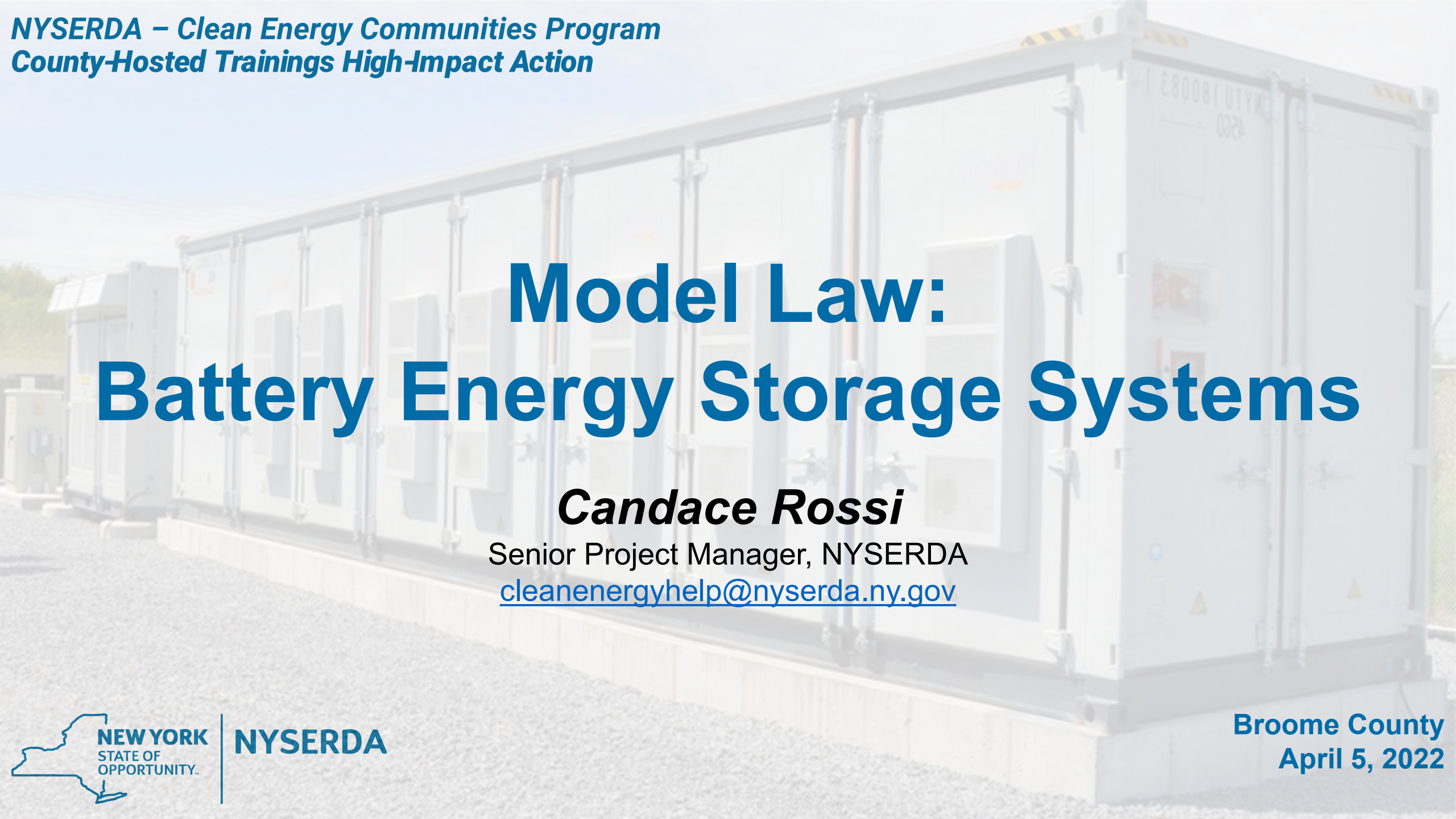

Model Law: Battery Energy Storage Systems

Candace Rossi
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Broome County
April 5, 2022

Agenda:

- Introduction to Battery Energy Storage Systems
- Overview of NYS Goals, Programs, and Policies
- Battery Energy Storage Systems Model Law and Fire Safety
- Q&A

Introduction

Candace Rossi
Senior Project Manager, NYSERDA
Candace.Rossi@nyserda.ny.gov

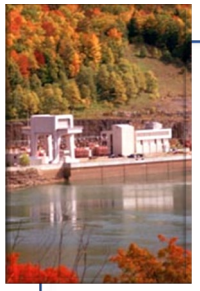
Clean Energy Siting Team:
www.nyserda.ny.gov/Siting

Introduction to Battery Energy Storage Systems

Battery Energy Storage Systems

- Potential Energy
- Energy Storage = Conversion of kinetic, electrical, or other forms of energy to potential energy.
- Examples of stored energy:
  - Electrical
  - Gravitational
  - Mechanical
  - Thermal

Battery Energy Storage Systems



Pumped Hydroelectric

Mechanical

- Compressed Air Energy Storage
- Flywheel

Electrochemical

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

Thermal

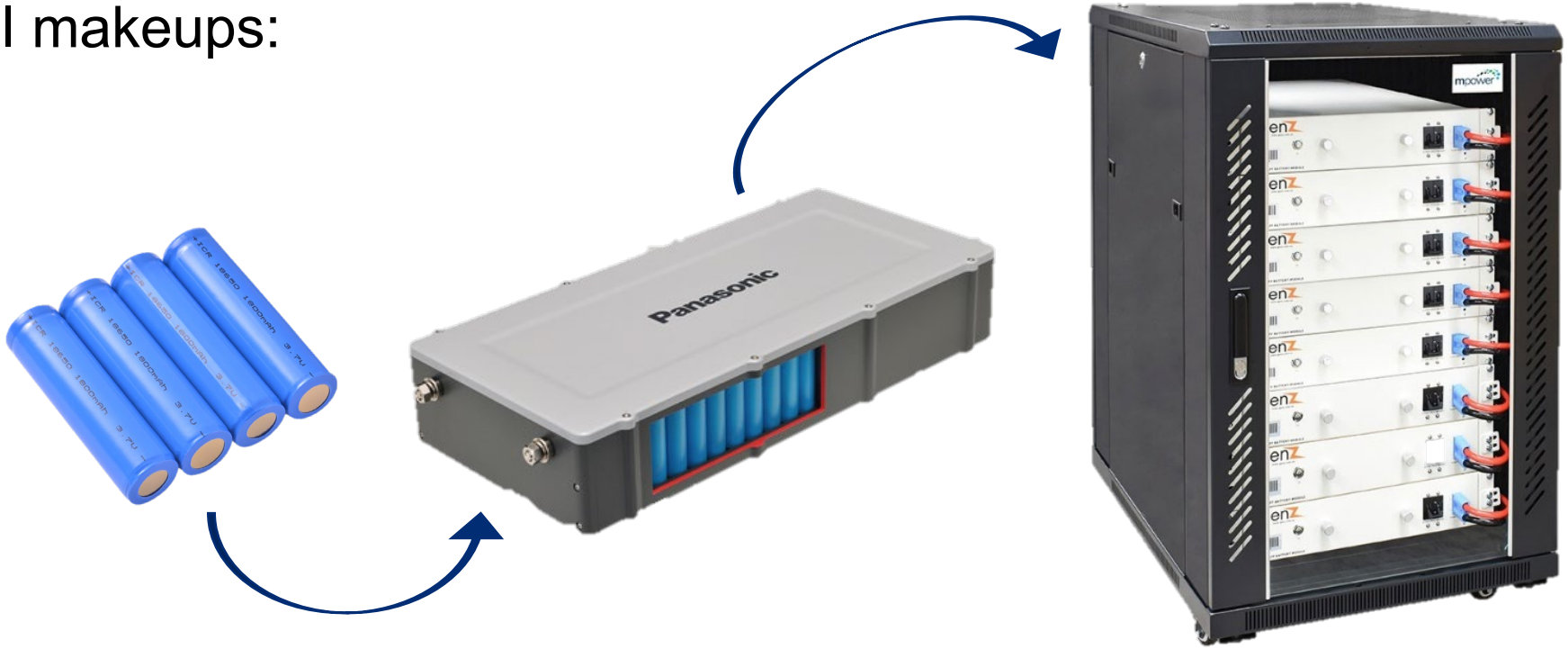
- Sensible – Molten Salt, Chilled Water
- Latent – ice storage, phase change materials
- Thermochemical storage

Chemical (Hydrogen)

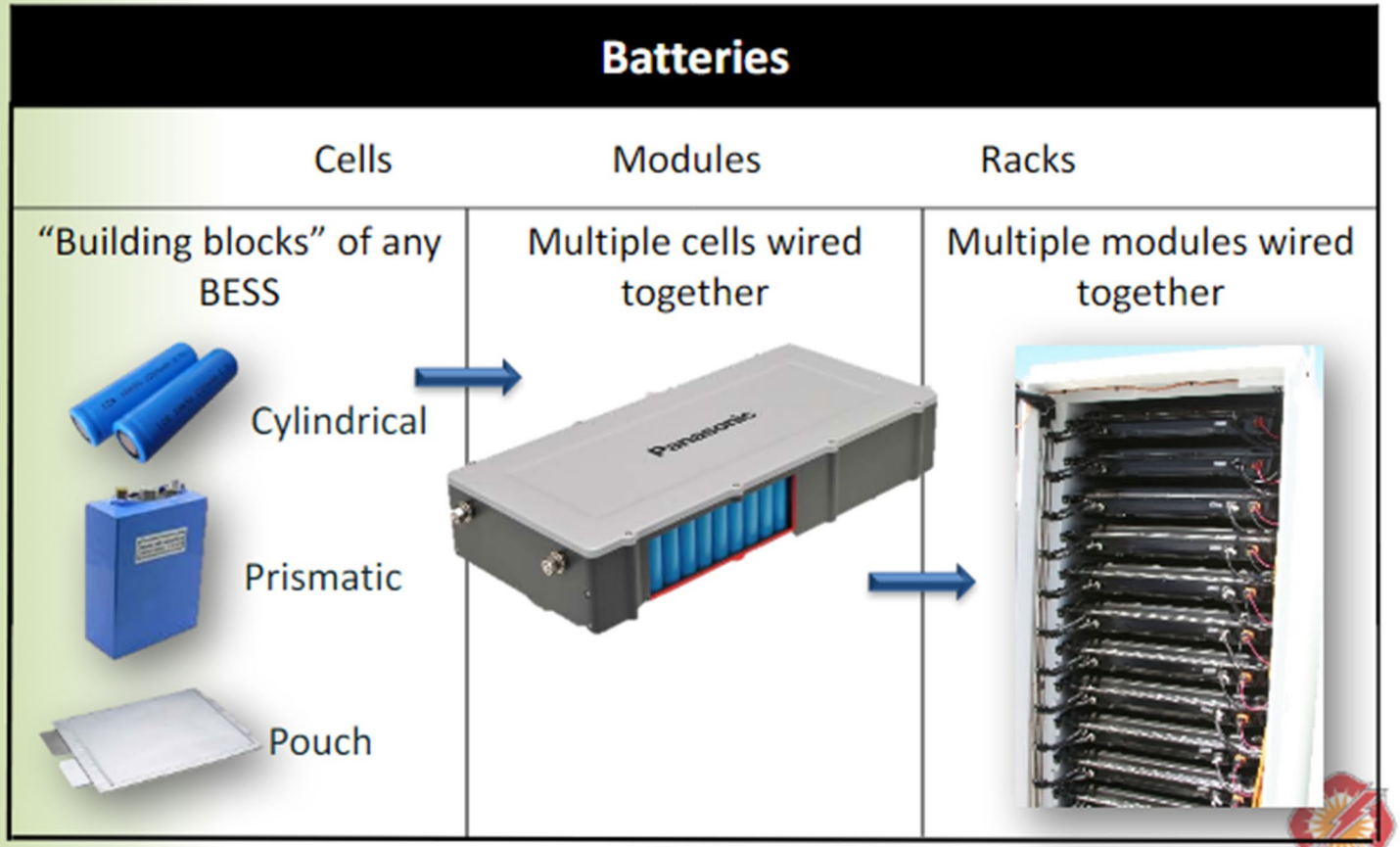
- Power-to-Power (Fuel Cells, etc)
- Power-to-Gas

