GREENFIRE SOLUTIONS

SUPPORTING RENEWABLE ENERGY

FIRE RISK MANAGEMENT PLAN

AND

COMPLIANCE REPORT FOR

BALLYCUNNEEN SOLAR & BESS

PL-500676-CE-26

JUNE 2026

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GREENFIRE SOLUTIONS

APPROVAL AND REVISION RECORD				
Issue No.	**Date**	**Prepared**	**Reviewed & approved**	**Revision Notes**
A	8th May 2026	M Blunden	D Etheridge	Initial issue for client review
B	12th May 2026	M Blunden	D Etheridge	Realigning of S2 to ROI Legislation
01	2nd June 2026	M Blunden	D Etheridge	Initial document issue

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Glossary of Terms

Term	Definition
ALARP	As Low As Reasonably Practicable; a principle requiring risk to be reduced so far as reasonably practicable, balancing risk reduction against time, trouble and cost.
An Coimisiún Pleanála	The Irish planning commission responsible for determining certain strategic planning matters and appeals.
Applicant	Tobin Environmental Services Ltd, acting in relation to the proposed BNRG Ballycunneen Ltd. development.
Application Site	The lands associated with the proposed development across the townlands of Ballycunneen, Drumline, Ballycasey More, Clonmoney West, Firgrove and Ardkyle, Co. Clare.
BESS	Battery Energy Storage System; an electrochemical energy storage installation used to store electrical energy for later use.
BMS	Battery Management System; the control and monitoring system that supervises battery condition, performance and protective responses, including voltage, current and temperature.
Burn policy	Operational approach whereby, if a unit enters sustained thermal runaway, the affected unit may be allowed to burn out under controlled conditions while defensive cooling protects surrounding assets.
Container / Enclosure	Factory-assembled housing containing battery modules, monitoring and protection systems, ventilation, and associated electrical and fire safety equipment.
DBSMP	Detailed Battery Safety Management Plan; sets out final safety measures, design controls, operational procedures, emergency interfaces and management arrangements for the installed BESS.
Deflagration	Rapid combustion causing a pressure rise that can result in an explosion within an enclosure if flammable gases ignite.
DESNZ	Department for Energy Security and Net Zero (UK); its grid-scale electrical energy storage guidance is referenced as non-statutory good practice.
ERP	Emergency Response Plan; sets out reactive arrangements, actions, roles and communications to be followed in the event of fire or other emergency.
Fire authority	The relevant local authority fire service or statutory fire authority with responsibility for emergency response and fire safety functions in the area of the proposed development.
Fire Risk Management Plan (FRMP)	Plan requested by An Coimisiún Pleanála to identify fire hazards, evaluate associated risks and set out preventative and mitigation measures for the BESS.

Term	Definition
FRS	Fire and Rescue Service; term used in some UK guidance. For this report, equivalent functions are undertaken by the relevant fire authority / local authority fire service in Ireland.
GS	Greenfire Solutions Ltd, author of the report.
Hazard Mitigation Analysis (HMA)	Structured assessment used to identify hazards and determine measures needed to prevent, control or mitigate their consequences.
HF	Hydrogen fluoride; a toxic and corrosive gas that may be generated during lithium-ion battery thermal runaway.
HSWA	Health and Safety at Work etc. Act 1974; UK legislation referenced as comparative good practice only, not as the governing statute in the Republic of Ireland.
IEC	International Electrotechnical Commission; international standards body responsible for the IEC 62933 series and other relevant electrical standards.
IDLH	Immediately Dangerous to Life and Health; a concentration threshold used when assessing hazardous gas exposure during emergency incidents.
LFL / LEL	Lower Flammable Limit / Lower Explosive Limit; the lowest concentration of a flammable gas or vapour in air capable of ignition.
LiFePO4	Lithium iron phosphate; a lithium-ion battery chemistry commonly used in stationary battery energy storage systems.
MVPS	Medium Voltage Power System; electrical equipment associated with conversion, transformation and export of power between the BESS and the wider electrical system.
NFCC	National Fire Chiefs Council (UK); publisher of the Grid-Scale BESS Planning Guidance used as a technical benchmark.
NFPA	National Fire Protection Association; publisher of fire safety standards including NFPA 68, NFPA 69 and NFPA 855.
NFPA 68	Standard on Explosion Protection by Deflagration Venting; provides requirements for venting explosion overpressures from enclosures.
NFPA 69	Standard on Explosion Prevention Systems; addresses active and passive measures for preventing explosion conditions and controlling ignition risks.
NFPA 855	Standard for the Installation of Stationary Energy Storage Systems; key benchmark for design, installation, operation and safety of stationary ESS.
Off-gas	Gases released from a battery during abnormal conditions, including overheating, cell failure or thermal runaway.
PCS	Power Conversion System; converts power between DC and AC and interfaces the BESS with the electrical network.
Planning Authority	County Clare, acting as the local planning authority for the proposed development.

Term	Definition
RFI	Request for Further Information issued by An Coimisiún Pleanála under the Planning and Development Act 2000 (as amended).
Shannon Estuary	Estuarine environment identified as a relevant receptor in relation to potential fire-water runoff and downstream contamination.
SPAR	Smoke Plume Analysis Report; site-specific assessment of dispersion and effects of smoke and hazardous combustion products on surrounding receptors.
Thermal runaway	Self-heating, self-accelerating failure process within a battery cell that can lead to fire, gas release, explosion hazards and propagation to adjacent cells or modules.
TRPT	Thermal Runaway Propagation Time; time taken for thermal runaway to spread from the initiating cell to adjacent units, used as a performance metric in UL 9540A:2025.
UL 9540	Standard covering energy storage systems and equipment.
UL 9540A	Standard test method for evaluating thermal runaway fire propagation behaviour in battery energy storage systems at cell, module, unit and installation level.
Ventilation system	Engineered mechanical system used to manage enclosure temperature, remove off-gases and prevent build-up of flammable atmospheres within the BESS enclosure.

Executive Summary

TOBIN (under the instruction of BNRG Ballycunneen Ltd.) (the Applicant) has commissioned Greenfire Solutions (GS) to prepare an independent Fire Risk Management Plan and Compliance Report for the proposed Ballycunneen Solar & Battery Energy Storage System (BESS) development, located across the townlands of Ballycunneen, Drumline, Ballycasey More, Clonmoney West, Firgrove and Ardkyle, Co. Clare (the Application Site). The report responds to a Request for Further Information from An Coimisiún Pleanála, specifically in relation to fire risk management, emergency response arrangements and fire-water runoff control for the BESS component of the scheme.

The assessment is based on the current indicative design for a containerised BESS installation, integrated with the proposed solar farm infrastructure. It evaluates the design and layout, operational safety management proposals, and site-specific environmental protections against a structured framework of criteria drawn from the Irish planning and fire-safety regime, relevant international standards (including BS EN IEC 62933, IEC 62619, NFPA 855:2026, UL 9540/9540A, NFPA 68 and NFPA 69), and the NFCC Grid-Scale Battery Energy Storage System Planning Guidance (Version 2) where used as good-practice benchmark guidance.

The report addresses three principal questions: whether the inherent fire and explosion risks associated with the proposed BESS can be reduced to a level that is tolerable and as low as reasonably practicable; whether the configuration and operation of the Application Site provides appropriate separation, access, water supply and environmental protection to manage a credible worst-case incident; and whether the information required by An Coimisiún Pleanála in respect of the Fire Risk Management Plan, Emergency Response Plan and fire-water runoff control has been adequately addressed for planning purposes. To answer these, GS has reviewed the proposed technology characteristics, the preliminary safety functions of the battery management, thermal management and suppression systems, the spatial arrangement of enclosures and infrastructure, and the proposed approach to operational safety management and liaison with the fire authority.

The analysis identifies a series of design and management measures that are already incorporated or conceptually allowed for within the current scheme, including separation distances between BESS enclosures and adjacent receptors, provision for dedicated firefighting water storage on site, bunding and drainage measures to contain contaminated runoff, and a commitment to develop a Detailed Battery Safety Management Plan and Emergency Response Plan in consultation with the relevant fire authority prior to commissioning. It also sets out further recommendations to be secured through the procurement process, detailed design and planning conditions, such as requirements for technology certification and performance evidence, configuration of off-gas detection and ventilation,

confirmation of hydraulic capacity and resilience of firefighting water supplies, and completion of any necessary plume and impact assessments for sensitive receptors.

On the basis of the current stage of design, and subject to the implementation of the recommended measures and conditions, GS considers that the Ballycunneen Solar & BESS development can be designed, specified and operated in a manner that aligns with relevant Irish legislative requirements and recognised industry best practice for grid-scale BESS. The framework and recommendations in this report are intended to enable the Applicant, County Clare planning authority, the relevant fire authority and An Coimisiún Pleanála to secure the remaining design detail and operational controls needed to ensure that fire-related risks to people, property and the environment are appropriately identified, managed and mitigated throughout the life of the installation.

