EAST LIMERICK SUBSTATION DEVELOPMENT

Project Code	**IOUK.6300301.00**
Document	**OUTLINE BATTERY SAFETY MANAGEMENT PLAN**
Document Code	**IOUK.6300301.000-BESS-DOC-G-001-2-Outline Battery Safety Management Plan**
Client	**Harmony Solar East Limerick Ltd.**
Document Object / Issued for	ISSUED FOR PLANNING SUBMISSION

Document Track Record					
Rev	Date	Description	Done	Reviewed	Approved
0	28/08/2026	Initial Issue	P.G.A.	K.B.	A.M.
1	07/09/2026	Issue for Planning Submission	P.G.A.	K.B.	A.M.
2	08/09/2026	Updated access details	P.G.A.	K.B.	A.M.

LRQA CERTIFIED ISO 9001-2015

CONTENTS

1 INTRODUCTION

1.1 PURPOSE

This Outline Battery Safety Management Plan (OBSMP) document, produced on behalf of Harmony Solar East Limerick Ltd. (hereafter referred to as 'the Applicant'), outlines the key safety provisions in the event the Battery Energy Storage System (BESS) proposed to be installed as part of the East Limerick Substation development project (hereafter referred to as 'the Proposed Substation Development') fails, including measures to reduce system failure risk and failure outcome mitigation measures.

The Proposed Substation Development will include a Battery Energy Storage System (BESS), providing up to 75 MW / 300 MWh of electricity storage capacity. The BESS will be located within a dedicated BESS compound forming part of the Proposed Substation Development. A full description of the Proposed Development and a description of the design is provided in the Planning and Environmental Report submitted with this application.

This document provides a summary of the safety related information requirements which will be provided in advance of construction of the BESS. The purpose of this OBSMP is to identify how the Applicant will use good industry practice to reduce risk to life, property, and the environment from the BESS.

This document details the types of safety systems available on the market at present, along with risk reduction barriers which are likely to be incorporated into the storage system to be installed at the Site. It is possible that by the time of construction, an alternative battery chemistry may be on the market and available for commercial use. This would, however, need to be fully tested and certified to the latest BESS safety standards.

1.2 DESCRIPTION OF THE BESS DEVELOPMENT

There are several battery storage technologies available to system designers. The generic system used for indicative planning purposes is a BESS system integrating four battery racks. The exact technology and system chemistry type is to be determined at the post-consent stage, but it will be a lithium-ion battery cell type. The popular types of this chemistry within the lithium-ion family are Lithium Nickel Manganese Cobalt Oxide (LiNiMnCoO2), known as "NMC" after the three key cathode materials; or Lithium Iron Phosphate (LiFePO4), known as "LFP". The final battery chemistry will be confirmed as part of the detailed design, prior to the commencement of construction.

For the purposes of this document only, a concept design has been considered that uses a BESS system based upon LFP lithium-ion battery technology. This technology has a lower risk of thermal runaway than other chemistry types.

The design of the BESS and its potential impacts will be controlled in several ways, including by being designed in accordance with both Irish and internationally recognised good practice guidance available at the time.

The outline BESS design, forming part of the Proposed Development, consists of a fenced compound accommodating the BESS enclosures, a switchroom, and the associated energy storage system (ESS) equipment i.e. transformers, inverters and switchgear. The Proposed Development includes provision for a BESS compound at one location within the Site.

The BESS enclosures and auxiliary systems, such as cooling, uninterruptible power supply (UPS), fire and gas detection, explosion protection mechanisms, suppression system, monitoring and control, will be designed in accordance with internationally recognised standards and the latest industry best practice guidance.

Once operational, the plant will be designed to operate unmanned with access required for maintenance only.

1.3 POTENTIAL BESS FAILURE

Causes of battery cell failure, which could lead to a thermal runaway event where a battery cell enters an uncontrolled self-heating state, include manufacturing defects (contaminants / imperfections), electrical abuse (overcharging/ over-discharging), and physical or mechanical damage (puncture / crushing).