Battery Energy Storage Systems

- Battery energy storage can comprise a variety of different electrochemical makeups:
  - Lithium ion
  - Lead Acid
  - Nickel-based
  - Flow batteries
- BESS building blocks:
  - Cells
  - Modules
  - Racks



Battery Energy Storage Systems



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

ENERGY
RESPONSE SOLUTIONS

Battery Energy Storage Systems

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

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

Battery Energy Storage Systems (BESS)

Residential

Commercial

Utility

Behind-the-meter
“Customer-side”

Front-of-the-meter
“Utility-side”

Battery Management System

- Monitors each individual cell within the system
- Will alarm if there are potential issues
- If required, can isolate affected cells or modules from the total system

Primary Land Use/Local Considerations

All technologies:

- Appropriate location/zoning
- Environmental impacts
- Bulk/area standards
- Decommissioning
- Taxation

Solar:

- Visual/aesthetic impacts
- Agricultural land impacts

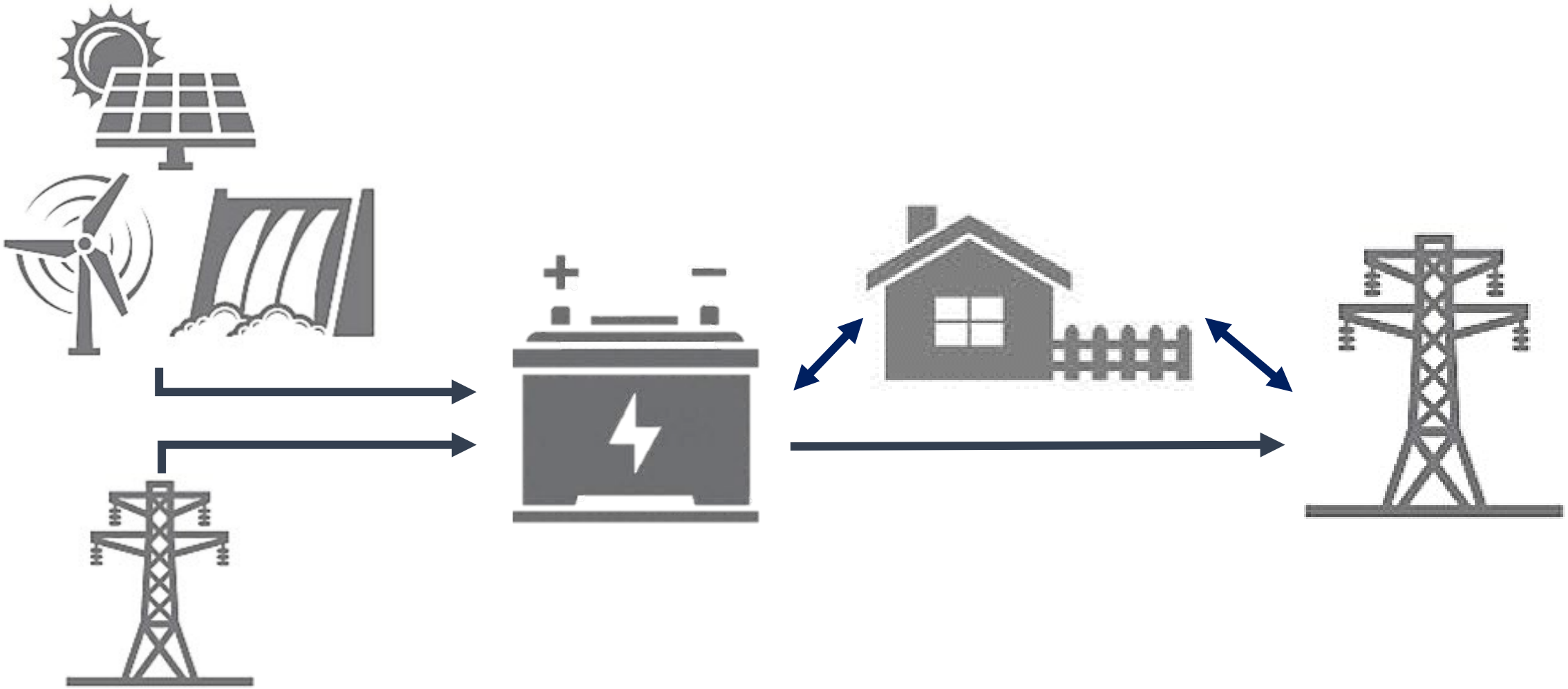
Wind:

- Visual/aesthetic impacts
- Noise
- Shadow flicker

Energy Storage:

- Fire safety
- Incident management training

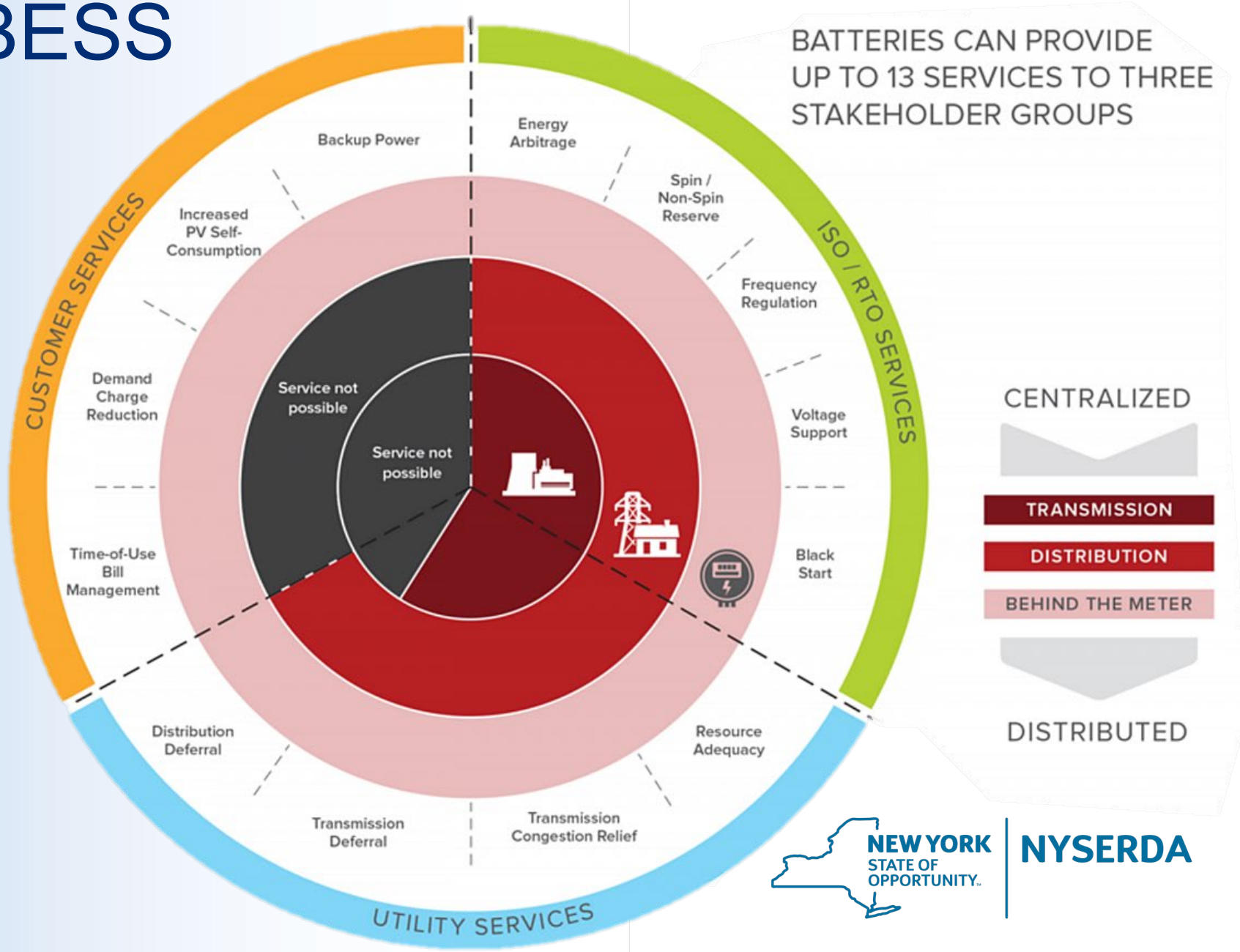
Applications for BESS



Applications for BESS

Services by group:

- Customer Services (Residential/Commercial)
- Utility Services
- Grid Services (ISOs / RTOs)



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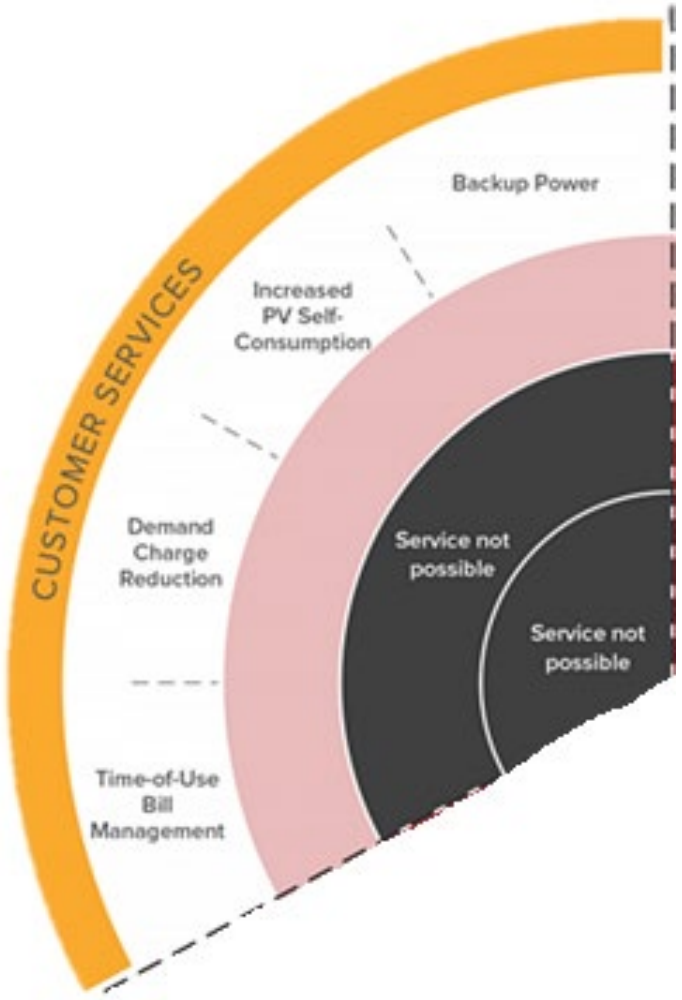
Customer Services (Residential/Commercial)



- **Backup Power** → Power availability during outages
- **Increased PV Self-Consumption** → If paired with solar PV, ability to better utilize your own generation
- **Demand Charge Reduction**
- **Time-of-Use Bill Management**

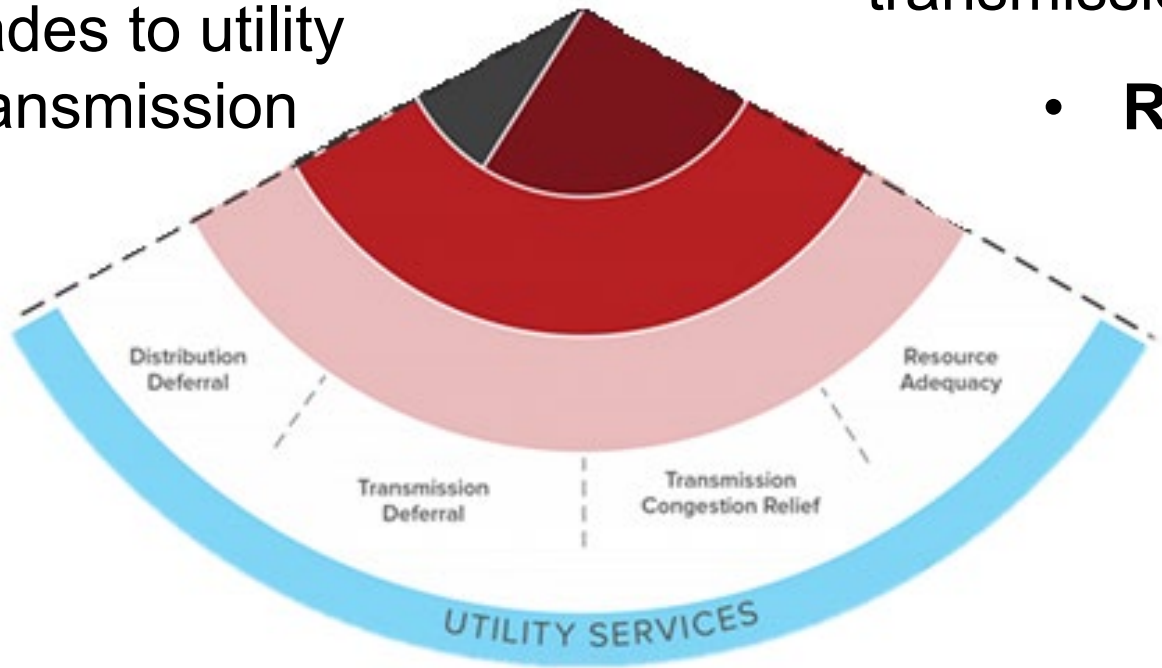
→ Shift your consumption to save money during periods of high demand

