UTILITY-SCALE BATTERY ENERGY STORAGE SYSTEM APPLICATIONS AND IMPACTS IN INDIANA
-EXECUTIVE SUMMARY-

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EXECUTIVE SUMMARY

Indiana's electric grid is confronting significant challenges: aging infrastructure, retiring power plants, rising demand, and the increased adoption of variable renewable energy generation. Utility-scale Battery Energy Storage Systems (BESS) are a flexible and, increasingly, cost-effective tool available to support Indiana's grid. BESS serve as a source of both energy supply and demand. In this capacity, BESS can help balance a diverse mix of power resources, enhance system reliability, and optimize energy costs. BESS development also presents economic opportunities and can be complementary to existing industries in Indiana. Deployment of BESS at scale, however, is not without its own challenges, including considerations related to siting and safety.

In light of the complexities facing Indiana's grid and the role of BESS therein, the Indiana Office of Energy Development (IOED) commissioned a comprehensive assessment of the role of utility-scale BESS in advancing Indiana's statutory energy objectives—reliability, affordability, resiliency, stability, and environmental sustainability—as established in Indiana Code § 8-1-2-0.6. This report specifically focuses on key information relevant to various stakeholders and best practices for the deployment, operation, and regulation of BESS. The objective of the report is to support informed policy, planning, and regulatory decisions throughout the state.

This report was prepared by Exeter Associates, Inc. (Exeter) pursuant to IOED Contract No. 88001 and CDFA 81.041 State Energy Program funding from the U.S. Department of Energy (DOE). Appendix A identifies the scope of Exeter's investigation in accordance with the IOED's requirements. Appendix A also identifies the applicable report section(s) where each RFP requirement is addressed. The subsequent overview reproduces key takeaways from the report, by section.

Current Status of BESS Technology

BESS technologies are an increasingly important part of the electric grid as technological advancements and rising demand both expand BESS's potential applications and increase deployment. This chapter reviews the major characteristics and status of BESS technologies both in Indiana and nationwide, including discussion of operational characteristics and deployment trends.

Key findings and insights from this analysis include:

- Lithium-ion (Li-ion) batteries currently lead the market. Li-ion battery systems are the most widely deployed BESS technology due to their high energy density, efficiency, and extensive operational experience. Their popularity also benefits from established supply chains and decreasing costs driven by manufacturing scale.
- Alternative technologies are advancing. Technologies such as flow, sodium-ion, and solid-state batteries continue to mature and have specific advantages compared to Li-ion batteries regarding safety, scalability, efficiency, and longevity.
- Operational performance differs by application. The ideal battery chemistry and configuration depends on the intended grid application. Frequency regulation and voltage support, for example, are best supported by batteries configured for short-duration, frequent cycling at low output levels. Conversely, capacity firming and grid resilience require longer discharge durations and higher power output.
- Policy and economic factors affect market growth. Policies at both the state and federal level, including investment tax credits, utility mandates, and market participation rules, have been key in facilitating BESS deployment. Indiana-specific market conditions depend on PJM Interconnection LLC (PJM), the Midcontinent Independent System Operator (MISO), both regional grid operators that each serve portions of the state.
- Projected growth is modest in all scenarios. Exeter estimates that Indiana's installed BESS capacity of approximately 225 megawatts (MW) (as of March 2025) will grow to between 2,156-2,975 MW by 2035, depending on the scenarios. The average scenario forecasts approximately 2,703 MW of installed capacity by 2035, driven primarily by federal incentives, declining costs, and planned utility projects. Growth forecasts are sensitive to economic and policy assumptions.
- Indiana's energy policies should continue to be technology-agnostic and outcome-focused. As conditions evolve, Indiana's energy policies and planning efforts should prioritize outcomes, such as reliability and cost, over specific technologies. Policymakers and regulators should design frameworks that are adaptable to innovations in grid solutions, including existing and emergent BESS technologies.

