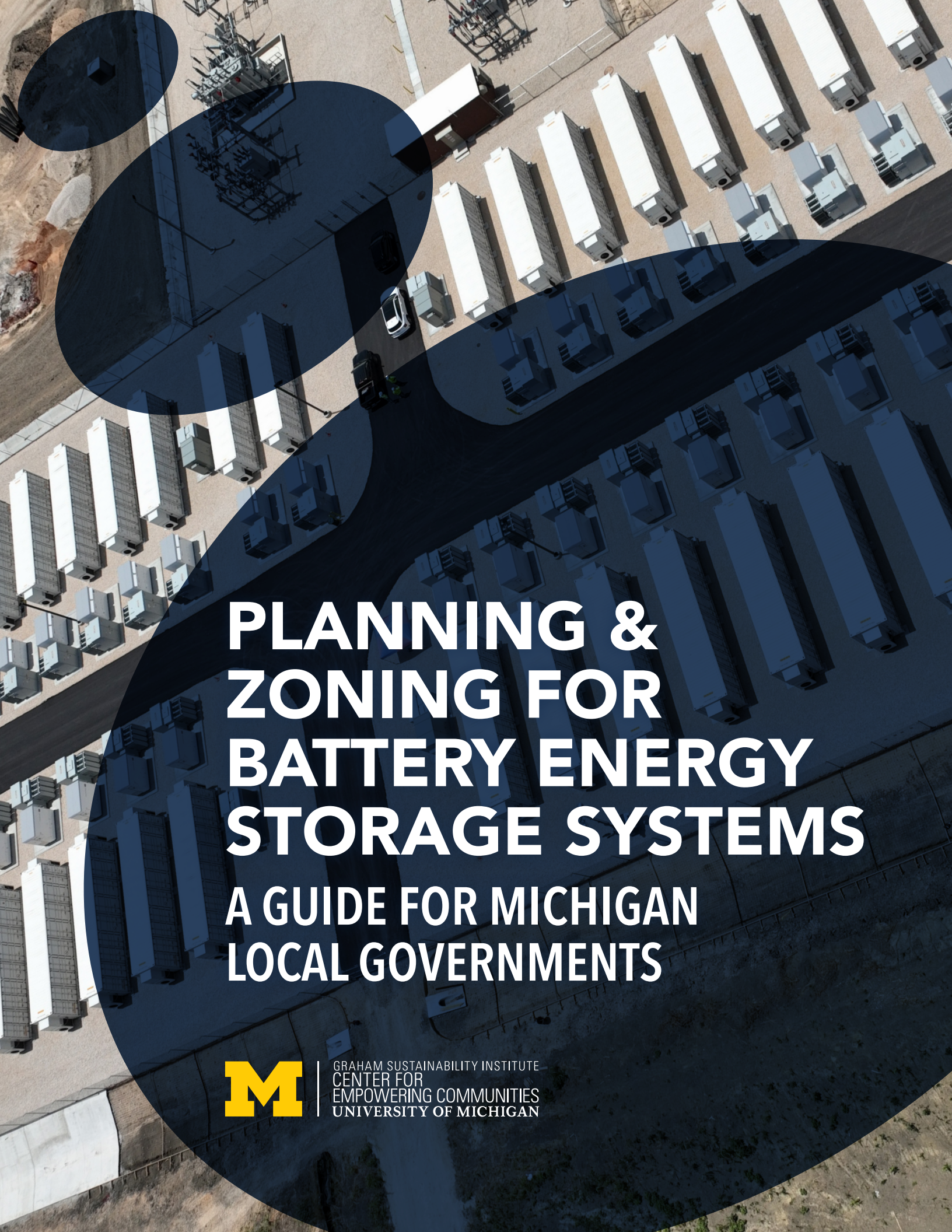

PLANNING & ZONING FOR BATTERY ENERGY STORAGE SYSTEMS

A GUIDE FOR MICHIGAN LOCAL GOVERNMENTS

GRAHAM SUSTAINABILITY INSTITUTE
CENTER FOR EMPOWERING COMMUNITIES
UNIVERSITY OF MICHIGAN

The 350 MW Crimson Storage project in Riverside County, CA.
(Photo: Bureau of Land Management California)

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Cover image by Key Capture Energy.

Rendering of DTE's planned Trenton Channel Energy Center with a 220 MW BESS on the site of the former Trenton Channel coal power plant. *(Photo: DTE Energy)*

OVERVIEW

Michigan is poised to lead the nation in deploying battery energy storage systems (BESS). Significant cost reductions in battery storage have made it a compelling option to enhance grid reliability and facilitate smoother integration of renewable energy sources.[1]

In November 2023, Michigan became the first state in the Midwest[2] to set a Statewide Energy Storage Target, calling for 2,500 megawatt (MW) of energy storage by 2029 in Public Act 235 of 2023.[3] Even prior to this legislation, Michigan's two largest utilities had announced plans to incorporate energy storage into their portfolios: Consumers Energy plans to deploy 75 MW of storage by 2027 and 550 MW by 2040, as outlined in its 2021 Integrated Resource Plan.[4] Similarly, DTE plans to add more than 1,500 MW of storage capacity by 2042.[5]

The purpose of this guide is to help Michigan local government officials and planners understand the current landscape of BESS deployment. It aims to empower them to effectively incorporate BESS considerations into their planning policies and local zoning ordinances. The guide first presents an overview of the current BESS context in Michigan, detailing common scales and components and discussing relevant land use considerations.

Starting on Page 15, the guide presents sample language for integrating BESS of all scales into municipal zoning ordinances. Beginning on Page 28, the guide includes a discussion of local zoning options for large-scale BESS in light of Michigan's new energy siting law (Public Act 233 of 2023). These options include adopting a "Compatible Renewable Energy Ordinance" (CREO), requiring all large BESS projects to obtain state certificates, or adopting incompatible but workable zoning regulations.

The recommendations and insights presented in this document are based on peer-reviewed research whenever available and conclusive. It is important to note that the zoning and regulatory frameworks discussed may not be applicable in other states and are primarily tailored for lithium-ion batteries, which currently dominate the market.[6] Given the rapid pace of innovation in energy storage technology, the authors acknowledge the guide's need for periodic updates as technology evolves and learnings are gleaned from BESS deployment.

Planning & Zoning for Battery Energy Storage Systems: A Guide for Michigan Local Governments was developed by experts at the Center for EmPowering Communities at the University of Michigan's Graham Sustainability Institute. The document underwent further review by content experts from local and state government, law, planning professionals, utility experts, renewable energy and energy storage developers, energy-related nonprofits, and academics. Its intent is to support Michigan communities in making informed public policy decisions related to BESS development.

1 U.S. Energy Information Administration. (2020). https://www.eia.gov/todayinenergy/detail.php?id=45596. National Renewable Energy Laboratory. (2022). https://www.nrel.gov/docs/fy22osti/83586.pdf. Together data show decline from $2,152/kWh in 2015 to $446/kWh in 2022.

2 MLive. (2023). Michigan first state in Midwest to set power storage benchmark. https://www.mlive.com/public-interest/2023/11/michigan-first-in-midwest-to-set-power-storage-benchmark.html

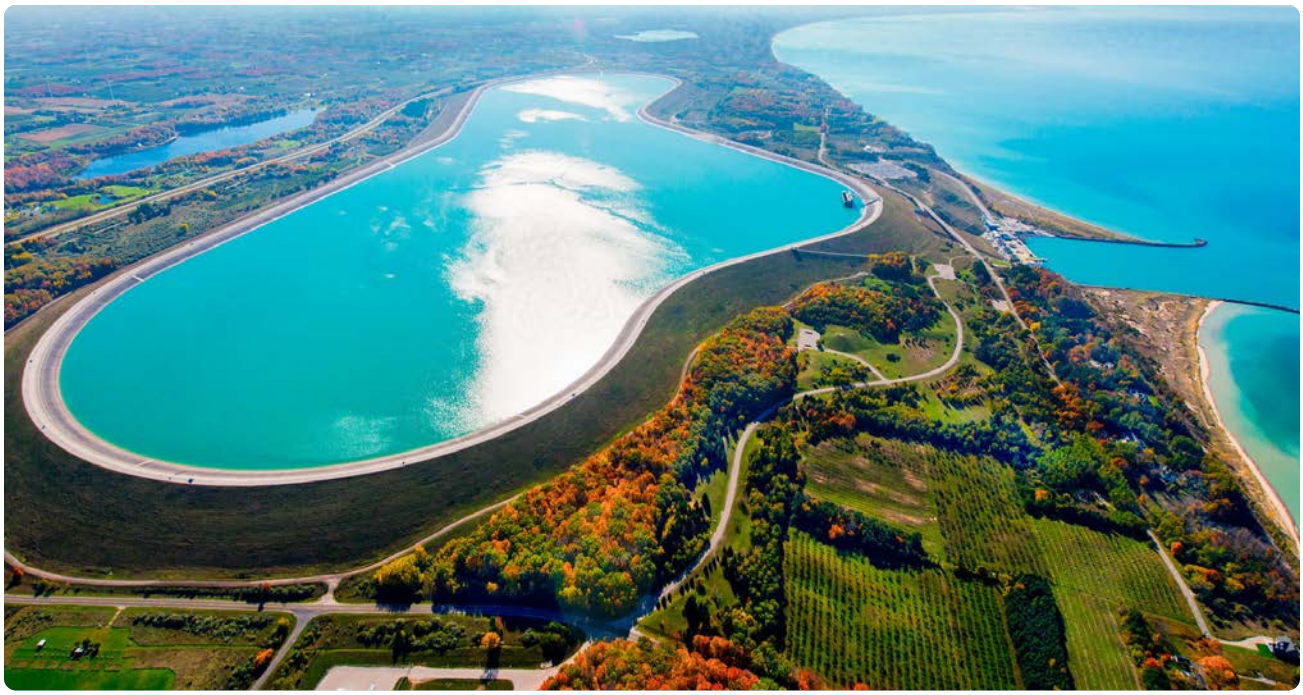
3 Michigan Legislature. (2023). Public Act 235 of 2023. https://www.legislature.mi.gov/Bills/Bill?ObjectName=2023-SB-0271

4 Michigan Public Service Commission. (2022). Consumers Energy 2021 Integrated Resource Plan, Issue Brief. https://www.michigan.gov/mpsc/-/media/Project/Websites/mpsc/consumer/info/briefs/Consumers-Energy-2021-Integrated-Resource-Plan-Issue-Brief.pdf

5 DTE Energy. Michigan's Clean Energy Future: Net Zero Carbon Emissions by 2050. https://dtecleanenergy.com

6 More than 97% of operable battery storage capacity in 2023 is based on lithium-ion batteries. U.S. Energy Information Administration (EIA). (2024). Form EIA-860 detailed data with previous form data (EIA-860A/860B). https://www.eia.gov/electricity/data/eia860/

ENERGY STORAGE IN MICHIGAN



With a capacity of 2,292 MW, the Ludington Pumped Storage Plant is located on a 1,000 acre site along Lake Michigan. It is jointly owned and operated by Consumers Energy and DTE Energy. *(Photo: Consumers Energy)*

Energy storage technologies are evolving in Michigan to meet increasing demands for renewable energy integration and grid stability. This guide explores the technologies' growing role in the state's energy landscape.

The concept of energy storage is not new to Michigan. The Ludington Pumped Storage Plant, located on the shores of Lake Michigan, has been operational since the early 1970s and is one of the largest pumped storage facilities in the United States.[7, 8] Initially built to store surplus nuclear power, the plant pumps water to a high elevation during periods of low demand and releases it to generate electricity during peak demand. This process exemplifies how storage facilities can balance energy availability and demand. As the energy mix increasingly includes intermittent sources like wind and solar, storage systems provide a suite of benefits to the overall functioning of the grid beyond smoother renewables integration, such as frequency regulation and voltage support.[9] However, due to the limited availability of suitable sites for new pumped storage projects, electric utilities are turning to alternative energy storage technologies.

