Ulster County Planning Board

Planner's Memorandum: Zoning and Siting Considerations for Battery Energy Storage Systems (BESS)

Introduction and Purpose

The purpose of this memorandum is to provide technical and regulatory guidance for municipalities on zoning, siting, and operational considerations for the review and approval of Battery Energy Storage Systems (BESS). These systems are increasingly being considered for development across New York State, with several proposed in Ulster County to support electric grid reliability, integrate renewable energy resources, manage peak demand, and enhance energy resiliency.

Battery energy storage plays a critical role in advancing New York State's energy policy. The State has established aggressive clean energy targets, including 70 percent renewable electricity by 2030 and a zero-emission electricity system by 2040 pursuant to the Climate Leadership and Community Protection Act codified in New York Environmental Conservation Law Article 75.

Energy storage is a foundational component of achieving these goals. The New York State Energy Research and Development Authority (NYSERDA) has established a statewide target of deploying 6,000 megawatts (MW) of energy storage capacity by 2030, including battery and other storage technologies.

This memorandum evaluates best practices and regulatory standards primarily on front-of-the-meter (FTM), utility-scale battery energy storage systems, which typically range from several megawatt-hours (MWh) to hundreds of MWh and are interconnected directly to the electric grid. (NYSERDA Guidebook, 2023). The major resources used to develop the memorandum are listed below:

- NYSERDA Battery Energy Storage System Guidebook for Local Governments (2023)
- NYSERDA Model Local Law for Battery Energy Storage Systems
- 2020 New York State Fire Code §1207 – Electrical Energy Storage Systems
- National Fire Protection Association Standard 855
- UL 9540 Energy Storage System Certification

- UL 9540A Thermal Runaway Fire Propagation Test Method
- American Planning Association land-use guidance
- Solano County, California BESS ordinance case study and local law
- U.S. Department of Energy, energy storage planning guidance
- Town of Poughkeepsie BESS Law

Overview of Battery Energy Storage Systems

Battery Energy Storage Systems store electrical energy and release it later when needed. They absorb electricity when supply exceeds demand and discharge electricity when demand increases. These operational characteristics work well when integrated with intermittent renewable energy sources such as wind and solar, and the typical demand curve seen by most, if not all, major utilities, helping to stabilize grid operations and improve reliability.

The U.S. Department of Energy identifies energy storage as essential infrastructure supporting renewable integration and grid resilience.

Typical System Components

Utility-scale BESS installations typically consist of the following integrated components:

- Battery modules (commonly lithium-ion chemistry)
- Battery Management System (BMS)
- Inverters and power conversion systems
- Thermal management systems
- Fire detection and suppression systems
- Electrical transformers and interconnection infrastructure
- Supervisory control and monitoring systems

Battery Type	Chemistry	Key Benefits	Common Use Cases	Safety Considerations
Lithium-Ion (NMC)	Nickel Manganese Cobalt	High energy density, widely available, good for compact spaces	Grid-scale storage, peak shaving, frequency regulation	Flammable electrolytes; thermal runaway risks; requires robust fire suppression systems
Lithium-Ion (LFP)	Lithium Iron Phosphate	Better thermal stability than NMC, longer cycle life	Solar-plus-storage projects, backup power, EV charging infrastructure	Still flammable, but safer than NMC; lower risk of thermal runaway
Flow Batteries	Various (Ex. Vanadium Redox, Zinc-Bromine)	Long duration storage, scalable, non-flammable electrolyte	Long-duration energy shifting, microgrids, renewable smoothing	Large footprint; complex maintenance; fewer fire hazards
Lead-Acid	VRLA (Valve-Regulated Lead-Acid)/ Flooded	Low upfront cost, mature technology	Small-scale backup, rural electrification, legacy systems	Heavy, toxic materials; shorter lifespan; limited depth of discharge

Lithium-ion batteries are currently the dominant technology due to their high energy density, efficiency, and declining cost (International Energy Agency, 2023). Lithium, as a chemical component, is not a catch-all term; other batteries use different chemical compositions. The IREC's Large-Scale Solar & Battery Storage Toolkit summarizes these as follows by different chemistries, benefits, common uses, and safety in the table to the left.