Also known as demand or peak shaving, load shifting

Utility Services

- **Distribution Deferral**
- **Transmission Deferral**

Defer costly upgrades to utility distribution and transmission infrastructure



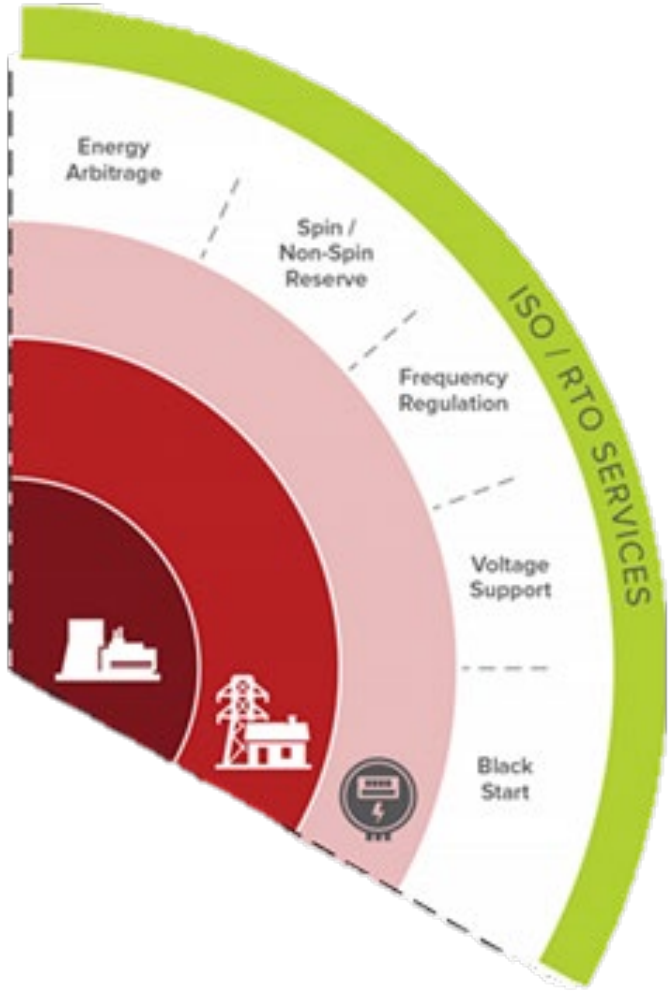
- **Transmission Congestion Relief:** Mitigate congestion in areas with lots of generation or inadequate transmission capacity
- **Resource Adequacy:** Have enough capacity to keep the lights on!

Grid Services (ISOs, RTOs)

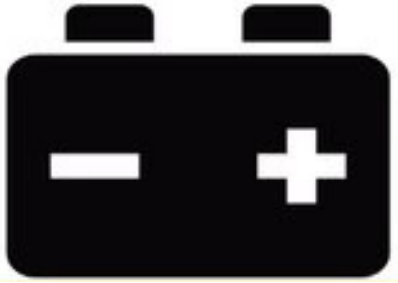
- **Energy Arbitrage** → Charging when electricity costs/demand are low, discharging when high; can also reduce curtailment of renewables
- **Spin/Non-Spin Reserve** → Dispatch energy as needed to ensure that grid supply = demand
- **Frequency Regulation** → Quickly ensure generators are synchronized for grid stability
- **Voltage Support** → Provide/absorb voltage as needed for grid stability

→ "Ancillary Services"

- **Black Start** → Help large generators come online following system failure



Example: Peaker Replacement



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

Overview: NYS Goals, Policies, and Programs

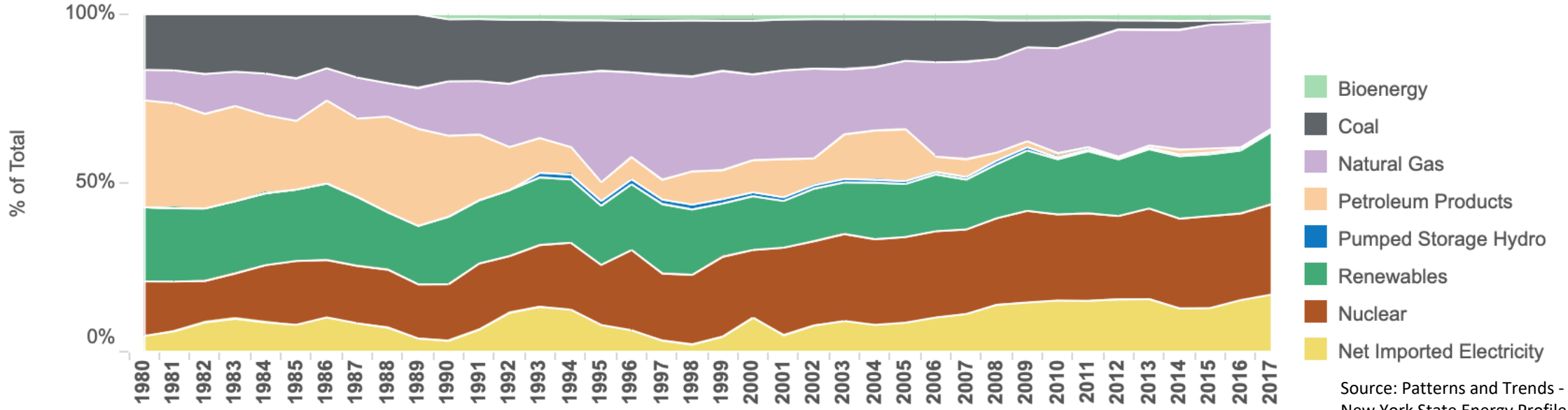
The Climate Leadership and Community Protection Act (Climate Act)

Electricity Sector Goals:

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

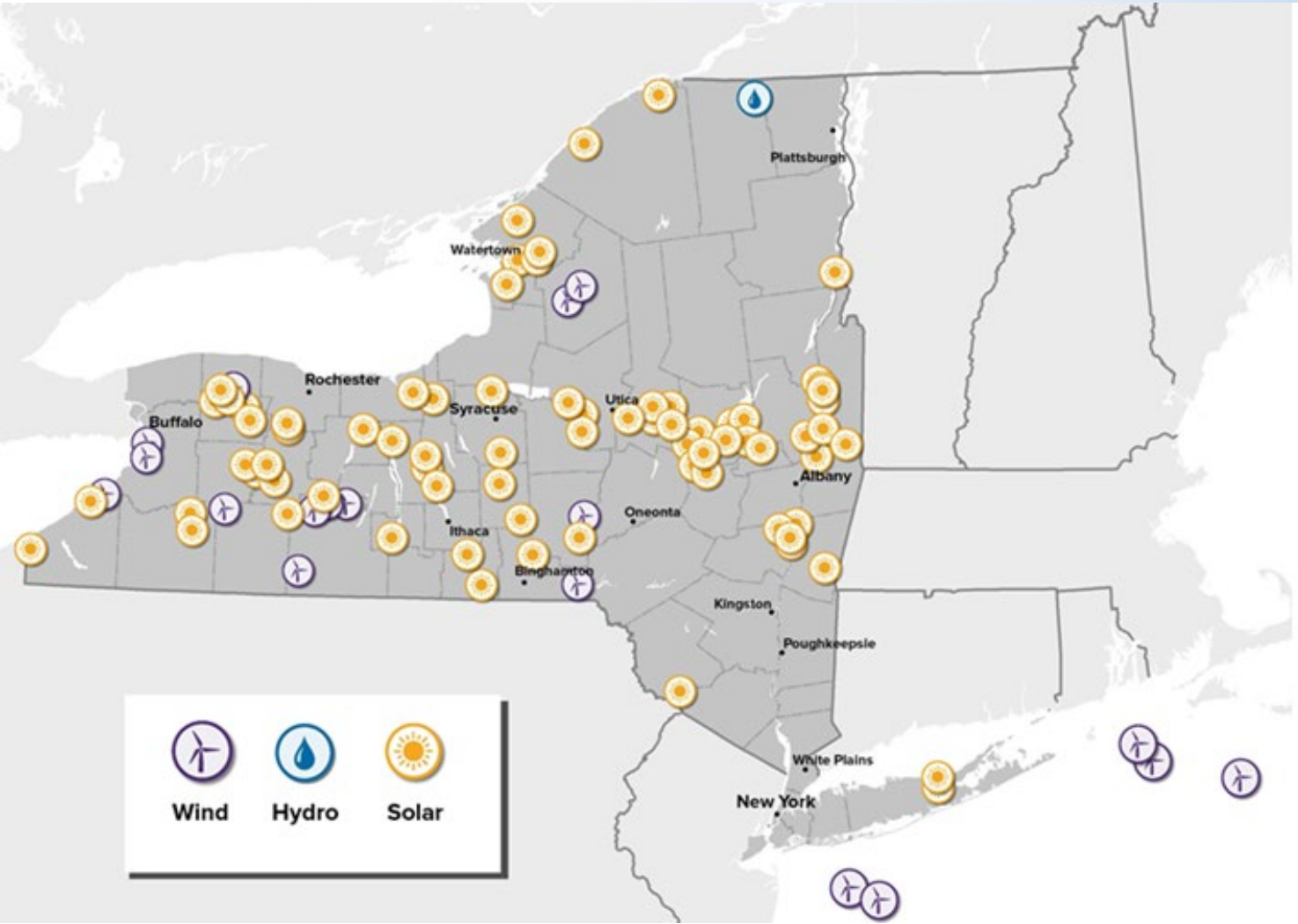
Technology-Specific Goals:

- 10,000 MW Distributed Solar by 2025*
- 9,000 MW Offshore Wind by 2035
- 1,500 MW Energy Storage by 2025; 3,000 MW by 2030



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

Solicitations for Large-Scale Renewables

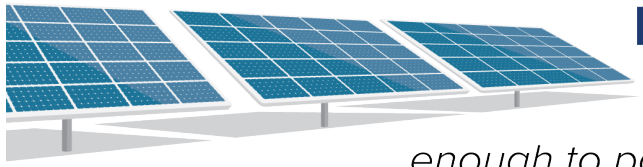


- Solicitations issued annually since 2017
- Total of **22** awarded projects for 2020 solicitation:
  - **21** solar projects (**2** including co-located energy storage)
  - **1** hydro-electric facility re-powering
- 2021 solicitation awards are forthcoming

NY-Sun Initiative

- NY-Sun is a **$1.6 billion** initiative to advance the scale-up of solar and create a sustainable, self-sufficient solar industry
- NY-Sun is helping New York to install **6,000 megawatts** of solar by 2025
  - Expanded existing goal of 3,000 MW by 2023
  - NY-Sun anticipates that most of the 6,000 MW goal will be achieved through community solar projects
- There is currently a Roadmap published to increase to 10GW by 2030. It is anticipated to be approved in the coming months.

