WCO | WIND CONCERNS ONTARIO REPORT

Battery Energy Storage Systems (BESS)

Assessment of Community Risks

Introduction

Ontario has placed emphasis on grid-scale Battery Energy Storage Systems (BESS) to address shortfalls in electrical generation capacity that may occur due to the shutdown of the Pickering nuclear station and increasing demand for electricity. Proponents see this technology as key to addressing the intermittent nature of renewable power generation. BESS is a relatively new technology; however, installations around the world provide significant information on design requirements and actual operating benefits. Learning from the operating experience of other facilities reveals risks associated with the technology and highlights the need for changes in the industry standards that govern development of BESS facilities. The overarching goal of the Government of Ontario should be to ensure that projects using this technology will not harm residents of Ontario or result in adverse environmental impacts.

Incidents Reported at BESS Facilities

The 2021 fire in the Tesla's 300 megawatt (450 megawatt hours) Megapack in Geelong, Victoria, Australia received considerable media coverage. This situation highlights the potential risks from BESS facilities:

> *The fire started on the morning of Friday July 30 and was not brought under control until the afternoon of Monday August 2. More than **30 fire trucks** and support vehicles and about **150 fire fighters** from the County Fire Authority and local Fire Rescue Victoria responded, containing the flames so they only affected two Megapacks of the approximately 210 that make up the system.*[1]

This incident is of particular note as it occurred in a facility designed and built by a company with extensive expertise in lithium battery technology. The duration of the fire and the scale of the response raise concerns. While Australian states have infrastructure to fight forest fires that can respond to this emergency, most municipalities, particularly in rural Ontario, do not

[1] CNBC News, Tesla Megapack fire highlights issues to be solved for utility 'big batteries', August 5, 2021.

have easy access to 150 firefighters that could be dedicated to an incident for 3 days, as was the case with this situation.

It is not an isolated incident: other similar situations have been documented in the United States. A fire at a BESS facility in Chandler, Arizona received wide coverage[2] and other incidents were assessed by authorities responsible for setting fire standards for the United States.[3] [4] This suggests that Ontario should be moving with caution on new BESS projects.

The potential for issues with BESS technologies should be viewed in the context of the experiences of rural Ontario communities with wind turbines. Even though they have since proven inadequate, at least the government set out some basic requirements for wind turbines such as separation from people's homes. These and other limitations governing the basic parameters for the approval of these projects were put in place before approvals were accelerated. A comprehensive set of reports that were made widely available before any community consultation or request for municipal support could move forward. While there are serious gaps in this process, it is robust compared to the review and consultation process that is currently underway for BESS in Ontario.

As we saw with the approvals for wind power, it could be left to "host" communities to deal with any negative impacts of these projects.

Key considerations

There are several key issues to consider related to BESS technology. These issues are developed based on reviews of proposals published as part of the current RFP process; responses to questions from residents that will be affected; and a review of published reports on incidents involving BESS technology.

It is not intended to be a comprehensive study but rather, an overview of the rapidly evolving situation while identifying current work in this area that is relevant to the problem and providing some preliminary suggestions on potential content for an Ontario regulation related to this technology. Even these preliminary findings indicate that a need for the IESO and Ontario government ministries **to put a more rigorous regulatory framework in place <u>before</u> BESS projects are approved and implemented**.

This view that more regulations are required is shared with the Canadian Renewable Energy Association or CanREA which notes the need for these requirements in their January 2022

[2] News 10 Phoenix, Fire at Lithium Battery Storage Facility prompts Evacuations, April 22, 2022.
[3] North American Electrical Reliability Corporation, Battery Energy Storage Cascading Thermal Runway, Lesson Learned, 21010301, March 29 2021, pp.1-4.
[4] National Fire Protection Association, Battery Energy Storage Hazards and Failure Modes, December 3, 2021.

white paper, "Laying the Foundation."[5] In particular, CanREA recognizes the need sufficient expertise in regulatory bodies to fairly evaluate proposed energy-storage installations.[6]

Based on the findings outlined here, it is clear that work is required on the Ontario process for approving BESS projects so that the errors of the Green Energy program are not repeated.