Key Takeaways from the IREC from this:

- "Lithium-ion (NMC and LFP) batteries are the most common for large-scale solar due to their high efficiency and fast response times.
- Flow batteries are ideal where long-duration (4+ hours) energy shifting is needed.
- Lead-acid batteries are becoming less common in new utility-scale installations but may still appear in legacy or low-cost applications."

Common Applications

Utility-scale battery energy storage systems provide multiple operational and economic benefits, including:

- Frequency regulation and grid stabilization
- Renewable energy integration, particularly wind and solar firming
- Peak demand reduction and load shifting
- Transmission and distribution system support
- Backup power and grid resiliency

The U.S. Department of Energy has identified energy storage as "essential for maintaining electric grid reliability while integrating variable renewable resources" (DOE, *Energy Storage Grand Challenge Roadmap*, 2020).

Tiered Regulatory Framework for BESS

The NYSERDA Model Local Law provides a two-category framework for municipal permitting review based on aggregate energy capacity: Tier 1 ≤ 600kWh and Tier 2 600kWh. These categories guide the permitting process but do not necessarily correspond directly to behind-the-meter or front-of-the-meter installations.

Tier 1 Battery Energy Storage Systems

Tier 1 systems are generally accessory, behind-the-meter installations. These systems require compliance with the Uniform Code, electrical permits, and applicable fire code provisions, but do not require Planning Board approval. This streamlined review reflects the limited land-use and public safety impacts of small-scale systems. NYSERDA would allow Tier 1 BESS to be permitted in all zoning districts, subject to the Uniform Code and "BESS Permit," and treated as an accessory exempt from site plan review.

Tier 2 Battery Energy Storage Systems

Tier 2 systems are typically front-of-the-meter, utility-scale installations. NYSERDA Model Law requires these systems to undergo Planning Board review through a special use permit and site plan approval. Application materials should include detailed site plans, equipment specifications, electrical diagrams, emergency response plans, fire safety compliance documentation, stormwater pollution prevention plans, operation and maintenance manuals, and decommissioning plans with financial assurance.

Municipal Regulatory Authority

Municipalities possess broad legal authority to regulate land use, including BESS systems, pursuant to their police powers to protect public health, safety, and welfare. In New York State, this authority is codified in:

- Town Law §261
- Village Law §7-700
- General City Law §20

These statutes authorize municipalities to regulate land use, building location, and infrastructure to promote safety, environmental protection, and orderly development.

BESS systems fall squarely within the purview of traditional zoning authority as utility infrastructure or energy facilities. Courts have consistently upheld municipal authority to regulate utility infrastructure through zoning provided such regulations are reasonable and serve legitimate public purposes (See *Matter of Consolidated Edison Co. v. Hoffman*, 43 N.Y.2d 598 (1978)).

Municipal zoning regulations serve several key functions in regulating BESS:

- Ensuring compatibility with surrounding land uses
- Minimizing public safety risks
- Establishing operational and safety standards
- Protecting environmental resources
- Providing predictable regulatory review

Land Use Classification and Zoning Framework

BESS systems are typically classified under municipal zoning codes as one of the following:

- Utility infrastructure
- Public utility use
- Energy generation or storage facility
- Major utility facility

The means by which they are classified per the above aligns with their operational characteristics, scale, and infrastructure function (American Planning Association, PAS Report 589, 2016).

Utility-scale BESS facilities are generally treated as principal uses rather than accessory uses because they operate independently of on-site energy consumption and provide grid-level services.

Zoning District Allowances

Based on national zoning practices and NYSERDA model regulations, Tier 2 battery storage systems are typically regulated as follows and are added to their municipalities' schedule of uses as follows:

Zoning	**Typical Review**
Industrial	Special Permit and/or Site Plan Review
Utility	Special Permit and/or Site Plan Review
Commercial	Special Permit and/or Site Plan Review
Agricultural	Special Permit and/or Site Plan Review – with restrictions such as Prime Soils and Soils
Residential	Prohibited or highly restricted

Municipal regulations governing where to allow Tier 1 BESS facilities should recognize their need to be located near utility corridors and/or substations. It should be noted that BESS facilities, as part of connecting high-voltage lines in transmission corridors, often build their own smaller substation to serve as the point of connection.