6,000 MW
of distributed solar
by 2025



enough to power 1 million homes

Energy Storage Initiative

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

Benefits:

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

NYSERDA Opportunities

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

2025 STATEWIDE ENERGY STORAGE TARGET

1,500 MW

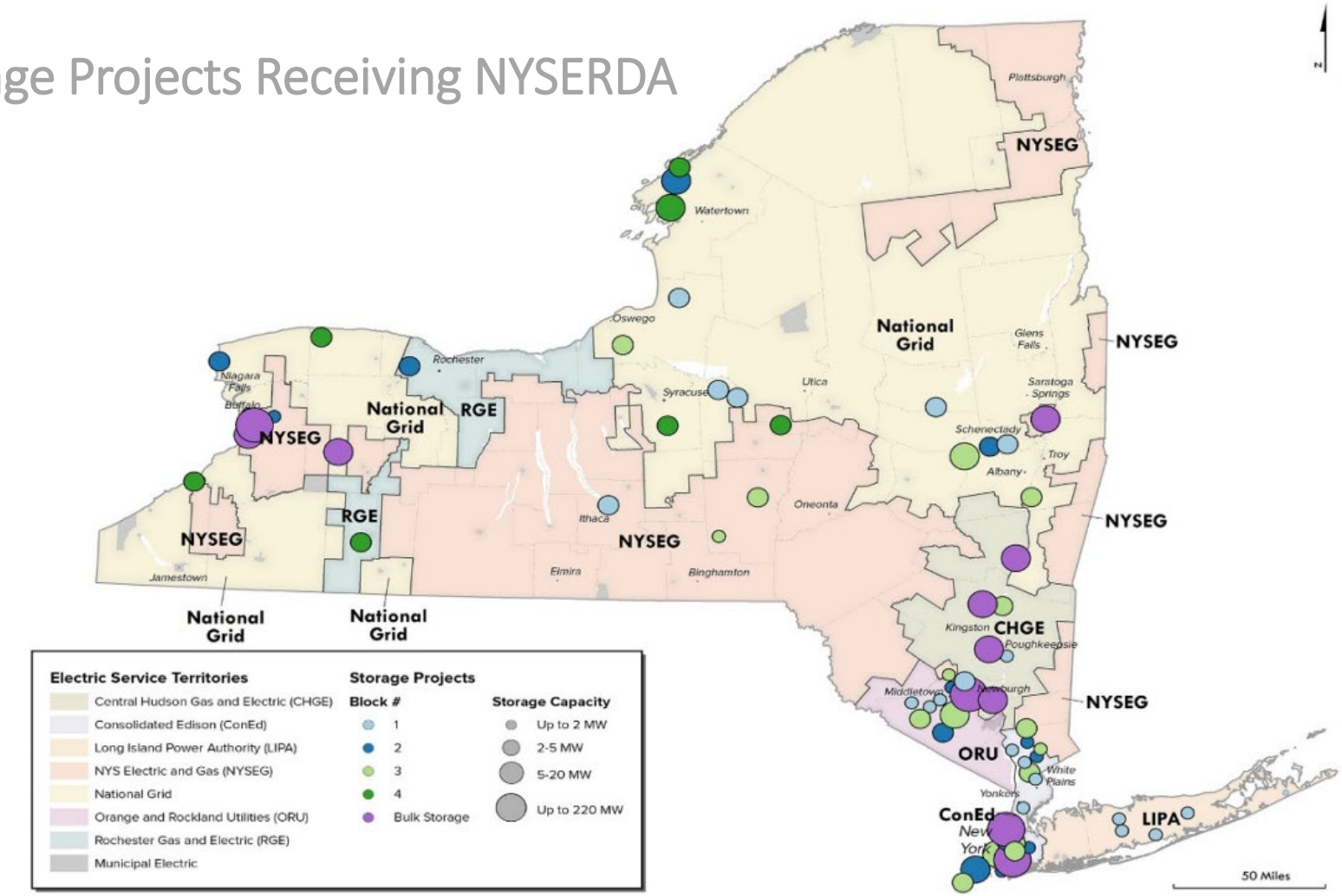
2030 STATEWIDE ENERGY STORAGE TARGET

3,000 MW*

***Potential 5,000 MW by 2030 Target via Governor's SOTS**

Energy Storage Snapshot

Map: Energy Storage Projects Receiving NYSERDA Bridge Incentive



Project Permitting in NYS

Processes for regulating/permitting clean energy development will vary based on size and type of the installation.

For solar/wind:

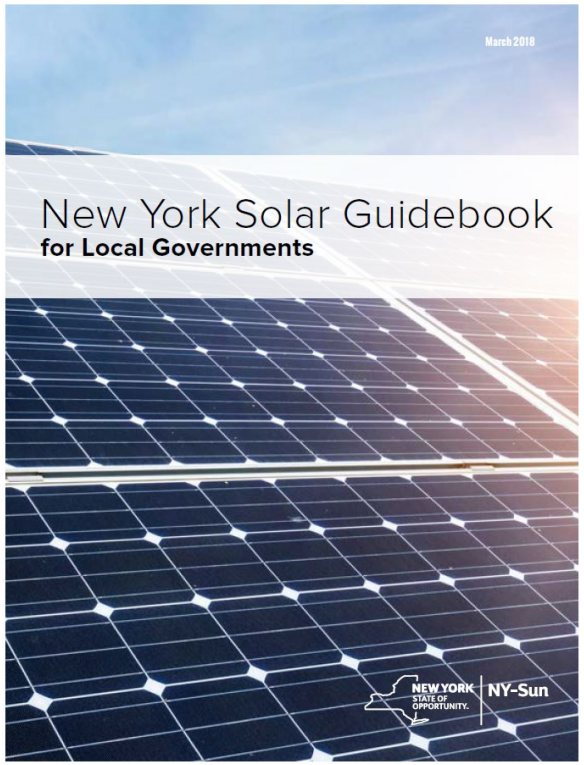
- **Projects < 25 MW: Permitted at local level (SEQR, municipal requirements)**
- **Projects > 25 MW: Permitted at State level (Article 10, Office of Renewable Energy Siting [ORES])**
- **Projects between 20 – 25 MW: May opt-in to State-level siting process through ORES**

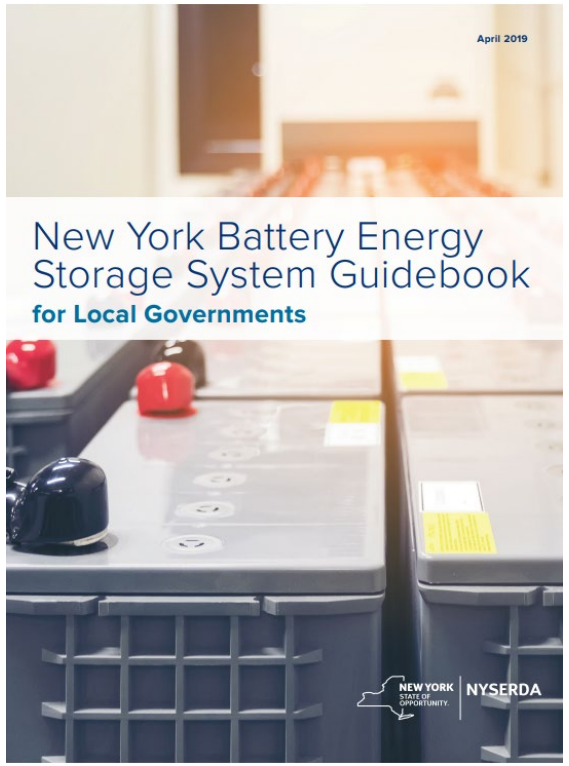
For energy storage:

- **Projects paired (or "co-located") with large-scale renewable generators: Permitted at State level**
- **Projects not paired with large-scale generators: Permitted at local level**

Clean Energy Siting Team

NYSERDA created clean energy guidebooks to assist local governments managing clean energy development in their communities.

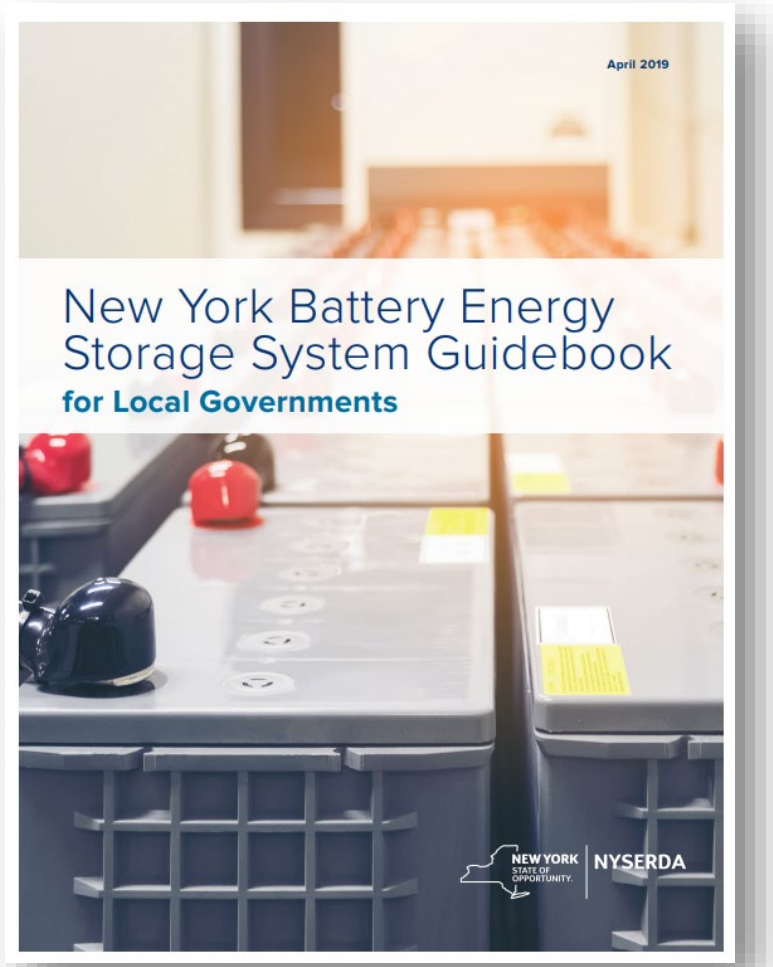




NYSERDA offers local governments free one-on-one technical assistance on topics including, but not limited to:

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

Battery Energy Storage Guidebook for Local Governments



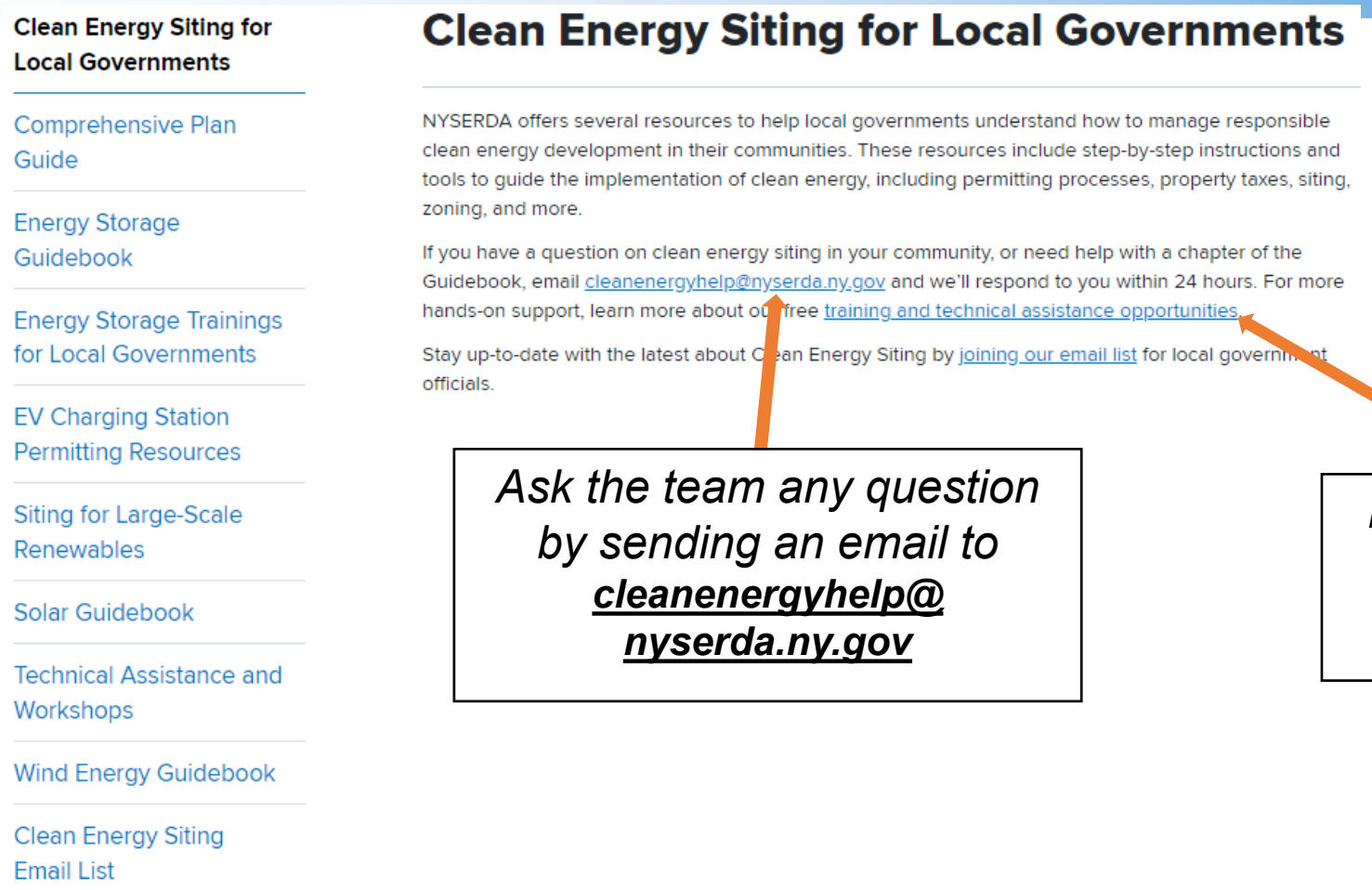
Chapter 1 – Battery Energy Storage Model Law