Among the various energy storage technologies under development, lithium-ion BESS have become the prevailing technology deployed across the country. Compared to other battery storage technologies, including nickel- or sodium-based batteries, lead-acid batteries, and flow batteries, lithium-ion batteries are favored for their better energy retention between recharge and discharge cycles and for their quick response time in

7 Consumers Energy. Pumped Storage Hydro Electricity. https://www.consumersenergy.com/about-us/electric-generation/renewables/hydroelectric/pumped-storage-hydro-electricity

8 DTE Energy. Energy Storage: Aligning Renewable Energy and Electricity Demand. https://www.dteenergy.com/us/en/residential/community-and-news/renewable-energy/energy-storage.html

9 Bowen, T., Chernyakhovskiy, I., & Denholm, P. (2019). Grid-Scale Battery Storage: Frequently Asked Questions. National Renewable Energy Laboratory. https://www.nrel.gov/docs/fy19osti/74426.pdf

delivering energy to customers, among other advantages. Widely used in electric vehicles and portable electronics,[10] lithium-ion batteries also account for more than 97% of the grid-scale battery storage capacity in the United States as of 2023.[11] Consequently, this guide focuses on lithium-ion BESS.

Lithium-ion BESS technologies are highly scalable and are already being marketed to consumers for private use, such as in Tesla Powerwalls and other home energy storage products. These small-scale applications are often paired with rooftop solar systems to store energy for use during the night, reduce electricity consumption during peak-rate hours, or serve as an emergency backup during power outages. In 2021, the energy storage capacity of residential systems in Michigan totaled just below 5 MW (4.897 MW).[12]

Currently, only one utility-scale BESS (≥1 MW) project is operational in Michigan. The Parkview Battery Project, located on Western Michigan University's campus and owned by Consumers Energy, has been storing energy from nearby solar sources since becoming operational in 2018.[13] Additionally, Consumers Energy operates two smaller BESS in Grand Rapids and Cadillac.[14, 15] The utility has plans for more BESS projects, and DTE is also looking to deploy BESS in the near future. In June 2024, DTE announced a 220 MW lithium-ion BESS to be constructed on the site of its retired Trenton Channel Power Plant in Wayne County, with an anticipated operation start in 2026. Once operational, this will be the largest BESS in the region.[16]

The 1 MW Parkview Battery Project on Western Michigan University's campus in Kalamazoo is the first lithium-ion BESS in Michigan. *(Photo: Consumers Energy)*

10 Pacific Northwest National Laboratory. Types of Batteries. https://www.pnnl.gov/explainer-articles/types-batteries

11 U.S. Energy Information Administration (EIA). (2024). Form EIA-860 detailed data with previous form data (EIA-860A/860B): 2023 (early release). https://www.eia.gov/electricity/data/eia860/

12 U.S. Energy Information Administration (EIA). (2023). 2023 Early Release Battery Storage Figures. (Figure 14). https://www.eia.gov/analysis/studies/electricity/batterystorage/

13 Consumers Energy. (2018). News Release: Consumers Energy Kicks Off Battery Storage Era at Western Michigan University. https://www.consumersenergy.com/news-releases/news-release-details/2018/09/17/Consumers-Energy-Kicks-Off-Battery-Storage-Era-At-Western-Michigan-University

14 Consumers Energy. (2019). News Release: Consumers Energy Dedicates First Ever Solar, Battery Storage Systems on Grand Rapids' West Side. https://www.consumersenergy.com/news-releases/news-release-details/2019/01/23/consumers-energy-dedicates-first-ever-solar-battery-storage-systems-on-grand-rapids-west-side; Presentation for Michigan Materials Management Division: Circuit West Battery Storage Project. https://www.michigan.gov/-/media/Project/Websites/egle/Documents/Programs/MMD/Energy/presentation/energy-storage-session4d.pdf?rev=66c14c706f5d4ff790aa989232edcd92

15 Consumers Energy. Solar Gardens Project Locations. https://www.consumersenergy.com/residential/savings-and-clean-energy/renewable-energy/solar-gardens/locations#cadillac-solar-garden

16 DTE Energy. (2024). DTE Energy to build region's largest battery energy storage center at site of retired Trenton Channel coal plant. https://ir.dteenergy.com/news/press-release-details/2024/DTE-Energy-to-build-regions-largest-battery-energy-storage-center----at-site-of-retired-Trenton-Channel-coal-plant/default.aspx

BESS SCALES & COMPONENTS

BESS at various scales: A residential on-site BESS, a small off-site BESS with 20 MW in New York, and a large off-site BESS with 100 MW in Texas. *(Photos: SunPower; Key Capture Energy)*

This section explores lithium-ion battery energy storage systems across various scales, configurations, and related components.

BESS TYPES

Battery energy storage systems generally fall into two distinct categories based on where the power will be used.[17]

On-Site: On-site BESS, sometimes referred to as "behind-the-meter," store power that is used directly by the home or business where the battery is located, making them inherently accessory to the property's primary use. These systems can vary in size, ranging from as small as a residential circuit breaker to as large as outdoor heating and cooling equipment. On-site systems may be mounted on the inside or outside walls of a building or housed in a ground-mounted, cabinet-style enclosure, typically no larger than an HVAC unit.

Off-Site: Off-site BESS, sometimes referred to as "front-of-the-meter," contain large-scale batteries that store energy from nearby power generation facilities or operate as standalone systems, charging from and discharging directly into the electrical grid. Standalone systems typically charge during periods of energy surplus on the grid and discharge during high-demand times. Before the electricity from off-site BESS can be used by individual consumers, it must pass through an electric meter located on each user's property. Off-site BESS may connect to the grid either through distribution lines serving local utility customers or transmission lines linking electricity distribution systems with distant power plants.

Hybrid BESS: When off-site BESS are co-located with power generation facilities, they are commonly referred to as hybrid projects. Many newly developed hybrid BESS in the U.S. are co-located with solar or wind energy systems. Just as different energy generation sources have distinct characteristics that influence their zoning treatment (e.g., wind and gas-fired power plants may be suitable in different zoning districts), BESS also have specific characteristics that make them more or less suitable for particular districts or situations. In a hybrid project, it may be appropriate to consider the BESS and generation components as two distinct principal land uses in close proximity, sometimes even on the same property.[18]

17 Marsh, J. (2023). Behind-The-Meter: What You Need to Know. EnergySage Blog. https://news.energysage.com/behind-the-meter-overview/

18 U.S. Department of Energy. Solar Integration: Solar Energy and Storage Basics. https://www.energy.gov/eere/solar/solar-integration-solar-energy-and-storage-basics

BESS COMPONENTS

All lithium-ion BESS require various components to function effectively, although the specific equipment may vary depending on the technology, type, and scale of the system. Beyond the battery cells themselves, the following are common components typically included in a BESS: thermal, battery, and energy management systems, fire detection and explosion prevention systems, inverters, and wiring.

Battery Cells, Modules, and Racks: Battery cells are the smallest units and provide the direct current (DC) storage capacity of the BESS. Cells come in different forms, including cylindrical cells similar to household batteries with a metallic outer shell, semi-flexible metallic pouch cells that are lightweight, or rectangular prismatic cells in rigid polymer casing.[19] Multiple cells connected in series form battery modules, the core building blocks of a BESS. The construction of each module varies by manufacturer and battery chemistry, but typically includes sensors to monitor cell performance and a wiring harness.

Modules are encased in a solid frame to protect against physical damage and to facilitate installation and connection on racks.[20] While most batteries in operation are broadly classified as lithium-ion, there is considerable variation in their chemical and material compositions. Small-scale devices like electronics and cell phones typically use Lithium Cobalt Oxide batteries,[21] while many electric vehicles use Nickel Manganese Cobalt (NMC) batteries.[22] Among BESS, NMC and Lithium Iron Phosphate (LFP) are the most common chemistries.[23] However, since 2021, there has been a notable shift towards LFP batteries in BESS due to their lower material costs and safety advantages.[24, 25]

Enclosure: To protect the battery modules from weather and temperature fluctuations, they are housed in protective enclosures that also contain critical equipment. These enclosures can range from refrigerator-sized utility cabinets to structures as large as shipping containers. Although many modern BESS enclosures resemble shipping containers, they are highly specialized for BESS needs. For example, many modern enclosures allow for maintenance and emergency access to all equipment directly from exterior doors, enhancing convenience during servicing and facilitating safety and emergency operations. In some cases, dedicated-use buildings similar to warehouses serve as the enclosure, with battery cells installed on racks within the building.

Thermal Management System: In addition to protection from the elements, batteries require temperature regulation to operate properly. The thermal management system is a crucial component of any BESS, as batteries and associated equipment generate significant heat during normal operation. Each module includes thermal barriers, thermal management systems (e.g., HVAC air movement or liquid cooling), and sensors. Additionally, each enclosure features fans and compressor equipment, which are the primary sources of sound in a BESS.

Battery and Energy Management Systems: BESS rely on complex control and monitoring systems to ensure the proper and safe functioning of all components. A central component of any BESS is the battery management system (BMS), which ensures the safe operation of the batteries. For off-site BESS, the BMS monitors and analyzes data, such as voltage and temperature, at multiple levels, including down to the individual cell level. In case of abnormal conditions, the BMS triggers alarms and automatically disconnects the affected module, rack, or enclosure.[26]

19 International Code Council. (2022). Energy Storage Systems: Based on the IBC, IFC, IRC and NEC. https://www.iccsafe.org/wp-content/uploads/Energy-Storage-Systems-Book_FINAL.pdf

20 Ibid.

21 Battery University. Types of Lithium-ion. https://batteryuniversity.com/article/bu-205-types-of-lithium-ion

22 Salgado et al. (2021). The Latest Trends in Electric Vehicles Batteries. Molecules, 26(11), 3188.

23 Pacific Northwest National Laboratory. Lithium-ion Battery (LFP and NMC). https://www.pnnl.gov/lithium-ion-battery-lfp-and-nmc

24 National Renewable Energy Laboratory. (2023). Utility-Scale Battery Storage. https://atb.nrel.gov/electricity/2023/utility-scale_battery_storage

25 Warner, J. (2019). Lithium-Ion Battery Chemistries: A Primer. Chapter 5. Elsevier.

26 National Fire Protection Association (NFPA). (2023). NFPA 855, Annex G.7.3.1. The code can be viewed for free by anyone who registers on the NFPA's website at https://www.nfpa.org/855.

Additionally, off-site BESS use an energy management system (EMS), which monitors the BMS system-wide and responds appropriately to inputs from an energy manager, utility, or operator to charge, discharge, or take other actions.

Fire and Explosion Prevention and Control Systems: Off-Site BESS are subject to stringent equipment standards that require an extensive suite of systems to prevent, detect, and respond to fire and explosion risks. This includes fire/flame, heat, and gas detection systems, as well as alarm and ventilation systems.[27] To manage explosion risk, BESS are equipped to monitor gas levels and prevent the accumulation of explosive concentrations of gases through emergency ventilation and/or safe deflagration and other performance-engineered explosion mitigation systems.[28]

Inverter: Inverters convert the direct current (DC) electricity stored by battery cells into alternating current (AC) electricity, which is compatible with the electrical grid. Some inverters produce sound during operation, which can be managed through proper placement or mitigation-oriented site design based on the sound pressure levels produced. (More detail on sound mitigation can be found on Page 12.)

Wiring: BESS enclosures are wired together to create an electrical circuit that allows current to flow through the component parts. Wiring extends beyond the enclosures to inverters, and depending on the size of the BESS, to transformers, substations, and distribution or transmission lines. Wiring between BESS components is typically installed underground, though connections to the accompanying substation often include above-ground lines.

(Clockwise from top left) Battery modules *(Photo: Agata Bogucka / NREL 88687)*; Battery enclosure *(Photo: Laura Beshilas / NREL 88842)*; Enclosures, inverters, and transformers *(Photo: Key Capture Energy)*; Thermal management system *(Photo: Dennis Schroeder / NREL 50688)*

27 National Fire Protection Association (NFPA). (2023). NFPA 855, Annex G, Section G.7.3. (2022). NFPA 72. The codes can be viewed for free by anyone who registers on the NFPA's website at https://www.nfpa.org/855 and https://www.nfpa.org/72.