Once these areas are known, the types of land that should be prioritized for these uses include brownfields, closed landfills, former mine lands, and previously disturbed, unproductive lands. Agricultural lands should be avoided where prime farmland or soils of statewide importance occur.

Other Considerations to include:

- Separation from residential uses and areas of congregation, such as churches and schools
- Separation from sensitive environmental areas
- Appropriate infrastructure capacity

The use of an overlay zoning technique appears most appropriate to accommodate the above considerations.

Special Permit and Site Plan Review

Municipalities should regulate BESS systems through special use permits and site plan review. This permitting process should be supplemented with specific criteria to ensure that the considerations mentioned above can be addressed as part of this structured framework for evaluating site-specific impacts and ensuring compliance with safety and zoning standards.

Special use permits allow municipalities to evaluate:

- Suitability
- Safety measures
- Emergency access
- Environmental impacts
- Compatibility with surrounding land uses – Visual Impacts, noise, neighborhood context

Site plan review enables municipalities to assess technical details such as:

- Facility layout
- Access roads and emergency access
- Screening and buffering
- Drainage and stormwater management
- Traffic Impacts

Siting and Location Considerations

Preferred Locations

Appropriate siting of BESS is essential to minimize risks and land-use conflicts. Preferred siting locations include:

- Industrial zoning districts
- Utility substations and electrical infrastructure corridors (high-voltage transmission lines)
- Brownfield and previously disturbed sites
- Areas with existing utility infrastructure

Again, locating battery storage near substations reduces the need for additional transmission infrastructure and minimizes environmental impacts (NYSERDA Guidebook, 2023). These location preferences are recommended to be prioritized and used to focus the zoning districts where these types of uses are allowed.

Restricted or Sensitive Locations

Municipal regulations commonly restrict or prohibit battery storage systems in sensitive areas, including:

- Residential zoning districts
- Schools and daycare facilities
- Hospitals and emergency services facilities
- Flood hazard areas
- Environmentally sensitive areas
- Prime Farmland and Farmland of Statewide Significance

These restrictions reduce risk exposure, protect the environment, and improve quality of life.

Setback and Buffer Requirements

Setbacks and buffers are critical safety and land use planning tools that provide physical separation between battery energy storage systems and surrounding properties.

Typical setback requirements include:

Feature	Setbacks
Property lines	20–100 feet
Residential structures	100–300 feet
Public rights-of-way	50–100 feet

Setbacks serve several purposes:

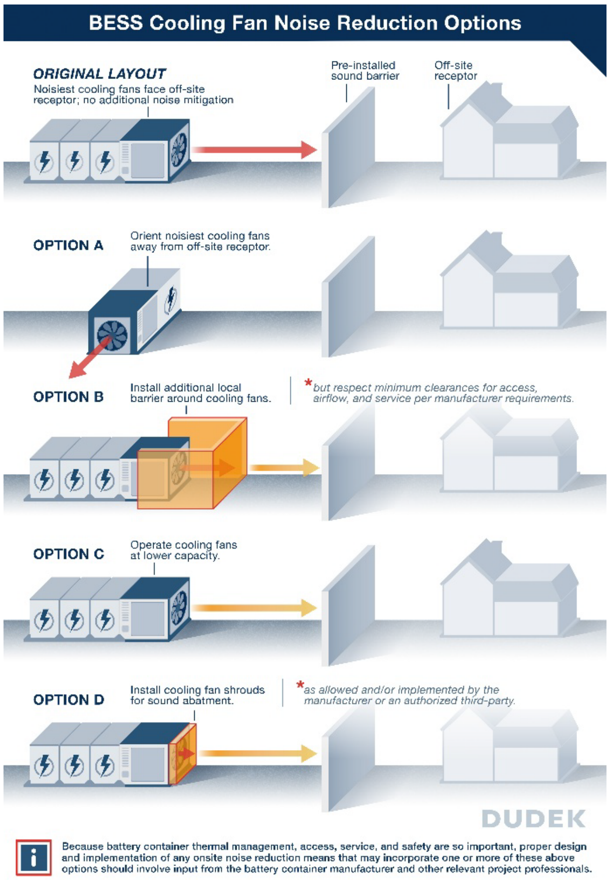
- Provide emergency response access
- Reduce fire risk exposure
- Minimize visual and noise impacts
- Protect adjacent properties

NFPA 855 and the New York State Fire Code also establish minimum separation distances between individual battery storage units and structures. Further setback considerations may also be applied to the question of whether the chosen battery technology poses a risk of thermal runaway. As an example, a safety isolation zone of 330 feet is often considered by various regulatory agencies.