BESS hazards for first responders, in the unlikely event of a battery failure and thermal runaway event, depend on the BESS design but are typically defined as: fire hazards, explosion hazards, electrical hazards (shock or arc flash), and chemical hazards (i.e. the release of toxic gases).

Regardless of the type of failure or the cause, the main potential hazard is thermal runaway and ultimately, if not controlled, a significant flaming or battery gas venting incident; therefore, this plan focusses on reducing risks associated with the BESS and managing the hazard, in the unlikely event that it occurs.

In addition to the batteries, the other electrical systems which form part of the BESS can also carry fire risks. However, due to the extensive historic long-term deployment of the other technologies such as transformers, inverters and switchgear, these risks are regulated through longstanding industry guidance and codes.

1.4 SAFETY OBJECTIVES

The overall approach is to follow the Health and Safety Authority's (HSE) hierarchy of controls (REF 1):

i. Elimination;
ii. Substitution;
iii. Engineering Controls;
iv. Administrative Controls; and
v. Personal Protective Equipment.

The safety objectives for the design of the BESS are:

i. To minimise the likelihood of an event. This is an overriding priority;
ii. To minimise the consequences should an event occur;
iii. To contain any event to inside the BESS compound and minimise any impact on the surrounding areas;
iv. To automatically detect and begin to fight a fire as soon as possible;
v. To ensure any personnel on Site can escape safely away from the Site;
vi. To ensure that firefighters can operate in reasonable safety where necessary;

vii. Minimise the requirement for direct Limerick City and County Fire and Emergency Service (LCCFES) intervention in a thermal runaway incident;

viii. Establish minimum equipment spacing distances that demonstrate there is no fire propagation to adjacent BESS enclosures or Energy Storage System (ESS) equipment.

2 BESS SAFETY REQUIREMENTS

2.1 PROCUREMENT

The Applicant recognises that robust quality processes are essential for the BESS development and procurement stages, in terms of ensuring safe and continuous operation. The BESS will be procured from a suitably experienced/certified integrator and will be required to meet the standards set out below.

The Applicant's policy is to work with battery storage integrators and component manufacturers which are ISO 9001, ISO 14001 and OHAS 18001 certified companies. The Applicant requires the designs to incorporate fully tested active and passive BESS failure protection systems, adhere to all relevant UL, IEC, and IEEE safety standards and be fully compliant with NFPA 855 (REF 2), as well as conform to local and Irish industry standards.

2.2 SAFE BESS DESIGN

The site will have comprehensive fire detection and suppression systems in place to ensure safety. When a fire is detected, the battery system will automatically shut down and electrically isolate, though batteries will retain some charge even after isolation. Comprehensive smoke, fire, and gas detection equipment will be installed throughout the site in compliance with NFPA 855 (REF 2) and NFPA 69 (REF 6) standards, with all systems validated before operation begins.

Battery cell will be certified to UL 1973 (REF 8) and / or I.S. EN 62619 (REF 9) and tested to UL 9540A (REF 5) unit or installation level for BESS designs.

Module design will be certified to UL 1973 (REF 8) and / or I.S. EN 62619 (REF 9) and tested to UL 9540A (REF 5) unit or installation level.

The battery enclosures are designed with high-level thermal insulation and validated spacing between units, established through large-scale fire testing as mandated by NFPA 855 (REF 2). This ensures that if a fire occurs, it will remain safely contained within a single enclosure without spreading to adjacent equipment or requiring direct fire service intervention.

2.3 SYSTEM LOCATION

The BESS that forms part of the Proposed Development is designed to provide peak generation and grid balancing services to the electricity grid by allowing excess electricity generated and imported from the electricity grid, to be stored in batteries and dispatched, when required.

The design for the Proposed Development has provision for up to 55 no. containerised BESS units and 28 no. containerised transformer and power conversion/conditioning units, to be enclosed inside a single compound.

2.4 SYSTEM LAYOUT

The site design provides separation between key system components or groups of key system components.

The BESS are be broken into discrete groups consisting of battery enclosures, and inverter and transformer enclosures. Each group are separated from the next. This separation will limit any fire that is not able to be contained to the affected group or part of the battery system and allow emergency access in case of an intervention.