1 Introduction

Overview

1.1 TOBIN have commissioned Greenfire Solutions (GS) to provide an independent Verification and Compliance Report for the Battery Energy Storage System (BESS) as part of a proposed solar farm development which is located across the townlands of Ballycunneen, Drumline, Ballycasey More, Clonmoney West, Firgrove and Ardkyle, Co. Clare (the Application Site).

1.2 This report assesses and evaluates the Development and Application Site against material planning considerations specifically related to batteries and fire safety and is in response to a request for more information (RFI) from An Coimisiún Pleanála.

The Application Site

1.3 The Commission has examined the appeal and is of the opinion that certain information is necessary for the purpose of enabling it to determine the appeal. In accordance with Section 132 of the Planning and Development Act, 2000, (as amended), the Applicant is required to submit the following information in respect of the proposed battery energy storage system component of the development, as set out below:

1.4 *Further detail is required in the form of a **Fire Risk Management Plan** (FRMP). The FRMP should be prepared by a suitably qualified technical expert / advisor and set out preventative measures for potential causes of fire hazard and evaluate the associated risk of same. I t should also include specific measures to reduce the risk of a fire occurring onsite including, for example, the safe storage and maintenance of flammable substances and materials, the intended method(s) of extinguishment, and the installation of fire safety equipment and apparatus (fire alarms, detection systems, methods of suppression, etc.). The FRMP should explicitly demonstrate how the potential risk of a fire occurring on the site would be addressed and minimised – **this report addresses this requirement.***

*1.5 Further detail is required in the form of an **Emergency Response Plan** (ERP). The ERP should be prepared by a suitably qualified technical expert / advisor. It should outline a reactive strategy with clear procedures to follow in the event of a fire, detailing the specific actions the facility operator must take to respond quickly and effectively in the event of fire or similar emergency – **a separate document from GS addresses this requirement.***

1.6 *A key environmental consideration during a fire event is the **run-off of fire water** into onsite and adjoining watercourses, including the Shannon Estuary. Further detail and mitigation is therefore required demonstrating that there will be no contamination of surface water or groundwater, that suitable catchment and containment measures would be in place for firewater runoff, and other potential firefighting substances and chemicals (such as foam), and that consideration has been given to potential downstream impacts – **s4.17-4.18 of this report assess the proposed provision to deal with this requirement.***

Greenfire Solutions

1.7 Greenfire Solutions (GS) is led by former senior officers of fire and rescue services with over three decades of operational and strategic experience in fire safety, emergency response and risk management. Drawing on this experience, we provide high quality, bespoke and ethically

sound advice to fire authorities, planning authorities and private sector clients across the UK and the Republic of Ireland, including projects determined under the Irish planning and fire safety regime.

1.8 Our work is founded on independence, objectivity, and uncompromising integrity. While commissioned and remunerated by clients, our professional judgment is never influenced by commercial interests; the protection of life, property, and community safety remains central to everything we do, whether advising on projects in the Republic of Ireland or elsewhere. This includes:

- Operational Advice and Assurance;
- Fire Safety Strategies, including Protection and Prevention;
- Legal Advice in Relation to UK Fire Legislation;
- Our services include:
- Liaison with local authority fire services and fire authorities in the Republic of Ireland and the UK on behalf of third parties.
- Liaison with planning authorities, including elected members and officers, in both the Republic of Ireland and the UK on behalf of third parties.
- Liaison with insurers, investors and other stakeholders with an interest in fire and life safety.

1.9 Since the launch of GS, we have enjoyed considerable growth, built upon the foundations of a solid reputation for delivering high quality outcomes. We work with multiple energy companies, helping to shape projects from inception through to delivery on the ground. Our extensive strategic, operational experience of the fire sector and local authorities enables GS to support developers and planners by:

- In respect of planning applications, reviewing designs and plans to prepare for fire service consultation in line with:
  – The planning and fire safety regime of the Republic of Ireland, including the Planning and Development Acts, relevant County Development Plan policies, the Building Regulations (in particular Part B – Fire Safety and associated Technical Guidance), and national energy and electrical storage policy for Ireland;
  – The Electrical Energy Storage Policy Framework for Ireland and any relevant guidance issued by Government departments or national agencies in relation to grid-scale energy storage and associated infrastructure;
  – Experience with analogous guidance used in other jurisdictions, including National Planning Policy and associated guidance in England, National Planning Framework 4 in Scotland, Planning Policy Wales and "Future Wales – The National Plan 2040", and the Planning (Development Management) Regulations (Northern Ireland) 2015. These are not determinative for developments in the Republic of Ireland, but provide useful comparative good practice for the design and assessment of battery energy storage schemes;
- Creating site-specific fire risk assessments and environmental fire risk assessments;
- Creating bespoke Fire Risk and Emergency Response Plans, plus Outline and Detailed Battery Safety Management Plans;
- Supporting the creation of bespoke Integrated Fire Risk Management Strategies (IFRMS);

- Creating bespoke Environmental Impact Assessments input in compliance with The Town and Country Planning (Environmental Impact Assessment) Regulations 2017;
- Working with Scientific Advisors (who provide advice to UK Fire and Rescue Services) to provide Smoke Plume Analysis Reports (SPAR);
- Generating solutions for site specific challenges through working alongside developers, engineers and planners when in discussions with third parties such as Fire and Rescue Services;
- Supporting liaison during engagement with Fire and Rescue Services to create a positive and open collaborative approach;
- Providing feedback, and updates to future design, from any lessons learned emerging from national and international incidents;
- In the UK, our support includes assisting Fire and Rescue Services to meet their statutory duties, for example in relation to the gathering of site-specific risk information. In the Republic of Ireland, we align our support with the statutory responsibilities of fire authorities under Irish fire safety legislation and associated guidance;
- Supporting liaison with Local Resilience Forums;
- Providing ongoing support to energy companies and local Fire and Rescue Services through the regular testing of procedures and stimulated exercises; and,
- Working with other professional institutions and associations such as the NFCC, Institute of Fire Engineers and the Fire Industry Association .

1.10 Our experience shows that to work effectively with fire authorities, local authority fire services and planning authorities, a collaborative and cohesive approach works best. For projects in the Republic of Ireland, this includes early and structured engagement with the relevant fire authority and the planning authority for the area, so that fire safety considerations can be fully integrated into the planning and design process. Our focus is to build trusting relationships with our clients to become their preferred partner of choice into the future and ensure that each site is as safe as is possible for the community in which it is located.

Objectives

1.11 This report assesses and evaluates the Development and Application Site against material planning considerations specifically related to batteries and fire safety, in the context of the planning and fire safety regime of the Republic of Ireland. The report is intended to assist County Clare, as the planning authority, and the relevant fire authority and statutory consultees, in understanding the fire‐related risks and the measures proposed to manage them.

1.12 Accordingly, the objectives of this report are to:

1.13 Determine whether the fire risks, because of the Development, are reasonable;

- Assess the design of the Development in terms of fire safety and mitigation measures for fire risks;

1.14 Assess the location of the Application Site in terms of whether the potential impacts of a fire are mitigated as far as possible, including potential fire spread to neighbouring sites / receptors; and,

- Evaluate the above against the material planning considerations specifically related to batteries and fire safety.

1.15 To facilitate the above objectives, this report presents specific assessment criteria to address procurement and design considerations, safety systems, operational procedures, and regulatory compliance. These criteria are used as a framework to:

1.16 Evaluate the Development and Application Site against the existing NFCC V2 Guidance, relevant legislation / regulation and current industry best practice / standards;

1.17 Identify potential gaps in safety measures;

- Assess the overall fire risks; and,

1.18 Make any relevant recommendations.

1.19 Taken together, the assessment criteria and recommendations provide a comprehensive framework for evaluating fire risks and serve as a tool for stakeholders to undertake ongoing assessment and evaluation to ensure the continuing safety and compliance of the Development and Application Site throughout the further development and operational phases.

Author

1.20 The author of this document is Martin Blunden, awarded the Queen's Fire Service Medal (QFSM) by her late Majesty, Queen Elizabeth II, in the 2021 New Years Honours list, a Member of the Institute of Fire Engineers (MIFireE) and a former Chief Fire Officer of the Scottish Fire & Rescue Service, with over 34 years' experience in the UK Fire and Rescue sector. His career experience also includes roles as the strategic lead for the National Fire Chiefs Council on Health and Safety, National Operational Learning, and the Joint Emergency Services Interoperability Programme.