Noise Considerations

For noise standards, the New York State Model Zoning Statute from NYSERDA currently recommends:

"The 1-hour average noise generated from the battery energy storage systems, components, and associated ancillary equipment shall not exceed a noise level of fifty (50) dBA during the day and forty-five (45) dBA during the night, measured twenty-five (25) feet from the façade of any residence or Occupied Community Building, existing or under construction at the time of the permit application. If the sound from any source from the structure exhibits a tonal prominence, then the respective noise limit shall be reduced by five (5) dBA. Applicants may submit equipment and component manufacturers' noise ratings to demonstrate if any source exhibits tonal prominence as measured from the residence or Occupied Community Building. The applicant may be required to provide Operating Sound Pressure Level measurements from one or more neighboring residences, within reason, to demonstrate compliance with this standard following system commissioning."



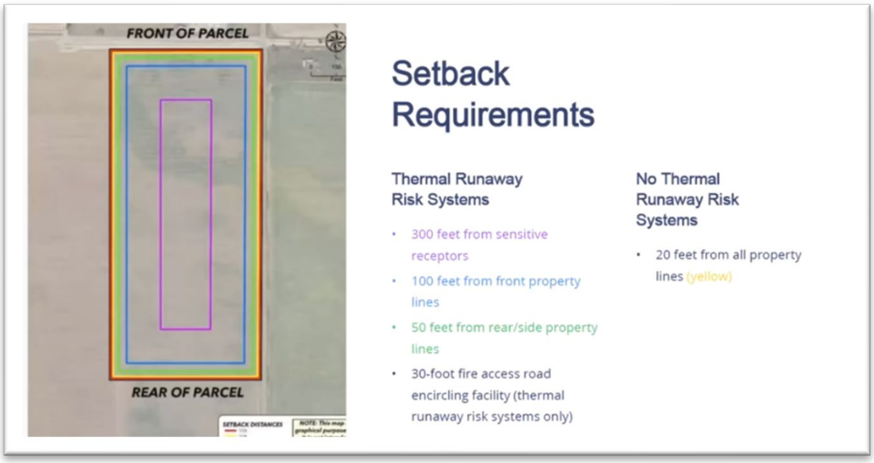
As such, buffer requirements should be contingent on an analysis of the system and testing against these noise-level standards. Other requirements to reduce noise have more to do with the placement, adjustment, or modification of equipment. Noise Monitoring Services offers a few such recommendations, as shown in the image to the left.

Thermal Runaway and Safety Risks/Technology-Based Regulations

Thermal runaway represents the primary safety hazard associated with lithium-ion battery systems. Thermal runaway is a chain reaction within a battery cell that can lead to a rapid rise in temperature, potentially causing a fire or explosion (National Renewable Energy Laboratory, 2021). Therefore, battery technologies that pose a thermal runaway risk require enhanced review.

It is recommended that all BESS proposals undertake a thermal runaway propagation analysis, hazardous gas plume modeling, hazardous chemical analysis, and include expanded setbacks from sensitive receptors as part of their site development. Furthermore, as part of the review and approval process, a hazard mitigation analysis should be completed, an emergency response plan developed, and a safety training plan implemented for local first responders. A UL 9540A test report is also a critical component. Additional requirements may include emergency response funding, environmental monitoring, and a fire apparatus access road surrounding the installation.

Technologies demonstrated to have no or low potential for thermal runaway propagation may qualify for reduced setbacks and simplified review requirements. For example, Solano County, California, uses the following setback requirements



A **performance-based regulatory approach** can allow sites to have reduced setbacks or simplified review when technologies demonstrate lower fire-propagation risk.