The layout of the proposed BESS provides adequate separation between battery enclosures, additional ESS (Energy Storage System) equipment, and other key site structures and infrastructure that form the other parts of the Proposed Development. The layout meets the requirements of NFPA 855 (REF 2) and comprises:

i. The indicative BESS layout (filename: COUK.6300301.01-BESS-P-101-G-GENERAL LAYOUT) maintains a minimum separation distance of 3m spacing between BESS groupings and other equipment.

ii. The separation distance between BESS units within the same grouping has been reduced to 0.92m (3 ft) as allowed in NFPA 855. This is allowed if large scale fire tests demonstrate that any loss will be safely limited to one BESS unit, without the intervention of LCCFES.

iii. The separation of the inverters and transformers have a separation distance of at least 3m to any other equipment to limit the spread of fire from them to the BESS equipment.

iv. BESS equipment is separated from means of egress by more than 3m.

v. The BESS are separated by at least 3m from any boundaries or areas containing vegetation that could be a combustible material.

vi. To protect BESS enclosures from exterior risks, they shall be provided with impact protection to prevent damage by vehicles or construction equipment, as well as using Damage Limiting Construction (DLC) techniques.

vii. The BESS enclosure will have an internal fire resistance rating of at least one hour (according to NFPA 855 (REF 2), Technical Guidance Document B (REF 11) and FM Global Datasheet 5-33 (REF 12)).

By adhering to the separation distances noted above, risk should be adequately minimised to limit a fire event to a single BESS unit or ESS structure.

2.5 BATTERY SYSTEM ENCLOSURES

The battery enclosures will house all battery systems, electrochemical components, and associated equipment, consisting of one or multiple containers mounted in accordance with the supplier's requirements. Each enclosure will be installed by certified installers and will meet UL 9540 (REF 3) and/or I.S. EN IEC 62933-5-2 (REF 4) certification standards, with Factory Acceptance Testing or independent audits conducted to verify compliance with required protection levels.

The enclosures are designed with safety features including gas exhaust vents and deflagration panels that direct any flames or toxic gases away from personnel and first responders, in accordance with NFPA 68 (REF 7), and I.S. EN 14797 (REF 10) standards. All enclosures will be locked to prevent unauthorised access and will have a minimum one-hour fire resistance rating as required by NFPA 855 (REF 2), Technical Guidance Document B (REF 11), FM Global Datasheet 5-33 (REF 12), I.S. EN 13501-2 (REF 13), and I.S. EN 1364-1 (REF 14) standards.

2.6 DETECTION AND SUPRESSION SYSTEMS

In order to achieve the safety objectives, the proposed BESS will employ monitoring systems that will help identify any abnormal operation and safely shutdown the system before it develops. These systems will be independent of the control systems and equipment that can cause the abnormal event and avoid the use of Safety Integrity Level (SIL) rated risk controls. Other measures include:

- Thermal monitoring of the battery containers and automated cut-out beyond safe parameters;
- Battery liquid cooling systems with automated fail-safe operation (air cooling systems will not be considered); and
- Emergency Stop – both remote and local.

In the event of a fire, the battery system and the transformers serving the BESS will be automatically electrically isolated when a fire is detected within a BESS enclosure. However, the batteries housed within the BESS Enclosures will still hold charge in the event of a fire, even after the electrical system is isolated. It will not be possible to confirm that there is no residual risk from the energised batteries within the BESS enclosures.

The fire and gas detection system for the proposed BESS will comply with NFPA 855 (REF 2) and NFPA 69 (REF 6) standards. This means that smoke, fire and gas detection equipment will be installed on site. The gas detection systems would have an external beacon and audible alert facility. All fire detection systems would be installed and commissioned to I.S. EN 54 (REF 15), I.S. 3218 (REF 16), NFPA 855 (REF 2), NFPA 850 (REF 17). The final BESS failure detection design will be validated by an independent assessor under the responsibility of the Operations, Engineering and Maintenance Contractor prior to construction.