Underwriters Laboratory (UL) Standards for BESS Systems

Canadian regulators generally point to two standards in terms of the requirements for BESS. For example, the Canadian Electrical Safety Association document published in May 2022[7] references a UL standard, **ANSI/CA/UL9540.**[8] This is safety standard for an energy storage system and equipment intended for connection to a local utility grid or stand-alone application. It designates key issues associated with these systems including safety of the battery system, functional safety, fire detection/ suppression/ containment and environmental performance. The standard was adopted in February 27, 2020 and updated on April 9, 2021.

The second standard, **UL9540A**[9] is related to the base UL9540 standard. It outlines a test methodology to evaluate the fire safety characteristics of a storage system at each of the cell, module, unit and installation levels. The focus is the ability of the BESS installation to handle thermal runaway propagation. Performance criteria are specified for each level within the installation. Meeting the criteria for each level is required before moving to the next level. Any installation that does not meet the applicable performance criteria is considered non-compliant and would need to be revised and re-tested.[10] These tests are designed to be undertaken in specialized fire testing facilities.

The UL9540 covers storage capacities up to 50 kWh. Installations larger than this need to comply with UL 9540A fire test performance criteria. These standards have been developed for the United States but have also been adopted for use in Canada.

National Fire Protection Association (NFPA) Standard 855

The US-based NFPA views BESS installations as systems that can provide clean, low-cost sources of energy but it notes that they also present significant life safety hazards. NFPA 855[11], a "Standard for the Installation of Stationary Energy Storage Systems", was originally published in 2020 to address the dangers of toxic and flammable gases, stranded energy, and increased fire intensity associated with using lithium metal or lithium-ion batteries. Based on learning since 2020, this standard has already been updated in 2023 requirements for fire detection and suppression, explosion control, exhaust

[5] Canadian Renewable Energy Association, Laying the Foundation, January 2022.
[6] IBID, page 14.
[7] Ontario Electrical Safety Code, Bulletin 64-7-1, Installation and Approval of Energy Storage Systems, May 2022.
[8] UL Solutions, Energy Storage Systems and Equipment, UL Standard 9540, 2nd Edition, February 27, 2020.
[9] UL Solutions, Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems, UL Standard 9540 A, November 12, 2019.
[10] UL Solutions, Webinar - Canadian Codes and Standards for Energy Storage Systems, May 13, 2021.
[11] National Fire Protection Association, NFPA 855, Standard for the Installation of Stationary Energy Storage Systems, 2020.

ventilation, gas detection, and thermal runaway have been added or revised.[12] In a technology environment that is rapidly changing, this more recent standard may include important new information. Even though this is a US standard, it can also be used for BESS projects in Canada.

Fire Suppression Systems

As there is no IESO requirement to address fire safety issues as part of the community meetings or requests for municipal support required in the RFP process, there is limited published information on how the proponents of BESS projects intend to comply with appropriate standards.

For example, Solar Flow-Through Funds, the company proposing a BESS system in Chesley (Arran-Elderslie), did not include this information in its presentation to the Arran-Elderslie Council when the municipal support resolution was requested nor is reflected in its community presentation. Limited information was provided to a local resident in response to a specific question about fire safety. The company responded that the system proposed for Chesley would include a comprehensive Fire Suppression System consisting of at least seven layers of protection. Below is the company description of each layer:

- First, the batteries are isolated from each other to prevent any current from flowing between them.
- Second, there are gas and fire monitoring and controls for each battery, rack and cabinet that provide immediate isolation, suppression, and mitigation in the experience of a thermal event.
- Third, each battery module can be isolated from the overall system, shut down and thermal management applied to suppress propagation.
- Fourth, deflagration systems are built into the containers that are designed to release gases in case of a build-up. The deflagration systems are designed to allow the container doors or roof to blow off if the gas detectors detect a rise in gas concentration beyond prescribed limits. When gases are released, the probability of a fire is significantly reduced as it is the combination of pressure, concentration, and heat that can cause a fire/explosion.
- Fifth, the fire suppression is planned to be accomplished with a potassium nitrate aerosol-based generator. Potassium Nitrate is a benign ionic salt.
- Sixth, in the event of a fire, a dry pipe sprinkler system is triggered to eliminate all thermal events within the cabinet.
- Finally, each system has 24/7 monitoring requirements and annual preventative maintenance plus training for the operators.