2 Use of Legislation, Standards and Design Guidance

Overview

2.1 The design, construction, operation and decommissioning of the proposed BESS are governed primarily by the safety, health and welfare at work and fire safety legislation of the Republic of Ireland, supplemented by European technical standards that apply in Ireland by virtue of adoption by the European Committee for Electrotechnical Standardisation (CENELEC) and international standards that represent current industry best practice. This section sets out the legislative and standards framework that has been applied in the preparation of this report, in order of normative priority.

2.2 The framework operates on four levels:

Tier 1 — Irish primary legislation and regulation (mandatory);

Tier 2 — European Standards adopted as EN standards (normative technical standards applicable in Ireland);

Tier 3 — International standards applied as technical benchmarks (NFPA and UL, used to demonstrate compliance with Tier 1 and Tier 2 requirements where no equivalent European standard exists at the same level of technical detail);

Tier 4 — Sector guidance (NFCC V2 and DESNZ, applied as good practice reference material).

Irish Primary Legislation and Regulation

2.3 The Safety, Health and Welfare at Work Act 2005 (the 2005 Act) and associated Regulations constitute the primary mandatory framework governing the design, construction, operation and decommissioning of the proposed BESS in the Republic of Ireland. The 2005 Act requires employers and those in control of places of work to ensure, so far as is reasonably practicable, the safety, health and welfare of employees and others who may be affected by their undertakings, through the identification of hazards, the assessment of risks and the implementation of appropriate control measures. These duties extend to the design and operation of high-hazard installations such as grid-scale battery energy storage systems.

2.4 The Safety, Health and Welfare at Work (Construction) Regulations 2013 establish duties on clients, designers, project supervisors and contractors during the design and construction phases, including the need to eliminate or reduce risks at source and to coordinate health and safety across the project lifecycle.

2.5 The Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001 (as amended) and the Safety, Health and Welfare at Work (Exposure to Chemical Agents) Regulations 2001 require the assessment and control of risks arising from hazardous substances, including flammable and toxic gases that may be generated during battery thermal runaway events. The Safety, Health and Welfare at Work (Explosive Atmospheres) Regulations 2003 (transposing ATEX Directive 1999/92/EC) impose specific duties where flammable off-gases accumulate in sufficient concentration to create an explosive atmosphere, including requirements for

hazardous area classification, ignition source control, and provision of appropriate explosion protection equipment. Together these instruments establish the mandatory Irish framework for the assessment and management of off-gas, deflagration and explosion risks associated with BESS installations.

2.6 The Fire Services Acts 1981 and 2003 and the Building Regulations (Part B – Fire Safety) and associated Technical Guidance Documents impose duties on building owners and occupiers and establish the functions of fire authorities in the Republic of Ireland. The relevant fire authority for this development is Co Clare Fire and Rescue Service. These instruments inform the expected operational engagement between the Applicant and the fire authority and the requirements for emergency planning and response.

2.7 The Planning and Development Act 2000 (as amended) governs the consideration of the proposed development by An Coimisiún Pleanála and Clare County Council as planning authority. The requirements addressed in this report respond directly to the Request for Further Information issued by An Coimisiún Pleanála under Section 132 of that Act.

2.8 Together, this Irish legislative framework provides the primary mandatory basis for the fire safety and risk management strategy set out in this report. All standards, guidance and good practice benchmarks referenced in the sections that follow are applied to support and demonstrate compliance with these overarching legislative duties.

European Standards — EN IEC 62933 Series: Electrical Energy Storage Systems

2.9 The IEC 62933 series of standards is published by the International Electrotechnical Commission (IEC) and has been adopted by CENELEC as a series of European Standards (EN). As European Standards, the EN IEC 62933 series is applicable in the Republic of Ireland and constitutes the principal European technical standards framework against which grid-integrated electrical energy storage systems are evaluated in this report. The parts of greatest relevance to BESS fire safety and planning are as follows.

- **EN IEC 62933-1** — Electrical Energy Storage (EES) Systems: Vocabulary;
- **EN IEC 62933-2-1** — Unit Parameters and Testing Methods;
- **EN IEC 62933-4-3** — Protection Requirements of Battery-Based EES Systems — Environmental Conditions;
- **EN IEC 62933-5-2:2020** — Safety Requirements for Grid-Integrated EES Systems — Electrochemical-Based Systems.

2.10 EN IEC 62933-5-2 is of particular significance. It establishes the primary European performance-based safety requirements for grid-integrated electrochemical energy storage systems, including requirements for risk assessment, hazard identification and mitigation, battery management, fire safety, thermal management, ventilation, and the control of electrical and chemical hazards across the full lifecycle of the system. Compliance with EN IEC 62933-5-2 is the principal European technical benchmark for demonstrating that the proposed BESS meets the safety performance objectives required by Irish safety, health and welfare at work legislation.

2.11 EN IEC 62619:2022 (Safety Requirements for Secondary Lithium Cells and Batteries for Use in Industrial Applications) is similarly adopted as a European Standard and establishes cell and module-level safety requirements for the lithium iron phosphate (LFP) technology proposed for

this development. Battery cells, modules and packs supplied for the proposed BESS should demonstrate compliance with EN IEC 62619:2022 as part of the procurement and certification evidence base.

European Standards — Explosion Venting and Suppression

2.12 The following European Standards (CEN/CENELEC publications, adopted by NSAI as Irish Standards) are applicable to the design of deflagration venting and explosion protection systems for the proposed BESS, and are applied in this report as normative technical standards:

- EN 14797:2007 — Explosion Venting Devices;
- EN 16009:2011 — Flameless Explosion Venting Devices;
- EN 14373:2021 — Explosion Suppression Systems.

2.13 These standards address the requirements for the specification, design, testing and marking of explosion venting and suppression equipment. They establish the normative European technical basis for demonstrating compliance with the explosive atmosphere and deflagration control duties imposed by the Safety, Health and Welfare at Work (Explosive Atmospheres) Regulations 2003, and are referenced in the assessment of deflagration venting arrangements in Section 3 of this report.

NFPA 855:2026 — Standard for the Installation of Stationary Energy Storage Systems

2.14 NFPA 855:2026, published by the National Fire Protection Association (NFPA) in the United States, provides minimum requirements for mitigating the hazards associated with stationary energy storage systems across a wide range of technologies and deployment scales. The 2026 edition represents a significant evolution from previous versions, incorporating expanded battery chemistry coverage, mandatory Hazard Mitigation Analysis requirements, and strengthened fire and explosion testing protocols that reference UL 9540A testing and large-scale fire testing to characterise thermal runaway propagation under realistic worst-case conditions.

2.15 NFPA 855:2026 is applied in this report as an international technical benchmark, in the absence of any equivalent European or Irish installation code offering the same scope and level of technical detail for grid-scale BESS. Its use is justified on the following basis:

2.16 NFPA 855:2026 provides a systematic, performance-based methodology for demonstrating that the fire and explosion safety performance objectives required by EN IEC 62933-5-2 are met at the installation level;

2.17 It is applied internationally, including by developers, regulators and competent authorities across EU member states, as the most comprehensive installation-level standard currently available for grid-scale BESS;

2.18 Its risk-based approach to separation distances, thermal runaway propagation, explosion control and emergency response is consistent with the ALARP principles required by the 2005 Act and associated Regulations.

2.19 NFPA 855:2026 does not replace or supersede EN IEC 62933-5-2 or the applicable Irish legislative requirements. It is applied alongside those instruments to provide additional technical rigour and specificity at the installation design and operational planning level.

UL 9540 / UL 9540A — Testing the Fire Safety Hazards Associated with Propagating Thermal Runaway within Battery Systems

2.20 UL 9540A:2025 provides a standardised methodology for evaluating thermal runaway fire propagation behavior in battery energy storage systems and is widely regarded internationally as the most comprehensive fire safety test protocol currently available for BESS installations. It is explicitly referenced in NFPA 855:2026 as the required evaluation procedure for demonstrating ESS fire propagation performance and is applied globally — including in EU member state projects — as the evidential basis for demonstrating that thermal runaway will not propagate between battery enclosures.

2.21 UL 9540A employs a four-level hierarchical testing approach that progressively evaluates thermal runaway propagation at cell, module, unit and installation level. The updated UL 9540A:2025 edition introduces the concept of Thermal Runaway Propagation Time (TRPT), defined as the duration from initiation of thermal runaway in the first cell until propagation to adjacent units, providing a quantitative performance metric that can be aligned with detection, notification and evacuation objectives. For grid-scale installations, a TRPT of at least 30 minutes is sought to provide adequate time for detection, fire authority notification and personnel evacuation.