Installation, Operation, Decommissioning, and Recycling Practices

In Indiana, developing a utility-scale BESS from first design to operation can take 6-8½ years. Decommissioning occurs at the end of a BESS's useful life, usually 10-20 years after commencing operation. This chapter analyzes the life of a BESS project, including all stages of design, permitting, construction, decommissioning, and disposal.

Key findings and insights from this analysis include:

- Indiana BESS permitting requirements largely align with other states' standards. State regulatory authorities typically evaluate the necessity, reliability, safety, and economic benefits of a project before installation.
- Local governments need additional ordinance guidance. Since BESS technology is relatively new, there are additional steps that can be taken on a local level to better inform and support planning and zoning ordinances. Indiana should institute a task force of state and local officials to create model BESS safety and siting standards for planning and zoning staff to reference as they develop their own standards. Alternatively, local governments should reference New York's model BESS ordinances.
- Best practices for safety, design, construction, installation, and commissioning are largely established on a national level. Specialty associations, such as the National Electrical Contractors Association (NECA), National Fire Protection Association (NFPA), and Underwriters Laboratories (UL) Standards, develop standards specifically for BESS that are widely used in the industry. This report references several of these associations and the standards they have developed that should continue to be incorporated in legislation and regulation as they are routinely updated.
- Environmental and land impacts can be reduced depending on project location. BESS require access roads and semi-permanent structures, such as cement foundations, that impact the land on which they are developed. Best practice is to not site facilities in protected areas, wetlands, or habitat for endangered species. Local governments may also choose to encourage siting on brownfields to further reduce impact.
- BESS project timelines are longer than expected. BESS projects currently take up to eight and a half years from design to operation. Design and engineering typically overlap with the developer's pursuit of local, state, and Regional Transmission Organization (RTO) reviews, which can speed up the timeline for placing a BESS online. However, delays in the RTO process, which is needed to determine the cost and terms for the project to interconnect, are resulting in long wait times. RTOs are aware of the wait times in the interconnection queues. If RTOs can effectively speed up their review process, the time it takes for a BESS to come online would lessen by as much as half.
- System safety documentation should be reviewed by a third party prior to construction. The Indiana Department of Homeland Security (IDHS) does not have explicit authority to require BESS developers to seek third-party review of their safety reports, such as UL 9540A reports and hazard mitigation analyses. Establishing this requirement through legislative action would ensure compliance with all relevant codes and standards for all utility-scale BESS projects and reduce the review burden for IDHS.
- High-stress operating conditions can speed up BESS degradation. Battery modules have a useful life of approximately 10 years. Three main factors determine a battery's lifespan: temperature, depth of discharge, and state of charge. When batteries are operated under more extreme conditions or in more stressful ways, such as discharging the battery to low levels, they will degrade in performance and lifespan at a faster rate compared with optimal use. BESS lifespans can be extended by 10 or more additional years by replacing battery cells.
- Project owners should be required to update their decommissioning costs every five years following commercial operation. Most decommissioning agreements in Indiana require a one-time update to decommissioning costs five years after commercial operation. Decommissioning costs may change as more projects reach their end of life (EOL) due to increased need for facilities and labor related to BESS disposal and recycling. Requiring regular decommission cost updates will improve the estimates and ensure more accurate financial assurances.
- Establishing a BESS-specific recycling industry in Indiana requires additional guidance. A more formalized recycling network is needed to promote safe handling, economic reuse of components, and sustainable workforce development in this sector. Prospective frameworks should include guidelines for safe battery disassembly, certification standards for recycling technicians, and dedicated industrial zones to process and redistribute recovered materials.

Safety Considerations

The rapid growth of BESS installations, particularly those using lithium-ion chemistries, has elevated the importance of ensuring robust safety, security, and emergency response strategies. This chapter explores certain risks associated with BESS technologies and best practices for mitigating those risks.

