Battery Energy Storage System (BESS) Adjacent to Kent Biomass Plant

Outline Battery Safety Management Plan

For: Kent Renewable Energy Limited

Project Number: 60714594

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Quality information

Prepared by	Checked by	Verified by	Approved by
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Revision History

Revision	Revision date	Details	Authorized	Name	Position
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Abbreviations and acronyms

The following technical terms and definitions have been used within this document and will form the basis of understanding.

Table 1: Technical terms and definitions

Term	Definition
ADR	European Agreement Concerning the International Carriage of Dangerous Goods by Road
BESS	Battery Energy Storage System
BMS	Battery Management System
BSMP	Battery Safety Management Plan
COSHH	Control of Substances Hazardous to Health
DA	Data Analytics
DSEAR	Dangerous Substances and Explosive Atmospheres Regulations 2002
ERP	Emergency Response Plan
FAT	Factory Acceptance Testing
FMEA	Failure Mode and Effects Analysis
FRS	Fire Rescue Service
HAZOP/HAZID	Hazard and Operability Analysis and Hazard Identification
HGV	Heavy Goods Vehicle
HSE	Health and Safety Executive
HVAC	Heating, Ventilation and Air Cooling
IP	Ingress Protection
LCRM	Land Contamination: Risk Management
LFP	Lithium Iron Phosphate ($LiFePO_4$)
MSDS	Material Safety Data Sheets
NFPA	National Fire Protection Agency
NMC	Lithium Nickel Manganese Cobalt Oxide ($LiNiMnCoO_2$)
OEM	Original Equipment Manufacturer
R&D	Research and Development
SAT	Site Acceptance Testing
SIL	Safety Integrity Level
SSRI	Site-Specific Risk Information
SME	Subject Matter Expert
UPS	Uninterruptible Power Supply
VESDA	Very Early Smoke Detection by Aspiration

1. Executive Summary

1.1.1 Battery Energy Storage Systems (BESS) are rapidly becoming an integral part of efficient and resilient power systems worldwide. BESS enable energy from sources of renewable generation such as wind and solar to be stored and released during periods of peak demand.

1.1.2 This Outline Battery Safety Management Plan outlines Kent Renewable Energy Limited's safety commitments for the proposed BESS facility adjacent to Kent Biomass Plant. It considers the latest best practices for battery fire detection and prevention relevant at the time of writing (October 2023).

1.1.3 Kent Renewable Energy Limited is committed to developing a safe BESS facility that provides long and dependable operation. The selected BESS technology used will be robust, particularly with regard to safe operation.

1.1.4 This Outline Battery Safety Management Plan outlines the processes that will be followed in the development of the Discovery Park BESS. This document also outlines the applicant's consultation with the local fire and rescue services and accountability to consult with other relevant stakeholders in the vicinity of the proposed BESS facility and to incorporate the outcomes of consultation in the design of the facility.

1.1.5 A summary of the safety provisions which will be committed to in the planning application for the BESS, and therefore will be followed by the project operator as standard, are listed below:

- *The BESS facility will be designed in accordance with the most up to date UK legislation and guidance, good industry practice, and related standards.*
- *Risk assessments will be carried out for the entire system and elements across the project lifecycle.*
- *The BESS facility will be sensitively designed to minimise impacts on receptors.*
- *Separation distances between components will be selected to minimise the chance of fire spread based on best practices.*
- *Equipment will, where possible, be selected to be fire limiting, such as by selecting transformer oils with low flammability and constructing a fire-resistant BESS enclosure. The BESS facility will be designed with multiple layers of protection to minimise the chances of a fire or thermal runaway.*
- *All equipment associated with the BESS will be monitored, maintained and operated in accordance with manufacturer standards and requirements.*
- *24-hour continuous remote monitoring of the BESS facility will be undertaken via a dedicated control facility. The control facility will have the capability to shut the system down should the need arise and will also be responsible for implementing the emergency plan and acting as a point of contact for the emergency services.*
- *The BESS facility will include integrated fire detection with automated suppression systems to deal with electrical fires. Following industry good practice (e.g., NFPA 855 2023), gas venting will avoid build-up of explosive gases. A site-specific Emergency Response Plan will be developed for the BESS post consent based on best practice measures.*
- *Communication and engagement with the local fire and rescue services will be carried out early in the project and will continue through the design and construction phases.*

2. Introduction

2.1 Document Overview

2.1.1 This Outline Battery Safety Management Plan (OBSMP) outlines the fundamental fire safety provisions for the proposed Battery Energy Storage System (BESS) adjacent to the Kent Biomass Plan at Discovery Park (hereafter referred to as the 'Proposed Development'). This OBSMP outlines the measures that will be implemented for fire protection and to reduce fire risk. It also summarises the safety-related information requirements and commitments for Proposed Development, as well as demonstrating how good industry practice will be applied to reduce risk to life, property and the environment from the proposed BESS.

2.1.2 This OBSMP covers Kent Renewable Energy Limited's ('the Applicant's') commitments to safety and explains how the Applicant will ensure that the safety measures presented in this document are delivered during detailed design, procurement, build, operation and maintenance, and decommissioning of the Scheme. It considers the latest best practices for battery fire detection and prevention, along with site-specific measures to assure safety, which have been taken into account, noting that the associated guidance continues to develop both in the UK and worldwide.

2.1.3 This document references measures and guidelines valid at the time of writing, in October 2023 and makes particular reference to the guidance outlined within the Grid Scale Battery Energy Storage System planning – Guidance for Fire Rescue Service (FRS) (2023) document.

2.2 Project Description

2.2.1 The Proposed Development is for the construction, operation and eventual decommissioning of a BESS facility and associated infrastructure on adjacent to the Kent Biomass Plant (hereafter 'the Site'). It will connect into and draw power from the adjacent biomass plant.

2.2.2 The Site is currently used for storage of logs for the adjacent biomass plant (which are to be removed as part of the normal operation of the biomass plant). Areas to the south and west of the Site are largely comprised of industrial development and internal roads associated with Discovery Park. The Site is located on hardstanding and there is no existing vegetation on-site. It is located approximately 20m southwest of the River Stour. The nearest residential properties are approximately 1.3km to the south of the Site in Sandwich. The closest Public Right of Way (PRoW) is located approximately 50m west of the Site.

2.2.3 The Proposed Development would have an expected operational lifespan of approximately 40 years, before the site is restored back to its former state. The Proposed Development would comprise approximately 16 containerised battery units, four inverters/transformer units and one switch room, set out in uniform rows (the specific configuration will not be known until post consent). The battery units, inverter/transformer units and switch room would be housed in shipping container size units. The Proposed Development would also include ancillary equipment including fencing, access tracks and CCTV cameras. An indicative site layout plan is shown on **Figure 1**. It is estimated that the BESS would have a total export capacity of 10 megawatts (MW).

2.2.4 Prior to commencement of construction of the Proposed Development, a final BSMP (substantially in accordance with this OBSMP submitted with the Planning Application) will be submitted to the relevant local planning authority and approved, in consultation with the local Fire and Rescue service (FRS).