2.22 UL 9540A testing provides the technical evidence required to demonstrate compliance with the propagation performance requirements of EN IEC 62933-5-2 and with the installation requirements of NFPA 855:2026. Compliance with UL 9540A:2025 is a required procurement and certification condition for the final selected battery technology under this report's recommendations.

2.23 UL 9540 is the overarching product standard for energy storage systems and equipment, establishing system-level safety requirements for the BESS as an installed unit. Combined with UL 9540A test results, it provides the fire authority and planning authority with independently verified, test-based assurance on fire propagation and system safety behaviour.

NFPA 68 — Standard on Explosion Protection by Deflagration Venting

2.24 NFPA 68 provides detailed requirements and methodologies for deflagration venting, including calculation of vent areas, sizing criteria and design requirements for venting arrangements to manage explosion overpressures in enclosures. In the context of BESS, NFPA 68 is applied to evaluate the potential for and consequences of deflagration arising from thermal runaway events, off-gas releases and ignition within enclosures. It is used in this report as a technical benchmark to supplement and complement the European Standards EN 14797:2007 and EN 16009:2011, providing detailed design methodology for demonstrating that deflagration venting arrangements meet the performance outcomes required by EN IEC 62933-5-2 and by the Safety, Health and Welfare at Work (Explosive Atmospheres) Regulations 2003.

2.25 NFPA 68 is recognised and applied internationally and is explicitly referenced by NFCC V2 Guidance alongside EN 14797:2007 and EN 16009:2011 as an acceptable means of evidencing explosion protection design. Its use in this report is consistent with the internationally accepted position that it provides complementary technical methodology to the European Standards, rather than a substitute for them.

NFPA 69 — Standard on Explosion Prevention Systems

2.26 NFPA 69 sets out requirements for the design, installation, operation, maintenance and testing of explosion prevention systems, covering active and passive methods including explosion suppression, inerting (oxidant concentration control), combustible concentration control, ignition source control and deflagration pressure containment. For the proposed BESS, NFPA 69-compliant combustible gas concentration control — maintaining enclosure atmosphere below 25% of the Lower Explosive Limit (LEL) — is applied as the primary active explosion prevention mechanism.

2.27 NFPA 69 is used in this report as a technical benchmark to supplement and complement the European Standard EN 14373:2021, providing detailed design methodology for demonstrating that active explosion prevention systems meet the performance outcomes required by EN IEC 62933-5-2 and by the Safety, Health and Welfare at Work (Explosive Atmospheres) Regulations 2003. Its use alongside EN 14373:2021 represents current international good practice for BESS explosion control design and is consistent with the requirements of NFPA 855:2026.

NFCC — Grid-Scale Battery Energy Storage System Planning — Guidance for FRS

2.28 The National Fire Chiefs Council (NFCC) in the United Kingdom has published "Grid-Scale Battery Energy Storage System Planning — Guidance for Fire and Rescue Services" (NFCC Version 2, approved December 2025 and published February 2026). NFCC V2 is the current UK sector guidance used by Fire and Rescue Services and recognised by UK planning authorities for the assessment of BESS installations.

2.29 NFCC V2 has no formal statutory status in the Republic of Ireland and is not binding on Co Clare Fire and Rescue Service, County Clare as planning authority, or on An Coimisiún Pleanála. It is applied in this report as a good practice technical benchmark only, on the basis that it represents a comprehensive, evidence-based synthesis of current knowledge on BESS fire and explosion hazards, emergency response requirements and incident impact assessment. In particular, its structured approach to fire communication frameworks, incident impact assessment, sensitive receptor identification, emergency water provision and firefighting strategy is applied as a framework of good practice principles to supplement the mandatory Irish legislative and EU standards requirements.

2.30 On 26 March 2026, NFCC published a Planning Policy Position Statement recommending that fire safety infrastructure, including firefighting water supplies and hydrants, should be secured through the planning system and funded by developers. While this Position Statement reflects planning processes in England and is not binding in Ireland, the underlying principles are consistent with good practice for high-risk infrastructure developments in any jurisdiction, and the approach of funding and securing firefighting water supply details by planning condition is adopted in this report as a reasonable precautionary measure.

DESNZ — Health and Safety in Grid-Scale Electrical Energy Storage Systems

2.31 The "Health and Safety in Grid-Scale Electrical Energy Storage Systems" guidance published by the UK Department for Energy Security and Net Zero (DESNZ) provides lifecycle risk management guidance across the design, construction, operation and decommissioning stages of grid-scale BESS projects. This guidance has no statutory status in the Republic of Ireland. It is referenced in this report only where it provides useful supplementary commentary on lifecycle

risk management methodology, and where its emphasis on design-stage risk reduction, early fire authority engagement and emergency planning is consistent with good practice obligations under the 2005 Act. In particular, the guidance's endorsement of EN IEC 62933-5-2 as the primary safety assessment framework for electrochemical-based BESS reinforces the Tier 2 position accorded to that standard in this report.

Applicability in the Republic of Ireland and EU Context

2.32 The standards and guidance referenced in this section have been selected and positioned to reflect their normative status in the Irish and European regulatory context. The primary basis for all fire safety and risk management conclusions in this report is the mandatory Irish legislative framework set out in paragraphs 3 to 8 above. The EN IEC 62933 series and the applicable European explosion protection standards constitute the normative technical framework within which compliance with that legislation is demonstrated.

2.33 NFPA 855:2026, UL 9540/9540A, NFPA 68 and NFPA 69 are applied not because they are accepted in the UK, but because they represent the most detailed and internationally recognised installation-level technical tools currently available for demonstrating that the safety performance objectives of EN IEC 62933-5-2 are met and that BESS fire, explosion and thermal runaway risks are reduced so far as is reasonably practicable in accordance with the 2005 Act. Their use reflects current good practice among competent persons advising on grid-scale BESS across the EU and internationally.

2.34 NFCC V2 and DESNZ guidance are applied as supplementary good practice references only. No conclusion in this report is dependent solely on NFCC V2 or DESNZ guidance where that conclusion would not also be supported by the Irish legislative framework, the EN IEC 62933 series or the NFPA/UL standards applied as benchmarks.

3 Assessment and Evaluation: Proposed Development Design

Overview

3.1 The assessment and evaluation in this section covers the Development's current design based on Lithium Iron Phosphate (LFP or LiFePO4) technology. The Site Layout Plan is shown in *Appendix 1 – 12099 2032 rev A*. This section will be written using this battery type, the specific battery storage unit/cabinet has not been selected for the project which is not unusual at such an early stage in the design process. As a result, there is no specific detail or confirmation concerning the exact type of battery unit/cabinet, how they are to be arranged e.g. a cell-module-rack-cabinet arrangement or how many cabinets there will be in each unit.

3.2 This report draws, in part, on indicative or sample-based information. While the inputs may not in all cases represent definitive data, the analysis and conclusions presented are based on professional judgment, proven methodology, and extensive operational experience. The indicative nature of some data does not diminish the validity, independence, or robustness of the findings and recommendations contained within this report.

3.3 The assessment and evaluation of the Development (which is dependent on proposed fire safety provisions and emergency response / recovery strategies) is considered in later sections.

Proposed Development: Summary

3.4 As noted above, the Development design is based on LiFePO4 technology and the procurement process for the battery enclosure has not yet been started. *Appendix 1* shows upto 20no. BESS containers and upto 5no. Medium Voltage Power Systems (MVPS) incorporating the inverters and transformers for the BESS containers.

3.5 The Site Layout will become fixed once approved, therefore controlling the distances, water provision and the access point, however as above it does not constitute a final decision or commitment to any manufacturer or battery model.

3.6 The ultimate selection of battery technology will be determined through a rigorous procurement process, considering the most up-to-date technology and safety standards available at the time of implementation, and the battery technology will be confirmed as part of the expected Detailed Battery Management Plan. It is expected that this will be likely controlled and required by condition prior to the operation of the Development submitted to and approved in writing, by the Local Planning Authority, in consultation with the Co Clare Fire and Rescue Service.

3.7 Whilst the technical specifications have not yet been finalised, and the procurement process has not commenced, this approach ensures that the relevant criteria are taken into account at the earliest possible opportunity such that the final Development and Application Site will meet or exceed current standards and design guidance requirements, thus allowing adaptability to future technological advancements in the rapidly evolving field of energy storage.