28 National Fire Protection Association (NFPA). (2023) NFPA 68. (2024). NFPA 69. The codes can be viewed for free by anyone who registers on the NFPA's website at https://www.nfpa.org/68; NFPA 69 (2024) available at https://www.nfpa.org/69.

WHERE OFF-SITE BESS ARE SITED

When developers consider locations for off-site BESS, several key factors come into play. Understanding these factors can help local governments identify areas within their communities that are most viable for BESS development.

Grid Access: Off-site BESS projects, like utility-scale renewable energy projects such as solar and wind, require proximity to power lines and, ideally, electric substations. Although there is no strict rule about how close a BESS must be to a power line or substation, sites located closer are generally more cost-effective, as they eliminate the need to extend lines to the substation or construct new substations. Besides the cost benefits, closer proximity also helps reduce energy losses. The largest off-site BESS typically connect to the transmission grid, while smaller projects may connect directly to the local distribution grid. Communities can use tools like the U.S. Department of Energy's free online Geospatial Energy Mapper (GEM) to find information about the location of substations and transmission lines within their jurisdiction.[29]

In hybrid projects, BESS are often situated within or immediately adjacent to a power generator (e.g., wind, solar, or natural gas plants) and share the same point of interconnection to the grid. However, stand-alone BESS, which are more common, can be located anywhere within the electric grid and do not necessarily need to be near a power generation facility.

Footprint and Land Availability: The footprint of standalone off-site BESS is relatively small compared to utility-scale renewable energy projects like wind and solar. A typical BESS, whether housed in standalone enclosures or a dedicated-use building, requires 0.03-0.1 acres/MW. In Michigan, the average BESS project under consideration is around 150 MW,[30] requiring up to 10 to 15 acres of land. Even the largest 500 MW off-site BESS would likely occupy no more than 50 acres. Smaller BESS can be deployed in urban areas on as little as one acre of land. When co-located with wind or solar energy systems, BESS often represent only a small fraction of the entire hybrid system's footprint.

Due to their modest footprint, BESS facilities can be sited in urban, suburban, and rural areas. Communities may encourage BESS development on marginal lands, including brownfields and other previously developed properties. BESS can enable the productive use of such lands, offering economic development opportunities for areas that might be compromised or disadvantaged from a redevelopment perspective (see Local Benefits section on Page 9). Examples of BESS on (partially) repurposed industrial sites include the planned Trenton Channel Energy Center on the former Trenton Channel coal plant site in Wayne County, Michigan,[31] and the Moss Landing Energy Storage Facility in California, co-located with an existing natural gas power plant.[32]

While the use of marginal land for BESS development has benefits, it is not yet a common practice due to several challenges. Developing on marginal land may require studies of soil composition to assess safety concerns related to flammable materials, as well as potential changes to foundation or stormwater design. Communities considering BESS as infill should also take into account the proximity of the BESS to neighboring uses. To attract BESS development on marginal land, communities may need to reduce other costs or barriers, such as expediting review and permitting processes, offering land at low or no cost, decreasing required setbacks, increasing noise limits, or providing other incentives where allowed.

29 Geospatial Energy Mapper (GEM) tool. https://gem.anl.gov/

30 Midcontinent Independent Systems Operator (MISO). The Generator Interconnection Queue provides information on BESS projects under consideration in an interactive map and an interactive queue. https://www.misoenergy.org/planning/resource-utilization/GI_Queue/

31 DTE Energy. (2024). DTE Energy to build region's largest battery energy storage center at site of retired Trenton Channel coal plant. https://ir.dteenergy.com/news/press-release-details/2024/DTE-Energy-to-build-regions-largest-battery-energy-storage-center----at-site-of-retired-Trenton-Channel-coal-plant/default.aspx

32 Vistra. (2023). News release: Vistra Completes Milestone Expansion of Flagship California Energy Storage System. https://investor.vistracorp.com/2023-08-01-Vistra-Completes-Milestone-Expansion-of-Flagship-California-Energy-Storage-System

LAND USE CONSIDERATIONS

As a community is deciding how to accommodate BESS in its local land use plans, it should consider not only the state permitting context but also local benefits and concerns. It can then translate this into appropriate zoning considerations.

LOCAL VS. STATE PERMITTING

In the fall of 2023, alongside the enactment of the Statewide Energy Storage Target (PA 235),[33] Michigan's legislature passed Public Act 233 of 2023 (PA 233). This law provides BESS developers the opportunity to bypass local zoning and instead obtain land use approval from the Michigan Public Service Commission (MPSC) for large-scale projects—those exceeding 50 MW and 200 MWh.[34] Developers and utilities may bypass local zoning unless:

1. All local zoning authorities where a project is proposed have enacted a Compatible Renewable Energy Ordinance (CREO), which must not impose stricter provisions than those outlined in PA 233.
2. The BESS project is entirely within a city or village, and that city or village is the BESS developer, owns participating property, or owns a utility that will utilize the BESS.[35] This exception does not extend to townships.

Despite the state-permitting option provided by PA 233, utilities and developers may still opt for local zoning approval, particularly if the applicable local zoning regulations are deemed "workable." Page 28 of this document outlines the pros and cons for local governments considering whether to adopt a CREO, establish a workable ordinance, or stipulate that all large projects undergo the state-level process.[36]

Regardless of the path chosen for large BESS projects (≥ 50 MW / 200 MWh), BESS below this threshold remain subject to local zoning authority. As with any energy source, BESS deployment can have significant impacts on a community—both positive and negative. These impacts can vary significantly depending on the context, the specific project, and the extent of local regulation. Through thoughtful master planning and zoning, communities can harness the benefits of BESS while mitigating potential concerns.

Two 50 MW BESS under construction in Texas, with a transmission substation in the background and a project substation on the right. *(Photo: Key Capture Energy)*

33 Michigan Legislature. (2023). Public Act 235 of 2023. https://www.legislature.mi.gov/Bills/Bill?ObjectName=2023-SB-0271

34 Michigan Legislature. (2023). Public Act 233 of 2023. https://www.legislature.mi.gov/Bills/Bill?ObjectName=2023-HB-5120

35 Michigan Legislature. (2023). Public Act 233 of 2023, Section 222 (4). https://www.legislature.mi.gov/Bills/Bill?ObjectName=2023-HB-5120

36 Center for EmPowering Communities. Resources on PA 233, including an overview of the Act and FAQs. https://graham.umich.edu/project/MI-energy-siting

LOCAL BENEFITS

Planning for BESS offers communities the potential to reach various goals, particularly in economic development and enhancing the reliability and resilience of the electricity grid.

ECONOMIC DEVELOPMENT

The economic impact of BESS on a community largely depends on the system's scale. For on-site BESS, which function similarly to other home mechanical equipment, the community-wide economic benefits are modest. The installation may create additional work for electricians, technicians, and local installers, but it is unlikely to generate appreciable local economic impact.

By contrast, off-site BESS provide substantial economic benefits, particularly through property tax revenue. Off-site BESS projects are a high-value investment, often surpassing other types of energy infrastructure on a per-acre basis. For example, a 100 MW BESS typically costs slightly more to build than a 100 MW solar array but occupies less than 1/100 of the land required for the solar project.[37] Although off-site BESS is expected to be taxed as industrial personal property like other energy infrastructure, explicit guidance from the State Tax Commission (STC) is still evolving. In late October 2024, the STC approved interim guidance on the valuation and assessment of BESS, including guidance related to both real and industrial personal property.[38] Hybrid solar projects that include BESS could also face unique tax considerations, so local assessors may be a valuable resource in estimating tax impacts.

In addition to tax revenue, communities hosting off-site BESS permitted by the Michigan Public Service Commission (see Zoning Pathways for Large Off-Site BESS on Page 28) are eligible for the one-time host community agreement payments of $2,000/MW, as prescribed in PA 233.[39] For projects permitted locally, communities are eligible for the Renewables Ready Communities Award, currently providing $5,000/MW from the Michigan Department of Environment, Great Lakes, and Energy.[40]

While the construction phase of BESS projects can provide a temporary economic boost to local employment, long-term job creation is minimal, as BESS facilities do not require daily on-site supervision.

GRID RELIABILITY & RESILIENCE

BESS enhance grid reliability and resilience at all scales. On-site systems can supply power during outages and stabilize voltage levels during brownouts, protecting property from damage. Off-site systems offer several broader benefits to the grid, such as balancing power demand and generation, providing voltage support, and managing peak loads. BESS help reduce the curtailment (i.e., intentional shutoff) of intermittent sources like wind and solar by storing excess electricity when production is high on windy or sunny days but demand is low at that moment. This increases the overall efficiency of these renewable energy resources. In areas where electricity demand is rising, BESS are often considered "non-wire alternatives," helping manage distribution network capacity and avoiding costly power line upgrades.[41]

37 Comparing National Renewable Energy Laboratory data on capital expenditures (CAPEX) for utility-scale solar ($1,610,905/MW) and utility-scale battery storage ($2,080,296/MW) in 2023 at https://atb.nrel.gov/electricity/2024/utility-scale_battery_storage and https://atb.nrel.gov/electricity/2024/utility-scale_pv.

38 Michigan Department of Treasury. (2024). Interim Guidance Regarding Valuation and Assessment of Battery Energy Storage Systems. https://www.michigan.gov/treasury/-/media/Project/Websites/treasury/STC/Meetings/2024/October-22-2024-Agenda-Packet-Items-3-thru-38.pdf

39 Michigan Legislature. (2023). Public Act 233 of 2023, Section 227 (1). https://www.legislature.mi.gov/Bills/Bill?ObjectName=2023-HB-5120

40 Michigan Department of Environment, Great Lakes, and Energy. Information on the Renewables Ready Communities Award. https://www.michigan.gov/egle/about/organization/materials-management/energy/rfps-loans/renewables-ready-communities-award

41 Bowen, T., Chernyakhovskiy, I., & Denholm, P. (2019). Grid-Scale Battery Storage: Frequently Asked Questions. National Renewable Energy Laboratory. https://www.nrel.gov/docs/fy19osti/74426.pdf

When assessing the grid resilience benefits of off-site BESS, communities should consider the system's connection to the electric grid. Some BESS connected to the distribution grid can provide local electricity to residences and businesses in the immediate vicinity for a few hours during outages, but this depends on the batteries' state of charge and requires special switching and control systems. These systems are crucial for safely isolating the BESS from the main grid during outages, preventing current from endangering line workers, and instead supplying power to the community.[42] Such distribution-connected BESS are key components of microgrids, which increase local grid resilience, particularly in neighborhoods or for critical uses like nursing homes, schools, or streetlights. While transmission-connected BESS projects contribute significantly to the overall reliability of the electric grid in the state, those benefits are not exclusive to the local community (see Page 2).

The AES Lawai Solar Project pairs BESS with solar photovoltaic energy to increase grid reliability and energy independence on Kaua'i Island, HI *(Photo: Dennis Schroeder / NREL 57997)*

LOCAL CONCERNS

While BESS offer several benefits to communities, their deployment also raises valid concerns, particularly related to safety, sound level, and visual impact. Zoning regulations and adherence to safety standards can help communities address and mitigate these concerns effectively. Additionally, industry standards provide tools to mitigate safety risks, particularly National Fire Protection Association standards.

RISK OF FIRE, EXPLOSION & GASES

The safety of lithium-ion BESS is a common concern, especially given reports of failures that have drawn public attention. However, these incidents have also driven the industry to improve its understanding of failure mechanisms and develop more robust mitigation measures, codes, and standards.[43] As BESS technology rapidly advances, so too does the knowledge of its safe operation, with modern systems being significantly safer than those produced just a few years ago.