Other safety measures described include 24/7 remote monitoring to ensure normal system functioning. This system is monitored for performance and safety continuously and integrated with the IESO command center to perform the dispatch functions required by the system operator.

[12] IBID,2023.

This layered system generally aligns with the requirements of UL9540, but the response did not provide a commitment that the system would meet the performance standards for 9540A testing. The statement that training would be provided for operators conflicts with the statement at the municipal council that the proponent would have no local operators but would contract with local electrical suppliers to undertake required repairs and maintenance. These contract arrangements will not ensure the availability of trained resources in the event of an emergency.

The discussions at the Prince Edward County Municipal Council[13] meeting regarding a municipal support resolution for a BESS project included a lengthy assessment of these provisions. Inadequate provisions to address fire safety issues were a key reason why the proposal did not receive support.

Safety measures were also a concerns raised residents living near the RES project proposed for Enniskillen Township. [14] Enniskillen Mayor Marriott said township officials tried to gather information on battery storage projects from provincial agencies and officials while attending a recent Rural Ontario Municipal Association conference in Toronto, "but the information is fairly sparse."[15]

Hydro One Setback Standards

The standards discussed above are primarily focused internally on the design of the battery structure but Hydro One has a set of additional standards that defines how BESS systems will be positioned relative to Hydro One infrastructure. As part of its Transmission Generation Interconnection Requirements, Hydro One includes a specific section on Setback Considerations for BESS facilities.

Hydro One explains that these requirements are necessary because:

> *Lithium battery storage facility fires can generate intense heat and smoke for prolonged periods of time and are difficult to extinguish. If these facilities are located in close proximity to Hydro One transmission facilities, there is an increased risk to the system. Of more concern is the risk associated with a fire in the BESS that can damage the Hydro One facilities and/or cause line or station equipment flashovers due to the ionization of the air. This can cause Hydro One facilities to be taken out of service and pose a risk to safe, secure and reliable operation of the transmission system.*[16]

Hydro One has established minimum set-back distances for BESS systems from Hydro One facilities as outlined in the following table.[17]

[13] Municipality of Prince Edward County, Municipal Council, January 31, 2023.
[14] Sarnia Observer, Oil City Battery Storage Proposal Dead in the Water, February 16, 2023.
[15] Sarnia Observer, Battery Storage Project Proposed, January 25, 2023.
[16] Hydro One, Transmission General Interconnection Requirements, December 8, 2020, pg.22
[17] IBID.

Item #	Hydro One Facilities	Setback Distance
1	500 kV Right of Way	500 m
2	230 kV Right of Way	350 m
3	230 kV or 115 kV Right of Way with 2 or more double circuit 230 kV or 115 kV lines	250 m
4	115 kV Right of way with single circuit 115 kV line	150 m
5	550kV station	500 m
6	230 kV switching station	350 m
7	115 kV Switching station or a 230 kV or 115 kV step down station	250 m

Source: Hydro One, General Transmission Interconnection Requirements, 2021

As Hydro One is involved in confirming circuit capacity availability, it is assumed that these setbacks will be implemented as part of that process. Enbridge advised residents that setbacks used in the petroleum industry were reflected in the design of the project proposed for St. Clair Township.

If Hydro One and Enbridge are concerned about the impacts of BESS facilities on neighbouring activities that it requires setbacks from rights of way and facilities, **should similar setbacks not be incorporated into a provincial standard that would also apply to municipal road allowances and/or other improvements on adjacent land?**

Requirements for Local Emergency Resources

The emergency response capabilities and resources available to respond need to be aligned with the types of emergency situations that can be encountered at each BESS location. As shown in the 2021 Tesla fire noted above, significant fire resources can be required for an extended duration to deal with emergency situations at these facilities.