Key findings and insights from this analysis include:

- BESS safety risks are real but manageable. While utility-scale BESS failure incidents remain rare, even infrequent events can carry significant consequences. Consistent adherence to all required safety measures outlined in House Enrolled Act (HEA) 1173 (2023), including compliance with NFPA 855 and emergency response planning, will be key to minimizing risk.
- Thermal runaway remains the most critical safety challenge. As Li-ion batteries dominate BESS

deployments, thermal runaway remains the leading cause of catastrophic failure. Emergency response planning should prioritize early detection, containment strategies, and coordination between system operators and emergency responders. IDHS should develop guidance to assist local fire departments in reviewing site-level safety protocols.

- Physical and cybersecurity must be prioritized. Indiana currently lacks formalized state guidance on physical and cyber threat mitigation for BESS. Local officials should consider requiring fencing, surveillance, and access control. The state should explore whether existing regulation or statutory authority allows it to require the use of cybersecurity best practices, aligned as applicable with National Electric Reliability Corporation (NERC) Critical Infrastructure Protection (CIP) standards and DOE guidelines. Cybersecurity expectations for BESS should be at least consistent with those for other critical energy technologies.
- Local facility design requirements should reflect industry best practices. Indiana planners should encourage (or require) containerized modular enclosures equipped with advanced ventilation, fire suppression, and explosion mitigation features. Local ordinances or zoning board approvals can be used to ensure projects meet or exceed design minimums, especially in populated or high-consequence areas.
- Setbacks and buffer zones should be uniformly applied. Local planning authorities should use existing tools, such as UL 9540A test data and NFPA 855 separation requirements for BESS containers, to establish setback distances and buffer zones for BESS installations. Siting projects on brownfields or co-locating them with substations may offer additional safety and land-use benefits.
- Emergency preparedness requires stronger state and local coordination. While HEA 1173 (2023) requires BESS operators to offer training and submit emergency response plans, recent discussions between Exeter and IDHS suggest these trainings are often underutilized. Indiana should consider making such training mandatory for local fire departments in proximity to BESS at the developer's expense. Other strategies could include embedding battery experts within emergency response teams and/or training regional BESS safety liaisons.
- Indiana's regulatory approach to BESS safety must remain adaptive. Lessons learned from past BESS safety incidents demonstrate the need for proactive, forward-looking safety policies capable of evolving alongside safety standards and industry best practices. One approach could be the creation of a BESS Safety Standards Advisory Panel, coordinated by IDHS, to evaluate new standards, issue interpretive guidance, and provide technical recommendations to counties and municipalities.

Economic Impacts and Workforce Development

This chapter of the report reviews the role of BESS in creating direct and indirect jobs in Indiana as well as contributing to Indiana's gross domestic product (GDP) and tax revenue.[i] It also evaluates economic growth opportunities in the state based on existing industry and resource gaps.

Key findings and insights from this analysis include:

- Input-Output modeling suggests modest economic benefits. The results of Exeter's economic impact analysis indicate that Indiana will observe modest growth both in terms of jobs created and economic output. Construction of BESS is estimated to contribute around $824.0 million in estimated cumulative sales (i.e., total output), with 61% of the total attributed to impacts directly associated with construction activities. Annual operations and maintenance (O&M) expenditures by the installed facilities are estimated to contribute roughly $831.9 million in total output.[ii] In aggregate, over the 10-year period analyzed, annual BESS deployment (construction and fixed O&M) is estimated to support between 719 and 1,007 full-time equivalent (FTE) jobs, on average.
- Construction and services industries contribute the most jobs. The identified economic benefits of BESS deployment are concentrated in the construction and service industries. During the construction phase, architectural, engineering, and related services comprise the highest (35%) portion of FTE job impacts, followed by power structure construction (16%). During the O&M phase of a project, activities are expected to be primarily sourced in-state and heavily concentrated (48%) in the commercial and industrial machinery repair services sector.
- Regional economic benefits align with the location of BESS deployments. The regions with the greatest concentration of actual BESS capacity also experience the highest economic benefits in terms of increased output and employment. However, Indiana's central region, including the Indianapolis metropolitan area, observed disproportionately higher indirect and induced benefits due to the concentration of service industries in the area. This includes firms providing architectural, legal, and

[i] Note that the use of GDP throughout this report refers to Gross State Product (GSP), which is simply the state equivalent of the national GDP measure. Indiana's state GDP (or GSP) is simply the monetary measure of all final goods and services produced within the state of Indiana.