The primary safety challenge with lithium-ion BESS is the risk of thermal runaway—a process where excessive heat builds up in the battery, leading to an uncontrolled, self-sustained, chemical reaction resulting in rapid release of energy. Thermal runaway can result from overcharging, mechanical damage, physical impact, manufacturing defects, or improper design or operation. While BESS do not emit gases during normal operation, thermal runaway can cause a battery cell to rupture and vent flammable gases such as hydrogen, carbon monoxide and carbon dioxide, and hydrocarbons like methane and propane. When plastics and other equipment in the BESS burn, toxic fluorine-based gases may be released.[44]

42 Broderick, R. et al. (2022). Microgrid Conceptual Design Guidebook. Sandia National Laboratories. https://energy.sandia.gov/programs/electric-grid/advanced-microgrids/

43 International Code Council. (2022.) Energy Storage Systems: Based on the IBC, IFC, IRC and NEC. https://www.iccsafe.org/wp-content/uploads/Energy-Storage-Systems-Book_FINAL.pdf

44 Twitchell, J., Powell, D., & Paiss, M. (2023). Energy Storage in Local Zoning Ordinances. Pacific Northwest National Laboratory. https://www.pnnl.gov/publications/energy-storage-local-zoning-ordinances

To mitigate these risks, BESS manufacturers, integrators, and developers take extensive precautions to prevent thermal runaway and contain it to a single cell or battery enclosure if it does occur. The preferred firefighting strategy is to allow the fire to burn out (to fully expel all stored energy) while focusing on containment and defensive firefighting (e.g., wetting the ground surrounding the fire). The physical construction of the enclosure makes it challenging for water to effectively cool the cells, and water can create complications with runoff. This is why the industry focuses on containing fire rather than extinguishing it with water.[45, 46]

The National Fire Protection Association's Standard 855 for the Installation of Stationary Energy Storage Systems (NFPA 855) provides comprehensive guidelines for the safe installation and operation of all scales of BESS.[47] Compliance with this standard is a requirement for all large BESS projects that are permitted by the Michigan Public Service Commission or through Compatible Renewable Energy Ordinances (CREOs).[48] It includes requirements for stress testing, spacing between components, and collaboration with local emergency responders.

NFPA 855 also requires compliance with standards like the Underwriters Laboratory (UL) 9540 Standard for Energy Storage Systems and Equipment and the UL 9540A Standard Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems. UL 9540A, often referred to as large-scale fire testing, involves intentionally inducing thermal runaway in a laboratory setting and analyzing the system's response, including whether and how thermal runaway propagates and how the system emits gases when set alight. Systems that are UL 9540 certified ensure that stringent safety and performance requirements will be met, preventing the spread of thermal runaway and limiting explosion risk.[49] Additionally, NFPA 855 includes requirements for BESS to comply with UL 1741 (Standard for Inverters, Converters, Controllers, and Interconnection System Equipment for Use With Distributed Energy Resources) and UL 1973 (Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail Applications), among others.

Local jurisdictions can enhance safety by requiring compliance with the latest edition of NFPA 855, requiring detailed safety plans and reports during project approval, and involving local emergency response officials in fire and emergency response planning. Regular training for emergency responders is essential to prepare for any potential incidents. These suggestions are incorporated into the sample zoning regulations (see Page 15).

Fire fighters look over a battery cabinet during on-site training for first responders learning how to respond in the event of an emergency. *(Photo: Werner Slocum / NREL 68385)*

45 National Fire Protection Association (NFPA). (2023.) NFPA 855, Annex C, Section C.3. The code can be viewed for free by anyone who registers on the NFPA's website at https://www.nfpa.org/855.

46 International Code Council. (2022.) Energy Storage Systems: Based on the IBC, IFC, IRC and NEC. https://www.iccsafe.org/wp-content/uploads/Energy-Storage-Systems-Book_FINAL.pdf

47 The latest edition of NFPA 855 can be viewed for free by anyone who registers on the NFPA's website at https://www.nfpa.org/855.

48 Michigan Legislature. (2023). Public Act 233 of 2023, Section 226 (8) (c) (ii). https://www.legislature.mi.gov/Bills/Bill?ObjectName=2023-HB-5120

49 Twitchell, J., Powell, D., & Paiss, M. (2023). Energy Storage in Local Zoning Ordinances. Pacific Northwest National Laboratory. https://www.pnnl.gov/publications/energy-storage-local-zoning-ordinances

WATER AND SOIL CONTAMINATION

Under normal conditions, BESS pose no greater risk to water or soil contamination than other land uses. Depending on the battery chemistry, some BESS may contain small amounts of gel or liquid electrolyte within each cell[50], but this is typically well-contained within the system's enclosure. Some BESS are designed with concrete foundations that further limit the potential for leakage into the water and soil. A recent study following three BESS incidents in New York State found, in fact, no concerning elevated levels of contamination.[51]

However, contamination risks may arise during fire suppression if water or other agents are used on the batteries, potentially spreading otherwise contained contaminants. If water-based firefighting is part of the fire and emergency response plans, secondary containment systems should be considered to capture runoff. Training local firefighters to understand when and how to use water in these situations is crucial to preventing contamination.

SOUND

The operation of BESS involves noise generated by inverters, ventilation systems, and transformers. Residential on-site BESS are typically designed to operate quietly, often producing less noise than whole-home generators or HVAC units. In contrast, off-site BESS can produce noise levels of between 60 - 80 dB at close range,[52] though this diminishes with distance and can be mitigated by sound-dampening measures such as architectural barriers (e.g., sound walls) and vegetative screening.

Existing noise ordinances automatically extend these standards to BESS to protect nearby residents. In the absence of such ordinances, zoning regulations can mandate increased distances between noise-producing BESS components and homes or enforce specific sound thresholds that require noise-dampening features.

VISUAL IMPACTS

On-site BESS enclosures generally resemble other utility cabinets. Even larger off-site BESS are relatively inconspicuous due to their small footprint and low height. A yard with its enclosures and electric equipment is often graveled, suggesting a visual impact not unlike an electrical substation or other industrial uses. Meanwhile, the visual impact of BESS in dedicated-use buildings is comparable to industrial warehouses.

Zoning regulations offer various tools to minimize visual impacts through combination of fencing and wall design requirements, vegetative screening, and setbacks. Communities can apply existing district-specific design standards or those associated with industrial uses. Additional screening or increased setbacks may be required to limit visibility from residential areas.

Communities should keep in mind that off-site BESS may be subject to safety regulations requiring the clearance of vegetation near the equipment and the installation of a perimeter fence. These regulations sometimes mandate a minimum fence height or the addition of barbed wire to restrict unauthorized access. When expressing preferences to mitigate visual impacts, a community should ensure that their zoning language includes an exemption from these requirements if no alternative would comply with the safety codes.

50 International Code Council. (2022.) Energy Storage Systems: Based on the IBC, IFC, IRC and NEC. https://www.iccsafe.org/wp-content/uploads/Energy-Storage-Systems-Book_FINAL.pdf

51 New York State Energy Research and Development Authority. (2023). Initial findings released by Inter-Agency Fire Safety Working Group on emergency response. https://www.nyserda.ny.gov/About/Newsroom/2023-Announcements/2023-12-21-Governor-Hochul-Announces-Results-of-Fire-Safety-Working-Group

52 Twitchell, J., Powell, D., & Paiss, M. (2023). Energy Storage in Local Zoning Ordinances. Pacific Northwest National Laboratory. https://www.pnnl.gov/publications/energy-storage-local-zoning-ordinances

ZONING CONSIDERATIONS

Each community must determine how different types and scales of BESS align with their Master Plan and Zoning Ordinance, particularly in terms of the districts in which they are a compatible land use and the permitting process required for BESS applicants.

Table 1 offers an example approach. In this table, on-site BESS are permitted as accessory uses in all zoning districts, effectively allowing any building connected to the grid to have battery back-up in case of emergencies. This approach treats on-site BESS similarly to whole-building generators, which are common in many settings, including residential.

While off-site BESS share a similar footprint and grid functionality to electrical substations, it is reasonable for communities to treat BESS differently within their land-use plans due to the rapidly evolving nature of the technology. Some communities have designated substations as "critical infrastructure" or "essential services," exempting them from zoning review.[53] However, this guide does not recommend such an approach for all types and scales of BESS at this time. More time is needed to allow for additional evaluation of impacts, including economic benefits and fire safety risks.

Given the local grid-reliability benefits provided by off-site BESS connected to the distribution grid, the table considers their placement in all districts. Typically, BESS smaller than 20 MW would connect into the distribution grid rather than the transmission grid, so the table defines "Small Off-Site BESS" as systems with a capacity of 20 MW or less.

For larger BESS that connect to the transmission grid, the table allows them by right in districts where noise and fire risk may be less problematic due to large open spaces (e.g., agricultural/resource production areas) or where land uses pose similar impacts (e.g., industrial zones). In other districts, this scale of BESS would be treated as a special land use, allowing more scrutiny of its compatibility with surrounding land uses (e.g., sparsely populated residential zones) and to assess whether its placement in these more sensitive districts would provide a reliability benefit to those immediately adjacent to the proposed project.

Since PA 233 governs some transmission-scale projects, the table includes two different size options: "Medium" and "Large." "Medium Off-Site BESS" are defined as systems greater than 20 MW but less than the 50 MW threshold, which may be eligible for regulation by the MPSC through PA 233 (see the discussion on Zoning Considerations on Page 13 and Zoning Pathways on Page 28). "Large Off-Site BESS" are systems that meet the PA 233 threshold of 50 MW or more with a discharge capacity of 200 MWh or more.

Table 1: BESS Scales and Types as Applied to Example Zoning Districts

Example Zoning District	Agricultural/Resource Production	Commercial/ Office	Industrial	Residential	Mixed Use
On-Site BESS	PA	PA	PA	PA	PA
Small Off-Site BESS (≤20 MW)	PP	PP	PP	PP	PP
Medium Off-Site BESS (>20 MW and <50MW)	PP	SLU	PP	SLU	SLU
Large Off-Site BESS (≥50MW)	See Page 28 for discussion of options in light of PA 233				

PA = Permitted (by right) Accessory; PP = Permitted (by right, with site plan review) Principal; SLU = Special Land Use

53 There is no state-wide definition of "critical infrastructure" or "essential services" or a blanket exemption of these sorts of land uses from zoning.

AUGMENTATION, REPOWERING, AND DECOMMISSIONING

Like any land use, components within a BESS may require repair, replacement, or supplementation over time, and this should be permitted. Additionally, as with other modern energy facilities, it is advisable to require decommissioning plans for off-site BESS to ensure that equipment is removed at the end of commercial operation and the site is restored. However, off-site BESS systems differ slightly from other types of energy infrastructure during the commercial operation period. BESS are often repowered or augmented with new equipment periodically to increase or maintain their nameplate capacity, accommodating battery degradation over time.

Augmentation and Repowering: While active research aims to extend battery life, current battery cells degrade more quickly than other energy technologies. To maintain the initially permitted energy capacity (e.g., amount of MW), many off-site BESS developers plan for this from the outset. Sometimes developers overbuild by selecting a larger battery than needed (e.g., 125% capacity) to allow for degradation while maintaining the required capacity. Other times this takes the form of replacement—removing an enclosure or the modules within it and installing new, similar equipment in the same footprint. Unique to BESS is the approach called augmentation, where BESS components are added periodically over time. This approach allows the remaining capacity in the original cells to contribute output to the grid while new cells added to the site make up the balance, maintaining overall capacity. Land use planners may consider this akin to phased development. Although BESS developers may not install the final number and footprint of permitted enclosures at the beginning, the foundations for future enclosures are often laid during the initial installation of the project to prepare the site for later augmentation.[54]

Zoning ordinances can require developers to account for any of these anticipated site design modifications during site plan review to understand whether there may be phased augmentation over time or if the plan involves replacing modules or enclosures as they age.

Decommissioning: Decommissioning is the process of removing the equipment and infrastructure associated with a project and restoring the land. The decommissioning plan details how the project equipment will be removed and the land restored after the BESS is no longer required or desired. Local governments often require a financial security to guarantee the availability of funding to implement the plan. Since lithium-ion batteries are considered hazardous waste, the project owner is responsible for managing them appropriately.