2.7 BESS ACTIVE AND PASSIVE SAFETY SYSTEMS

Other measures to minimise the risk and consequences of a BESS failure event that will be implemented include:

- An automatic ventilation system will remove dangerous gases to prevent explosions, activating well before gas levels become hazardous, and will safely direct flames and gases away from people in accordance with NFPA 855 (REF 2) / NFPA 69 (REF 6).
- Heating and cooling of the battery modules will be provided by an independent liquid cooling system which is separate to any HVAC system providing climate control for the BESS enclosure.
- Backup power for the gas detection system must have a 24-hour duration in standby and 2 hours in alarm, as demonstrated via NFPA 72 (REF 21) compliant battery calculations and required by NFPA 855 (REF 2).
- All fire suppression and safety systems will work together without interfering with the ventilation system, and emergency ventilation will be clearly marked to prevent accidental shutdown during incidents.
- The battery enclosures are built to withstand internal pressure from battery failures, with pressure relief vents and explosion prevention systems that have been validated through full-scale testing and independent expert review according to NFPA 68 (REF 7) and NFPA 69 (REF 6).

3 BESS CONSTRUCTION AND OPERATION

3.1 SAFE BESS CONSTRUCTION

The BESS would be constructed in two distinct phases. Firstly, the civil works and balance of plant equipment will be started. Then at the appropriate stage, the BESS equipment would be delivered to be installed on the foundations and connected to the balance of plant.

The transportation of the system from the factory will be a combination of sea and land freight. The system is certified for transportation in all potential environmental conditions. The equipment will be certified for transport to UN 38.3 (REF 19). Transportation will be managed in accordance with the European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR) 2019 (REF 20) and the Health and Safety Authority ADR – Carriage of Dangerous Goods by Road guidance (REF 21) webpage.

The appointed contractor will ensure the transported BESS equipment will be prepopulated with batteries, and it will have undergone Factory Acceptance Testing (FAT) to IEC 62933-5-2 (REF 4) standards. Site Acceptance Tests (SAT) will follow IEC 62933-5-2 and IEEE 2962 (REF 22) standards and protocols.

By following a logical sequence of works with each step being built upon the preceding one, the system can be safely assembled with minimal risk, and all mitigations against residual risk in place, before the next step occurs.

3.2 SAFE BESS OPERATION

3.2.1 Operational Control

Safe BESS operation will be achieved through the following control systems and measures:

- 24/7 Remote Monitoring and Control: A dedicated control room continuously monitors the battery system, can immediately shut it down if needed, manages emergency response coordination with fire services, and can safely discharge batteries when required for incident response.
- Automated Battery Management System (BMS): Intelligent monitoring that detects dangerous conditions (overheating, battery failures, electrical faults) and automatically isolates affected equipment before problems escalate, with data analytics to predict maintenance needs and prevent issues.
- Clear Site Safety Information: Visible signage displaying hazards, emergency contact details, and system information to ensure first responders have critical safety information immediately available when arriving on site.

3.2.2 Security

The BESS compound will have security fencing with a minimum of two points of ingress / egress for first responders and will be clearly signed, with incident emergency response contact details, clear identification of BESS site hazards, details of site access arrangements such as key codes, which will be provided to the LCCFES.

The BESS site will utilise thermal Imaging Cameras to alert and locate on site fire risks and integrate high-definition CCTV with video analytics to alert and respond to unauthorised site access.

3.2.3 Maintenance

The BESS will be maintained and operated by skilled personnel ensuring that the system is in optimal condition and that all parts of the system are fully serviced and functional at all times.

Routine maintenance will be undertaken on the BESS equipment every 6-12 months, depending on the risk profile of the equipment to be selected. This typically consists of a major maintenance period and a minor maintenance period. This will encompass all BESS and supporting equipment supplied by the Original Equipment Manufacturer (OEM) including the fire protection and explosion prevention system.

During operation, all works on the site will be controlled under safe systems of work. This will mean all work is risk assessed to protect both personnel and equipment. Therefore, safety systems such as fire systems will not be stopped or taken out of service without appropriate mitigation, following the system being made safe so far as is reasonably practicable, and only for the minimum time required to undertake any specific maintenance tasks.