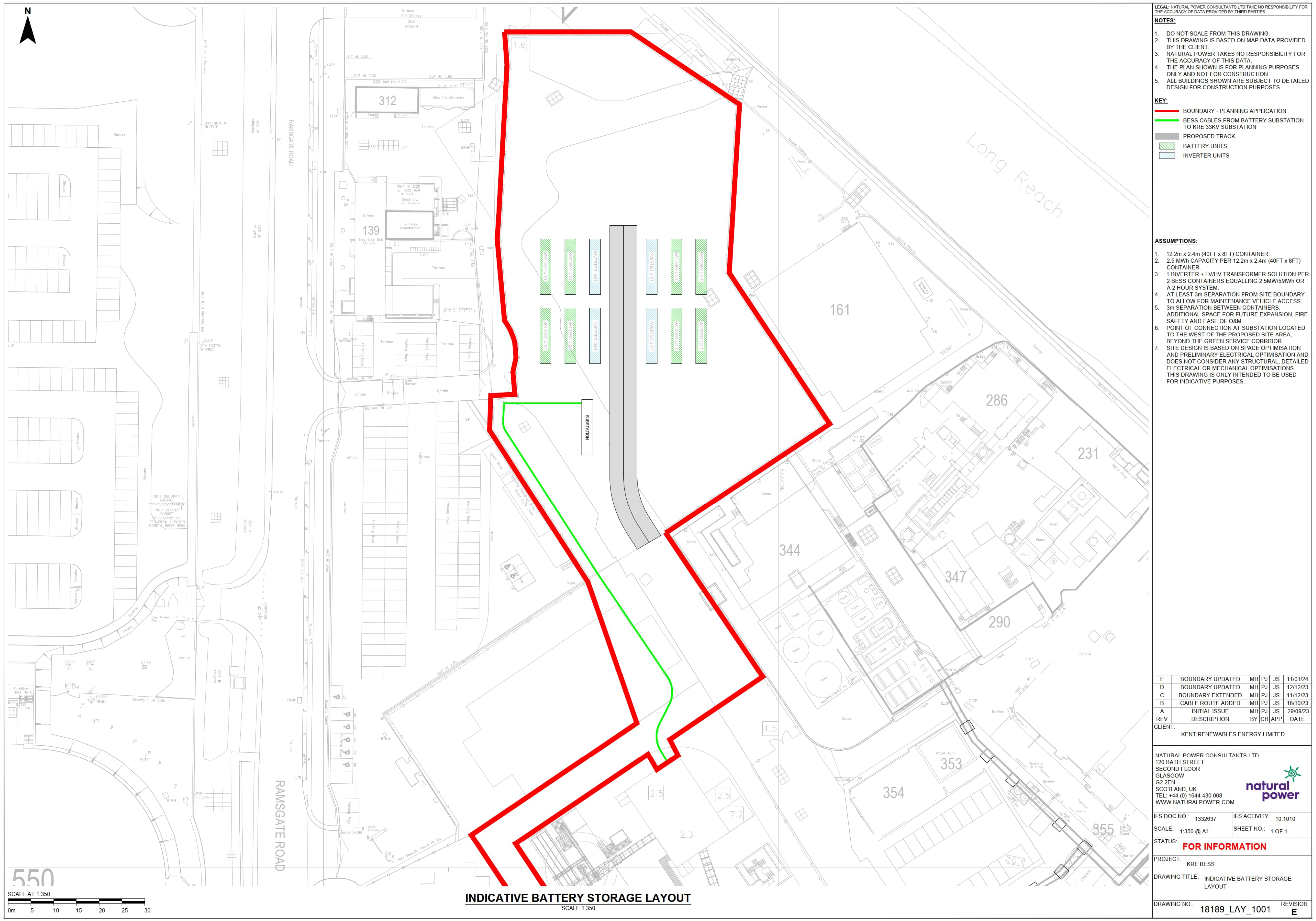

Figure 1: Indicative site layout for the Proposed Discovery Park BESS facility

2.3 BESS Incident Response

2.4.1 The risk of a battery fire or explosion is very low, however this document is provided as part of the Planning Application to ensure best practice measures are embedded within the design of the Proposed Development to minimise this risk. Causes of battery cell failure which could lead to a thermal runaway event include manufacturing defects (contaminants / imperfections), electrical abuse (overcharging/ over-discharging), and physical or mechanical damage (puncture / crushing).

2.4.2 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). First responders will wear full PPE and remove all jewellery, fire management should not generally be conducted within any exclusion zones identified by the fire and rescue services.

2.4.3 Regardless of the type or cause of battery failure, the main potential hazard is a thermal runaway, which is the uncontrollable increase in a battery's temperature. This document focuses on the mitigation measures that will be incorporated to reduce fire and explosion risks and to manage BESS incident hazards.

2.4 Safety Objectives

2.5.1 The principal safety objectives that will be incorporated into the design of the Proposed Development are as follows:

- To minimise the likelihood of a fire or deflagration (~~overheating until it burns away~~ subsonic explosion) event in BESS equipment.
- To minimise the consequences should an incident occur.
- To restrict any event to the incident locality, minimise equipment damage, and minimise impacts on any site personnel, first and second responders, local respondents and the environment.
- To automatically detect and quickly differentiate between electrical fires and thermal runaway incidents.
- To provide evacuation procedures with appropriate training provided in case of the unlikely event that service personnel are on-site during an incident.
- To ensure that first responders can coordinate incident response at minimum risk to their life and safety.
- To deliver BESS design and site layout that minimises the requirement for direct FRS intervention in a thermal runaway incident, i.e., direct hose streams or spray directly on BESS battery systems. FRS intervention in worst case scenarios would ideally be limited to boundary cooling of adjacent BESS and ESS units to prevent the fire from spreading. This strategy should be finalised with the local FRS and be clearly communicated in the ERP.
- To ensure that fire, smoke and any release of toxic gases do not significantly impact site operatives, first responders and the local community.

2.5.2 The following sections of this document set out the key fire safety provisions that would be incorporated into the Proposed Development, in order to achieve the safety objectives outlined above.

2.5 Relevant guidance, codes and standards

2.6.1 There is currently limited UK-specific guidance for BESS facilities and battery safety; however, international good practice has been reviewed and incorporated into this document.

2.4.2 This document considers the recommendations of the following standards and best practice documentation currently used in the UK:

- National Fire Chiefs Council (NFCC) Grid-Scale Battery Energy Storage System planning – Guidance for FRS (2023).
- National Fire Protection Agency (NFPA) 855 (2023): Standard for the Installation of Stationary Energy Storage Systems.
- NFPA 68: Standard on Explosion Protection by Deflagration Venting.
- BS EN 14797 (2006): Explosion venting devices.
- NFPA 69: Standard on Explosion Prevention Systems.
- Underwriters Laboratories (UL) 9540A 4th Edition: Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems.
- UL 1642: Standards for Lithium Batteries.
- UL 1973: Batteries for Use in Stationary and Motive Auxiliary Power Applications.
- UL 9540 3rd Edition (2023) Standard for Energy Storage Systems and Equipment.
- EPRI 3002022540 (2021) EPRI BATTERY STORAGE FIRE SAFETY ROADMAP: EPRI's Immediate, Near, and Medium-Term Research Priorities to Minimize Fire Risks for Energy Storage Owners and Operators Around the World.
- FM DS 5-33 (2023) FM Global Datasheet. Lithium-Ion Battery Energy Storage Systems.
- United Kingdom Power Networks (UKPN) Engineering Design Standard 07-0116: Fire Protection Standard for UK Power Networks Operational Sites, 2016.
- DNV GL-Recommended Practice-0043: Safety, Operation and Performance of Grid-Connected Energy Storage Systems, 2017.
- Scottish and Southern Energy TG-PS-777: Limitation of Fire Risk in Substations, Technical Guide, 2019.
- BS 5839 Part 1 2017: Fire Detection and Fire Alarm Systems for Buildings.
- BS EN IEC 61936, Power installations exceeding 1 kV AC and 1,5 kV DC-AC.
- BS EN IEC 62619 (2017) Secondary cells and batteries containing alkaline or other non-acid electrolytes. Safety requirements for secondary lithium cells and batteries, for use in industrial applications.
- BS EN IEC 62933-2-1 (2018) Electrical Energy Storage (EES) systems. Part 2-1 Unit parameters and testing methods - General Specification.
- BS EN IEC 62933-5-2 (2020) Electrical Energy Storage (EES) systems. Part 5-2 Safety requirements for grid-integrated EES systems. Electrochemical-based systems.