As technology and battery recycling continue to advance, the cost of disposal may change over time. A periodic review (e.g., every 3-5 years) of the financial security ensures that adequate funds are available to cover decommissioning costs down the road. A review might also be triggered if there is a change of ownership. When establishing the financial security requirements for BESS, communities could review how performance guarantees are handled for other types of developments, such as landscaping guarantees, and consider whether these processes should be the same or different.

54 International Code Council. (2022). Energy Storage Systems: Based on the IBC, IFC, IRC and NEC. https://www.iccsafe.org/wp-content/uploads/Energy-Storage-Systems-Book_FINAL.pdf

SAMPLE ZONING FOR BESS

The sample zoning language is meant to be a starting point for informing zoning amendments related to BESS.

Communities should work with their municipal attorney and a knowledgeable planner to consider the different permitting options for large BESS systems (see discussion on Zoning Considerations on Page 13 and Zoning Pathways on Page 28). Together, you can modify the sample zoning language in this document to develop regulations that fit identified community goals and are tied to master plan objectives, the foundations upon which zoning must be based.[55]

DEFINITIONS

The definitions below are needed for the BESS provisions. Select, modify, and add these definitions to the Definitions Section/Article of your zoning ordinance as appropriate. Note that some may already be included in the Definitions Section/Article of your zoning ordinance with similar or identical meanings (e.g., battery, decommissioning). Alternatively, you may adopt the Sample Zoning as its own Article or Section within your code, using the following:

> *The following definitions apply only to the provisions of _____ [e.g., Article or Section for Battery Energy Storage Systems, depending on the naming convention in your jurisdiction's zoning ordinance].*

Augmentation: The process of supplementing or replacing some or all of the system components to maintain the nameplate capacity (measured in megawatts).

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 (BESS): One or more devices, assembled together, capable of storing and discharging electricity primarily intended to supply electricity to a building or to the electrical grid. This includes, but is not limited to, the following: battery cells; enclosures and dedicated-use buildings; thermal, battery, and energy management system components; inverters; access roads; distribution, collection, and feeder lines; wires and cables; conduit; footings; foundations; towers; poles; crossarms; guy lines and anchors; substations; interconnection or switching facilities; circuit breakers and transformers; overhead and underground control, communications and radio relay systems, and telecommunications equipment; utility lines and installations; and accessory equipment and structures.

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.

Decommissioning: The process of removing equipment and other infrastructure associated with a project and restoring the site for viable reuse consistent with the zoning district.

Dedicated-Use Building: A building that is only used for battery energy storage system components and equipment, as defined in the NFPA 855 Standard for the Installation of Stationary Energy Storage Systems.[56]

55 MCL 125.3203(1) of the Michigan Zoning Enabling Act, PA 110 of 2006, as amended.

56 National Fire Protection Association (NFPA). (2023.) NFPA 855, Sections 3.3.9.3 and 9.3.1.1. The code can be viewed for free by anyone who registers on the NFPA's website at https://www.nfpa.org/855.

Non-Participating Property: Real property that is not participating property.

On-Site Battery Energy Storage System: A Battery Energy Storage System (BESS) that is intended primarily to serve the electricity needs of the applicant property but may, at times, discharge into the electric grid.

Off-Site Battery Energy Storage System: A Battery Energy Storage System (BESS) for the primary purpose of off-site use through the electrical grid.

- **Small Off-Site Battery Energy Storage System:** An Off-Site Battery Energy Storage System (BESS) with a nameplate capacity of 20 MW or less.
- **Medium Off-Site Battery Energy Storage System:** An Off-Site Battery Energy Storage System (BESS) with a nameplate capacity greater than 20 MW and less than 50 MW. Off-Site BESS with a nameplate capacity of 50 MW or more but with an energy discharge capability of less than 200 MWh are also considered Medium Off-Site BESS.
- **Large Off-Site Battery Energy Storage System:** An Off-Site Battery Energy Storage System (BESS) with a nameplate capacity of 50 MW or more and an energy discharge capability of 200 MWh or more.

Participating Property: Real property that is either owned by an applicant or that is the subject of an agreement that provides for the payment by an applicant to a landowner of monetary compensation regardless of whether any part of the BESS system is constructed on the property.

Repowering: The process of reconfiguring, supplementing, or replacing some or all of the system components to increase the nameplate capacity (measured in megawatts).

COMMENTARY: Many communities exempt essential services from zoning requirements. Essential services typically refer to utility distribution infrastructure, such as water and sewer pipes, manholes, electric wires, and utility poles. While utility-related buildings and facilities may also be classified as essential services, many ordinances impose additional requirements on facilities like water or wastewater treatment plants, lift stations, electric power plants, and outdoor storage yards within utility service areas, often subjecting them to site plan and/or special use reviews. The sample zoning provided in this document would regulate all types of BESS within zoning. If communities adopt this language, they may also wish to revise their definition of essential services to explicitly state that Battery Energy Storage Systems are not considered essential services.

GENERAL PROVISIONS

Add to the General Provisions Article of the ordinance as a separate Section.

A. ON-SITE BATTERY ENERGY STORAGE SYSTEMS (BESS)

1. On-Site BESS are permitted as an accessory use in _____ [all] zoning districts and shall follow the regulations associated with accessory uses.

COMMENTARY: Since On-Site BESS operate similarly to backup generators, the effect of the above provisions is to extend any existing requirements for mechanical equipment, such as HVAC units, to On-Site BESS. For example, if your ordinance requires mechanical equipment to be screened or subject to noise standards, these same requirements would also apply to BESS.

2. [A zoning permit is required for On-Site BESS with an aggregate energy capacity of more than 600 kWh. Documentation showing compliance with NFPA 855[57] shall be submitted for review by _____ [e.g., zoning administrator] [see commentary below about coordinating with your fire marshal/chief to determine other application requirements]. On-Site BESS with an aggregate energy capacity of less than or equal to 600 kWh do not require a zoning permit.]

COMMENTARY: NFPA 855 sets additional standards for BESS over 600 kWh. These Large On-Site BESS, which are typically used in multi-family residential, commercial, or industrial applications, may require a zoning permit and/or review by the local fire official to ensure compliance with codes and preparedness for emergencies. You should coordinate with your local fire official to determine the appropriate review process in your jurisdiction (e.g., what should be submitted with the zoning permit). Alternatively, if your zoning administrator lacks the technical capacity to evaluate compliance with NFPA 855, you may choose to omit this provision, as it applies to a relatively small subset of BESS projects.

B. OFF-SITE BATTERY ENERGY STORAGE SYSTEMS (BESS)

1. Small Off-Site BESS are a permitted use in _____ [all] zoning districts and subject to Site Plan Review by the _____ [e.g., zoning administrator].
2. Medium Off-Site BESS:
   - **a.** Are a permitted land use in _____ [e.g., non-residential; agricultural and industrial] zoning districts and subject to Site Plan Review by the _____ [e.g., zoning administrator].
   - **b.** In _____ [e.g., all other] zoning districts, Medium Off-Site BESS are a special land use subject not only to the requirements for Off-Site BESS, but also to the applicable standards and requirements for Special Land Uses outlined in Section _____ [insert reference to where your zoning ordinance outlines Special Land Uses], as well as the following criteria for approval:
     i. The public benefits of the proposed BESS justify its construction. Public benefits include, but are not limited to, any contributions to meeting identified energy, capacity, reliability, or resource adequacy needs of this jurisdiction.

COMMENTARY: Applying this Special Land Use standard to all Medium and/or Large Off-Site BESS in every zoning district may be exclusionary. The language provided allows BESS by right in some districts and applies the Special Land Use standard only to projects that offer public benefits and are located in more sensitive areas. Local jurisdictions should consider adjusting the list of benefits to align with the goals of the community's Master Plan or Comprehensive Plan, or amending the criteria for Special Land Use approval based on the criteria used for other special land uses in the zoning ordinance.

3. Large Off-Site BESS are permitted _____. [See the discussion on Page 28 for options on how to complete this provision in light of PA 233. Choosing any option other than the second option (i.e., sending Large Off-Site BESS projects to the MPSC) will require making other amendments to this template, as outlined in the guidance on Page 28.]

57 National Fire Protection Association (NFPA). (2023.) NFPA 855 Standard for the Installation of Stationary Energy Storage Systems. The code can be viewed for free by anyone who registers on the NFPA's website at https://www.nfpa.org/855.

4. **Hybrid Energy Projects:** If an Off-Site BESS is to be co-located with another energy facility, such as a wind or solar energy facility, both land uses may be included in one application and each component shall be reviewed for compliance with the appropriate standards.

COMMENTARY: Existing guidance on zoning for solar and wind energy is available through the Michigan Department of Environment, Great Lakes, and Energy.[58] Communities with existing wind or solar ordinances may want to update these sections of their code to align with the language for hybrid energy projects. Specifically, they should consider adding the following provision: "If the [wind or solar] energy system is to be co-located with another energy facility, such as battery energy storage, both land uses may be included in one application and each component shall be reviewed for compliance with the appropriate standards."

5. **Use Standards:** All Off-Site BESS shall comply with the following use standards.
   a. **System Certification:** All Off-Site BESS shall be in compliance with the latest edition of NFPA 855 Standard for the Installation of Stationary Energy Storage Systems at the time of application. Compliance includes that all system components and equipment shall be listed by a Nationally Recognized Testing Laboratory to UL 9540 (Standard for Energy Storage Systems and Equipment) and that BESS are subject to UL 9540A (Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems), as applicable.
   b. **Setbacks:**
      i. Setback distances shall be measured from the nearest edge of the perimeter fencing.
      ii. Off-Site BESS are not subject to property line setbacks for common property lines of two or more participating properties with these exceptions _____ [i.e., "road right-of-way" or "front property line," depending on how you measure front setbacks in your jurisdiction] in which setbacks shall apply.
      iii. Small Off-Site BESS: A Small Off-Site BESS shall follow the setback distance for primary buildings or structures for the district in which it is sited.
      iv. Medium Off-Site BESS: The following minimum setback distances shall apply to any Medium Off-Site BESS:
         1. _____ [e.g., 300] feet from any community buildings and occupied dwellings on a non-participating property.
         2. _____ [e.g., underlying zoning district or 50-100] feet from _____ [i.e., "the nearest edge of a public road right-of-way" or "the front property line," depending on how you measure front setback in your jurisdiction].
         3. _____ [e.g., 50-100] feet from the side or rear property line.
         4. _____ [e.g., 100-300] feet from any existing dwelling unit on a participating property.

PA 233 CONTEXT: To provide context, the setback standards for BESS in PA 233,[59] measured from the nearest edge of the perimeter fencing (not the nearest point of any BESS equipment) are:

- **300** feet from any community buildings and occupied dwellings on a non-participating property measured from the nearest point on the outer wall;
- **50** feet from the nearest edge of a public road right-of-way;
- **50** feet from the property line of a non-participating property.

58 Michigan Department of Environment, Great Lakes, and Energy. Community Energy Management. https://www.michigan.gov/egle/about/organization/materials-management/energy/communities

59 Michigan Legislature. (2023). Public Act 233 of 2023, Section 226 (8) (b). https://www.legislature.mi.gov/Bills/Bill?ObjectName=2023-HB-5120

COMMENTARY: To mitigate the risk of explosion impact, current guidance in NFPA 855 recommends a clearance of 100 feet between BESS and non-associated structures and roads. In the event of an emergency, NFPA advises evacuating buildings within 100 feet of the BESS, which may also support a setback from adjacent structures.[60] However, while these recommendations address explosions, they do not address the risks associated with gas plumes that may be emitted. To better understand the potential spread and toxicity of gas plumes resulting from a fire, some communities may consider adding a Toxic and Flammable Gas Plume Dispersion Analysis as part of the Fire Response Plan requirements for site plan review.[61] This analysis can help assess potential impacts on surrounding areas.

c. Sound:

i. [Small Off-Site BESS shall comply with the _____ [reference to existing noise ordinance].]

