	<ul style="list-style-type: none"> • Can cell exhibit thermal runaway • Thermal runaway characteristics • Flammability/composition of vent gas
Module 	<ul style="list-style-type: none"> • Thermal runaway containment/characteristics • Flammability/composition of vent gas • Heat and gas release rates
Unit 	<ul style="list-style-type: none"> • Evaluation of fire/thermal runaway spread • Heat and gas release rates • Deflagration and re-ignition behavior
Installation 	<ul style="list-style-type: none"> • Effectiveness of fire protection systems • Heat and gas release rates • Deflagration and re-ignition behavior

NYS Uniform Code

Energy Storage in the NYS Uniform Fire Prevention and Building Code (Uniform Code):

- **2019:** NYS Uniform Code Council adopts the *2019 Energy Storage System Supplement*
 - **2020:** 2020 Uniform Code cycle goes into effect; codifies requirements for ESS in multiple codes:
 - 2020 Residential Code
 - 2020 Building Code
 - 2020 Fire Code
- Applicable across NYS without need for local adoption



NYS Uniform Code

2020 NYS Residential Code

- **Size, Location, and Separation requirements**
 - 20 kWh per unit
 - Allowable in attached/detached garages, on exterior walls, within utility closets and storage/utility spaces
 - Up to 40 or 80 kWh in aggregate depending on location of installation(s)
 - Minimum separation of 3 feet from other units, as well as doors, windows, etc.
- **Fire-Resistance Rating requirements**
 - For walls/ceilings of rooms and areas containing ESS
- **Protection from Impact**

Certain requirements may be modified by the AHJ based on large-scale fire testing



NYS Uniform Code

2020 NYS Fire Code:

- **Hazard Mitigation Analysis**
 - Required for larger commercial/grid-scale systems (>600 kWh)
 - Evaluates consequences of ESS failure modes
 - Approval contingent on demonstration that consequences of ESS failure (fires, toxic or flammable gases) will be contained, controlled, or limited by system protections
- **Large-Scale Fire Testing**
 - Conducted in accordance with UL 9540A or approved equivalent
 - Demonstrates that fire will not spread to adjacent systems/areas
 - Testing results will inform necessary protections and requirements
 - Required for systems >600 kWh; may also be utilized to seek exception from certain requirements

NYS Uniform Code

2020 NYS Fire Code (cont.):

- **Fire Remediation**
 - ESS owner required to provide a fire remediation team to relieve first responders, notify FD as needed.
- **Peer Review**
 - As required by the AHJ, ESS owner required to retain and fund services of an approved peer reviewer.
- **Commissioning Plan:**
 - Operations & Maintenance Manual
 - Provided prior to commencing operation
 - Maintained at onsite location
 - Decommissioning Plan
 - Planning for removal at end-of-life, or in the event of fire or other damage

NYS Uniform Code

2020 NYS Fire Code (cont.):

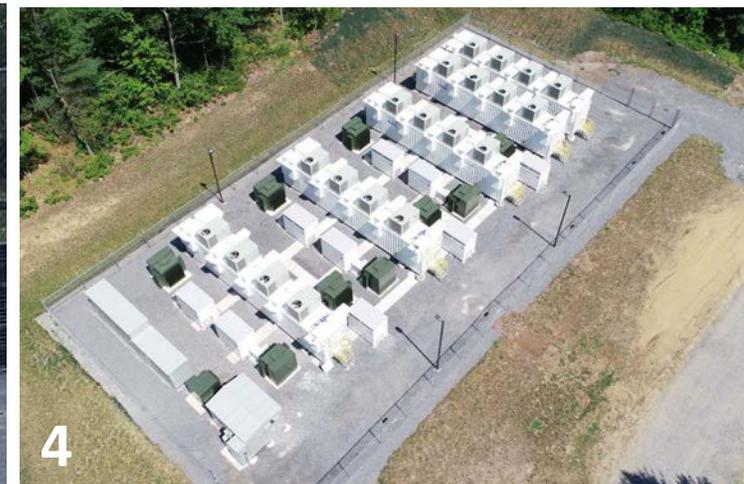
- Technology-Specific Requirements
 - Establishes safety and mitigation requirements based on risks associated with different ESS technologies

Compliance Required	Battery Technology				Other Energy Storage System and Battery Technologies	Capacitor Energy Storage System
	Lead-acid	Ni-Cad and Ni-MH	Lithium-ion	Flow		
1206.13.1. Exhaust ventilation	Yes	Yes	No	Yes	Yes	Yes
1206.12.2 Spill control and neutralization	Yes ^c	Yes ^c	No	Yes	Yes	Yes
1206.12.3 Explosion control	Yes ^a	Yes ^a	Yes	No	Yes	Yes
1206.12.4 Safety caps	Yes	Yes	No	No	Yes	Yes
1206.12.5 Thermal Runaway	Yes ^d	Yes	Yes ^e	No	Yes ^e	Yes