4 FIREFIGHTING

4.1 FIRE SERVICE ACCESS

The BESS compound will provide access suitable for LFCCFES that includes:

i. Two separate access points to the BESS compound to account for opposite wind conditions/direction.

ii. Emergency access to the Site will be via the Main Access Route, secondary access route to the Site will be provided to the LCCFES.

iii. Emergency access route plans for first responders will be included in the Emergency Response Plans and hard copies will be available on site. Route sign requirements will be agreed with LCCFES.

Signage will be installed in a suitable and visible location on the outside of BESS enclosures identifying the presence of a BESS system. Safety signage will be installed in accordance with the Safety, Health and Welfare at Work (General Application) Regulations 2007 (REF 24). Signage will include details of:

- Relevant hazards posed.
- The type of technology associated with the BESS.
- Any suppression system fitted.
- 24/7 Emergency contact information.

A site plan will be provided at the detailed design stage to LCCFES that will include, as relevant:

- Key Infrastructure and Hazards: Building layouts, locations of hazardous materials, combustible storage areas, separation distances between equipment, and emergency shutdown points.
- Emergency Access and Equipment: Primary and alternative fire service access routes, drainage systems, pollution control features, and spill kit locations clearly marked for first responders.

- Specific Safety Features: Natural ground areas, fixed and mobile equipment locations, quarantine areas, and any other relevant safety information needed for emergency response.

4.2 EMERGENCY PLANNING

The proposed BESS will have a robust and validated emergency plan, developed in consultation with LCCFES. Some example BESS and site design information which is anticipated to be shared with LCCFES, to establish a risk profile for first responders, is listed below:

- Battery System Details: Information on battery type, cooling systems, and enclosure design including fire protection features and ventilation systems, all validated through testing.
- Site Layout Information: Number and capacity of battery units, spacing between equipment, and distances to site boundaries, access routes, and other infrastructure.
- Emergency Response Resources: Location of access routes, observation points, and monitoring/control system capabilities for incident response coordination.

Digital provision of safety information and procedures must be provided to site operatives, first responders and SMEs during BESS incident response – hard copy printed materials must be available onsite (location agreed with LCCFES). As a minimum content should include:

- Emergency Procedures and Documentation: Digital emergency plans, shutdown procedures, hazardous material information, and site maps readily accessible to first responders.
- Information on Real-Time Safety Monitoring Data: Details of what gas detection data and fire protection system is available for use in the response to an emergency.
- Emergency Contacts: Contact personnel, battery safety experts, and community contacts.

An ERP will be developed post planning consent to facilitate effective and safe emergency response. It will follow NFPA 855 (REF 2) guidelines and will include as a minimum:

- Site Information and Access: Detailed site maps showing access routes, emergency equipment locations, hazardous materials stored, and emergency shutdown points to enable safe and effective fire service response.
- Communication and Alert Systems: Clear procedures for alerting fire services, up-to-date emergency contacts including battery safety experts, and explanations of all on-site warning systems and alarms.
- Emergency Procedures: Protocols covering incident discovery through resolution, site evacuation, firefighting roles and limitations, and post-incident recovery including reignition monitoring.

The site owner during design development, as well as the operator once appointed, will work closely with LCCFES to provide all relevant information on BESS and site design features to inform all necessary hazard and risk analysis studies and assist in the development of comprehensive Risk Management Plan and Emergency Response Plan.

Information will be supplied as early as possible in the detailed design stage to allow an initial appraisal of the BESS to be made. This information will be provided to LCCFES with appropriate evidence provided to support any claims made on performance, and with appropriate standards cited for installation. Such information should also be made available to LCCFES for inclusion in Site Specific Risk Information (SSRI) records.

A Risk Management Plan shall be developed with LCCFES post consent at the detailed design stage which, as a minimum, will provide advice in relation to potential emergency response implications including:

- The hazards and risks to the facility and their proposed management.
- Any safety issues for firefighters responding to emergencies at the BESS facility.
- Safe access to and within the facility for emergency vehicles and responders, including to key site infrastructure and fire protection systems. Establishment of response times and site arrival protocols.
- Natural and built infrastructure and on-site processes that may impact or delay effective emergency response.