3. BESS Safety Requirements

3.1 BESS procurement and testing

3.1.1 The Applicant recognises that robust quality processes are essential for safe, continuous operation in the development and procurement stages. The Applicant only considers and engages with suppliers that conform to relevant standards such as ISO 9001, ISO 14001, OHAS 18001, CE, and local regulations.

3.1.2 The Applicant will work with leading global tier-one battery Original Equipment Manufacturers or BESS integrators with requisite expertise in BESS systems and controls.

3.1.3 A non-exhaustive list of safety standards for the BESS facility equipment is set out in Table 2. Adherence to the standards outlined below provides robust and good industry practice safety protection measures. The Applicant will secure this through an appropriately worded planning condition agreed with the council.

Table 2: Standards to be applied for equipment

Group Category	Standard	Year	Description
Fire Detection and Alarm	BS EN 54	-	All parts
	BS 5839-1	2011	Fire detection and fire alarm systems for buildings. Code of practice for design, installation, commissioning, and maintenance of systems in non-domestic premises.
	BS 6266	2011	Fire protection for electronic equipment installations.
	BS EN 60079-29-3	2014	Part 29-3. Gas detectors. Guidance on functional safety of fixed gas detection systems.
Automatic Fire protection	BS 5306-0	2020	Fire protection installations and equipment on premises. Guide for selection, use and application of fixed firefighting systems and other types of fire equipment.
	BS EN 12845	2015	Fixed firefighting systems. Automatic sprinkler systems. Design, installation and maintenance.
	BS EN 14972-1	2020	Fixed firefighting system. Water mist Systems. Design, installation and maintenance.
	FM Global Property Loss Prevention Data Sheet 2-0	2021	Installation guidelines for automatic sprinklers
	United Kingdom Power Networks (UKPN) Engineering Design Standard 07-0116	2016	Fire Protection Standard for UK Power Networks Operational Sites
Battery Safety	UL 1973	2022	Batteries for Use in Stationary and Motive Auxiliary Power Applications
	UL 9540A (4th Edition)	2019	Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems
	BS EN IEC 62619	2017	Secondary cells and batteries containing alkaline or other non-acid electrolytes. Safety requirements for secondary lithium cells and batteries, for use in industrial applications.

Group Category	Standard	Year	Description
	UN 38.3		UN Recommendations on the Transport of Dangerous Goods Manual of Tests and Criteria
	BS EN IEC 62281	2019	Safety of primary and secondary lithium cells and batteries during transport.
ESS EMC Safety	BS EN IEC 61000-4-2	2008	Electromagnetic compatibility (EMC). Testing and measurement techniques. Electrostatic discharge immunity test.
	BS EN IEC 61000-4-3	2020	Electromagnetic compatibility (EMC). Testing and measurement techniques. Radiated, radio-frequency, electromagnetic field immunity test.
	BS EN IEC 61000-4-4	2012	Electromagnetic compatibility (EMC). Testing and measurement techniques. Electrical fast transient/burst immunity test.
	BS EN IEC 61000-4-5	2014	Electromagnetic compatibility (EMC). Testing and measurement techniques. Surge immunity test.
	BS EN IEC 61000-4-6	2023	Electromagnetic compatibility (EMC). Testing and measurement techniques. Immunity to conducted disturbances, induced by radio-frequency fields.
	BS EN IEC 61000-4-8	2009	Electromagnetic compatibility (EMC). Testing and measurement techniques. Power frequency magnetic field immunity test.
	BS EN IEC 61000-6-2	2016	Electromagnetic compatibility (EMC). Generic standards. Immunity standard for industrial environments
	BS EN IEC 61000-6-4	2018	Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments.
	IEC CISPR 11	2022	Industrial, scientific, and medical equipment. Radio-frequency disturbance characteristics. Limits and methods of measurement. Conducted emissions and Radiated emissions tests.
BESS Safety	NFPA 855	2023	Standard for the Installation of Stationary Energy Storage Systems.
	UL 9540	2023	Standard for Energy Storage Systems and Equipment
	NFPA 70	2023	National Electric Code
	NFPA 68	2018	Standard on Explosion Protection by Deflagration Venting
	BS EN 14797	2007	Explosion venting devices
	NFPA 69	2019	Standard on Explosion Prevention Systems
	BS EN 16009	2011	Flameless Explosion Venting Devices
	BS EN 14373	2021	Explosion Suppression Systems
	CE mark		European conformity - Low voltage and EMC directives
	UKCA mark		UK conformity – Low voltage and EMC directives
	BS EN IEC 62933-2-1	2018	Electrical Energy Storage (EES) systems. Part 2-1 Unit parameters and testing methods - General Specification.
	BS EN IEC 62933-5-1	2020	Electrical energy storage (EES) systems – Part 5-1: Safety considerations for grid-integrated EES systems – General specification

Group Category	Standard	Year	Description
	BS EN IEC 62933-5-2	2020	Electrical Energy Storage (EES) systems. Part 5-2: Safety requirements for grid integrated EES systems. Electrochemical-based systems.
	BS EN IEC 61439-1	2020	Low-voltage switchgear and control gear assemblies – Part 1: General
	BS EN IEC 61439-2	2020	Low-voltage switchgear and control gear assemblies – Part 2: Power switchgear and control gear assemblies
	BS EN IEC 60364	2009	Low-voltage electrical installations
	FM DS 5-33	2023	FM Global Property Loss Prevention Data Sheets: Electrical Energy Storage Systems
	BS EN IEC 60812	2018	Failure modes and effects analysis (FMEA and FMECA)
	EPRI 3002022540	2021	EPRI BATTERY STORAGE FIRE SAFETY ROADMAP: EPRI's Immediate, Near, and Medium-Term Research Priorities to Minimize Fire Risks for Energy Storage Owners and Operators Around the World
BESS Enclosure Integrity	BS EN IEC 60529	2013	Degree of Protection Provided by Enclosure (IP Code)
	UL 50E	2020	Enclosures for Electrical Equipment, Environmental Considerations.
	BS EN IEC 62262	2002	Degrees of Protection Provided by Enclosure for Electrical Equipment Against External Mechanical Impacts (IK code).
BESS Enclosure wall fire resistance (1 hour minimum)	BS EN 13501-2	2016	Fire classification of construction products and building elements. Classification using data from fire resistance tests, excluding ventilation services (E60/EI15 single wall, EI60 double wall).
	BS EN 1364-1	2015	Fire resistance tests for non-loadbearing elements: Walls
ESS Seismic integrity (control and switchbox)	IEEE 693	2018	IEEE Recommended Practice for Seismic Design of Substations
	BS EN IEC 60068-3-3	2019	Environmental testing. Supporting documentation and guidance. Seismic test methods for equipment.
PCS standards (common standards)	UL 1741	2021	Standard for Safety Inverters, Converters, Controllers, and Interconnection System Equipment for Use with Distributed Energy Resources
	IEEE 1547	2018	IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces.
	CSA C22.2 No. 107.1:16	2021	Power conversion equipment
	BS EN IEC 62109-1	2010	Safety of power converters for use in photovoltaic power systems. General requirements.
	BS EN IEC 62109-2	2011	Safety of power converters for use in photovoltaic power systems. Particular requirements for inverters.
	BS EN IEC 62477-1	2022	Safety requirements for power electronic converter systems and equipment. General.