NYS Uniform Code

2020 NYS Fire Code (cont.):

- Location-Specific Requirements
 - Indoor Installations:
 1. Dedicated-Use
 2. Non-Dedicated-Use
 - Outdoor
 3. Outdoor Near Exposures
 4. Outdoor Remote



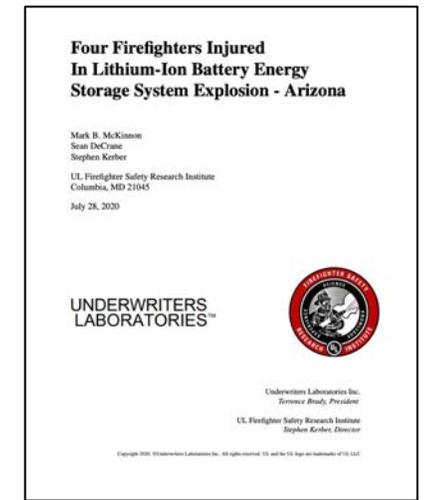
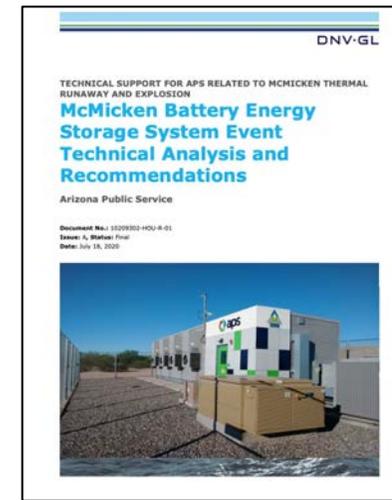
A long row of white BESS containers with electrical panels on a gravel site. The containers are arranged in a line, and each has a large electrical panel on its side. The ground is covered in gravel, and the sky is clear and blue. The text "BESS: Fire Safety Incident Management" is overlaid in large blue font on the left side of the image.

BESS: Fire Safety Incident Management

Incident Management

Learning from previous incidents:

- Hawaii
- Wisconsin
- Electric Vehicles
- Consumer Electronics (hoverboards, cell phones/laptops)
- McMicken Battery Fire – Arizona
 - Key Takeaways (now addressed in Codes & Standards):
 - Inadequate gas detection
 - Inadequate emergency response protocol
 - Deflagration and/or mechanical venting
 - Clean agent fire suppression



Incident Management

Fire Operations:

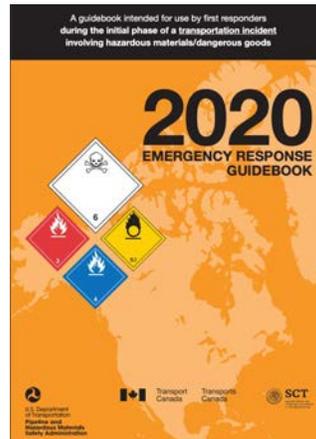
- Fire
 - Stored and stranded energy
 - Assume defensive operation
 - Prevent propagation (enclosure to enclosure)
- No fire
 - Battery Management System (BMS)
 - Battery's State of Health
 - Temperature Monitoring
 - Gas detection
 - Smoke without fire → explosion concern?

Incident Management

Fire Operations:

2020 Emergency Response Guidebook:

- Ventilation
- Evacuation
- Fire response
- Spill or leak



GUIDE 147 LITHIUM ION BATTERIES

POTENTIAL HAZARDS

FIRE OR EXPLOSION

- Lithium ion batteries contain flammable liquid electrolyte that may vent, ignite and produce sparks when subjected to high temperatures (> 150°C (302°F)), when damaged or abused (e.g., mechanical damage or electrical overcharging).
- May burn rapidly with flare-burning effect.
- May ignite other batteries in close proximity.

HEALTH

- Contact with battery electrolyte may be irritating to skin, eyes and mucous membranes.
- Fire will produce irritating, corrosive and/or toxic gases.
- Burning batteries may produce toxic hydrogen fluoride gas (see GUIDE 125).
- Fumes may cause dizziness or asphyxiation.

PUBLIC SAFETY

- **CALL 911. Then call emergency response telephone number on shipping paper.** If shipping paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.
- Keep unauthorized personnel away.
- Stay upwind, uphill and/or upstream.
- Ventilate closed spaces before entering, but only if properly trained and equipped.