4.3 FIREFIGHTING TECHNIQUES

Due to the BESS not having personnel access into the battery enclosures, there is unlikely to be any immediate threat to life arising from a BESS fire.

The selected BESS technology will have undergone testing to UL 9540A (REF 5) or CSA TS800 (REF 25) standards, demonstrating its capability to limit thermal runaway propagation and reduce the potential for fire spread beyond the affected unit. Water is not proposed to be used on site for fire suppression or boundary cooling as the testing completed on the BESS units has shown this not necessary to prevent fire propagation to other units.

5 CONCLUSIONS

This Outline Battery Safety Management Plan (OBSMP) has demonstrated in a systematic way the mitigation of the potential risks posed by the BESS that forms part of the Proposed Substation Development.

The Applicant is committed to developing a BESS project incorporating equipment which provides optimal levels of performance and safety during its lifecycle.

This OBSMP demonstrates that the Applicant has relevant experience of BESS systems; that the relevant standards and guidance have been consulted, and therefore safety will be inherent in the overall design, minimising the risk of a BESS failure event occurring, and reducing the impact of such an event should it occur.

6 REFERENCES

1. https://www.hsa.ie/topics/hazards/
2. NFPA 855 (2026): Standard for the Installation of Stationary Energy Storage Systems.
3. UL 9540 3rd Edition (2023): Standard for Energy Storage Systems and Equipment.
4. I.S. EN IEC 62933-5-2 (2020) Electrical Energy Storage (EES) systems. Part 5-2: Safety requirements for grid integrated EES systems. Electrochemical-based systems
5. Underwriters Laboratories, UL 9540A (2025) Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems
6. NFPA 69 (2024): Standard on Explosion Prevention Systems.
7. NFPA 68 (2023): Standard on Explosion Protection by Deflagration Venting.
8. UL 1973 (2022): Batteries for Use in Stationary and Motive Auxiliary Power Applications.
9. I.S. EN IEC 62619 (2022) Secondary cells and batteries containing alkaline or other non-acid electrolytes. Safety requirements for secondary lithium cells and batteries, for use in industrial applications.
10. I.S. EN 14797 (2006): Explosion venting devices.
11. Technical Guidance Document B (Fire Safety) (2026).
12. FM DS 5-33 (2023): FM Global Datasheet. Lithium-Ion Battery Energy Storage Systems.
13. I.S. EN 13501-2 (2023): Fire classification of construction products and building elements - Part 2: Classification using data from fire resistance and/or smoke control tests, excluding ventilation services
14. I.S. EN 1364- 1 (2015): Fire resistance tests for non-loadbearing elements - part 1: walls
15. I.S. EN 54 series: fire detection & alarm systems
16. I.S. 3218 (2024): Fire Detection and Alarm Systems – System Planning, Design, Installation, Commissioning, Servicing, and Maintenance.
17. NFPA 850 (2020): Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations
18. NFPA 72 (2025): National Fire Alarm and Signaling Code®
19. UN 38.3: Recommendations on the Transport of Dangerous Goods – Manual of Tests and Criteria – (Lithium Metal and Lithium-Ion Batteries).
20. International Carriage of Dangerous Goods by Road (ADR) (2019)
21. https://www.hsa.ie/your_industry/adr_-_carriage_of_dangerous_goods_by_road/
22. IEEE 2962 (2025): Recommended Practice for the Installation, Operation, Maintenance, Testing, and Replacement of Lithium-ion Batteries for Stationary Applications
23. European Union (Waste Batteries and Accumulators) Regulations 2014 (S.I. No. 283 of 2014).
24. Chapter 1 of Part 7 (Safety Signs at Place of Work) of the Safety, Health and Welfare at Work (General Application) Regulations 2007
25. CSA TS-800:24 (2024): Large-Scale Fire Test (LSFT) Procedure


ENERTIS
Applus