COMMENTARY: In communities with an existing noise ordinance, applying the current noise regulations to Small Off-Site BESS may be the most reasonable and consistent approach. If your jurisdiction does not have a noise ordinance, you may choose to omit this provision or consider adapting language from Medium Off-Site BESS regulations. However, be aware that such provisions might be cost-prohibitive for smaller systems, particularly if the community-wide noise ordinance applies to property lines rather than individual dwellings.

ii. For Medium Off-Site BESS, the sound pressure level shall not exceed a noise level of _____ [e.g., 55] dBA (Leq (1-hour)) or the existing ambient noise level, whichever is greater, modeled at the nearest _____ [e.g., property line of an adjoining non-participating property; or, outer wall of the nearest dwelling located on a non-participating property]. Decibel modeling shall use the A-weighted scale as designed by the American National Standards Institute.

PA 233 CONTEXT: When considering noise levels for Medium and Large Off-Site BESS, a community should determine whether noise levels will be measured from a property line or a dwelling. The zoning language above provides both options. PA 233 measures sound from the "outer wall" of a dwelling unit, a location which is not common in most zoning ordinances and which requires relatively complex modeling methodology.[62] Instead, it is more common to regulate sound at the property line, though doing so may be more restrictive for projects where there is no existing dwelling unit on a neighboring property.

d. Lighting: The BESS shall implement dark sky-friendly lighting solutions that are designed to minimize the amount of light that escapes upward into the sky.

PA 233 CONTEXT: This language on lighting is consistent with the language in PA 233.

60 National Fire Protection Association (NFPA). (2023). NFPA 855, Sections G.11.8.3 and G.11.8.4. The code can be viewed for free by anyone who registers on the NFPA's website at https://www.nfpa.org/855.

61 For further reading, see NFPA 551 (2022): Guide for the Evaluation of Fire Risk Assessments. https://www.nfpa.org/551

62 Michigan Legislature. (2023). Public Act 233 of 2023, Section 226 (8) (c) (iii). https://www.legislature.mi.gov/Bills/Bill?ObjectName=2023-HB-5120

e. **Fencing:** If perimeter fencing is installed, [it is not subject to the fencing requirements in Section _____ of this zoning ordinances, and] barbed wire is prohibited, unless there is no other option that would comply with other applicable codes.

COMMENTARY: Off-Site BESS may be subject to safety regulations requiring a perimeter fence. These regulations sometimes mandate a minimum height or the addition of barbed wire to restrict unauthorized access. While a community may express preferences regarding fence height or design, it should ensure that its regulations include a compliance exemption, as outlined in the provision above.

f. **Vegetation/Tree-Cutting:** An Off-Site BESS shall be subject to screening and landscaping requirements of the underlying zoning district. Any screening and landscaping shall be placed outside the perimeter fencing.

g. **Screening/Visibility:** An Off-Site BESS shall be subject to screening and landscaping requirements of the underlying zoning district. Any screening and landscaping shall be placed outside the perimeter fencing. Screening is not subject to setbacks.

   i. In districts that call for screening or landscaping along rear or side property lines, these shall only be required where an adjoining non-participating property has an existing residential or public use.

   ii. When current zoning district screening and landscaping standards are determined to be inadequate based on a legitimate community purpose consistent with local government planning documents, the Zoning Administrator [or Planning Commission] may require substitute screening consisting of native deciduous trees planted _____ [e.g., 30] feet on center, and native evergreen trees planted _____ [e.g., 15] feet on center along existing non-participating residential uses.

   iii. The Zoning Administrator [or Planning Commission] may reduce or waive screening requirements provided that any such adjustment is in keeping with the intent of the Ordinance and is appropriately documented (e.g., abutting participating properties; existing vegetation).

h. **Lot Size and Lot Coverage:** An Off-Site BESS shall not be subject to minimum or maximum lot size requirements, or lot coverage requirements of the underlying zoning district.

COMMENTARY: While lot size and lot coverage regulations are common in zoning ordinances, they can have unintended consequences when applied to BESS, potentially causing the development to sprawl across more land than necessary. Setbacks, height limits, and screening address concerns about visual impacts and bulk, while stormwater management regulations can handle impervious surface issues often associated with development.

i. **Access Drives:** Access drives shall be designed in consultation with _____ [AHJ for fire safety] and shall be maintained to enable year-round emergency vehicle access.

COMMENTARY: NFPA 855 makes multiple references to Authority Having Jurisdiction (AHJ). An AHJ is defined as an "organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure."[63] AHJs may include fire marshals, building officials, and electrical inspectors. Where AHJ appears in this zoning ordinance, communities shall replace it with the appropriately named authority in their local government (e.g., ABC Township Fire Marshal or City of XYZ Fire Chief).

63 National Fire Protection Association (NFPA). (2023). NFPA 855, Sections 3.2.2 and Annex A, Section A.3.2.2. The code can be viewed for free by anyone who registers on the NFPA's website at https://www.nfpa.org/855.

j. **[Stormwater Management:** The entire site upon which Off-Site BESS is located must comply with stormwater requirements as outlined in _____ [reference to the general stormwater management plan requirements in the local ordinance]. Stormwater management structures shall be designed based on the final footprint of the BESS project, accounting for any planned augmentation, if applicable.]

COMMENTARY: Under normal conditions, BESS pose no greater risk of water or soil contamination than other land uses, so it is appropriate to manage stormwater on the site in the same way as for other land uses. However, if a jurisdiction's zoning ordinance does not include stormwater management requirements, this regulation should be omitted.

i. [For BESS in a well-head protection zone and/or if the Fire Response Plan requires liquids for firefighting, then the Stormwater Management System must include a containment system within _____ [e.g., 10] feet of any BESS enclosure, designed so as to retain run-off on site in case of emergency release of liquids with the use of water retention liners or similar impervious material.]

COMMENTARY: To mitigate water contamination in the event of a safety incident, especially when liquid agents are used for firefighting or the facility is located in a sensitive area, this guide recommends implementing an emergency runoff containment system. This system should allow for the retention of stormwater in the immediate vicinity of the BESS to prevent runoff generated during an emergency from escaping. While this approach may be more complex and costly for the BESS developer, it serves as a precautionary measure until further research on the environmental impacts of BESS incidents is completed or technological advancements reduce the risk of such incidents. This regulation can be applied even in communities without existing stormwater management requirements.

k. **Height:** Any Dedicated-Use Building shall be a single story subject to the height restrictions for principal structures in the underlying zoning district, but not to exceed _____ [e.g., 35] feet. The total height of an Off-Site BESS enclosure, including any roof-mounted mechanic equipment, shall not exceed _____ [e.g., 16] feet. Other equipment (e.g., poles, substations, towers) is exempted from height requirements if alternative design options are not feasible.

COMMENTARY: This regulation allows communities to set different height standards for BESS enclosed in a dedicated building compared to those located outdoors. The rationale is that a BESS housed in a dedicated building, which may resemble a typical barn or warehouse, might be less visually intrusive than an outdoor area filled with enclosures. However, your community may decide that a single height standard for all Off-Site BESS is more appropriate.

l. **Wiring:** All on-site utility lines shall be placed underground to the extent feasible, 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.

m. **Signage:**

i. **Safety Signage:** Safety signage shall comply with NFPA 855 or other applicable safety codes [and is exempt from maximum sign surface area calculations in _____ [reference to district or sign type standard of local government ordinance]].

ii. **Other Signage:** Additional signage may be permitted subject to the requirements of Section _____ [reference to district or sign type standard of local government ordinance].

n. **Repair, Augmentation, and Repowering:** In addition to repairing or replacing BESS components to maintain the system, an Off-Site BESS may at any time be augmented or repowered without the need to submit a new site plan so long as the augmentation or repowering is within the same footprint (e.g., same dedicated use building or on footings/foundations in the same location) as the original permit and there is no significant change in the battery chemistry (e.g., a change from one lithium-ion battery type, such as Lithium Iron Phosphate, to another, such as Nickel Manganese Cobalt). When a BESS is anticipated to be augmented, the applicant shall submit an augmentation plan as part of the site plan application.

   i. A proposal to change the project footprint or a significant change in battery chemistry shall be considered a new application, subject to the ordinance standards at the time of the request.

COMMENTARY: The rationale for including significant changes in battery chemistry in the repair, augmentation, and repowering requirements is due to the varying local impacts of different battery chemistries, particularly concerning fire safety (e.g., fire behavior, thermal runaway, off-gassing, and smoke generation). Given the diverse battery chemistries used in BESS, it may be helpful to define significant changes by adopting the typology used in NFPA 855, which distinguishes hazard considerations for the three main types of lithium-ion batteries: Lithium Iron Phosphate (LFP), Lithium Nickel Manganese Cobalt (NMC), and Lithium Nickel Cobalt Aluminum (NCA).[64]

o. **Decommissioning:** A Decommissioning Plan is required for any Off-Site BESS at the time of application.

   i. The Decommissioning Plan shall include the specifications laid out in Section _____ [reference to Site Plan Requirements] and the requirements for Decommissioning Plans outlined in NFPA 855.[65]

   ii. An update of the Decommissioning Plan, including a review of the amount of the financial security based on inflation and the current removal costs [not to include salvage value], shall be completed every _____ [e.g., 5] years, for the duration of commercial operations, and approved by the _____ [legislative body]. The amount shall be calculated by a mutually-agreed-upon third party with expertise in decommissioning, hired by the BESS system owner. The amended and approved Decommissioning Plan shall be provided to the _____ [AHJ for fire safety].

   iii. An Off-Site BESS owner may at any time:

      1. Proceed with the approved Decommissioning Plan and remove the system as indicated after prior notification of the _____ [AHJ for fire safety], or

      2. Amend the Decommissioning Plan with _____ [legislative body or zoning administrator] approval and proceed according to the revised plan after prior notification of the _____ [AHJ for fire safety].

   iv. A BESS that has not stored electrical energy for _____ [e.g., 12] consecutive months shall prompt an abandonment hearing. Decommissioning an Off-Site BESS, in accordance with an approved Decommissioning Plan, must be completed within _____ [e.g., 12 months] after abandonment.

64 National Fire Protection Association (NFPA). (2023). NFPA 855, Annex B, Section B.5.3. The code can be viewed for free by anyone who registers on the NFPA's website a https://www.nfpa.org/855.

65 National Fire Protection Association (NFPA). (2023). NFPA 855, Section 8.1.3, or applicable sections in the most recent version of NFPA 855. The code can be viewed for free by anyone who registers on the NFPA's website at https://www.nfpa.org/855.

PA 233 CONTEXT: This zoning language on decommissioning differs from the requirements of PA 233 for decommissioning large energy storage projects permitted by the Michigan Public Service Commission (MPSC).[66] The most significant differences depend on how the blanks in Sections (ii) and (iv) are filled. For example, the financial assurance amount for MPSC-permitted projects is determined after deducting salvage value (ii). Also, a jurisdiction may specify scenarios triggering decommissioning, such as abandonment (iv), or opt for shorter time frames, both of which could impose greater burdens on developers. Additionally, PA 233 requires that financial assurance for large energy storage facilities be posted in increments staggered over time. If your jurisdiction has policies for abandonment in other land uses, consider applying them to BESS. If no such policies exist, consult with your municipal attorney.

6. **Site Plan Requirements:** Off-Site BESS are not subject to site plan requirements in _____ [reference to the section in your zoning ordinance that includes general site plan requirements] but instead shall include the following:

COMMENTARY: Several unique documents are required to determine compliance with the use standards mentioned above. To avoid duplicative site plan documentation requirements, the drafted language exempts BESS site plans from the general site plan requirements in your zoning ordinance. If you wish to apply any generic site plan requirements to BESS, you can modify the language above or add those requirements to the list below.

   a. **Site Layout and Context:** A site plan at a scale and format that allows details to be clear and legible (e.g., as separate maps, or by showing some areas at a finer scale) showing:
      i. The location and dimensions (including footprint and height) of all BESS components proposed for the final stage of installation (i.e., accounting for any future augmentation, if applicable), including enclosures or dedicated-use buildings, ancillary structures and electric equipment, buried or above ground wiring, utility connections, temporary and permanent access drives;
      ii. The location of existing structures on participating property;
      iii. The location of existing dwellings and primary structures on non-participating properties within _____ [e.g., 1,000] feet of the property boundary;
      iv. Participating and non-participating property lines;
      v. Setbacks;
      vi. Details of proposed fencing, screening/landscape, berm, and signage;
      vii. A photometric plan.
   b. **Land Clearing and/or Grading Plan:** A plan showing proposed clearing and/or grading as required for the installation and operation of the system.
   c. **[Stormwater Management Plan:** Computations and design of a stormwater management system as outlined in _____ [reference to the general stormwater management plan requirements of the local ordinance]].
      i. [For a BESS in a well-head protection zone and/or if the Fire Response Plan requires liquid agents for firefighting, additional calculations and design of the emergency runoff retention system in the area within _____ [e.g.,10] feet of the BESS shall be submitted].