Chapter 2 – Battery Energy Storage Model Permit

Chapter 3 – Battery Energy Storage Inspection Checklist

Chapter 4 – 2020 New York State Uniform Code

Clean Energy Siting Homepage

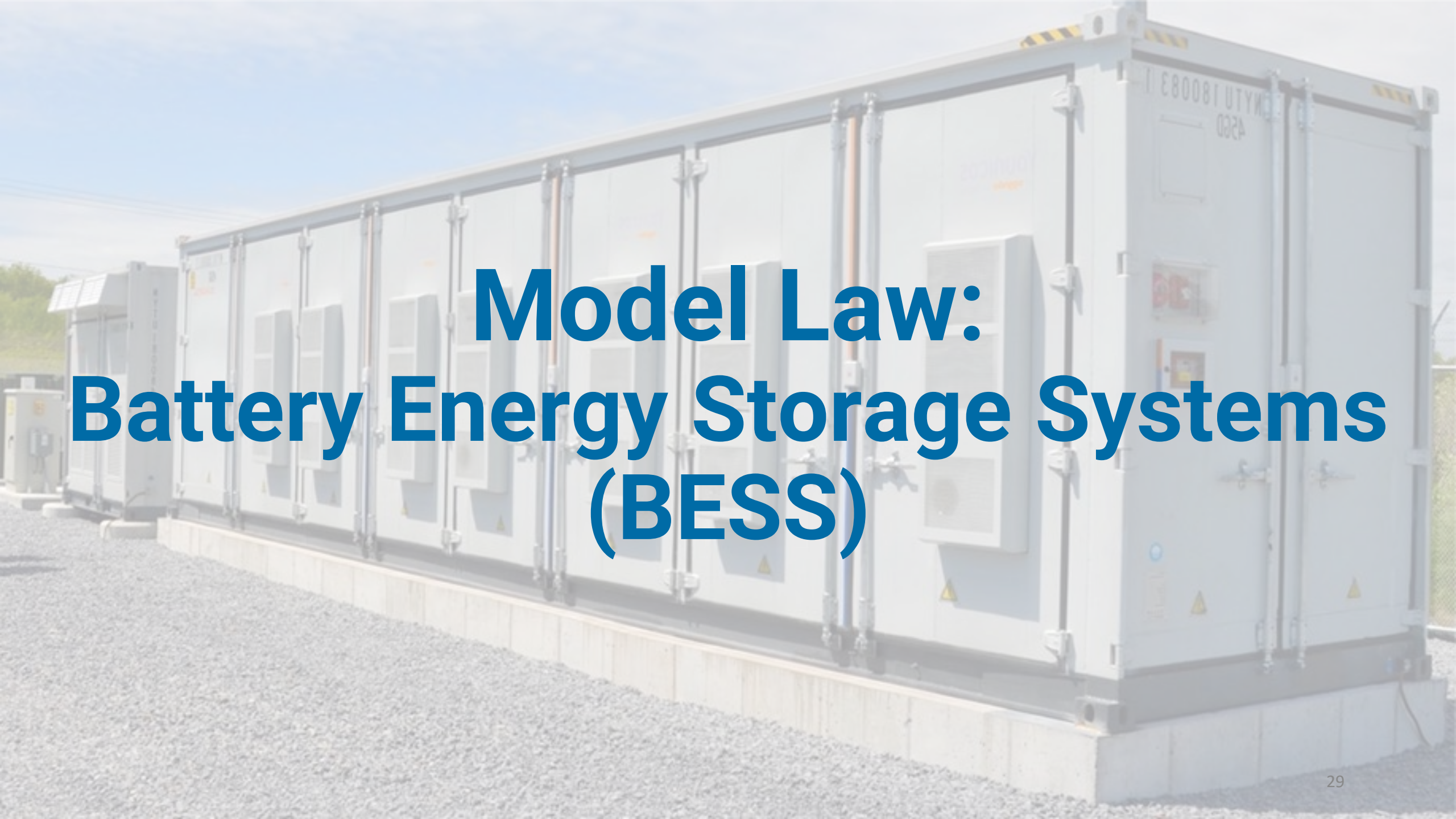


The Battery Energy Storage Guidebook is available for download here

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

Municipalities can request technical assistance here

www.nyserda.ny.gov/Siting



Model Law: Battery Energy Storage Systems (BESS)

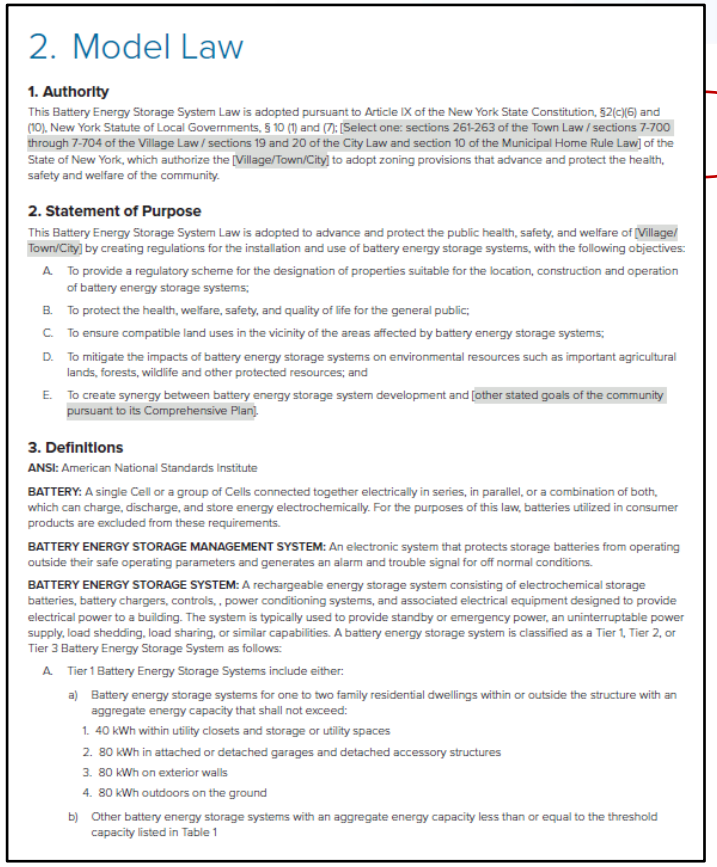
Permitting Battery Energy Storage Systems

Permitting process varies based on whether or not system is paired with generation:

- **Paired with Renewable Generator <25 MW: Permitted at local level (SEQR, municipal/county requirements)**
- **Paired with Renewable Generator > 25 MW: Permitted at State level (Article 10, ORES)**
- **Standalone System, regardless of size: Permitted at local level (SEQR, municipal/county requirements)**

Contents

Section 1: Authority



2. Model Law

1. Authority

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

2. Statement of Purpose

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

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

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

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

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

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

3. Definitions

ANSI: American National Standards Institute

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

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

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

A. Tier 1 Battery Energy Storage Systems include either:

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

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

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

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.

Section 3: Definitions

System Sizes

Tier 1

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.

Tier 2

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.

Tier 1 BESS Installation Photos

Tier 2 BESS Installation Photos

Section 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.

Section 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.

Section 6-7: Permitting Requirements

Section 6: Tier 1 Battery Energy Storage Systems

- Battery Energy Storage System Permit
- Inspection Checklist
- Applicable fire code

Section 7: Tier 2 Battery Energy Storage Systems

- Special Use Permit
- Site Plan Review
- Applicable fire code

Battery Energy Storage System Model Permit

Tier 1 Requirement

Overview

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

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

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

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

PERMIT APPLICATION

Battery Energy Storage System Model Permit

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

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

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

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

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

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

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

- 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.

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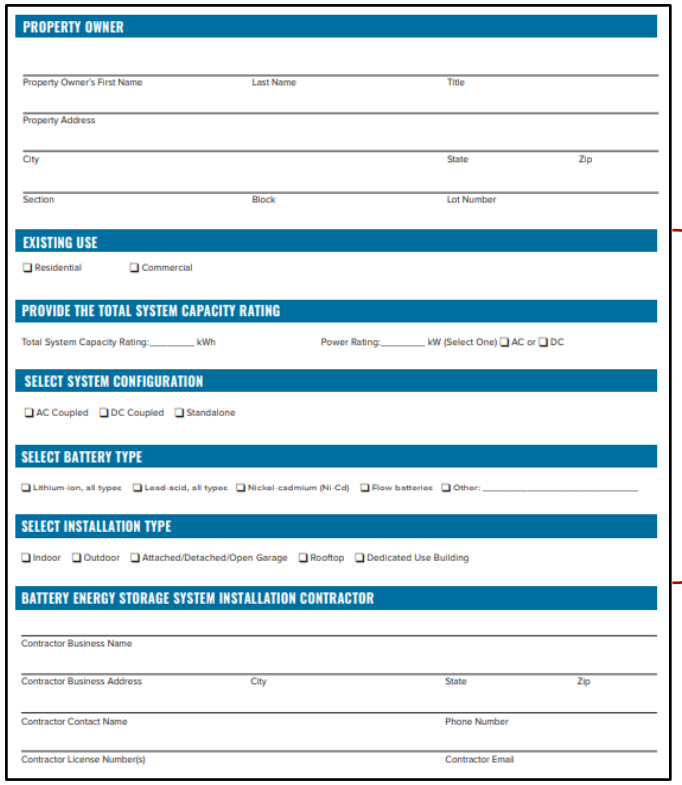
Battery Energy Storage System Model Permit