3.8 This process also ensures that the fundamental spacing, provision, and access requirements set out in NFCC V2 Guidance are approved and fixed at the time the Planning Authority grants permission. The specific technology can then be confirmed at a later stage, allowing the incorporation of any advancements in safety measures and regulatory testing. This approach

ensures a robust and safe Development prior to operation. LiFePO4 technology offers several significant benefits:

- $LiFePO_4$ technology provides excellent thermal stability, making it one of the safest lithium-ion battery chemistries currently available, reducing the risk of thermal runaway and fire hazards;

3.9 $LiFePO_4$ batteries, offer a long service life, maintaining 80% state of health (SOH) after more than 2,500 cycles at room temperature;

- The $LiFePO_4$ chemistry ensures stable performance over time, contributing to the overall reliability of the energy storage system;

3.10 $LiFePO_4$ batteries are substantially cobalt-free, making them more environmentally friendly and less dependent on scarce resources; and,

3.11 $LiFePO_4$ technology provides adaptability to a broad range of operating temperatures, thereby providing versatility in various environments.

Assessment Criteria 1: Management Systems

The final Development should be equipped with Management Systems compliant with the relevant standards and design guidance requirements, also meeting any wider health and safety requirements of the Republic of Ireland and the European Union.

3.12 Through our discussions with the Applicant, it has been confirmed that ultimately each battery container will have its own Battery Management System (BMS) which will monitor and manage the performance, safety, and health of the batteries within each container, ultimately providing an effective method for early identification of potential faults.

3.13 The following paragraphs provide information on the management systems for containerised BESS.

Battery Management System

3.14 The BMS will monitors and manages various aspects of the battery's operation. It continuously monitors critical parameters such as voltage, current, and temperature of the battery cells. It also provides various protection features including overcharge protection, over-discharge protection, and short circuit protection.

3.15 Working in conjunction with the liquid-cooled system, the BMS manages the thermal conditions of the battery pack and includes algorithms for estimating the state of charge (SOC) and state of health (SOH) of the batteries.

3.16 The BMS in each cabinet connects with other cabinets and the overall site BMS through a combination of communication protocols and network interfaces. This is how it typically works:

- Internal Communication: Each cabinet has its own BMS which has been outlined above.

- Inter-Container Communication: The BMS in each cabinet communicates with the BMS in other cabinets using standardised communication protocols or Ethernet which allows for coordinated operation and data sharing between containers.
- Site-Level BMS: All container BMS units are connected to a central site-level BMS. This central BMS aggregates data from all cabinets, providing a comprehensive overview of the entire energy storage system and therefore ensures optimal performance, safety, and efficiency across the site.
- Real-Time Monitoring and Control: The site-level BMS enables real-time monitoring and control of the entire energy storage system. It can adjust based on the aggregated data to balance loads, manage charging and discharging cycles, and ensure overall system stability.

3.17 In relation to battery design fire safety provisions for the cabinets to comply with industry best practice, smoke, heat and flammable gas detection systems should be included in the technical specification/requirements of the procurement documentation. GS can see that a range of detection, warning and ventilation systems are to be installed as standard. The specific operating parameters of detectors and emergency alarms for the cabinets should be defined in the DBSMP

Thermal Management Systems

It is expected that the chosen container will use a Thermal Management System that continuously monitors temperature at the cell level. This system works to prevent conditions that could lead to thermal runaway by maintaining optimal operating temperatures.

Summary

Overall, the combination of real-time monitoring, smart cooling and automatic safety responses is designed to ensure a safe operating environment, mitigate thermal risks within the BESS and prevent conditions that could lead to thermal runaway, and ensure a safe operating environment.

Assessment Criteria 1: Recommendations

GS recommends that:

- *During the procurement process, the Applicant should specify management system requirements – including any associated installation, test methods and certification standards – for all elements of the final Development – including the batteries, BESS containers and associated components; and,*
- *During the detailed design, the Applicant should provide the specification of the selected management systems and demonstrate how these are compliant with the relevant standards and design guidance requirements, and how these meet any wider UK health and safety requirements.*
- *These should be done through a Detailed Battery Safety Management Plan.*

Assessment Criteria 2: Embedded Detection and Protection Systems

The final Development should be equipped with embedded detection and protection systems compliant with the relevant standards and design guidance requirements.

3.18 Alongside management systems, detection and protection systems provide an effective method for early identification of potential faults.

3.19 The following paragraphs provide information on the detection and protection systems for the chosen technology.

Integrated Design and Safety Features

3.20 It is expected that the chosen container will use advanced lithium iron phosphate (LiFePO4) cells which are engineered to deliver high energy density and system efficiency. The technology solution is based on a modular, liquid-cooled design for flexibility and site-specific customisation, and it includes early fire hazard detection and suppression systems, which meet **UL 9540**, **UL 9540A**, and **NFPA 855:2026**.

3.21 The fire safety features will include compartmentalised ventilation, gas and temperature detectors, early smoke detection, explosion venting, aerosol fire suppression, which work together to extinguish fires and prevent propagation to surrounding battery containers.

Assessment Criteria 2: Recommendations

GS recommends that:

- *During the procurement process, the Applicant should:*
  - *Specify detection and protection system requirements, including any specific operating requirements such as:*
    - *How the systems should be monitored; and,*
    - *How the systems should respond to a detection event e.g. the identification of a potential fault or issue that could lead to a safety hazard, such as thermal runaway and / or, the early identification of gases released by the $LiFePO_4$ cells leading to the initiation of suppression measures:and,*
  - *Confirm the published Thermal Runaway Propagation Time (TRPT) of the selected BESS enclosure (as per UL 9540A:2025), and that a minimum TRPT of 30 minutes is achieved to provide adequate time for detection, FRS notification, and defensive strategy initiation. The TRPT result should be documented in the DBSMP.*
- *During the detailed design, the Applicant should provide the specifications of the selected detection and protection systems and demonstrate how these compliant with the relevant standards and design guidance requirements.*

Assessment Criteria 3: External Protection Systems (inc. Spacing Considerations)

The final Development should be equipped with external protection system as appropriate for the final layout (including any spacing considerations) and should be compliant with the relevant standards and design guidance.

3.22 Regarding external protection systems, to comply with NFPA 855:2026, fire protection should be provided between the cabinets in the unit to limit thermal runaway and fire spread. Additionally, the outer steel enclosure of each battery cabinet should be designed with a thermal barrier to mitigate fire spread to and from neighbouring battery containers.

3.23 In terms of inter-enclosure spacing, the NFCC V2 Guidance now explicitly confirms that where a BESS enclosure has been tested to a standard such as UL 9540A:2025 and that testing demonstrates that thermal runaway propagation does not occur between BESS cabinets or enclosures, it is possible to reduce the separation distance to a minimum of 3 ft (0.914 m) in accordance with NFPA 855: Standard for the Installation of Stationary Energy Storage Systems (2026).

3.24 The guidance further states that any reduction beyond 0.914 m should only be made on the basis of technical advice from a competent person, and that NFPA 855:2026 must be considered in its entirety to ensure that separation distances are not taken out of context. In order to demonstrate that a reduction to 0.914 m is appropriate, the following must be satisfied:

- A fire involving one ESS unit will not propagate to an adjacent unit, as demonstrated by large-scale fire testing;
- Complete UL 9540A test reports, including cell, module and unit level testing, are provided to the Authority Having Jurisdiction; and
- Testing evaluates thermal runaway propagation potential, heat and gas release rates, radiant heat flux measurements, and potential for deflagration or re-ignition.

3.25 Where the developer cannot demonstrate that a thermal event or fire can be contained to the BESS enclosure or cabinet of origin, the developer should refer to the separation distance guidance within the current edition of NFPA 855:2026.

3.26 NFCC V2 Guidance also clarifies that suppression systems cannot compensate for reduced spacing, the no-propagation performance must be demonstrated by fire testing alone. The FM Global Data Sheet 5-33 is no longer the primary reference for separation distances under NFCC V2 Guidance; NFPA 855:2026 and UL 9540A:2025 are the governing standards.

3.27 The current site layout positions the containers side-to-side at 6m spacing within arrays, with 6m between the containers and the MVPS. Each array consists of 4no. containers and 1no. MVPS. The 6m inter-array separation substantially exceeds the 0.914m minimum and provides an additional defensive barrier. Final confirmation that the chosen equipment's UL 9540A test certificate covers the proposed layout configuration will be required as part of the procurement process and must be documented in the Detailed Battery Safety Management Plan.

3.28 The container separation distance will be independently validated during the Large-Scale Fire Test that is required as part of **NFPA855:2026** and **UL9540A:2026**.

Assessment Criteria 3: Recommendations

GS recommends that:

- *During the procurement process, the Applicant should specify that external protection systems should be appropriate for the proposed layout, including any spacing considerations; and,*
- *During the detailed design, the Applicant should provide the specifications of the selected external protection systems (including for both the BESS enclosure and the partitions between BESS enclosures) and demonstrate how these are appropriate for the final layout when considering the final proposed spacing. GS further recommends that this demonstration should include risk assessment / modelling considering the possibility of fire spread from a BESS enclosure to other site-critical infrastructure.*

Assessment Criteria 4: Fire Suppression Systems

The final Development should be equipped with fire suppression systems compliant with the relevant standards and design guidance.