Visual Screening and Land Use Compatibility

Battery energy storage systems can have visual impacts due to equipment enclosures, fencing, and electrical infrastructure. Municipal regulations typically require visual mitigation measures such as:

- Opaque fencing
- Landscaping buffers, including berms
- Screening walls
- Placement in industrial zones
- Wildlife-friendly fencing

These measures preserve neighborhood character and reduce aesthetic impacts.

The American Planning Association recommends buffering and screening of utility infrastructure to minimize visual impacts and maintain land-use compatibility (APA PAS Report 589).

Fire Safety and Code Compliance

Battery energy storage systems must comply with applicable fire and building codes, including:

- New York State Fire Code §1207
- NFPA 855 Standard for Energy Storage Systems (2023 edition)
- UL 9540 Energy Storage System Certification
- UL 9540A Fire Safety Testing Standard

These codes regulate:

- Fire detection and suppression
- Emergency access
- Separation distances
- Hazard mitigation

The New York State Fire Code Section 1207 establishes specific requirements for lithium-ion battery installations, including system spacing, fire suppression, and emergency access provisions.

Planning Board Review Considerations by Tier and Technology

For Tier 1 systems, review is limited to building and fire code compliance. For Tier 2 systems using lower-risk technologies, Planning Board review should focus on land-use compatibility, screening, noise, and decommissioning. For Tier 2 systems with thermal runaway risk, a full technical review should include hazard mitigation analysis, including a review of available or specialized fire response equipment, emergency response training necessary, plume modeling, which analyzes the impacts from thermal runaway events based on prevailing winds, emergency access, fire department coordination, and environmental monitoring.

Step 1: Determine system capacity.

• 600 kWh or less → Tier 1 → Administrative review (building permit, electrical permit, fire code compliance).

• Greater than 600 kWh → Tier 2 → Proceed to Step 2.

Step 2: Determine functional role.

• Behind-the-meter and accessory → Confirm zoning compliance → Site plan review if locally required.

• Front-of-the-meter and principal use → Special use permit + Site plan review + SEQRA.

Step 3: Determine battery chemistry risk profile.

• No thermal runaway risk demonstrated → Standard setbacks and buffering.

• Thermal runaway risk present → Enhanced setbacks, hazard mitigation analysis, emergency response coordination, and technical studies.

Step 4: Confirm required submittals for Tier 2 systems.

• Site plan and grading
• Electrical one-line diagram
• Equipment specifications
• Fire safety and emergency operations plan
• Stormwater and environmental controls
• Noise analysis
• Decommissioning Requirements including:
  - removal of battery equipment
  - site restoration
  - cost estimate
  - financial security (bond or letter of credit).

Step 5: Planning Board decision-making.

• SEQRA determination
• Compatibility with zoning and comprehensive plan
• Adequacy of emergency access and fire protection
• Visual, noise, and environmental impact mitigation

Conclusion

Battery Energy Storage Systems represent critical infrastructure that supports renewable energy integration, grid reliability, and energy resilience.

With appropriate zoning regulations, safety standards, and planning review procedures, municipalities can accommodate these facilities while protecting public health, safety and preserving both the environment and quality of life.

Adopting regulations consistent with NYSERDA guidance, national fire codes, and established planning practices provides a predictable regulatory framework that supports both community protection and state energy policy goals.

References

New York State Energy Research and Development Authority. (2023). *Battery Energy Storage System Guidebook for Local Governments.*

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U.S. Department of Energy. (2020). *Energy Storage Grand Challenge Roadmap.*

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Solano County, California. Battery Energy Storage Ordinance.

Interstate Renewable Energy Council (IREC) Large-Scale Solar & Battery Storage Toolkit LSS_BESS Toolkit Checklist 5.9.25.docx

Battery Energy Storage Systems (BESS) Ordinances: Solano County CA Case Study Planning Webcast Series - https://www.youtube.com/watch?v=uP2CMpiCgr4

https://noisemonitoringservices.com/battery-energy-storage-system-noise-solutions/

Please contact the Ulster County Planning Department for More Information or Technical Assistance on this topic and more.

ulstercountyny.gov/planning

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