This situation and emergency events at other BESS facilities provide some key learning for the emergency response plans for the BESS facilities being approved for Ontario:

- Rapid emergency responses are required suggesting that automated calls sent directly to the emergency call system for the community when an emergency situation is detected.
- Local emergency crews who respond need to be trained to handle lithium fires.
- While water will not put out a fire in a lithium battery, large volumes of water are required to cool all adjacent modules to stop an expansion of the fire. As a result, hydrants connected to a municipal water system are recommended on site.[18] The dry pipe system proposed as part of the BESS facility in Chesley assumes that this water source is available.
- The facility needs to be designed to allow emergency personnel to reach the problem module and to introduce water into the container at a safe distance.

[18] Brendan D. Miller, P.E. Westwood Professional Services, 4 Requirements you may be missing on your BESS project, July 28, 2021.

- Toxic fumes can be released when most of these facilities are experiencing an emergency situation. These emissions can contain hydrocarbons, carbon dioxide and carbon monoxide.[19] These can include flammable gases and designs include venting procedures to prevent an explosion within the unit. These situations need to be monitored remotely with warning provided to affected people.

The ability of the local community to supply these emergency resources needs to be confirmed as part of the approval process and in many cases may determine the locations where these facilities can be developed. An emergency plan should be developed in conjunction with the host municipality for each site that documents which services are expected from the municipality and which services the proponent will be providing or sourcing elsewhere. This plan should be reviewed and updated annually.

In response to questions from a local resident about the proposed St. Clair BESS, Enbridge stated that there were going to provide equipment and training to local fire departments as part of their implementation. Enbridge also stated that it is evaluating how it might integrate local Enbridge staff to work in conjunction with local fire departments in the event of a fire emergency. This confirms that Enbridge sees these risks are worth addressing and all projects should be providing similar support to local emergency services.

Noise Emissions

The potential for noise emissions form BESS installation has been raised at a number of public meetings with the discussions largely centred on the equipment used to cool the batteries. In most of the discussions, it has been generally dismissed by proponents as “just noise from fans”.

More details on the noise emissions were provided in the discussion at the Arran-Elderslie Council meeting [20] in response to a specific question from a Councillor. The proponent indicated that current ventilation systems used for their type of small application generated noise levels of about 75 dBA at source. They expected that this noise level would decrease to a 40–45 dBA level over distance, but no support or engineering estimates for these statements was provided. The proponent also stated that the facility would be located in an area zoned for light industrial uses (i.e., not residential) where noise of this level could be expected.

Though not challenged at the Council meeting, there is a reasonable probability that these noise emissions of 75 dBA will violate the Arran-Elderslie noise by-law. Section 3.16[21] of this by-law prohibits commercial operations from discharging noise that is clearly audible 15.25 metres (50 feet) from the property line on which the structure is located. **The proponent was not correct** in stating that noise levels are determined by the zoning of the property on which the operation is located. In Chesley, it is assessed based on noise levels at nearby receptors. If the nearby site is seniors’ housing that is designated as a “Quiet Zone”, noise emissions are more restrictive.

[19] UL Solutions, Webinar - Canadian Codes and Standards for Energy Storage Systems, May 13, 2021.
[20] Municipality of Arran-Elderslie, Video of Municipal Council Meeting, January 9, 2023.
[21] Municipality of Arran-Elderslie, By-law 61-09 (Noise Bylaw), November 9, 2009

The District Office of the Ministry of Environment Conservation and Parks will have a role in responding to any complaints that are logged with the Spills Action Centre or the local ministry offices. Addressing the noise levels early in the development process to ensure would reduce the need for local interventions after the project is built. In particular, noise barriers can be used to address these problems but a noise assessment of each location should be included in the application so that the need for any remedial sound abatement can addressed before the project is approved. This would also allow the abatement to be designed before the construction phase is understood,

Transformer stations are another potential source of problem noise. Regulation 359/09 sets out noise mitigation measures for transformer stations linked to renewable energy projects.[22] It is assumed that these will also apply to any transformer station needed to link a BESS to the grid.