Tier 1 Requirement



PROPERTY OWNER

Property Owner's First Name | Last Name | Title

Property Address

City | State | Zip

Section | Block | Lot Number

EXISTING USE

❑ Residential ❑ Commercial

PROVIDE THE TOTAL SYSTEM CAPACITY RATING

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

SELECT SYSTEM CONFIGURATION

❑ AC Coupled ❑ DC Coupled ❑ Standalone

SELECT BATTERY TYPE

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

SELECT INSTALLATION TYPE

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

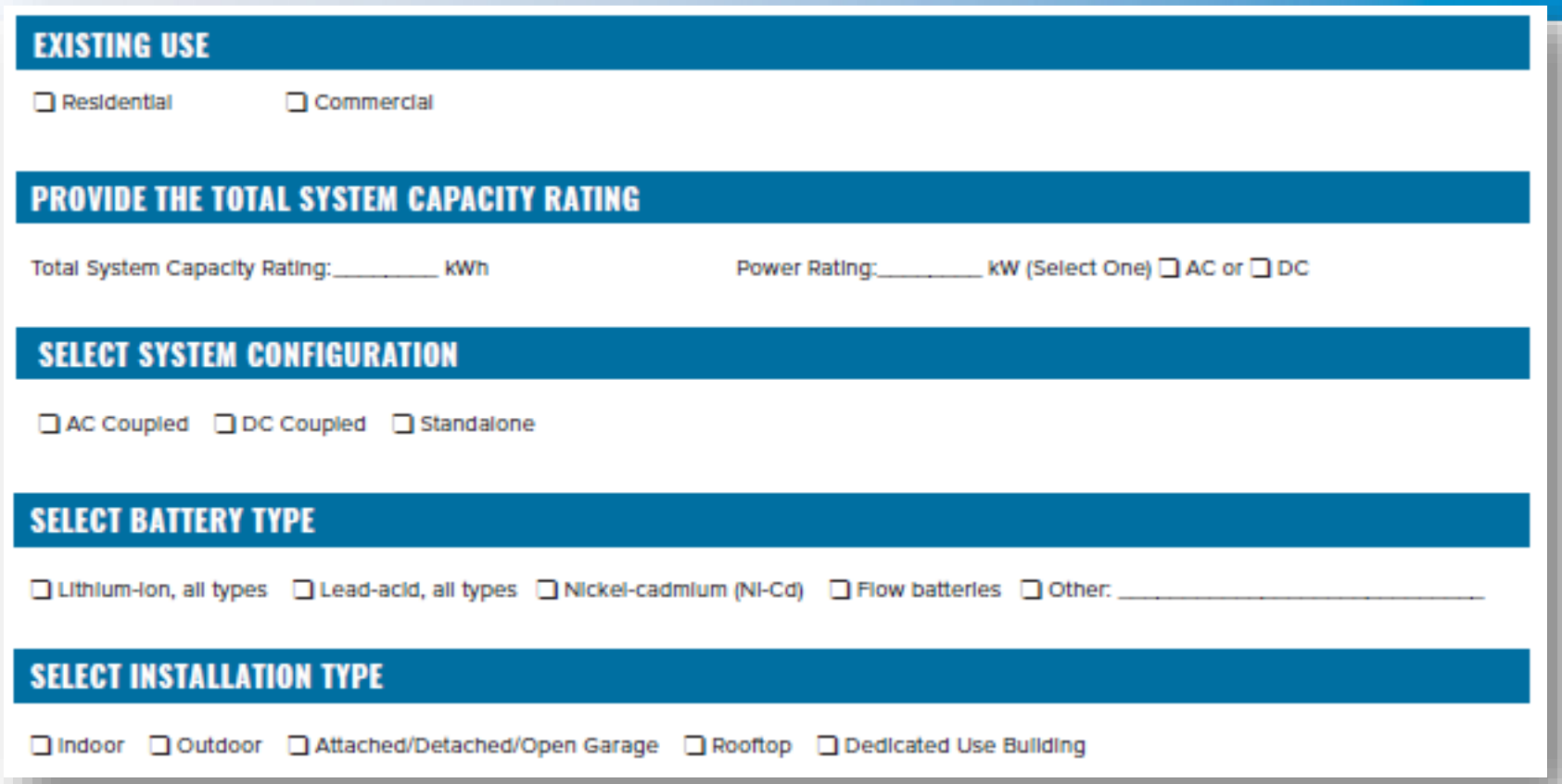
BATTERY ENERGY STORAGE SYSTEM INSTALLATION CONTRACTOR

Contractor Business Name

Contractor Business Address | City | State | Zip

Contractor Contact Name | Phone Number

Contractor License Number(s) | Contractor Email



EXISTING USE

❑ Residential ❑ Commercial

PROVIDE THE TOTAL SYSTEM CAPACITY RATING

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

SELECT SYSTEM CONFIGURATION

❑ AC Coupled ❑ DC Coupled ❑ Standalone

SELECT BATTERY TYPE

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

SELECT INSTALLATION TYPE

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

Battery Energy Storage System Model Permit

Tier 1 Requirement

Electrician Business Name

Electrician Business Address | City | State | Zip

Electrician Contact Name | Phone Number

Electrician License Number(s) | Electrician Email

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

Property Owner's Signature | Date

Battery Energy Storage System Company Representative Signature | Date

PERMITS AND APPROVALS REQUIRED

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

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

SUBMITTAL REQUIREMENTS

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

a) Completed Application form on page 2.

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

General Requirements

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

SUBMITTAL REQUIREMENTS

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

a) Completed Application form on page 2.

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

General Requirements

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

Section 7: Tier 2 Permitting Requirements

- Process for Approval

  Choose which zoning district(s) to permit systems.

  Applications shall be reviewed for completeness within 10 business days.

  Applications shall be subject to a public hearing and a notice shall be published in the official newspapers 5 days in advance.

  Referred to the [County Planning Department] pursuant to General Municipal Law **§** 239-m as required.

  Upon closing the public hearing, the reviewing board shall have 62 days to take action on the application. The 62-day period may be extended.

- Requirements for Approval

  B. Utility Lines and Electrical Circuitry
  C. Signage
  D. Lighting
  E. Vegetation and Tree-cutting
  F. Noise
  G. Decommissioning
  H. Site Plan Application
  I. Special Use Permit Standards
  J. Ownership Changes

Section 7: Tier 2 Permitting Requirements

B: Utility Lines and Electrical Circuitry

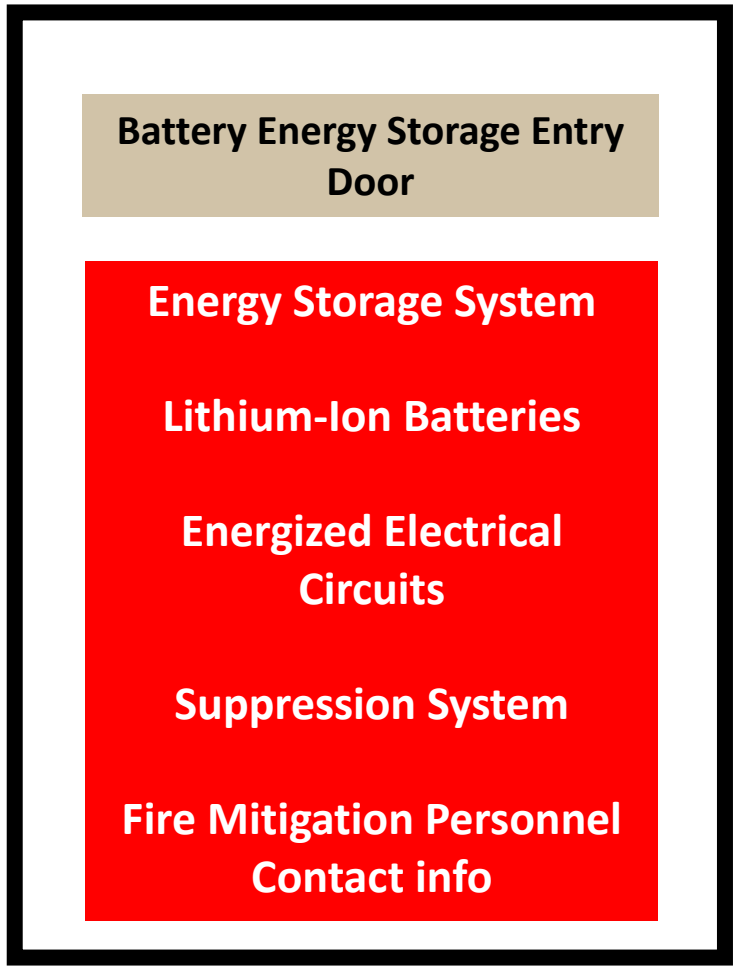
All on-site utility lines shall be placed underground to the extent feasible and as permitted by the serving utility

Section 7: Tier 2 Permitting Requirements

C: Signage

1) The signage shall include:
    1) the type of technology associated with the battery energy storage systems,
    2) any special hazards associated,
    3) the type of suppression system,
    4) 24-hour emergency contact information

2) As required by the NEC, disconnect and other emergency shutoff information shall be clearly displayed on a light reflective surface.



Section 7: Tier 2 Permitting Requirements

D: Lighting & E: Vegetation and Tree-cutting.

Lighting

- Shall be limited to what is minimally required for safety.
- Shall be shielded and downcast from abutting properties

Vegetation and Tree-cutting

- Areas within [10] feet on each side of the system shall be cleared.
- Removal of trees should be minimized to the extent possible

Section 7: Tier 2 Permitting Requirements

F: Noise

The [1-hour] average noise generated from the battery energy storage systems shall not exceed a noise level of [60] dB as measured at the outside wall of any non-participating occupancy.

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.

Section 7: Tier 2 Permitting Requirements

G: Decommissioning

Decommissioning Plan

i. Anticipated life of system;

ii. Estimated decommissioning costs;

iii. How estimate was determined;

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

v. Method to keep decommissioning cost current; and

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

Decommissioning Fund

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

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

Section 7: Tier 2 Permitting Requirements

H: Site Plan Application

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

Section 7: Tier 2 Permitting Requirements

H: Special Use Standards

1. **Setbacks** – comply with the underlying zoning district requirements for principal structures
2. **Height** – comply with the underlying zoning district requirements height limitations for principal structures
3. **Fencing requirements** – Shall be enclosed by a [7-foot] fence with a self-locking gate to prevent unauthorized access
4. **Screening and visibility** – shall have views minimized from adjacent properties that will harmonize with the character of the property but will not interfere with ventilation or exhaust ports.

Fire Safety

Applicable Codes

Code Evolution for BESS in NYS

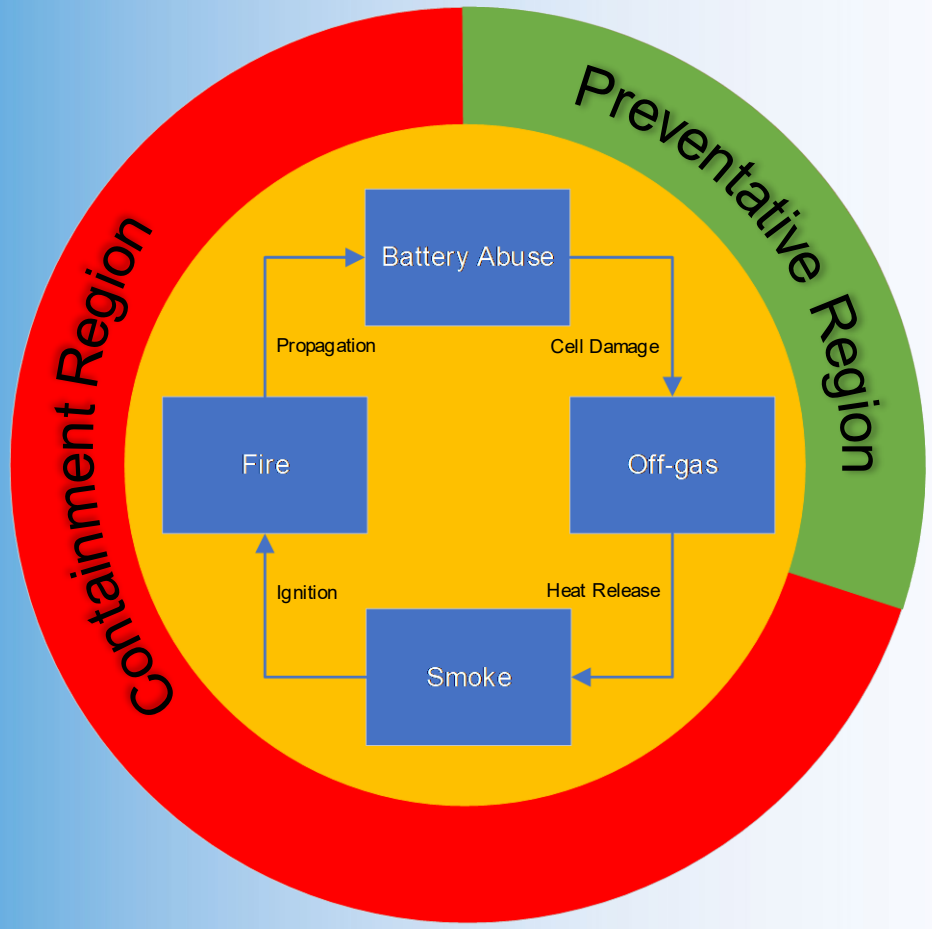
2019 Energy Storage Supplement amended New York State's Uniform Code, effective July 1, 2019

- Added provisions related to the installation, use, and maintenance of energy storage systems
- Permanent ruling put in place November 1, 2019

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

Applicable without the need for adoption at the local level

Fire Safety



Thermal runaway - What happens?