COMMENTARY: The zoning language on stormwater management should be adjusted based on the existing stormwater management practices in the jurisdiction. Please refer to the commentary on Use Standards on Page 21 for further guidance.

66 Michigan Legislature. (2023). Public Act 233 of 2023, Section 225 (1) (r). https://www.legislature.mi.gov/Bills/Bill?ObjectName=2023-HB-5120

d. **Pre-Development Sound Modeling Study** including sound isolines extending from the sound source(s) to all [property lines and] dwellings on non-participating properties within _____ [e.g., 1,000] feet of the property boundary. A Pre-Development Sound Modeling Study is not required for Small Off-Site BESS.

COMMENTARY: The text in brackets is intended for jurisdictions with noise ordinances that apply broadly beyond BESS, as these often include sound limits measured from property lines. In jurisdictions without such ordinances, the bracketed text can be omitted. The Michigan Public Service Commission has provided sound modeling guidelines for modeling sound at the "outer wall" of a dwelling on a non-participating property. If this is the measuring location that you chose, you may want to reference that methodology in your ordinance.[67] This methodology does not apply to other measuring locations, such as the property line.

e. **Augmentation Plan (if applicable):** Demonstrating through description and an annotated site plan the anticipated augmentation phases, including which structures/components are expected to be installed in which time frames.

f. **Preliminary Equipment Specification Sheet:** This sheet 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 as part of Post-Construction Reporting.

g. **System Maintenance Plan:** A detailed maintenance schedule covering all affected equipment and the activities performed as outlined in the NFPA 855 Standard for the Installation of Stationary Energy Storage Systems.[68]

h. **Contact Information:** Name, address, and contact information of proposed or potential system installer and the owner and/or operator of the battery energy storage system. Information of the final system installer shall be submitted as part of Post-Construction Reporting.

i. **NFPA 855 Compliance:** Confirmation that the facility complies with the latest edition of NFPA 855 "Standard for the Installation of Stationary Energy Storage Systems."

COMMENTARY: The completeness and acceptability of some site plan requirements, especially those related to NFPA 855 compliance, will require expert consultation. Communities should consider setting application fees, including escrow fees, to cover the cost of hiring external consultants for this review. Local governments should review their existing fee schedules and consider amending them in consultation with their municipal attorney.

j. **Fire and Emergency Response Plans:** An Emergency Response Plan and a Fire Response Plan developed in consultation with the _____ [AHJ for fire safety] shall be submitted and contain the following:

   i. **Emergency Response Plan (ERP):** The ERP shall include:

      1. An identification of contingencies that would constitute a safety or security emergency (fire emergencies are to be addressed in a separate Fire Response Plan);
      2. Emergency response measures, evacuation control measures, and community notification measures by contingency;
      3. An identification of potential approach and departure routes to and from the facility site for police, fire, ambulance, and other emergency vehicles;
      4. A commitment to review and update the ERP with _____ [e.g., fire department, first responders, and county emergency managers] at least once every _____ [e.g., 3] years.

67 MPSC's Application Filing Instructions and Procedures. https://mi-psc.my.site.com/s/case/5008y000009kJfbAAE/in-the-matter-on-the-commissions-own-motion-to-open-a-docket-to-implement-the-provisions-of-public-233-of-2023

68 National Fire Protection Association (NFPA). (2023). NFPA 855, Section 7.2, or applicable sections in the most recent version of NFPA 855. The code can be viewed for free by anyone who registers on the NFPA's website at https://www.nfpa.org/855.

5. An analysis of whether plans to be implemented in response to an emergency can be fulfilled by existing local emergency response capacity, and identification of any specific equipment or training deficiencies in local emergency response capacity;
6. Other information the applicant finds relevant.

ii. **Fire Response Plan (FRP):** The FRP shall include:

1. A description of all on-site equipment and systems to be provided to prevent or handle fire emergencies;
2. A description of all contingency plans to be implemented in response to the occurrence of a fire emergency, including evacuation control measures and community notification measures;
3. [The results of a toxic and flammable gas plume dispersion analysis for the anticipated BESS equipment in a severe fire emergency scenario to assess potential impacts on surrounding communities.]
4. A commitment to offer to conduct, or provide funding to conduct, site-specific training drills with _____ [e.g., emergency responders] before commencing operation, and at least once per year while the facility is in operation, at the expense of the project owner. Training should familiarize the _____ [local fire department] with the project, hazards, procedures, and current best practices.
5. A commitment to review and update the FRP with _____ [e.g., fire department, first responders, and county emergency managers] at least once every _____ [e.g., 3] years.
6. An analysis of whether plans to be implemented in response to a fire emergency can be fulfilled by existing local emergency response capacity. The analysis should include identification of any specific equipment or training deficiencies in local emergency response capacity and recommendations for measures to mitigate deficiencies.
7. Other information the applicant finds relevant.

iii. Copies of Fire and Emergency Response Plans shall be maintained at _____ [e.g., an approved on-site location accessible to facility personnel, the local fire department, and emergency responders, which should be outside the perimeter fence].

PA 233 CONTEXT: PA 233 requires both an Emergency Response Plan (ERP) and a Fire Response Plan (FRP) for BESS projects permitted by the Michigan Public Service Commission (MPSC).[69] While the zoning language for ERPs and FRPs provided here aligns with what the MPSC requires for state-permitted projects, the requirement for a dispersion analysis (see Point 3 of the Fire Response Plan) is not included in the MPSC's Application Filing Instructions and Procedures.[70] Communities may choose not to include such language depending on their zoning preferences (see discussion on Page 28).

69 Michigan Legislature. (2023). Public Act 233 of 2023, Section 225 (1) (q). https://www.legislature.mi.gov/Bills/Bill?ObjectName=2023-HB-5120

70 MPSC's Application Filing Instructions and Procedures. https://mi-psc.my.site.com/s/case/5008y000009kJfbAAE/in-the-matter-on-the-commissions-own-motion-to-open-a-docket-to-implement-the-provisions-of-public-233-of-2023

k. The **Decommissioning Plan** shall, in addition to requirements for Decommissioning Plans in NFPA 855,[71] include:

i. A narrative description of the activities to be accomplished for removing the BESS from service, including who will perform that activity and at what point in time, for complete physical removal of all BESS components, structures, equipment, security barriers, and transmission lines from the site. The description shall also include hazardous material use and removal from the site based upon what is known at the time the application is filed;

ii. A description of which above-grade and below-grade improvements will be removed, retained, or restored for viable use of the property consistent with the zoning district;

iii. A listing of any contingencies for removing an intact operational BESS, and for removing a BESS that has been damaged by a fire or other event;

iv. The projected decommissioning costs for BESS removal and site restoration [not to include salvage value] and how said estimate was determined by a mutually-agreed-upon third party with expertise in decommissioning, hired by the applicant;

v. The method of ensuring that funds totaling _____ [e.g., 100-125 percent] of projected costs will be available for site decommissioning and restoration (in the form of surety bond, irrevocable letter of credit, or cash deposit);

vi. The method by which the decommissioning cost will be kept current, including in the case of a change of ownership or operational authority.

l. **Statement of Public Benefits:** For Off-Site BESS that require Special Land Use approval, a statement explaining the expected public benefits of the proposed BESS.

COMMENTARY: There are several important documents for fire safety outlined in NFPA 855 that may not be available at the site plan approval stage. We have categorized these into two groups: "Pre-Construction Documents," which should be submitted prior to construction, and "Post-Construction Reporting," which should be updated or filed before commercial operations commence.

7. **Post-Approval Documentation:** Any Zoning Permit or Special Land Use Permit for any Off-Site BESS shall be conditioned upon the submission of the following documents:

a. **Pre-Construction Documents:** Prior to the commencement of construction activities, the following documents shall be prepared and/or updated in compliance with NFPA 855 and developed in consultation with the _____ [AHJ for fire safety]. These shall be submitted to the _____ [AHJ for fire safety] and the _____ [e.g., Zoning Administrator]. Copies of all Pre-Construction Documents shall be maintained at _____ [e.g., an approved on-site location accessible to facility personnel, the local fire department, and emergency responders].

i. **Final Equipment Specification Sheet:** Documenting the final battery energy storage system components, inverters, and associated electrical equipment.

ii. **Contact Information:** Name, address, and contact information of the system installer and the owner and/or operator of the battery energy storage system.

iii. **Amended ERP and FRP (if applicable):** Changes to the design, type, manufacturer, etc. of BESS facilities or equipment after site plan approval must be analyzed to determine if changes are necessary to the ERP or FRP. Additional consultation with the _____ [e.g., fire department, first responders, and county emergency managers] is required for amended plans.

71 National Fire Protection Association (NFPA). (2023). NFPA 855, Section 8.1.3, or applicable sections in the most recent version of NFPA 855. The code can be viewed for free by anyone who registers on the NFPA's website at https://www.nfpa.org/855.

iv. **Commissioning Plan:** A Commissioning Plan as outlined in NFPA 855.[72]

v. **Hazard Mitigation Analysis (HMA):** A Hazard Mitigation Analysis as outlined in NFPA 855.[73]

b. Post-Construction Reporting: Prior to the commencement of commercial operations, the following documents shall be prepared and/or updated in compliance with NFPA 855 and developed in consultation with the _____ [AHJ for fire safety]. These shall be submitted to the _____ [AHJ for fire safety] and the _____ [e.g., Zoning Administrator] prior to final inspection and approval by the _____ [e.g., building official]. Copies of all Post-Construction Reporting shall be maintained at _____ [e.g., an approved on-site location accessible to facility personnel, the local fire department, and emergency responders].

i. **Amendments or updates to any Pre-Construction Documents**

ii. **Commissioning Report:** A Commissioning Report as outlined in NFPA 855.[74]

iii. **Emergency Operations Plan:** An Emergency Operations Plan as outlined in NFPA 855.[75] [An Emergency Operations Plan shall be required for all applications, including applications for any facilities under the exclusive control of electric utilities, notwithstanding any potential exemption of this requirement provided by NFPA 855.[76]]

c. Post-Construction Sound Survey: Documentation of sound pressure level measurements shall be provided to the Zoning Administrator by a third-party qualified professional selected by the Planning Commission and at the expense of the BESS system owner within _____ [e.g., 6] months of the commencement of the operation of the project. The study will be designed to verify compliance with sound standards applicable to this ordinance. Small Off-Site BESS are exempt from this requirement.

COMMENTARY: The Michigan Public Service Commission established sound reporting requirements for state-level permitted projects, which measure sound compliance at the "outer wall" of a dwelling on a non-participating property.[77] If your sound standard regulates sound levels at the outer wall, too, then you may want to reference the MPSC's methodology in your ordinance. This methodology does not apply to other measuring locations, such as the property line.

72 National Fire Protection Association (NFPA). (2023). NFPA 855, Sections 4.2.4, 6.1.3, and 6.1.5, or applicable sections in the most recent version of NFPA 855. The code can be viewed for free by anyone who registers on the NFPA's website at https://www.nfpa.org/855.

73 National Fire Protection Association (NFPA). (2023). NFPA 855, Section 4.4, or applicable sections in the most recent version of NFPA 855. The code can be viewed for free by anyone who registers on the NFPA's website at https://www.nfpa.org/855.