IESO Requirements

The IESO's current submission requirements for applicants to respond to the RFP with a BESS project are fairly general except for those requirements that relate to the contractual relationship with the IESO. The requirements in the contract are similarly general:

> *The Supplier agrees to design and build the Facility using Good Engineering and Operating Practices and meeting all relevant requirements of the IESO Market Rules, Transmission System Code, Distribution System Code, the Connection Agreement, in each case, as applicable, and all other Laws and Regulations. The Supplier shall ensure that the Facility is designed, engineered and constructed to operate in accordance with the requirements of this Agreement*[23]

Beyond "using Good Engineering and Operating Practices", there are no further details in terms of the standards that need to be met. Similarly the "Municipal Support" form does not require the submission of any information on standards the proposed project will meet. The primary focus of the RFP and contract on matters of direct concern to the IESO: bid price, timing of completion, etc. With the limited information submitted, it is not clear how the IESO will distinguish between submissions in which bid price reflects an identified need to invest heavily in safety features and practices and one that has cut corners in the design to generate a lower bid price. Similarly, the value of a Municipal Support Resolution based on the minimal information required is questionable when municipal support may be withdrawn when the full details of the project are known. The legal implications in the event that a municipality withdraws its support resolution after a proponent has been awarded a contract are unknown. If a proponent has incurred costs for consultancy reports, deposits for equipment and infrastructure components, etc., is it possible the company could opt to initiate legal action against the municipality as a means of coercion if support is withdrawn?

The limited role of the IESO was less of an issue with wind turbine and solar projects when the IESO was only responsible for the approval of the contract. For those projects, there was a separate approval process operated by the environment ministry that had an application and municipal consultation process that a required detailed submission documenting the details of the proposal including

[22] Ontario, Regulation 359/09 Renewable Energy Projects, Section 35, October 10, 2009.
[23] Ontario Independent Electricity System Operator, ET1 – Contract Consolidated – February 3, 2023, Section 2.1 a

equipment proposed for use, siting arrangements, operating procedures, estimates of noise emissions and decommissioning arrangements. It is not clear what additional approval steps the IESO or the government as a whole are anticipating being applied to these projects.

Role of Ontario Regulation 359/09

Development of some renewable energy facilities is regulated by Regulation 359/09. As shown by this review, a BESS facility can generate emissions that can be considered as "Adverse Effects" as defined by the Environmental Protection Act.[24] A BESS can also require significant resources from the host municipality.

There are no specific regulations applicable to BESS projects.

The field staff of the Ministry of the Environment, Conservation and Parks will be responsible for management of any complaints about their noise emissions. This creates the potential for regulations and enforcement procedures related to BESS facilities to be developed after construction through the enforcement process.

New BESS facilities can also be linked to wind and solar projects which are covered under the Regulation and it is expected that new wind and solar projects may incorporate BESS capabilities to maximize revenue generated by the projects.

Despite these relationships, BESS projects are neither included, nor excluded, from the list of activities covered by Regulation 390/09. This regulatory environment needs to be clarified before moving forward with the approval of BESS projects:

- The approval process set out by the IESO only deals with the contractual relationship related to the generation and sale of electricity.
- The information that proponents are providing to municipalities to request a support resolution is not sufficient to consider this endorsement as an "approval" to proceed with construction of the project.
- The technology and standards related to BESS facilities continue to evolve rapidly, meaning that it is inappropriate to leave the technical requirements in the hands of local municipal building officials.

Cost/Benefit Assessments

The IESO requirements for presentations to community meetings or municipal councils did not include any requirement to present cost-benefit analysis for the specific BESS project; however, proponents in the meetings already reference did put forward benefits from the project being proposed.

In their presentations, Solar Flow Through Funds focus on preventing local brownouts. For example, in their presentation to Arran-Elderslie Council,[25] the company representative indicated that the area had

[24] Ontario, Environmental Protection Act, RSO 1990, July 1, 2020, Section 1 (1) Interpretation – Adverse effect.
[25] Municipality of Arran-Elderslie, Video of Municipal Council Meeting, January 9, 2023.

been identified by the IESO as needing this type of back-up capacity "to prevent potential brown-outs" in the Chesley/Paisley area. In a subsequent question, the Deputy Mayor reported on a community meeting where she learned confirmed that isolating the community from brown-outs was a key driver of the project.