Group Category	Standard	Year	Description
	BS EN IEC 61000-6-2	2016	Electromagnetic compatibility (EMC). Generic standards. Immunity standard for industrial environments
	BS EN IEC 61000-6-4	2018	Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments.
	IEC CISPR 11	2022	Industrial, scientific, and medical equipment. Radio-frequency disturbance characteristics. Limits and methods of measurement. Conducted emissions and Radiated emissions tests.
	BS EN IEC 62909-1	2017	Bi-directional grid-connected power converters. General requirements.
	BS EN IEC 62909-2	2019	Bi-directional grid-connected power converters. Interface of GCPC and distributed energy resources.
Fire and Rescue Service	Local Government Association and Water UK	2007	National Guidance Document on the Provision of Water for Firefighting
	National Fire Chiefs Council (NFCC)	2023	National Operational Guidance. Hazard – Fire water run-off
	National Fire Chiefs Council (NFCC)	2023	Grid Scale Battery Energy Storage System planning – Guidance for FRS
Cybersecurity	UL 1741	2021	Standard for Safety Inverters, Converters, Controllers, and Interconnection System Equipment for Use with Distributed Energy Resources
	UL 2941	2023	Outline of Investigation for Cybersecurity of Distributed Energy and Inverter-Based Resources
	BS EN IEC 62433	2021	Security of Industrial Automation and Control Systems (IACS)
	IEEE 1547.3	2023	Guide for Cybersecurity of Distributed Energy Resources (DER) interconnection with Electric Power Systems (EPS)
	IEEE 1815	2012	Standard for EPS Communications-Distributed Network Protocol (DNP3)

3.1.4 As a minimum, the battery system will have completed unit or installation level UL 9540A testing, demonstrating that thermal runaway propagation will not spread between modules or between battery racks and the generation of explosive gases will not threaten container structural integrity. This offers a high level of protection against fire and explosion risk.

3.2 Safe BESS Design

3.2.1 The BESS will be designed to address prevailing industry standards and good practices at the time of design and implementation. BESS system and components used to construct the facility will be certified to UL 9540 (2023) standards.

3.2.2 NFPA 855 (2023) currently provides the most comprehensive guidelines for BESS design and site installation specifications. BESS design structural integrity will be demonstrated through full-scale fire and explosion testing or by integrating NFPA 69 (explosion prevention) and NFPA 68 (Explosion protection through deflagration venting) features.

3.2.3 A BESS fire suppression system, if integrated by the BESS OEM will conform to NFPA 855 (2023) guidelines, and the suppression system should be tested to UL 9540A latest standard or significant scale 3rd Party fire and explosion testing. The trend for BESS cabinet systems is not to integrate fire suppression systems and to demonstrate that a worst-case scenario is the safe burn out of a single BESS cabinet without fire brigade intervention, decommissioning is an easier process if stranded energy (live battery modules) risks are removed. If a BESS enclosure is a container design (20 ft, 40 ft, 53 ft), a fire suppression system will probably need to be integrated unless a full free burn test has shown that both fire and explosive events can be safely contained. If the BESS enclosure is a walk-in design, a fire suppression system must be installed. As best practice, fire suppression system performance should be benchmarked against free burn testing and a minimum of three suppression tests should be conducted. An independent Fire Protection Engineer specialising in BESS should review all UL 9540A test results and any additional fire and explosion test data which has been provided and validate the suppression system design.

3.2.4 NFPA 855 (2023) confirms water is the most effective battery fire suppression agent and, therefore if a BESS Fire Suppression System (FSS) is integrated, a water-based system should be considered for each BESS enclosure designed to control or fully suppress a fire without the intervention of the FRS. The suppression system must be capable to operate effectively in conjunction with a gas exhaust/ventilation system to minimise deflagration risks. System design and water supply requirements must be fully agreed with the FRS.

3.2.5 If the BESS system is designed to safely burn out without internal fire suppression systems (to remove the risk of stranded energy in the battery systems), full-scale free burn testing should be conducted to demonstrate that loss will be safely limited to one container without the intervention of the FRS. Tesla Megapack, Fluence Cube, and Wartsila GridSolv Quantum BESS cabinets have all conducted UL 9540A and 3rd Party full scale free burn testing to validate safe equipment spacing and demonstrate that deflagrations do not occur or can be safely constrained. UL 9540A heat flux test data can also establish safe distances between containers and ESS equipment but will not be conclusive if full propagation of the battery system does not occur in the test. As best practice, additional 3rd Party fire and explosion testing should be utilised by the BESS OEM to demonstrate that structural integrity is maintained and toxic gas emissions to the closest receptors are below PHE guidelines when the battery system is fully. An independent Fire Protection Engineer specialising in BESS should review all UL 9540A test results and any additional 3rd Party fire and explosion test data which has been provided and share conclusions with the FRS.

3.2.6 In addition to this, good practice guidance for the Proposed Development will be consulted with regard to the proposed site layout and separation distances for the transformers and inverters.

3.2.7 Safety Certifications and mitigation features typically found within battery module design, which the Applicant will commit to for the Proposed Development, include:

- Internal fuses.
- Liquid cooling system.
- Active Thermal Management System.
- Overcharge safety device.
- Internal passive protection products.
- Venting systems and gas channels.
- Thermal or multi-sensor monitoring devices.

3.2.8 Battery cell certified to UL 1973 and tested to UL 9540A unit or installation level for BESS designs.

3.2.9 Module design will be certified to UL 1973 and tested to UL 9540A unit or installation level.

3.3 Siting and Layout

3.3.1 The Proposed Development is located in a low-risk environment. The Site comprises hard surfaced, brownfield land which is currently used for the storage of logs for the adjacent biomass plant. Areas to the south and west of the Site are largely comprised of industrial development and internal roads associated with Discovery Park. The nearest residential receptors are located over 1km south of the Site.

3.3.2 National Fire Protection Agency (NFPA) 855 (2023) defines basic operation H&S protocols for all BESS site designs which should be incorporated into emergency response plans:

a) Potential debris impact radius is defined as 100 feet (ft) or 30.5 metres (m) i.e. this is a typical explosion risk safe exclusion zone radius as modelling and previous BESS incidents typically show 25 m to be maximum radius.

b) Automatic building evacuation area is defined as 200 ft or 61 m from the affected BESS enclosure.

3.3.3 The layout of the Proposed Development provides adequate separation between enclosures, additional ESS (Energy Storage System) equipment, and other key site structures and infrastructure. The UK National Fire Chiefs Council (NFCC) 'Grid Scale Battery Energy Storage System planning – Guidance for FRS (2023)' will be followed at an indicative design stage, which comprises:

- To protect BESS enclosures from exterior risks, they shall be provided with impact protection to prevent damage to battery enclosures by vehicles or construction equipment and use Damage Limiting Construction (DLC) techniques.
- Where practical, a minimum separation distance of 6m between BESS enclosures and ESS equipment, as stated in NFCC guidelines. This exceeds the NFPA 855 (2023) guidelines of 3m, considered safe practice if sufficient UL 9540A testing and/or 3rd Party Fire and Explosion testing heat flux data has validated that closer spacing does not increase explosion risks or fire propagation risk. The current concept design allows for 3m spacing and the applicant will therefore provide sufficient UL 9540A testing and/or 3rd Party Fire and Explosion testing heat flux data to the council and FRS as part of the final safety management plan, or otherwise revert to the 6m spacing.
- NFCC guidelines allow reduced separation distances if suitable design features can be introduced. If reducing distances, a clear, evidence-based case for the reduction will be shown in the detailed design phase and supported by heat flux test data i.e. UL 9540A unit or installation testing and / or 3rd Party Fire and Explosion testing. .
- Separation distance between the BESS enclosures and boundary of the Kent Renewable Energy site would be 25m. The concept design achieves a minimum 30m distance.
- Areas within 10m of BESS enclosures do not contain combustible vegetation and would not be planted with any new combustible vegetation. Where this is not feasible a full risk assessment would be conducted, and mitigation features applied if required by the FRS. Any other vegetation on site would be kept in a condition such that they do not increase the risk of fire on site.
- The BESS enclosure would have an internal fire resistance rating of at least one hour (according to NFPA 855 and FM Global Datasheet 5-33).
- The BESS area would be designed to integrate fire hydrants and/or static water tanks for firefighting, dependent on available water supply. Water tanks will be located at least 10m from the nearest BESS enclosure. Water access points, whether hydrants or tank connections, would be located in consultation with the local FRS to provide redundancy and safe operating distances for firefighters with 30 – 50m, which is considered an optimal safe distance.
- Tanks and water outlets would be clearly labelled with appropriate signage and marked on site plans. Additionally, to avoid any mechanical damage, outlets and hard suction points would be safeguarded with bollards.

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

3.4 The BESS Enclosure

3.4.1 The BESS enclosure will be installed by a certified and qualified installer. The BESS enclosure will be UL9540 certificated. Ingress protection testing of BESS enclosures is conducted under UL9540 and/or IEC62933-5-2 certification of any BESS system. Typical BESS enclosure ingress protection levels are IP55 / NEMA 3R or IP66 / NEMA 4. IEC Factory Acceptance Testing (FAT) or an independent manufacturing audit will be carried out to ensure the supplied BESS enclosures comply with the requisite certified ingress protection levels.

3.4.2 Ingress Protection[2] (IP) ratings of BESS containers will be shared with the FRS at the detailed design stage so that risks associated with boundary cooling can be understood and implemented into the ERP. Potential boundary cooling water ingress points such as Heating, Ventilation and Air Cooling (HVAC) systems and deflagration vents will be considered as part of an incident response strategy.

3.5 BESS Fire Detection and Suppression

3.5.1 Whilst it is unlikely that a fire event will occur, good international practice requires the incorporation of fire detection and suppression systems to minimise both the risk of an incident and the consequences of any incident should one occur at the BESS.

3.5.2 As a preventative measure, battery modules will integrate liquid cooling systems with automated fail-safe operation.

3.5.3 The fire and gas detection system for the Proposed Development will comply with NFPA 855 (2023) and NFPA 69. This means that smoke, fire and gas detection equipment will be installed on site. New BESS multi-sensor equipment in development which measures combinations of air temperature, hydrogen, volatile organic compounds, overpressure, shock and vibration, and moisture ingress will also be considered if fully tested with the BESS design. The gas detection systems will have external BESS beacon and audible alert facility. The final fire detection design will be validated by an independent Fire Protection Engineer under the responsibility of the Operations, Engineering and Maintenance Contractor prior to construction, and will be approved by the FRS.

3.5.4 The BESS fire suppression system will conform to NFPA 855 (2023) guidelines, and the suppression system will be tested to UL 9540A latest standard or significant scale 3rd Party fire and explosion testing. Fire suppression system performance will be benchmarked against free burn testing. An independent Fire Protection Engineer specialising in BESS will be contracted by the Operations, Engineering and Maintenance Contractor to review all UL 9540A test results and any additional fire and explosion test data which has been provided and validate the suppression system design.

3.5.5 NFPA 855 (2023) confirms that water is the most effective battery fire suppression agent, therefore a water-based system will be considered for each BESS enclosure designed to control or fully suppress a fire, without the intervention of the FRS. The suppression system will be capable of operating effectively in conjunction with a gas exhaust / ventilation system to minimise deflagration risks. System design and water supply requirements will be fully agreed with the FRS.

3.5.6 Each BESS enclosure integrating water or aqueous fire suppression systems will be provided with a sump and drain valve to allow extraction of contaminated fire water and / or electrolyte spill without having to open the door of the container and will prevent contamination of surrounding environment with the extracted liquid being taken off site for treatment. The sump construction will be designed to allow for chemical resistance of electrolyte which may be released from a battery fire and have capacity to hold the total volume of electrolyte plus a 10% safety factor. The sump will encompass the entire floor area of the BESS container with mesh grating type floor to allow spilled electrolyte to drain

[2] Ingress Protection (IP) rating grade the resistance of an enclosure against the intrusion of solids or liquids.

without pooling near other racks, other designs proven capable to protect against electrolyte spills will be permissible, i.e. separate fire water drainage and electrolyte spill systems.

3.5.7 A post-incident recovery plan shall be developed, as recommended by the NFCC guidance that addresses the potential for reignition of BESS battery systems, as well as removal and disposal of damaged equipment. A fire watch will be present until all potentially damaged BESS equipment batteries are removed from the area following a fire event. The water supply for suppression systems and / or firefighting will be replenished as quickly as feasible.

3.5.8 Environmental and Social Management Systems / Battery Management Systems (ESMS / Battery Management System (BMS) controls will follow NFPA 855 (2023) recommendations (new IEC and IEEE standards are being drafted). Battery system data analytics will be integrated into ESMS / BMS systems and controls which reduces Thermal Runaway risks. Data Analytics can also be used to predict accurate End-of-Life timeframes and provide operator maintenance alerts.

3.5.9 Other measures to minimise the risk of a fire event that could be implemented include:

- Any ventilation and gas extraction system will be designed to exhaust flames and gases safely outside in case of fire inside the BESS enclosure, without compromising the safety of first responders. The ventilation system shall be provided with suitable ember protection to prevent embers from penetrating BESS enclosures (HVAC, gas exhaust, deflagration panels).
- As a minimum, a BESS ventilation system will comply with NFPA 855 (2023) / NFPA 69 guidelines which require the prevention of a dangerous build-up of explosive gases (25% LEL). The gas exhaust / ventilation system must have redundancy and can be separate to any HVAC system providing climate control. 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. When mechanical ventilation is required to maintain concentrations below the required limits, it shall be interlocked, so that the system shuts down upon failure of the ventilation system.
- Where emergency ventilation is used to mitigate an explosion hazard, the disconnect for the ventilation system should be clearly marked to notify personnel or first responders to not disconnect the power supply to the ventilation system during an evolving incident.
- The BESS enclosure will be designed to withstand overpressures generated by the battery system during thermal runaway. An explosion prevention system to NFPA 69 standards and ~~/ or~~ explosion protection system to NFPA 68 and EN 14797 standards will be integrated. If BESS design only integrates explosion protection systems i.e. deflagration panels, then performance must be validated through BESS free burn testing and requisite pressure testing required by NFPA and EN standards. Further, the BESS enclosure will have completed UL 9540A unit and / or installation testing or large-scale 3rd Party Fire and Explosion testing without pressure waves occurring or shrapnel being ejected. An independent Fire Protection Engineer specialising in BESS will review all UL 9540A test results and any additional fire and explosion test data which has been provided.
- Inclusion of a BESS Emergency Stop system – both remote and local.
- BESS local manual gas exhaust mechanism for first responders (separate to BESS enclosure) will be installed.

3.6 Safe BESS Transportation and Construction

3.6.1 The installation of the Proposed Development will be subject to prerequisites such as a contractor emergency protocol detailing the actions to be taken in an emergency, including a construction emergency response plan that would be coordinated with the relevant stakeholders and emergency services. In addition, installation would not take place until practical provisions have been completed.