74 National Fire Protection Association (NFPA). (2023). NFPA 855, Sections 4.2.4, 6.1.3, and 6.1.5, or applicable sections in the most recent version of NFPA 855. The code can be viewed for free by anyone who registers on the NFPA's website at https://www.nfpa.org/855.

75 National Fire Protection Association (NFPA). (2023). NFPA 855, Section 4.3.2.1, or applicable sections in the most recent version of NFPA 855. The code can be viewed for free by anyone who registers on the NFPA's website at https://www.nfpa.org/855.

76 National Fire Protection Association (NFPA). (2023). NFPA 855, Section 4.3.2.1.5, or applicable sections in the most recent version of NFPA 855. The code can be viewed for free by anyone who registers on the NFPA's website at https://www.nfpa.org/855.

77 See Exhibit A-1.7 and Attachment D of the MPSC's Application Filing Instructions and Procedures. https://mi-psc.my.site.com/s/case/5008y000009kJfbAAE/in-the-matter-on-the-commissions-own-motion-to-open-a-docket-to-implement-the-provisions-of-public-233-of-2023

ZONING PATHWAYS FOR LARGE OFF-SITE BESS

As noted on Page 8, a new state law (PA 233), effective November 29, 2024, presents Michigan local governments with three options for zoning Large Off-Site BESS (outlined briefly below), each with its own set of pros and cons.

For more information about the law and these options—especially any updates since this guide was published—consult the Michigan Department of Environment, Great Lakes, and Energy (EGLE)'s Renewable Energy Academy and the University of Michigan's Graham Sustainability Institute, which offer resources and programming to help communities understand the law and their options within it.[78]

OPTION 1: ADOPT A COMPATIBLE RENEWABLE ENERGY ORDINANCE (CREO) FOR LARGE OFF-SITE BESS

The law defines a CREO as an ordinance "the requirements of which are no more restrictive than the provisions included in Section 226(8)" of the law.[79]

Pros: This is the only option that ensures that developers must seek approval through local zoning. Additionally, because local authorities using a CREO are subject to strict time limits for approving or denying applications, this option is generally viewed as favored by developers and has the potential to attract more projects. BESS projects approved at the local level under a CREO are also eligible for the Renewables Ready Communities Award.[80]

Cons: A CREO does not allow for additional local requirements beyond those specified in the law, including common zoning provisions, such as screening. Moreover, local governments with a CREO may face penalties for failing to approve a project within the mandated time limits, denying a project that meets the standards set in Section 226(8) of the Act, or amending their zoning ordinance to impose additional restrictions after a project has been announced.

How to amend your zoning:

- Insert the following language in the General Provisions Section B.3 (Large Off-Site BESS):
  - Large Off-Site BESS are subject to the provisions and procedures for _____ [e.g., Large Principal-Use Energy Storage Systems (ESS)] laid out in the Compatible Renewable Energy Ordinance Section of this ordinance.
- Using the sample language for CREOs,[81] create a new section within your ordinance. This section should include all relevant definitions, as well as the standards and procedures applicable to BESS and any other energy technologies (e.g., wind, solar) that you wish to include in your ordinance.

78 For resources on PA 233, refer to https://graham.umich.edu/project/MI-energy-siting and https://www.michigan.gov/egle/about/organization/materials-management/energy/renewable-energy/renewable-energy-academy.

79 Michigan Legislature. (2023). Public Act 233 of 2023, Section 225 (1) (f). https://www.legislature.mi.gov/Bills/Bill?ObjectName=2023-HB-5120

80 Michigan Department of Environment, Great Lakes, and Energy. Information on the Renewables Ready Communities Award. https://www.michigan.gov/egle/about/organization/materials-management/energy/rfps-loans/renewables-ready-communities-award

81 A sample CREO is available on our webpage at https://graham.umich.edu/project/MI-energy-siting. Other institutions have created sample CREOs as well, such as the Michigan Townships Association at https://michigantownships.org/mta-sample-creo-now-available/ (members only).

OPTION 2: LET LARGE BESS PROJECTS BE PERMITTED BY THE MICHIGAN PUBLIC SERVICE COMMISSION

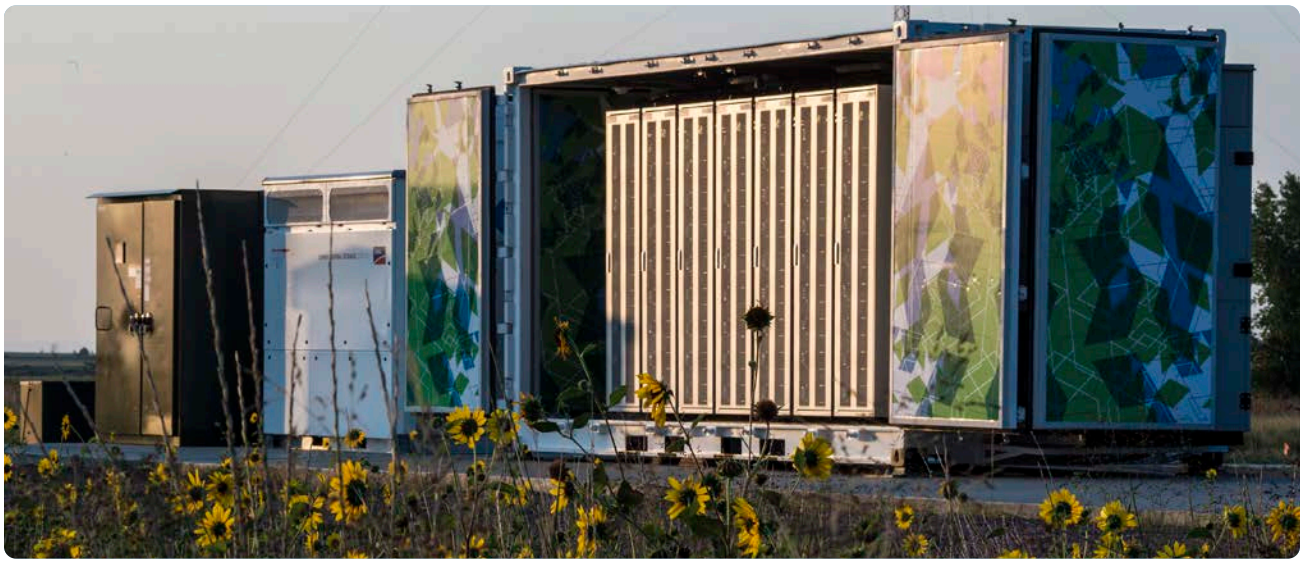
The law allows communities to "request the MPSC to require" all large-scale BESS to seek approval from the MPSC.[82]

Pros: This option requires minimal effort from the local government in terms of establishing zoning or evaluating projects. It allows experts at the State to assess proposed projects and, in communities where BESS may be contentious, pushes any controversy to the State. Additionally, the local government will receive a one-time payment of $2,000/MW after entering into a host community agreement with the BESS developer.[83]

Cons: There is limited opportunity to influence the outcome of the proposal or to incorporate local community priorities into the approval process. Additionally, projects approved by the MPSC are not eligible for the Renewables Ready Communities Award.[84]

How to amend your zoning:

- Insert the following language in the General Provisions Section B.3 (Large Off-Site BESS):
  - Large Off-Site BESS are not regulated by this zoning ordinance and instead shall require a siting certificate from the Michigan Public Service Commission pursuant to Public Act 233 of 2023, Section 222 (2).
- Once a BESS project is proposed in your community, you should contact the MPSC Executive Secretary and MPSC Staff to inform them that you would like the Commission to review the project. Provide a copy of the request to the developer. You may also ask MPSC Staff any questions about the process and filing requirements.[85] Relevant emails are:
  - MPSC Executive Secretary: LARA-MPSC-Edockets@michigan.gov
  - MPSC Staff: LARA-MPSC-Siting@michigan.gov



National Renewable Energy Laboratory's grid integration research facility in Colorado. *(Photo: Dennis Schroeder / NREL 47220)*

82 Michigan Legislature. (2023). Public Act 233 of 2023, Section 222 (2). https://www.legislature.mi.gov/Bills/Bill?ObjectName=2023-HB-5120

83 Michigan Legislature. (2023). Public Act 233 of 2023, Section 227 (1). https://www.legislature.mi.gov/Bills/Bill?ObjectName=2023-HB-5120

84 Michigan Department of Environment, Great Lakes, and Energy. Information on the Renewables Ready Communities Award. https://www.michigan.gov/egle/about/organization/materials-management/energy/rfps-loans/renewables-ready-communities-award

85 See Attachments C-2 and C-4 of the MPSC's Application Filing Instructions and Procedures. https://mi-psc.my.site.com/s/case/5008y000009kJfbAAE/in-the-matter-on-the-commissions-own-motion-to-open-a-docket-to-implement-the-provisions-of-public-233-of-2023

OPTION 3: ADOPT WORKABLE ZONING REGULATIONS FOR LARGE OFF-SITE BESS

PA 233 does not define a workable ordinance, but it is generally understood as one that is somewhat more restrictive than a CREO, yet still preferable to MPSC approval for developers. For more information on why a developer might favor permitting a project through a workable ordinance rather than the State process (Option 2), refer to our FAQs[86] on PA 233 and other available resources.[87]

Pros: This option allows local governments to incorporate local preferences for BESS development within their ordinance, provided these preferences are not overly burdensome for developers. (Otherwise, the ordinance would not be considered "workable.") Additionally, Large Off-Site BESS projects approved at the local level, including through a workable ordinance, are eligible for the Renewables Ready Communities Award.[88]

Cons: There is no guarantee that a developer will choose local approval over MPSC approval. Additionally, there is no consensus among BESS developers on what constitutes a workable ordinance, meaning that what one developer considers workable may not be seen the same way by another.

How to amend your zoning:

- Use the provisions outlined in this guide for Medium Off-Site BESS as a starting point, including both the General Provisions (B.2) and the Use Standards (B.5).
  - o If a BESS developer is already showing interest in your community, you may ask them which provisions of Medium Off-Site BESS are deal-breakers.
  - o If there is no developer currently interested, use the green commentary boxes throughout the sample ordinance to understand the provisions within PA 233. While a "workable" ordinance may not fully comply with PA 233 regulations, if it is significantly more restrictive in multiple areas, the developer is likely to choose the MPSC path. Many items in the sample zoning are not part of PA 233 and are, therefore, more restrictive. Except for provision B.5.j.i (emergency runoff containment), the authors do not believe these will impose significant enough costs to be considered unworkable. However, there is a risk that some developers may find them too onerous and opt for MPSC approval instead.
- If the community decides to apply all the standards for Medium Off-Site BESS to Large Off-Site BESS, the only changes needed in the document are:
  - o Edit B.2 to begin "Medium Off-Site BESS and Large Off-Site BESS are permitted …" [see Table 1 on Page 13 for suggestions].
  - o Delete B.3.
  - o Edit B.5.b.iv (Setbacks) to begin "Medium Off-Site BESS and Large Off-Site BESS: The following minimum setback distances shall apply to any Medium Off-Site BESS and any Large Off-Site BESS: ..."
  - o Edit B.5.c.ii (Sound) to begin "For Medium Off-Site BESS and Large Off-Site BESS, the sound…"
- If the community decides to differentiate between Medium and Large Off-Site BESS, the sample ordinance needs to be amended in Sections B.3 (General Provisions), B.5.b (Setbacks), and B.5.c (Sound) to include standards specific to Large Off-Site BESS. All other provisions in the sample zoning apply broadly to all Off-Site BESS, so language would need to be added selectively to exempt Large Off-Site BESS from certain standards or to articulate alternate (likely less restrictive) standards.

86 FAQs on PA 233: https://graham.umich.edu/media/files/FAQ-How-HB5120-Works.pdf.

87 Resources on PA 233: https://graham.umich.edu/project/MI-energy-siting.

88 Michigan Department of Environment, Great Lakes, and Energy. Information on the Renewables Ready Communities Award. https://www.michigan.gov/egle/about/organization/materials-management/energy/rfps-loans/renewables-ready-communities-award

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