This information presented to Arran-Elderslie conflicts with the priorities indicated in the IESO RFP which is focused on fixing capacity issues west of London and east of Pickering as the current problem areas. Four of the six sites being proposed by Solar Flow Through align with those criteria and it not clear why the IESO has specifically identified Chesley as a problem location or how at 4.99 MW project that is only capable of generating 19.96 megawatt hours for a period of four hours would provide a robust solution to this problem. It is also unlikely that Chesley would have a higher exposure to brownouts than other area communities without BESS facilities if the project did not proceed.

As no proponent has been willing to discuss costs for their proposed BESS projects, it is difficult to prove confirm that these BESS projects are providing real value to electricity users across Ontario. Given that the IESO reports that 70% of capacity shortfalls last for more than four hours[26], the concern about the parallel community risk being created by increasing dependence on what is a very expensive supply with a very limited output.

Conclusion

Residents of rural Ontario have extensive experience with energy projects that were approved without sufficient attention to the impact on people and communities. We are concerned that the current IESO RFP is repeating the mistakes of the past by launching a new RFP process that requires very few details on what is proposed or how its operation will integrate with existing municipal structures and services.

We do not want the situation with wind turbines to be repeated. The failure of the IESO or other agencies of the Ontario government to set out a comprehensive set of siting requirements for battery storage systems seems to be preparing rural Ontario for a repeat of the situation with wind turbines.

Recommendations

It appears that the process for projects receiving an IESO contract is that following acceptance of a submission, the proponent would proceed to develop a more detailed proposal for implementation to be presented to local building officials for review and issuance of permits. Given the complexity of these projects and the rapidly changing technology, it is expected that this process could result in substantial delays in implementation of these projects as each small municipality involved gains an understanding of the detailed requirements required to issue the necessary permits. At the same time, these projects require detailed support from municipal partners meaning that the final approval must rest with local authorities.

On that basis, it is recommended that BESS systems be added to the list of renewable energy projects covered by Regulation 359/09.

[26] IESO, LT1 RFP and Additional Mechanisms Engagement, June 9, 2022, Slide 14.

In addition, Regulation 359/09 needs to be amended to add setbacks from nearby activities. These setbacks would likely, at a minimum, mirror the setbacks established by Hydro One for setbacks from their facilities.

Proponents awarded contracts should be required to present detailed proposals for review by the Ministry of Environment, Conservation and Parks for technical completeness. These proposals should include the following:

- A design showing the proposed location of the facility in relationship to nearby activities that could be affected by an emergency at the facility.
- Confirmation that their technology provider(s) assembling the completed battery storage system has been certified by an accredited body that the BESS conforms to all requirements of ANSI/CAN/UL 9540A and NFPA 855.
- Confirmation that the design of the project includes fire monitoring and suppression system in the design of the project.
- A detailed construction and commissioning plan, including the on-site expertise required from start of construction to connection to the grid.
- The proponents must confirm that noise emission from all aspects of the proposed project will meet the requirements of the noise by-law of the host municipality or not exceed 40 dBA nighttime, and 45 dBA daytime, at the closest receptor to the project during times when the receptor is downwind of the project site whichever is more restrictive. Where noise barriers are required to meet these standards, they would be shown in the design of the facility.
- The proponent must confirm that it has established an emergency plan, in conjunction with the local municipalities and fire authorities, in the event of a battery fire. This would include details on the resources that it is expected that the host municipality would provide.
- The proponent must confirm that its emergency plan includes a communication plan with nearby residents and the local communities in the event of a battery fire.
- The proponent must confirm that its emergency plan includes an evacuation strategy for nearby residents, and livestock if necessary, in the event that evacuation is required.

Once the MECP has confirmed that the plan is technically complete, the package would be presented to the community for comment and the municipality Council for review and approval.

Only after the project has been reviewed by MECP and approved by the host municipal council would the formal requests for building permits be initiated.

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