3.29 Any fire suppression system should be chosen based on its effectiveness and suitability for the specific environment, and the nature of the potential fire risks associated with the battery technology. Further, any fire suppression system should ensure rapid response and minimal disruption whilst maintaining the safety and integrity of the overall facility and the surrounding area and be effective at suppressing thermal runaway events as well as other combustible materials e.g. wiring looms within the battery cabinets.

3.30 The following paragraphs provide information on the expected fire suppression systems for the chosen technology.

Fire Suppression System

3.31 GS understands that, in the event of a thermal anomaly, the fire suppression system deploys aerosol agents for 22 seconds to extinguish any fire. This system is integrated with other safety features, including advanced ventilation and gas detection systems, to ensure comprehensive protection.

Assessment Criteria 4: Recommendations

GS recommends that:

- *During the procurement process, the Applicant should specify fire suppression system requirements, including any specific operating parameters; and,*
- *During the detailed design, the Applicant should provide the specification of the selected fire suppression systems and demonstrate how these are compliant with the relevant standards and design guidance requirements, and how they will be effective for any fire within the Proposed Development / at the Application Site.*

Assessment Criteria 5: Deflagration Venting / Explosion Prevention

The final Development shall be equipped with deflagration venting and explosion protection systems appropriate to the hazard and compliant with relevant Republic of Ireland, European, UK and international standards and design guidance, including:

- ***BS EN 14797:2007 - Explosion Venting Devices***
- ***BS EN 16009:2011 - Flameless Explosion Venting Devices***
- ***BS EN 14373:2021 - Explosion Suppression Systems***
- ***NFPA 68 - Standard on Explosion Protection by Deflagration Venting***
- ***NFPA 69 - Standard on Explosion Prevention Systems***
- ***NFPA 855:2026 - Standard for the Installation of Stationary Energy Storage Systems***

All designs shall be developed by competent persons with demonstrable evidence of design suitability. Where exhaust systems are designed to prevent deflagration, they shall maintain the environment below 25% of Lower Explosive Limit (LEL).

Flames and materials discharged through venting shall be directed to safe locations and shall not contribute to fire propagation beyond the affected unit or present risk to persons.

During detailed design, the Applicant should commission a cable route vapour migration assessment covering all conduit and cable trunk connections between BESS enclosures, PCS units, and the substation, in accordance with NFCC V2 Guidance Section 9 and DSEAR 2002, with mitigation measures documented in the DBSMP.

Secondary Vapour Cloud Explosion Risk — Cable Route Leakage Paths

3.32 The NFCC V2 Guidance (Section 9, published February 2026) introduces a specific new requirement that designs for BESS installations must give consideration to the potential for explosive vapour to migrate via cable trunks, conduits, and cable routes connecting BESS enclosures to associated infrastructure such as Power Conversion Systems, substations, and control buildings. Migration of off-gas through these pathways could result in a secondary remote vapour cloud explosion at a location removed from the primary thermal event, which was a failure mode identified in the 2021 Dahongmen BESS fire in Beijing, resulting in firefighter fatalities.

3.33 GS recommends that, during procurement and detailed design, the Applicant requires the Principal Contractor and specialist fire engineer to undertake a cable route vapour migration risk assessment in accordance with NFCC V2 Guidance and DSEAR 2002, covering: (a) identification of all cable routes and conduits connecting BESS enclosures to the PCS units, substation, and control building; (b) assessment of the potential for explosive vapour to migrate along these routes under thermal runaway conditions; and (c) specification of appropriate engineering controls to prevent such migration (including, where necessary, fire-stopping, gas-

tight cable entry seals, or pressure-relief measures at penetration points), to be documented in the DBSMP.

3.34 The following paragraphs provide information on the deflagration venting / explosion prevention systems for the chosen technology.

Deflagration Venting and Off-Gas Pressure Relief

3.35 It is expected that the chosen technology will incorporate comprehensive active and passive safety features to prevent and manage deflagration risks, compliant with:

- BS EN 14373:2021 - Explosion Suppression Systems
- NFPA 69 - Standard on Explosion Prevention Systems (active measures)
- NFPA 68 - Standard on Explosion Protection by Deflagration Venting (passive measures)
- NFPA 855:2026 - Standard for the Installation of Stationary Energy Storage Systems

3.36 It is expected that the system will use **NFPA 69**-compliant active explosion prevention measures as the primary control mechanism. The design will be evaluated through deflagration studies conducted in accordance with **NFPA 68** methodologies and supported by **UL 9540A:2025** testing to assess full-scale and partial-volume deflagration scenarios within the battery enclosure. This integrated approach ensures the chosen technology is equipped with robust active safety measures to manage and mitigate potential explosion hazards effectively through combustible gas concentration control and, where appropriate, supplementary passive protection.

Active Explosion Prevention (Primary Mechanism)

3.37 It is expected that the primary explosion control strategy shall comply with **NFPA 69** and will include:

- Continuous combustible gas monitoring and detection systems designed to maintain gas concentrations below 25% of Lower Explosive Limit (LEL).
- Active mechanical ventilation systems for purging dangerous gases and preventing off-gas buildup.
- Automatic system shutdown capability in response to detected anomalies.

3.38 It is expected that these active measures will be designed as the primary control mechanism for explosion prevention, with supporting design evidence and performance validation. Backup power capabilities shall be provided to maintain ventilation system operation during grid disconnection.

Passive Deflagration Venting (Supplementary Protection)

3.39 In support of the primary **NFPA 69** active explosion prevention system, passive deflagration venting in accordance with **BS EN 14797:2007 or NFPA 68** may be incorporated as supplementary protection. However:

- Deflagration venting alone does not constitute acceptable explosion control under NFPA 855:2026 and should not be relied upon as the sole means of explosion protection.
- Where passive venting is incorporated, it should complement (not substitute for) active prevention measures.

- Passive venting systems must direct discharge safely, without contributing to fire propagation beyond the affected unit or presenting risk to persons.

Advanced Off-gas Detection and Pressure Management

3.40 It is expected that the technology will incorporate the following integrated off-gas detection and pressure management mechanisms:

Gas Detection and Monitoring

3.41 The system should be equipped with continuous sensors monitoring combustible gas density (hydrogen, carbon monoxide, and volatile organic compounds) with the following characteristics:

- Trigger alarms when gas density exceeds predefined thresholds
- Activate the ventilation system upon detection of off-gassing events
- Maintain concentrations below 25% of the Lower Flammable Limit (LFL) during normal operation
- Provide early detection and rapid response capability to thermal runaway events
- Integrate with the Battery Management System for coordinated response

Active Ventilation Systems

3.42 The active ventilation system shall be designed to:

- Purge dangerous gases through controlled exhaust.
- Maintain a safe operating environment by preventing combustible gas buildup.
- Maintain combustible gas concentrations below hazardous levels as specified by NFPA 69.
- Provide the primary mechanism for achieving NFPA 69 compliance in explosion prevention.
- Mitigate thermal runaway risks by rapidly removing off-gas products
- Remain operational during the critical period of battery failure and gas release.
- Include backup power capabilities to remain functional during grid disconnection.

System Monitoring and Shutdown Capability

3.43 In the event of detected anomalies (thermal, electrical, or gas-related), the system shall:

- Automatically shut down to prevent further risks and thermal runaway propagation
- Maintain high levels of safety and reliability in operation
- Provide backup capability in the event of primary ventilation system failure
- Integrate alarms and notifications with site control systems and emergency response protocols

Assessment Criteria 5: Recommendations

GS recommends that:

- *During the procurement process, the Applicant should specify active explosion prevention systems compliant with UK, European, and international standards, including:*
  Primary Standards:
  - *NFPA 69 (Standard on Explosion Prevention Systems) - active measures*
  - *BS EN 14373:2021 (Explosion Suppression Systems)*

  Supporting Framework:
  - *NFPA 855:2026 (Standard for the Installation of Stationary Energy Storage Systems)*
  - *DSEAR 2002 (UK regulatory requirement for explosive atmospheres)*

  *The specification must include design methodology for combustible gas concentration control maintaining levels below **25% of Lower Explosive Limit (LEL)**. Any supplementary deflagration venting should be specified with reference to:*
  - *NFPA 68 (Explosion Protection by Deflagration Venting)*
  - *BS EN 14797:2007 (Explosion Venting Devices)*
  - *BS EN 16009:2011 (Flameless Explosion Venting Devices - where applicable)*

Assessment Criteria 6: Medium Voltage Power System (MVPS)

The final Development should be based on appropriate installation and maintenance practices to ensure the safe and reliable operation of the Inverters and Transformers (PCS) and any associated electrical components.