3.6.2 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 Transportation and will be managed in accordance with the European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR) 2019 and the UK guidance on the transport of dangerous goods 'Moving dangerous goods, Guidance' website.

3.6.3 The appointed Contractor will ensure the transported BESS equipment will be prepopulated with batteries and will have undergone Factory Acceptance Testing (FAT) to IEC 62933-5-2 standards. Site Acceptance Tests (SAT) will follow IEC 62933-5-2 and IEEE 2962 (in development) standards and protocols.

3.6.4 By following a logical sequence of works with each step being built upon the preceding one, the system can be safely assembled without risk and all mitigation against issues can be implemented before the next step occurs.

3.7 Safe BESS Operation

3.7.1 The Proposed Development will preferably be monitored and managed closely by a 24/7 remote facility.

3.7.2 Staff will be fully trained and familiar with the BESS technologies and will be responsible for alerting the local FRS and for connecting the FRS with BESS incident Subject Matter Experts (SMEs).

3.7.3 A 24/7 remote control facility will monitor the security of the BESS site, and monitoring and detection systems will be repurposed in an emergency to support first responders. NFPA 855 (2023) defines the minimum monitoring and control standards.

3.7.4 The 24/7 control facilities will have the capability to immediately shut the system down should an incident occur, and the need arise. It will also implement the ERP, acting as a point of contact to the emergency services.

3.7.5 In some circumstances it will be necessary to discharge the batteries to enable the first / second responders to deal with the incident. This capability could potentially be achieved through the remote facility (24/7). The precise methodology in this regard will be agreed in the ERP once the detailed design of the BESS is known. This will be prepared in conjunction with the relevant fire services and is secured through this document.

3.7.6 Signage should be installed in a suitable and visible location on the outside of the BESS units, identifying the presence of a BESS system. Signage would be as per NFCC guidelines and will also include details of:

- Relevant hazards posed i.e., the presence of High Voltage DC Electrical Systems is a risk, therefore their location should be identified.
- The type of technology associated with the BESS.
- Any suppression system fitted.
- 24/7 Emergency Contact Information.
- Signs on the exterior of a building or enclosure will be sized such that at least one sign is legible at night at a distance of 30m or from the site boundary, whichever is closer.

3.8 BESS Site Security

3.8.1 The site security profile will be assessed by an on-call team with dedicated service level agreement in place with input from all local key safety stakeholders. The package of security measures will be agreed with this stakeholder group.

3.8.2 Where practical and required by the local FRS or risk assessment, the BESS area 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 FRS.

3.8.3 The Proposed Development site will also have 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.

3.9 Maintenance

3.9.1 The Proposed Development 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 fully functional.

3.9.2 Routine maintenance will be undertaken on the BESS equipment every 6-12 months depending on the risk profile of equipment. 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 including the fire protection and explosion prevention system. Minor maintenance is typically a visual inspection and rectification of any accumulated noncritical defects.

3.9.3 All maintenance will be undertaken in a carefully controlled manner following the site-specific safety rules.

3.9.4 During operation of the BESS facility, 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 or battery monitoring systems will not be stopped or taken out of service without appropriate mitigation, following the system being made safe so far as reasonably practicable, and only for the minimum time required to undertake any specific maintenance tasks.

4. Firefighting

4.1 Fire Service Guidance

5.1.1 Guidance for the Fire Service for dealing with electrical apparatus is contained in the Fire Service Manual Volume 2 Fire Service Operations – Electricity.

5.1.2 The Fire Service Manual stipulates that it is essential to ensure, on arrival, that the apparatus is electrically isolated and safe to approach. This should be carried out remotely and the electrical or associated equipment should not be touched or even approached unless it is confirmed to be isolated and safe.

5.1.3 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 container. However, the batteries within the enclosures will still hold the charge in the event of a fire, even after the electrical system is isolated.

5.1.4 The Applicant has commenced engagement with Kent FRS and will continue to do so throughout the design, construction and commissioning phases of the project.

5.1.5 In order to determine the volume storage of external water supplies for firefighting, NFCC guidance will be used which states provisional firefighting supplies *"should be capable of delivering no less than 1,900 litres per minute for at least 2 hours."* The local FRS will be able to view the selected BESS system fire test data and an independent Fire Protection Engineer will validate the final water supply requirements. A BESS design which may require direct FRS firefighting engagement tactics will not be selected for this facility.

5.1.6 Water volumes required for BESS suppression are established during free burn tests by BESS Original Equipment Manufacturers (OEMs) and the formula ultimately considers the number of BESS enclosures on site and that water is commonly stored in above ground tanks.

5.1.7 Formula example: $WSmin = VStot\ OHC\ (CC) * 1.5$

WSmin = Minimum water supply in litres

VStot = Total volume of structure in metres^3

OHC = Occupancy hazard classification number

CC = Classification of construction

5.1.8 If a dedicated automatic water-based system is provided within each BESS container this will be designed to control or fully suppress a fire, without the direct intervention of the FRS.

5.1.9 If the BESS system is designed to safely burn out to remove the risk of stranded energy in the battery systems, then full scale free burn testing will have been conducted to demonstrate that loss will be safely limited to one container without the intervention of the FRS.

5.1.10 The Applicant will ensure engagement with Kent FRS has been undertaken for the Proposed Development and will require the design team to continue this engagement throughout the design, installation, and commissioning phases of the project.

5.1.11 Site and BESS design principles and ERP content will ensure that the FRS are expected to employ a defensive strategy i.e., only boundary cooling should be employed for cooling of adjacent BESS or associated supporting equipment.

4.2 Fire Service Access

5.2.1 UK National Fire Chiefs Council BESS planning guidance stipulates that suitable facilities for safely accessing and egressing the site should be provided. Designs will be developed in close liaison with Kent FRS as specific requirements may apply due to variations in vehicles and equipment. This will include:

- Roads/hard standing capable of accommodating fire service vehicles in all weather conditions. As such there will be no extremes of grade.
- For larger BESS sites a perimeter road or roads with passing places suitable for fire service vehicles. (This is not applicable to the Proposed Development, which doesn't provides or need an internal road network)
- At least two separate access points to the site to account for opposite wind conditions / direction. If the Proposed Development site is not able to accommodate this requirement due to topographic limitations, then alternative site-specific ingress / egress arrangements will be agreed with the local FRS.
- Road networks on sites will enable unobstructed access to all areas of the BESS facility.
- The size of any turning circles and passing places is to be advised by FRS depending on the nature and size of the expected fleet.
- Turning facilities will be provided in any dead-end access route that is longer than 20m.
- The minimum proposed access road width to reach the BESS facility will be a minimum of 4m.
- If FRS observation areas are incorporated into the site design, they will be more than 30m from the nearest BESS enclosure (upwind).
- Any water storage tanks designed to be used for firefighting will be located at least 10m away from any BESS enclosure. They must be clearly marked with appropriate signage. They will be easily accessible to FRS vehicles and their siting should be considered as part of a risk assessed approach that considers potential fire development/impacts. Outlets and connections should be agreed with Kent FRS. Any outlets and hard suction points should be protected from mechanical damage (e.g., through use of bollards).

4.3 Emergency Planning

5.3.1 The Proposed Development will have a robust and validated ERP, developed in consultation with the local FRS.

5.3.2 NFPA 855 (2023) defines basic operation H&S protocols for all BESS site designs which will be incorporated into the ERP:

- The ERP will consider measures to protect any features located within 30.5 m of the BESS. This is a typical safe exclusion zone in the unlikely event of a fire or overheating occurring.
- The ERP will establish measures for a safety evacuation area 200 feet / 61m from the BESS.