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

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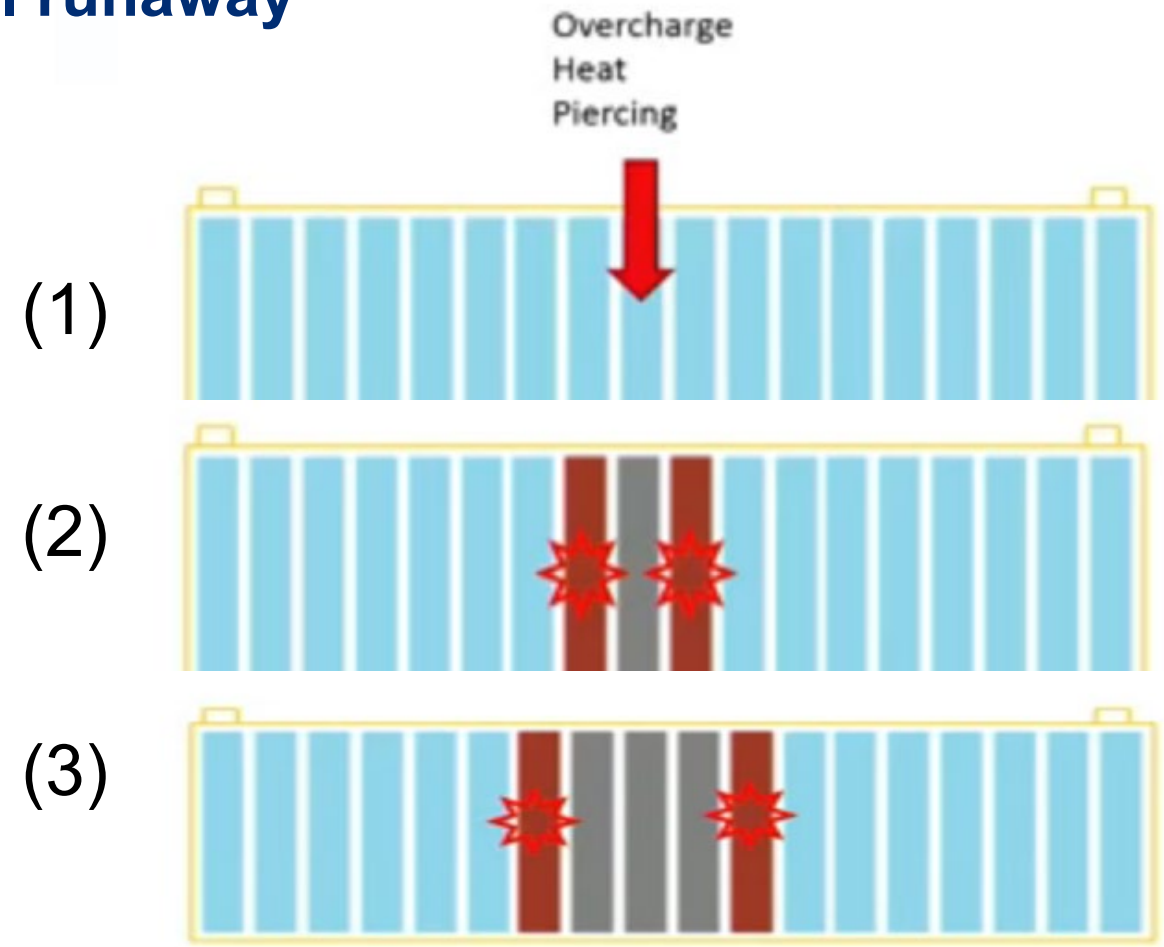
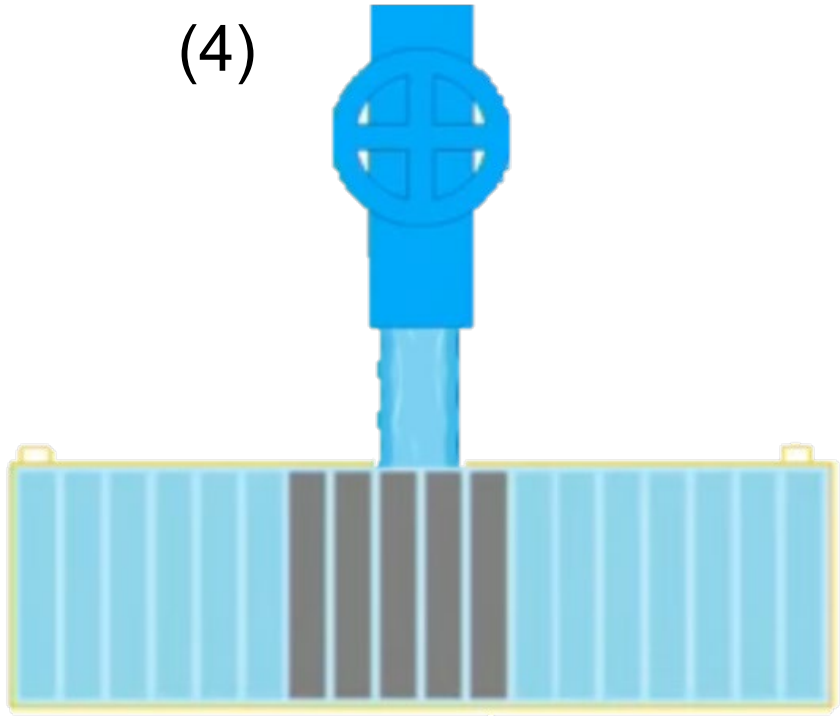
Image adapted from: "Compliance Requirements and Fault Detection." Steve Cummings, Nexceris, LLC, June 28, 2018 - http://energystorage.org/system/files/resources/nfpa_webinar_combined_slides_v5.pdf

Fire Safety

Thermal runaway





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

Fire Safety

Protection Methods for Stages of Thermal Runaway Battery Failure

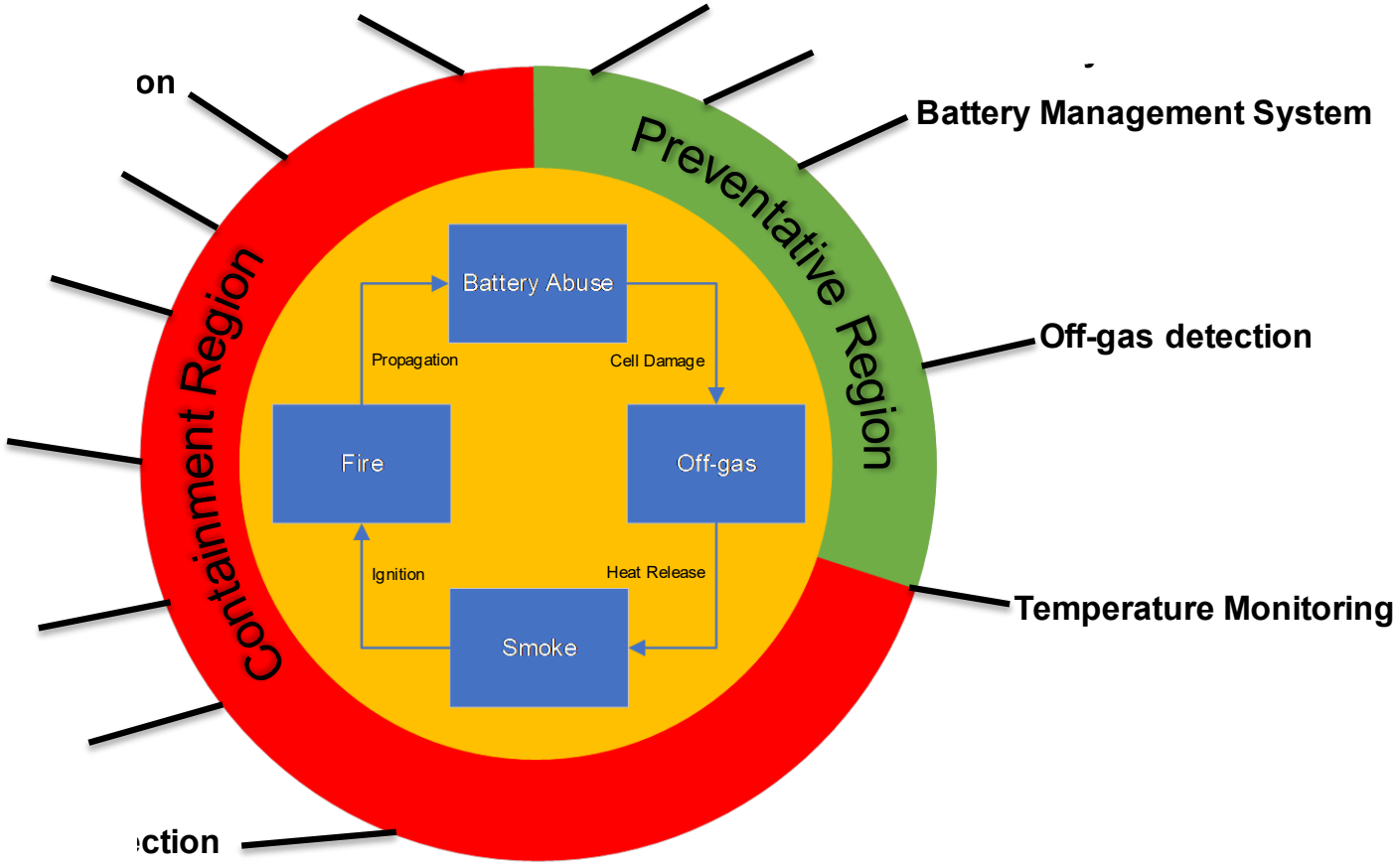


Image adapted from: "Compliance Requirements and Fault Detection." Steve Cummings, Nexceris, LLC, June 28, 2018 - http://energystorage.org/system/files/resources/nfpa_webinar_combined_slides_v5.pdf

2020 Fire Code of NYS

Section 1206 Electrical Energy Storage Systems

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Energy Storage System Threshold Quantities

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

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, polysulfide-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

Hazard Mitigation Analysis

HMA will evaluate the consequences of failure modes

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

Analysis approval

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

Large Scale Fire Test

- Where required, must be conducted in accordance with **UL 9540A** or approved equivalent
- Demonstrates that fire will not spread to adjacent systems and will be contained for duration of fire-resistance rating of assemblies
- May be used for fire code official to approve exceptions to certain requirements

Electrochemical BESS Protections

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.