3.44 A MVPS allows for integration between the BESS enclosures and the transformer equipment. The following paragraphs provide information on the PSs for the chosen technology.

Power System (PS)

3.45 GS understands that mineral or synthetic oils are likely to be used to insulate and cool the electrical components in the PCS. Such oil will be stored in an independent reservoir that is bunded to 110% capacity and fitted with a polycarbonate filter. This filter will trap hydrocarbon contaminants while allowing rainwater to drain freely into the environment.

3.46 Regular inspection and maintenance of insulation oil storage will be essential to ensure the oil quality and integrity. Further, pre-operation, a suitable monitoring system will need to be established to track oil levels, temperature, and condition to facilitate prompt maintenance and replacement as required.

Assessment Criteria 6: Recommendations

GS recommends that:

- *During the detailed design, the Applicant should establish the installation and maintenance practices required to ensure the safe and reliable operation of the PCS and the associated electrical components.*

4 Assessment and Evaluation: Application Site

Overview

4.1 The assessment and evaluation in this section covers the Application Site, including proposed fire safety provisions and emergency response / recovery strategies.

Assessment Criteria 7: Access Arrangements

The final Development should incorporate appropriate access arrangements, both from the main motorway network and around the site, to support Fire and Rescue access requirements.

4.2 Appendix 1 shows two, separate, access points to the eastern and western sides of the Application Site, which are, in turn accessed from internal tracks.

4.3 In the BESS compound, *Appendix 1* shows the two access points joining a 'through' internal trac with short spurs off of it to access the BESS arrays. A minimum design width of the internal tracks is 6m, which is therefore capable of accommodating a Co Clare FRS appliance. The overall size of the BESS compound is approximately 75m long x 16mm wide.

4.4 In the event of a fire at the BESS facility, Co Clare FRS will likely establish a 50-metre safety exclusion zone (inner cordon) around the container suffering a thermal event. The inner cordon is measured from the location of the fire itself.

4.5 For a site measuring this size, the exclusion zone will extend beyond the site's perimeter boundary on all sides. This means the safety cordon will necessarily encompass the main access gates and extend onto adjacent land.

4.6 The cordon is established to protect emergency responders and the public from the hazards of a BESS fire, including potential explosions, toxic gases, intense heat, and flying debris. During an incident, the area beyond this cordon serves as the operational base for fire crews, command facilities, and emergency coordination – ensuring all personnel remain at a safe distance from life-threatening hazards.

Assessment Criteria 7: Recommendations

GS recommends that:

- *The Applicant should:*
  - *Engage with Co Clare Fire and Rescue Service, provide details of the proposed access arrangements; and,*
  - *Seek an appropriate condition to be applied whereby the access arrangements will be agreed as part of the Emergency Response Plan / site-specific Tactical Fire Response Plan.*

Assessment Criteria 8: Raw Water Availability Requirements

The final Development should incorporate appropriate fire safety provisions, including (if required) appropriate raw water availability requirements.

Water Storage Capacity

4.7 Several BESS manufacturers now advocate that should a BESS unit have a thermal event and progress to thermal runaway; the BESS unit should be allowed to consume itself i.e. burn itself out. This 'burn' policy is recognised within the existing NFCC V2 Guidance and also accepted by many insurers. GS experience is that the vast majority of applicants also adopt a burn policy across their sites, and we also advocate such an approach.

4.8 Furthermore, an increasing number of BESS manufacturers suggest that applying firefighting branches (water) to a BESS unit undergoing the thermal event will have no effect and could prolong the duration of the thermal event unnecessarily.

4.9 Therefore, should water be required / used, the recommended firefighting tactic is for water to be used defensively via water fog or spray pattern branches. These branches should be directed onto areas adjacent to the BESS container undergoing the thermal event, to minimise the likelihood of an incident developing beyond the BESS unit of origin.

4.10 This is commonly known as boundary cooling, and is intended to significantly reduce overall water requirements, and thus the associated drainage / environmental protection requirements. This tactic is currently recognised as an appropriate operational approach by the UK fire and rescue services.

4.11 Regarding the site requirements, the NFCC V2 Guidance specifies that private fire hydrants should be capable of achieving a flow rate of no less than 25 L/s (1,500 L/min) in accordance with the current Water UK/LGA guidance. Where a flow rate of 25 L/s cannot be achieved from hydrant infrastructure, it is prudent to provide an equivalent static water supply sufficient to deliver that flow rate for a duration of 120 minutes, equating to a minimum static supply of approximately 180,000 litres.

4.12 Private fire hydrants and any connections to dry pipe systems should be installed in accordance with BS 9990 (Non-automatic fire-fighting systems — Code of Practice) and identified in accordance with BS 3251 (Indicator plates for fire hydrants and emergency water supplies).

4.13 The Site Layout provides 4no. 50m^3 on-site water tanks and therefore is in excess of the NFCC V2 Guidance minimum static supply requirement of 180,000 litres.

4.14 GS believe that it is unlikely that provisions for fire hydrants to be installed will be required by Co Clare FRS.

Assessment Criteria 8: Recommendations

GS recommends that:

- *As part of any planning permission, the Applicant should seek an appropriate condition to be applied whereby the exact details of any raw water availability requirements will be agreed as part of the Emergency Response Plan / site-specific Tactical Fire Response Plan;*
- *During the procurement process, the Applicant should specify:*
  - *That the BESS units should be IP65/6 rated to ensure boundary cooling risks can be mitigated; and,*
- *During operation, the Applicant should ensure the selected BESS technology instructions are followed (and incorporated into any Emergency Response Plan / site-specific Tactical Fire Response Plan) to ensure any incident is able to be brought to a safe and swift conclusion with minimal damage to the local environment.*

Assessment Criteria 9: Used Water Storage Requirements

The final Development should incorporate appropriate fire safety provisions, including (if required) appropriate used water storage requirements.

4.15 Whilst the technical specifications have not yet been finalised, and the procurement process has not commenced, (as previously noted) GS expects that in the unlikely event of a fire, the affected BESS unit will be allowed to consume itself i.e. burn itself out.

4.16 Therefore, should water be required / used, this water would be used defensively on areas adjacent to the BESS unit undergoing the thermal event to prevent an incident developing beyond the BESS unit of origin. Consequently, any runoff generated is highly unlikely to create a contamination risk.

4.17 In order to address the council's concerns, drainage details are added to the proposed BESS layout shown in *Appendix 1*. The underground piped system will be connected to an attenuation structure with a capacity of 36m^3. Water generated during boundary cooling of BESS containers adjacent to the one having a thermal event (damping down) will flow into the drainage network. Water generated can be recycled (reused) repeatedly to reduce overall water demand and this is an operational tactic that is used across the fire services in the ROI and UK.

4.18 The water collected will be tested at the collection sump following the cessation of any fire event. Based on the testing water will either be reused in the tanks on site or sent for disposal. All water will be contained on site within an a.

4.19 The BESS location was identified to maximise the distance to any surface water stream. The BESS is over 430 m from the nearest stream and over 125 m from the nearest drainage channel.

4.20 In addition, all BESS units and Transformer Units will be bunded, with a separate Class 1 retention system to add an extra later of security in preventing contamination of local water supplies. The bunding will be lined with an impermeable membrane, ensuring that any contaminants would be captured within the associated bunding, preventing any contamination of local water supplies.

Assessment Criteria 9: Recommendations

GS recommends that:

- *As part of any planning permission, the Applicant should seek an appropriate condition to be applied whereby the exact details of any used water storage requirements will be agreed as part of the Emergency Response Plan / site-specific Tactical Response Plan. Such details should include:*
  - *Calculations made for the specification of any runoff storage capacity, demonstrating how this meets requirements during normal and emergency operations;*
  - *Measures for pumping out individual catchments following an incident; and,*
  - *Measures to be implemented for failure / loss of containment events, and a description of the potential environmental damage for such events.*

Assessment Criteria 10: Incident Impact Assessment and Sensitive Receptor Plan

The application for planning permission should be accompanied by a plan identifying all sensitive receptors within a 1km radius of the development area, together with a compass rose indicating the prevailing wind direction(s). Where a credible worst-case BESS fire could generate a toxic vapour plume affecting nearby sensitive receptors, a site-specific fire gas plume assessment (Smoke Plume Analysis Report) should be commissioned from a competent person

4.21 NFCC V2 Guidance (Section 17–18) requires that applications are accompanied by a plan identifying all sensitive receptors within 1km of the BESS installation, together with a compass rose showing prevailing wind directions. This enables the local FRS and the planning authority to assess the directional risk from fire-generated gas plumes under realistic wind scenarios. The assessment should also cover business continuity, neighbourhood disruption, and potential economic disruption arising from a credible worst-case incident, including impacts on the local road network, commercial activities, and community infrastructure within the 1km radius.