5.3.3 Some example BESS and site design information which will be included in the Battery Fire Safety Management Plan and will be shared with the FRS to establish a risk profile for first responders, are listed below:

- Battery chemistry integrated into BESS – can provide fire and explosive risk profile.
- Battery form factor (cylindrical, pouch, prismatic).
- Battery energy Wh / KWh – confirmation of new vs second life cells.
- Battery module cooling system details (e.g., liquid cooling design, air cooling design) – cooling system capability assessment to stop or reduce battery cell thermal runaway propagation.
- Battery module vent or gas exhaust specifications.
- Battery module KWh energy + number of cells contained in the module + battery circuitry details (number of cells in series vs number of cells in parallel).

- Direct suppression system details – module or rack level integration.
- Rack design – number of modules and KWh energy, spacing between modules, passive protection features, gas exhaust features, electrical isolation functions, heat or thermal runaway sensor integration, etc.
- Rack configuration – spacing to adjacent racks, number of racks in BESS, spacing to walls, doors, gas vents and roof.
- Type of BESS design e.g., container or cabinet, gas exhaust / ventilation features, deflagration vent design features, BESS enclosure level fire protection & suppression system details (proof of testing with BESS design + test data), additional fire or explosion protection features i.e., thermal barriers.
- EMS / BMS data monitoring capabilities and incident response integration capacity.
- Number of BESS containers/cabinets on site.
- Size and MWh capacity of each BESS unit.
- BESS and ESS equipment spacing; spacing to other equipment, boundaries, vegetation, roads or access routes, fire hydrants / water tanks, site building structures, etc.
- Access routes, observation points, turning areas, FRS equipment & assets, water supply locations and capacity, drainage, and water capture design.
- Definition and frequency of BESS equipment testing and maintenance requirements.
- 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 Kent FRS). As a minimum content should include:
  - Digital emergency response plans.
  - Remote emergency shutoff procedures.
  - SDS / Hazardous material documentation.
  - Maps or design drawings.
  - Gas detection capabilities; could include multi-sensor data metrics e.g., Carbon Dioxide (CO_2), Carbon Monoxide (CO), Hydrogen (H_2), VOC off gas and overpressure and local temperatures.
  - Fire protection system data e.g., temperature, alarming, suppression status, etc. – establish discharge warrantee clauses, emergency BESS venting procedures, discharge times, impact on ventilation and detection systems, etc.
  - ERP training drills for site operatives + FRS engagement (site familiarisation + training drills) and SME engagement (fire protection experts or battery experts)
  - Other documentation as required by specific BESS project i.e., local response stipulations, contact information for nominated response personnel, community contacts, etc.

5.3.4 An ERP will be developed post planning consent to facilitate effective and safe emergency response. It will follow UK National Fire Chiefs Council (NFCC) and NFPA 855 guidelines and will include as a minimum:

- How the fire service will be alerted and incident communications and monitoring capabilities.
- Facility description, including infrastructure details, operations, number of personnel, and operating hours.
- Site plan depicting key infrastructure:
  - Site access points, internal roads, agreed access routes, observation points, turning areas, etc.
  - Firefighting facilities (water tanks, pumps, booster systems, fire hydrants, fire hose reels etc).
  - Water supply locations and capacity.
  - Drainage and water capture design and locations.

- Details of emergency resources, including fire detection and suppression systems and equipment; gas detection; emergency eyewash and shower facilities; spill containment systems and equipment; emergency warning systems; communication systems; personal protective equipment; first aid.
- Up-to-date contact details for facility personnel, and any relevant off-site personnel that could provide technical support during an emergency.
- A list of dangerous goods stored on site.
- Site evacuation procedures.
- Site operation Emergency Management protocols - four phases: discovery, initial response / notification, incident actions, resolution and post incident actions / responses.
- Emergency procedures for all credible hazards and risks, including building, infrastructure and vehicle fire, wildfires, impacts on local respondents, impacts on transport infrastructure.
- The operator will develop a post-incident recovery plan that addresses the potential for reignition of the BESS and de-energizing the system, as well as removal and disposal of damaged equipment.

5.3.5 A Risk Management Plan shall be developed 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. Establish response times and site arrival protocols.
- The adequacy of proposed fire detection and suppression systems e.g., water supply on-site.
- Natural and built infrastructure and on-site processes that may impact or delay effective emergency response i.e., firefighting water runoff capture.

4.4 Fire and Rescue Service (FRS) Engagement and Consultation

5.4.1 It is not anticipated that firefighting techniques will require direct hose streams or spray directly on battery systems and will be limited to boundary cooling of adjacent BESS units and supporting equipment to prevent the fire from spreading. This strategy will be finalised with the local FRS and be clearly communicated in the ERP.

5.4.2 The Applicant will work closely with the FRS to provide all necessary information regarding the installation of the Proposed Development, including site design features, to facilitate hazard and risk analysis studies. The Applicant will also assist in developing comprehensive Risk Management (RM) and ERPs.

5.4.3 The Applicant will continue to engage with Kent FRS before submitting the planning application.

5.4.4 Preliminary site designs will be shared with the local FRS for feedback during consultation. Any recommendations will be considered and incorporated into the proposed scheme's concept design, which will be submitted for planning consent.

5.4.5 Throughout the submission, post-consent and detailed design stages, consultation with the local FRS will continue to ensure all key stakeholders are satisfied with agreed mitigation and safety requirements prior to construction.

5.4.6 During the detailed design stage, information about the BESS will be provided as early as possible to Kent FRS. This will allow for an initial assessment of the BESS, along with appropriate evidence to support any claims made on its performance, and with the necessary installation standards cited. The FRS will be provided with this information.

5.4.7 Such information should also be made available to FRSs for inclusion in their Site-Specific Risk Information (SSRI) records (in most cases there is a lead designated FRS station for incident response). UK legislation sets the requirement for site-specific assessment. Collating and disseminating SSRI involves several FRS tasks:

- Selecting premises to be inspected.
- Assessing the nature and magnitude of the risk.
- Considering a proportionate response.
- Recording significant findings.
- Making sure information is available in a usable form.
- A site-specific assessment takes account of current legislation on inspection information and includes information on pre planning firefighting tactics.

5.4.8 A fire water management plan should include the containment, monitoring, and disposal of contaminated fire water. Infrastructure shall be provided for the containment and management of contaminated fire water runoff from the BESS. This can include bunding, sumps, and purpose-built impervious retention facilities. All process water used in the system shall be prevented from contaminating potable water sources in accordance with local regulations through the use of check valves or other means as part of the system design.

5.4.9 The FRS will be consulted to determine the location, volume storage, and flowrate of firewater. This may be required for each group of BESS.

5.4.10 The Applicant will work with the council and proposes that there is a planning commitment to confirm that consultation will continue with the local FRS throughout the post-planning detailed design stage and requiring a Battery Safety Management Plan in accordance with this Outline Battery Safety Management Plan submitted with the application. It should be noted that many new or revised BESS standards and codes will be released in 2023-24, which the company carrying out the detailed design are expected to consider in the final design.

5. Pre-construction Risk Assessment and Hazard Mitigation Requirements

6.1.1 The detailed design phase of the Proposed Development will consider the lifecycle of the battery system from installation to decommissioning. At the detailed design stage, risk assessment tools will be utilised together with detailed consequence modelling to provide a comprehensive site operations and emergency response safety audit.

6.1.2 The battery system mitigation measures adopted in a final Battery Safety Management Plan, will reflect the latest BESS safety codes and standards applicable at that stage. Mitigation measures will be discussed and coordinated with Kent FRS.

6.1.3 A Failure Modes and Effects Analysis (FMEA) of the BESS will be conducted to lay the foundation for predictive maintenance requirements and complement the fault indicator capabilities of the BMS data analytics system.