[ii] Both estimates regard the Benchmark scenario with a forecasted annual capacity addition of 247.8 MW.

engineering support to BESS facilities during construction and operations.

- Battery storage is not a direct economic substitute for retiring conventional energy plants. In general, BESS facilities are less labor-intensive, smaller in scale, and often sited away from communities affected by conventional (e.g., coal, gas) plant closures. As a result, BESS offers only a partial substitute for the jobs and local economic activity once provided by coal and natural gas generating facilities. This difference highlights the need for intentional workforce planning and community reinvestment.
- Indiana's industrial base and emerging electric vehicle (EV) battery initiatives position it for growth in the BESS sector. The state's strengths in steel production, chemical processing, advanced manufacturing, and logistics are directly applicable to BESS deployment. These assets, along with Indiana's central location, can serve as a foundation for a broader in-state BESS supply chain and deployment hub.
- Targeted workforce development will be essential to capitalize on BESS-related opportunities. While Indiana's workforce possesses relevant industrial skills, specialized training for BESS installation, utility integration, and recycling remains limited. Expanding such efforts—especially to support transitions from legacy energy sectors and to differentiate between EV and BESS workforce needs—will help mitigate labor constraints and bolster Indiana's competitiveness in a growing regional "Battery Belt."

Community Engagement

Thoughtful community engagement is fundamental to effective BESS deployment. This chapter reviews best practices and strategies for local governments to facilitate effective communication and engagement with residents regarding utility-scale BESS technology. It also looks specifically at IOED's role in facilitating community engagement.

Key findings and insights from this analysis include:

- Survey results highlight educational needs. A statewide survey revealed predominantly neutral attitudes toward BESS, with increased support closely tied to greater familiarity. Most respondents recognized potential cost savings and local job opportunities. All residents, but particularly rural residents (where most BESS are located), expressed concern about rate impacts and environmental impacts. The results underscore the importance of clear, accessible information.
- Local governments should follow established community engagement practices. For BESS project planning and deployment, local governments should utilize established engagement practices. These include proactively developing and distributing clear, accessible educational materials tailored to local contexts; initiating public meetings and providing multiple participation channels early and consistently throughout the project lifecycle; and employing structured systems to gather, document, and review community feedback for consideration in relevant decision-making processes.
- Model ordinances streamline approvals. Adopting vetted templates—such as New York's model BESS ordinance or Michigan's BESS planning and zoning guide—can help localities ensure thorough and comprehensive standards.
- IOED has an important convening and technical assistance role. IOED can host public forums, produce outreach materials, and partner with experts to guide municipalities in establishing BESS permitting and zoning requirements, especially with regard to safety and land-use standards. IOED is well-positioned to assist because of its existing relationships with local governments, its under-standing of statewide energy policy goals, and its ability to coordinate across jurisdictions to align local implementation with best practices.

Conclusion

Projects like Northeastern Rural Electric Membership Cooperative's distributed batteries, the Petersburg Energy Center, and the Dunns Bridge Energy Center highlight how storage is already becoming an integral part of the grid. This study finds that utility-scale BESS has strong potential to continue supporting Indiana's energy goals across all five statutory pillars. Realizing this potential will require:

- Regulatory and permitting streamlining at regional, state, and local levels;
- Continued enforcement and refinement of safety standards;
- Workforce development and supply chain investments;
- Transparent, community-oriented project planning; and
- Policy flexibility to accommodate emerging technologies.

With appropriate policy and planning, Indiana can capitalize on opportunities to deploy BESS to enhance the state's grid and promote positive economic outcomes.