Assessment Criteria 10: Recommendations

GS recommends that:

- *The Applicant should prepare a 1km sensitive receptor plan in accordance with NFCC V2 Guidance Sections 17-18, identifying all receptor categories and including a compass rose showing the prevailing wind direction(s) for the site. This plan should be submitted with the application for planning permission or, where agreed with the Local Planning Authority and Co Clare Fire and Rescue Service, secured by way of a pre-commencement planning condition.*

- *Where the 1km receptor plan identifies residential, ecological, or other sensitive receptors within a credible fire gas plume zone, the Applicant should commission a site-specific Smoke Plume Analysis Report (SPAR) from a competent person, evaluating hazardous gas concentrations under representative meteorological conditions and confirming that IDLH (Immediately Dangerous to Life and Health) thresholds for CO and HF are not exceeded at receptor locations. If required, the SPAR should be secured by planning condition prior to construction commencing.*
- *The findings of the sensitive receptor plan and, where required, the SPAR should be incorporated into the site-specific Emergency Response Plan and used to inform any community notification protocols agreed with Co Clare Fire and Rescue Service.*

5 Assessment and Evaluation: Operational Safety Management, Liaison and Emergency Response / Recovery

Overview

5.1 The assessment and evaluation in this section covers operational safety management, liaison and emergency response / recovery strategies.

Assessment Criteria 11: Operational Safety Management

Prepare and implement a Detailed Battery Safety Management Plan, alongside relevant Emergency Response Plans.

5.2 As previously noted, whilst the technical specifications have not yet been finalised, and the procurement process has not commenced, the assessment and evaluation in this report is based on current indicative scheme designs to ensure that the relevant criteria are taken into account at the earliest possible opportunity such that the Development and Site will meet or exceed current standards and design guidance requirements, thus allowing for adaptability to future technological advancements in the rapidly evolving field of energy storage.

Assessment Criteria 11: Recommendations

GS recommends that:

- *As part of any planning permission, the Applicant should seek an appropriate condition to be applied whereby a Detailed Battery Safety Management Plan will be agreed prior to commencement of construction / operation to ensure that any outstanding matters are addressed in full either through fire safety provisions or appropriate emergency response / recovery plans.*

Assessment Criteria 12: Liaison

Prepare and implement a Fire Communication Framework to ensure that relevant information is communicated to / developed in consultation with Co Clare Fire and Rescue Service.

5.3 To promote transparency and joint understanding with Co Clare FRS, and to support their understanding and mitigation of risk, the NFCC V2 Guidance recommends that a Fire Communication Framework (FCF) is established between the developer or operator and the local Fire and Rescue Service, and that this engagement is maintained throughout all stages of the project lifecycle. The NFCC V2 Guidance emphasises that this liaison process should be

consistent and ongoing, without placing an undue burden on the developer of the BESS installation.

5.4 It now places the communication and coordination obligations within the framework of a comprehensive risk management process. This process requires the developer and operator to develop, implement, maintain and review risk controls in consultation with the local Fire and Rescue Service, and should cover all project development stages including pre-planning, site commissioning, site operations and site decommissioning. The outcome of this process should be a robust Battery Safety Management Plan (BSMP) and an Emergency Response Plan (ERP), both developed in conjunction with the local Fire and Rescue Service.

5.5 Regarding the information requirements, the NFCC V2 Guidance sets out several categories of information that should be communicated to, or developed in consultation with, the local Fire and Rescue Service to support operational pre-planning and enhance safety and preparedness. This information includes:

- **Installation and Location Details**, to aid in operational pre-planning and to ensure that the local Fire and Rescue Service requirements are aligned with the hazards and risks involved, including battery chemistry, form factor, unit type, number and layout of BESS containers or cabinets, and evidence that site geography such as prevailing wind conditions has been taken into account;
- **Site Access Details**, including access routes and hard standing capable of accommodating fire service vehicles in all weather conditions, a perimeter road with passing places, and details of any site access arrangements such as key codes to be provided to the Fire and Rescue Service;
- **Fire Safety Provision and Emergency Response and Recovery Strategies**, including details of any fire suppression systems, detection systems, gas detection systems, deflagration venting systems, and confirmation of the firefighting strategy to be adopted in the event of a thermal event;
- **Emergency Response Plan (ERP)**, presenting the detailed emergency response actions to be taken, supported by a Risk Management Plan that addresses all credible hazards and risks. The ERP should be supported by a site-specific Tactical Fire Response Plan (TFRP) and should include site evacuation procedures, up-to-date contact details for facility and off-site personnel, and details of dangerous goods stored on site; and
- **Secure Information Box (SIB) Contents**, which should include the ERP and TFRP, details of water supplies for firefighting, signage details, runoff drainage plans, and any other information of relevance to Fire and Rescue Service crews attending an incident at the site.

Assessment Criteria 12: Recommendations

GS recommends that: *the Applicant should prepare and implement a Fire Communication Framework to ensure the required information is communicated to / developed in consultation with Co Clare FRS, in particular the Emergency Response Plan to be supported by a site-specific Tactical Fire Response Plan.*

6 Information Accompanying the Application for Planning Permission

6.1 The application for planning permission for the Proposed Development on the Site has been developed in strict accordance with the NFCC V2 Guidance, relevant legislation / regulation and current industry best practice / standards.

6.2 This approach has ensured that relevant criteria – including regulatory compliance, fire safety provisions and required emergency response / recovery strategies – are taken into account at the earliest possible opportunity, and are embedded from the outset, such that the final Development and Site will meet or exceed current standards and design guidance requirements. Furthermore, that the application for planning permission can be robustly supported by technical evidence / information and stakeholder engagement.

6.3 Relevant information to accompany the application for planning permission is anticipated to include:

- This Risk Management and Compliance Report
- An Emergency Response Plan

7 Conclusions

7.1 This report has assessed the proposed Ballycunneen Solar & BESS development, insofar as the BESS element is concerned, against the material planning considerations relating to battery and fire safety identified by An Coimisiún Pleanála in its request for further information. The assessment has been undertaken in the context of the planning and fire safety regime of the Republic of Ireland, informed by relevant international standards and by NFCC Version 2 guidance as a technical benchmark where this provides useful good-practice support.

7.2 At the current stage of the project, the final battery enclosure manufacturer and the detailed technical specification have not yet been fixed. That is not unusual for a development at this phase, provided that the application establishes, and any permission secures, the fundamental parameters necessary to ensure that the final scheme is selected, designed, installed and operated in a manner that is demonstrably safe and compliant. In this case, the report considers that the proposed layout, access arrangements, indicative technology basis, and the framework for fire safety management provide a sufficient basis for the fire-related effects of the BESS to be assessed at planning stage.

7.3 The assessment indicates that the principal fire and explosion risks associated with the proposed BESS can be appropriately managed through a combination of technology selection, container-level monitoring and protection systems, thermal management, gas detection, ventilation, segregation, emergency water provision, drainage and containment measures, and structured operational controls. In particular, the report identifies the need for the final selected system to demonstrate compliance through recognised testing, certification and design standards, and for the detailed configuration of safety systems to be fixed through procurement and detailed design rather than left undefined.

7.4 The report also concludes that the site can be supported by an appropriate operational safety and emergency planning framework, provided that this is formalised prior to construction and operation through a Detailed Battery Safety Management Plan, an Emergency Response Plan and a site-specific Tactical Fire Response Plan developed in consultation with the relevant fire authority. These documents should confirm, among other matters, the selected battery technology and enclosure specification, firefighting strategy, alarm and detection set-points, water supply arrangements, runoff containment measures, emergency communications, and the information to be made available to responding crews.

7.5 With regard to environmental protection, the report recognises that fire-water runoff and potential contamination of surface water and groundwater are key considerations for this site, particularly given the reference to adjoining watercourses and the Shannon Estuary in the further information request. Subject to the confirmation of final hydraulic and containment details at detailed design stage, and the securing of suitable planning conditions in relation to raw water availability, used water storage and drainage containment, the report considers that these risks can be addressed through the proposed bunding, impermeable retention measures and drainage strategy.

7.6 Overall, GS considers that the Ballycunneen Solar & BESS development can be brought forward in a manner that is consistent with relevant planning, fire safety and risk management expectations, provided that the recommendations in this report are carried through into procurement, detailed design, construction and operation. On that basis, and subject to the

imposition of appropriate planning conditions and the agreement of the outstanding technical detail with the relevant stakeholders, the fire-related risks arising from the BESS element of the proposed development are capable of being reduced to an acceptable level.

Appendix 1 – Proposed Site Layout plan