6.1.4 Comprehensive Hazard Mitigation Analysis (HMA) will be conducted by a BESS specialist independent Fire Protection Engineer following NFPA 855 (2023) guidelines and recommendations.

6.1.5 Additional risk assessments likely to be conducted at the detailed design stage are Fire Risk Analysis (FRA), Explosion Risk Analysis (ERA), Hazard and Operability Analysis (HAZOP). BESS 3rd Party risk analysis is sometimes automatically provided by Tier one BESS manufacturers and / or BESS integrators.

6.1.6 If the BESS system supplied differs from the specification considered for risk assessments and consequence modelling, then a full safety audit will be repeated for the new BESS system specification. These studies will be completed and signed off before construction commences.

6.1.7 Safe decommissioning of the BESS facility will be addressed prior to decommissioning of the Scheme.

6. Conclusion

7.1.1 The Applicant is committed to developing a safe BESS facility that will provide long and dependable operation. The selected BESS technology used for the Proposed Development will be robust, particularly with regard to safe operation. The Applicant's commitment to developing a robust facility with good practice safety provisions embedded within the design, as guided by industry standards is summarised and reiterated within **Table 3**, an Equipment Compliance Schedule, which details how the Applicant proposes to adhere to the guidance as written within 'Grid Scale Battery Energy Storage System planning – Guidance for FRS (2023).

Table 3: National FRS Guidance (2023) Equipment compliance schedule for the Proposed Development

Ref	Description	How this OBSMP adheres to guidance
1	No residential properties will lie within a 60 m radius of the BESS.	There are no residential properties within 1km of the Proposed Development
2	The separation distance between the BESS and transformer will be a minimum of 6 m unless sufficient 3rd Party data demonstrates less is safe (as agreed with the FRS)	The concept design shows 3m spacing. This will be increased to 6m if the FRS is not satisfied by the 3rd party safety data at detailed design and as part of agreeing the final safety management plan.
3	Each group of battery enclosures, inverters and transformers will be separated from the next by a minimum of 6 m, unless sufficient UL 9540A testing and/or 3rd Party Fire and Explosion testing heat flux data can be provided and it is agreed with the FRS	The concept design shows 3m spacing. This will be increased to 6m if the FRS is not satisfied by the 3rd party safety data at detailed design and as part of agreeing the final safety management plan.
4	The separation distance between the battery enclosures and the perimeter fence will be a minimum of 25 m.	The separation distance is generally >25m, except a small distance at the western perimeter where it is about 6.5m and on the eastern perimeter where it is 5.5m at the closest points. It is considered that there is sufficient distance for Fire and Rescue Services to manoeuvre, with >30m from the fence line of the Kent Biomass Plant to prevent members of the public from being in the vicinity.
5	The separation distance between the BESS enclosures and a hedge or tree will be a minimum of 10 m from the edge of the canopy.	There is no vegetation within 10m of the proposed BESS enclosures.
6	BESS will be separated from the site boundaries by a minimum of 25 m.	The minimum distance of BESS from the site boundary of Kent Renewable Energy is 30m.
7	BESS will be separated from any public rights of way by a minimum of 30 m.	The closest Public Right of Way is located approximately 50m west of the Site
8	BESS will be separated from any buildings by a minimum of 30.5 m.	The layout of the Proposed Development would provide adequate separation between enclosures, additional ESS (Energy Storage System) equipment, and other key site structures and infrastructure.

9	BESS will be separated from stored combustible materials by a minimum of 10 m.	A minimum 10m will be adhered to.
10	BESS will be separated from hazardous materials by a minimum of 30 m.	A minimum 30m will be adhered to.
11	BESS will be separated from high-piled stock by a minimum of 10 m.	A minimum 10m will be adhered to.
12	Is there a mains water supply accessible.	Yes. The fire main flow rate within the site is $390m^3/h$ which equates to 6,500 l/min
13	Hydrants or fire-fighting water tanks will be located a minimum distance of 10 m from the nearest BESS enclosure (ideally upwind from the prevailing wind direction).	The hydrants onsite are a minimum distance of 10 m from the nearest BESS enclosure.
14	Vehicle turning facilities will be provided in any dead-end access route that is longer than 20 m.	There are no dead-end access routes longer than 20m onsite.
15	The minimum access road width to reach a BESS facility will be 4 m.	The BESS can be accessed directly from a public highway which is >4m width.
16	Consideration to provide a secondary access point from a public highway (for future)	The layout of the Kent Biomass Plant allows this if the FRS requests it. The current proposals include multiple vehicle and pedestrian access.

7. References

Ref 1 DNV (2017) GL-Recommended Practice-0043: Safety, Operation and Performance of Grid Connected Energy Storage Systems.

Ref 2 Lithium-ion Battery Storage (Fire Safety and Environmental Permits) Bill 2022-23; First Reading (2022) Hansard.

Ref 3 Scottish and Southern Energy (2019) TG-PS-777: Limitation of Fire Risk in Substations, Technical Guide.

Ref 4 Water UK (2018) Protocol for the disposal of contaminated water and associated wastes at incidents (Jointly issued by Water UK, Environment Agency, NIEA, Natural Resources Wales, DWI, Fera, Defra's CBRN Recovery Team, NFCC National Resilience).

Ref 5 British Standard (2017) BS 5839-1:2017 Fire Detection and Fire Alarm Systems for Buildings.

Ref 6 Regulatory Reform (2005) The Regulatory Reform (Fire Safety) Order 2005.

Ref 7 BSI Standards Publication (2021) BS EN IEC 61936, Power installations exceeding 1 kV AC and 1,5 kV DC – AC.

Ref 8 UL Standard (2020) UL9540A Energy Storage Systems and Equipment.

Ref 9 NFPA (2023) NFPA 855, Standard for the Installation of Stationary Energy Storage Systems.

Ref 10 UK Statutory Instrument (2002) The Dangerous Substances and Explosive Atmospheres Regulations 2002.

Ref 11 International Standards Organisation (2015) ISO9001:2015 Quality Management Systems – Requirements.

Ref 12 United Nations (2015), Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria (UN 38.3).

Ref 13 Fire and Emergency Planning Directorate (1998) Fire Service Manual Volume 2: Fire Service Operations, Electricity.

Ref 14 United Kingdom Power Networks (UKPN) (2016) Engineering Design Standard 07-0116: Fire Protection Standard for UK Power Networks Operational Sites.

Ref 15 HM Government (2019) The Building Regulations 2010, Fire Safety – Approved Document Volume 2: Buildings other than dwellings. (Incorporating 2020 amendments).

Ref 16 United Nations (2021) Agreement Concerning the International Carriage of Dangerous Goods by Road.

Ref 17 Richard Chitty (2014) External fire spread: building separation and boundary distances (BR 187 2nd edition).

Ref 18 HSE (2002) The Dangerous Substances and Explosive Atmospheres Regulations 2002.

Ref 19 Environment Agency (2021) Land contamination risk management (LCRM) Stage 1-3.

Ref 20 BSO British Standard (2017) BS 10175:2011+A2:2017 Investigation of potentially contaminated sites. Code of practice.

Ref 21 International Society of Automation (2018) ISA62443 Security of Industrial Automation and Control Systems.

Ref 22 UK Statutory Instruments (2009) The Waste Batteries and Accumulators Regulations 2009.

Ref 23 HSE (2017) Operation Guidance document OG86 Cyber Security for Industrial Automation and Control Systems (IACS).

Ref 24 M. Rosen (2021) ESIC Energy Storage Reference Fire Hazard Mitigation Analysis