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

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

Battery Energy Storage Management System

- Monitors and balances within the manufacturer's specifications
  - Cell voltages
  - Currents
  - Temperatures
- BMS shall disconnect electrical connections to the BESS or place it in a safe condition if potentially hazardous temperatures or other conditions such as short circuits, over voltages, or under voltages are detected

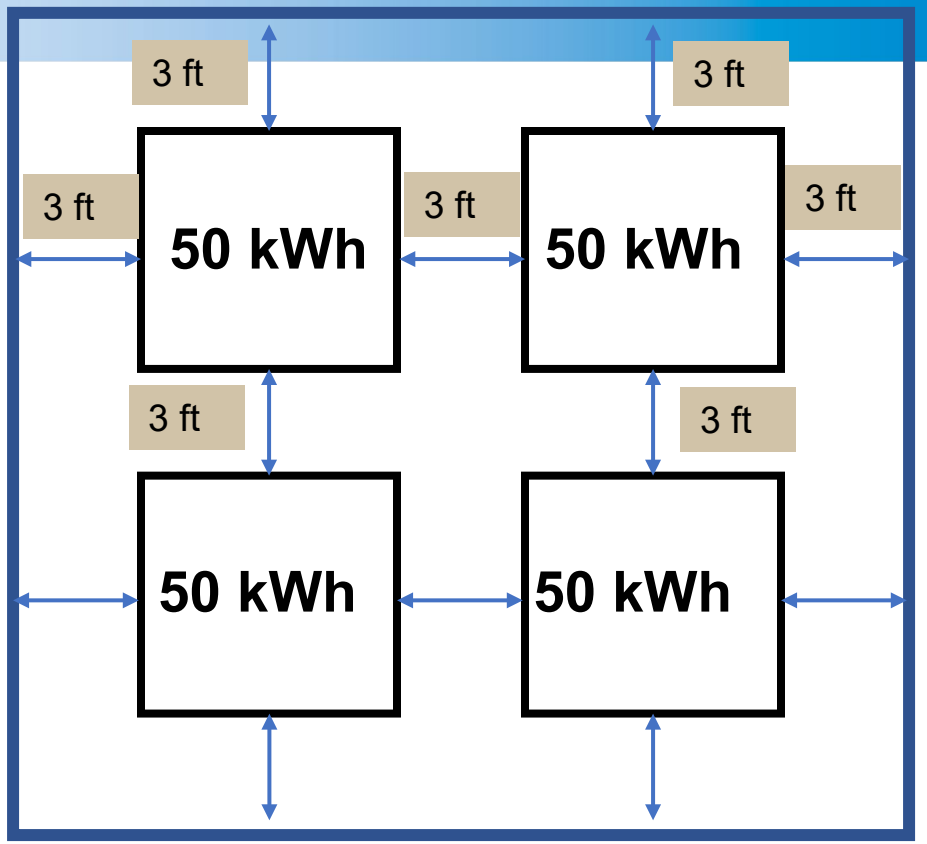
Image from: https://www.eepowersolutions.com/products/centroid-snet-2-battery-management-software/

Electrochemical BESS Protections

Size and separation

Segregated into groups not exceeding 50 kWh

Each group separated a minimum of 3 feet from other groups and from walls in the storage room or area



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

Electrochemical BESS Protections

Maximum enclosure size

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

General Installation Requirements

Toxic and highly toxic gases

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

Fire Remediation

- BESS owner shall mitigate the hazard or remove damaged equipment from the premises to a safe location
- BESS owner shall dispatch fire mitigation personnel to respond to possible ignition or re-ignition of a damaged BESS and remain on duty after the fire department leaves the premise until the damaged energy storage equipment is removed from the premises
- On-duty fire mitigation personnel shall have the following responsibilities:
  - Fire watch
  - Notify FD if a fire occurs
  - Maintain until decommissioning is finished
  - Evacuate building if needed

Electrochemical BESS Tech Specific Protections

Compliance Required [b]	Battery Technology				Other Energy Storage System and Battery Technologies [b]	Capacitor Energy Storage System [b]
	Lead-acid	Ni-Cad and Ni-MH	Lithium-Ion	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.

Electrochemical BESS Tech Specific Protections

Exhaust ventilation

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

Intake port

Electrochemical BESS Tech Specific Protections

Gas detector

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

- Initiate distinct audible and visible alarms, transmit an alarm to an approved location, de-energizing of the battery charger, activate the mechanical ventilation, and 2 hours of standby power

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

Electrochemical BESS Tech Specific Protections

Spill control and neutralization

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

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

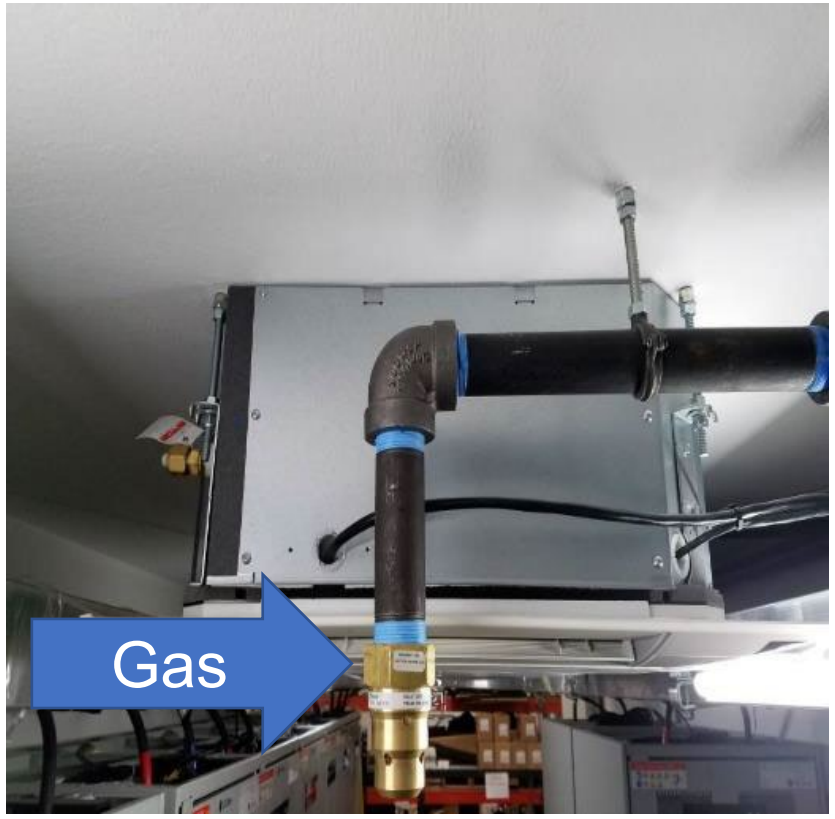
Electrochemical BESS Tech Specific Protections

Explosion control

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

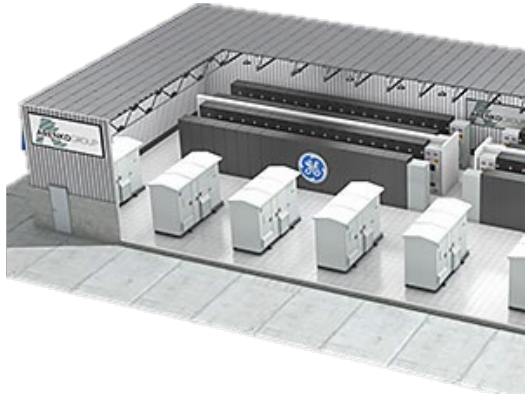
1. Deflagration venting
   - Pressure panels
2. Deflagration prevention
   - Exhaust fans
   - 25 % of LFL

Fire Suppression



Fire Safety

Dedicated Use Building



Non-Dedicated Use Building

Outdoors Near Exposures

Outdoors Remote

Walk-in Containers

Max Enclosure Size

Means of Egress

Security of Installations

HVAC units

Exhaust ventilation

SDGE, Escondido 120 MW installation

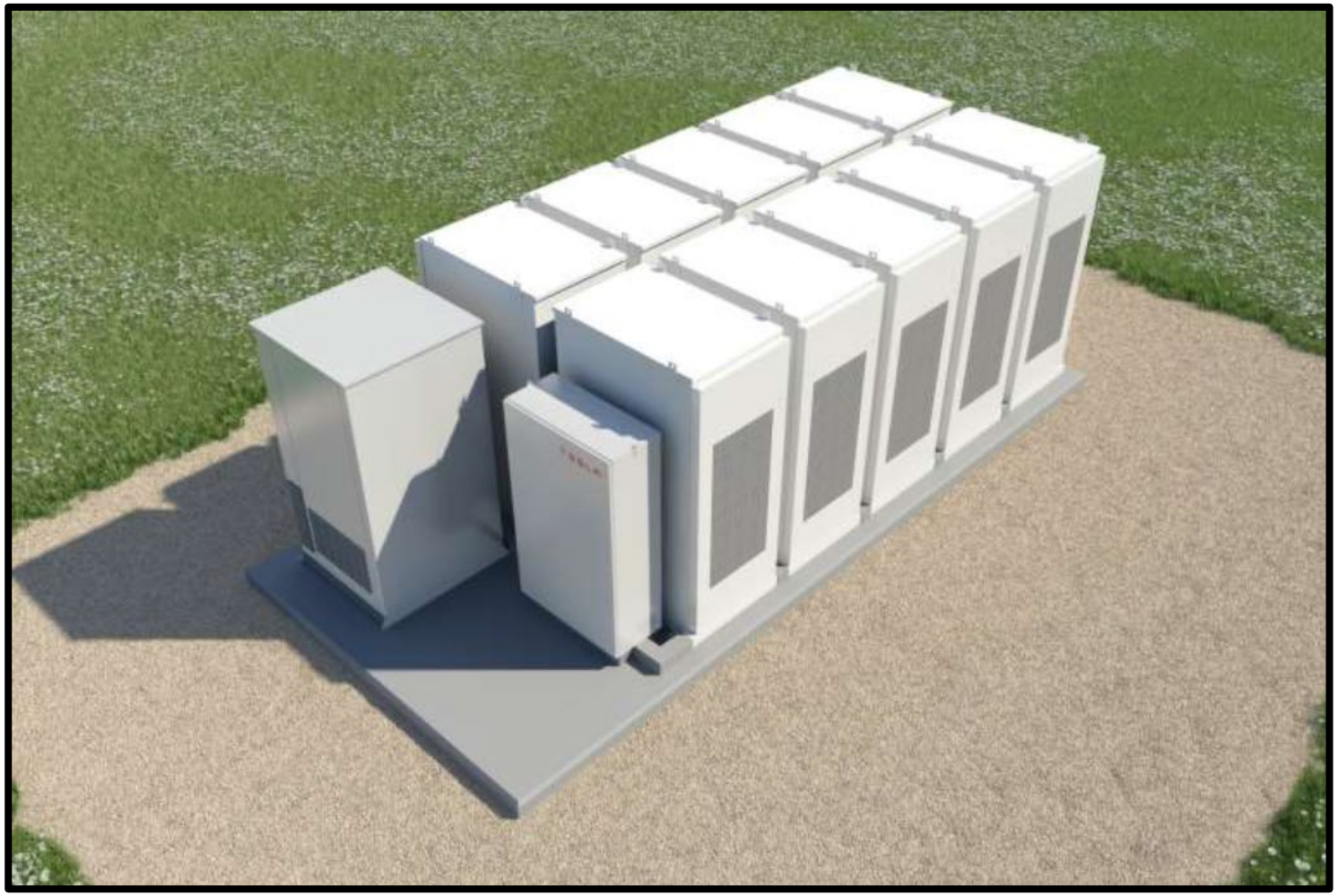
Walk-in Unit Installation

#	Description
1	Battery rack
2	Fire Suppression System: Clean Agent
3	Energy Management System
4	HVAC: No ingression, exchanger type
5	Battery Control Panel
6	Power Inverter

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

BESS Cabinets

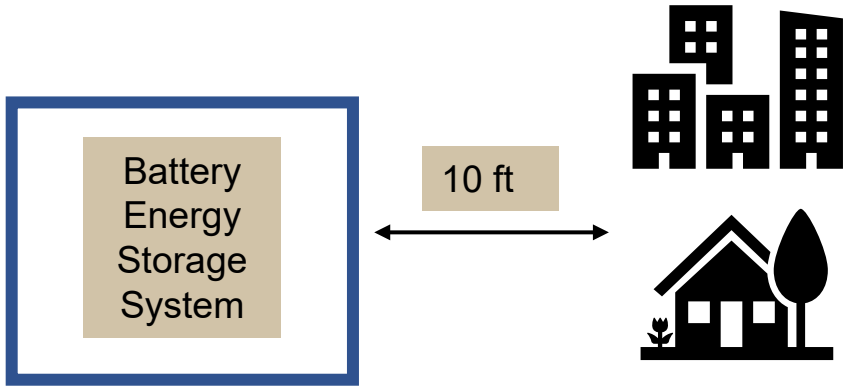
Cabinet Systems



Outdoor Installations

Clearance to exposures

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



Exceptions to reduce clearance to 3ft:

- All exposures:
  - 1-hour fire barrier 5ft above and around system boundary
- Buildings:
  - Wall adjacent to system is noncombustible, 2-hour fire rated, with no openings or combustible overhangs
  - Noncombustible, weatherproof enclosure around system and large-scale fire testing demonstrates fire won't spread

Outdoor Installations

Exterior wall installations

May be installed on exterior walls if:

1. Max capacity of each unit ≤ 20kWh
2. Otherwise in compliance with Fire Code
3. Installed according to manufacturer specifications
4. Individual unit separation ≥ 3ft
5. Units ≥ 5ft from doors, windows, operable openings into buildings, or HVAC inlets

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

Questions?

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CleanEnergyHelp@nyserda.ny.gov

Helpful Links

Clean Energy Siting Homepage
www.nyserda.ny.gov/Siting

Battery Energy Storage Guidebook
www.nyserda.ny.gov/StorageGuidebook

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