PROTECTIVE CLOTHING

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing provides thermal protection **but only limited chemical protection.**

EVACUATION

Immediate precautionary measure

- Isolate spill or leak area for at least 25 meters (75 feet) in all directions.

Large Spill

- Consider initial downwind evacuation for at least 100 meters (330 feet).

Fire

- If rail car or trailer is involved in a fire, ISOLATE for 500 meters (1/3 mile) in all directions; also initiate evacuation including emergency responders for 500 meters (1/3 mile) in all directions.

LITHIUM ION BATTERIES GUIDE 147

EMERGENCY RESPONSE

FIRE

Small Fire

- Dry chemical, CO₂, water spray or regular foam.

Large Fire

- Water spray, fog or regular foam.
- If it can be done safely, move undamaged containers away from the area around the fire.

SPILL OR LEAK

- ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area.
- Do not touch or walk through spilled material.
- Absorb with earth, sand or other non-combustible material.
- Leaking batteries and contaminated absorbent material should be placed in metal containers.

FIRST AID

- Call 911 or emergency medical service.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.
- Move victim to fresh air if it can be done safely.
- Give artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.

Incident Response

Decommissioning

- **End-of-Life (EOL) Removal**
 - Planned Removal
- **Emergency Removal**
 - Unplanned Removal
 - Damaged Equipment
 - Investigation?
 - Time-consuming?
 - Qualified Subject Matter Expert (SME)



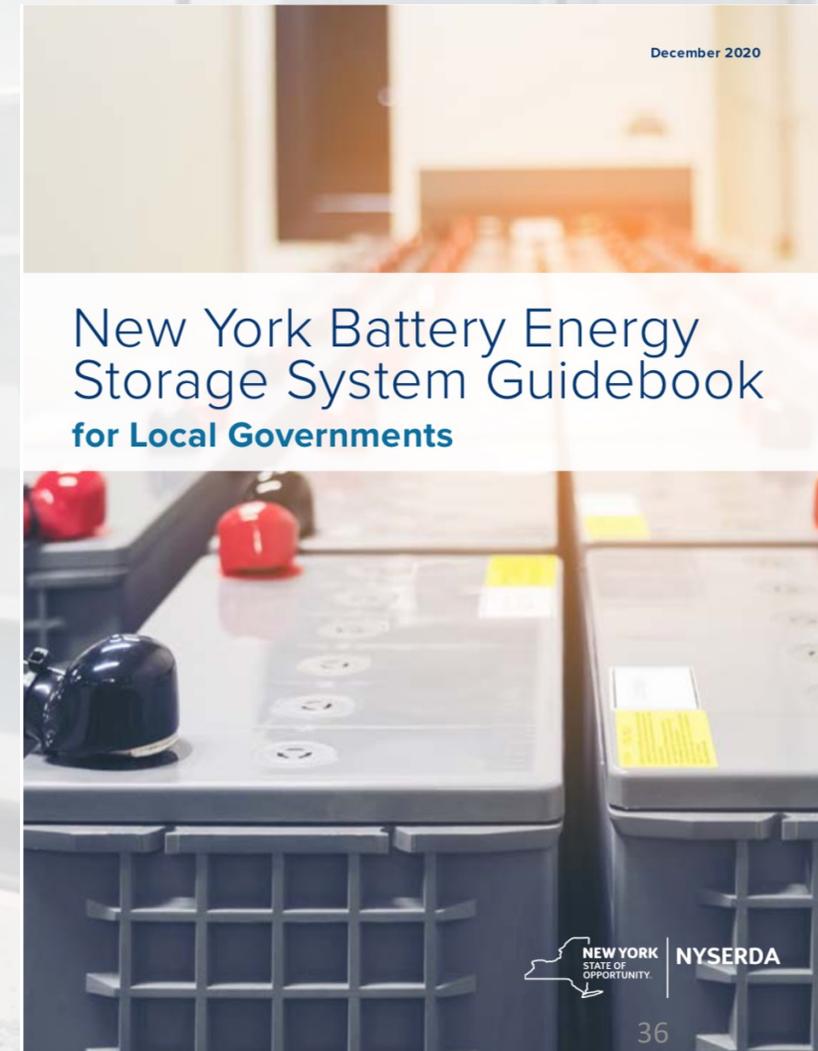
NYSERDA Resources for Local Governments

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



NYSERDA



Battery Energy Storage Systems: Key Considerations for Local Governments

Next Webinar in Series:

Zoning and Permitting (Wednesday, June 2nd)

Questions?
Email cleanenergyhelp@nyserda.ny.gov

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](#)