Technical Appendix 3.2: Battery Safety Statement

Cossans Solar & BESS EIA Report

Trio Power Limited

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Acronyms and Abbreviations

AC	Alternating Current
BESS	Battery Energy Storage System
BMS	Battery Management System
BSMP	Battery Storage Safety Management Plan
DC	Direct Current
EMS	Energy Management System
FRS	Fire and Rescue Service
FSS	Fire Suppression Systems
IEC	International Electrotechnical Commission
Li-Ion	Lithium-ion
MW	Megawatt
MWp	Megawatt peak
NFCC	National Fire Chiefs Council
NFPA	National Fire Protection Agency
OBSMP	Outline Battery Storage Safety Management Plan
PCS	Power Conversion System
PV	Photovoltaic
SoC	State of Charge
SuDs	Sustainable Drainage Systems

1.0 Introduction

1.1.1 This Battery Energy Storage System (BESS) Safety Statement has been developed by SLR to provide a summary of the safety and operational principles, and best practices which need to be considered for the operation of the BESS. This BESS Safety statement will provide a general description of the battery technology that will likely be selected and includes an introduction with the principles in regards of BESS safety, risk mitigation for potential fire related events and explosions.

1.1.2 The Proposed Development will comprise a ground-mounted solar photovoltaic (PV) array with an export capacity of 49.9 MW and a build out of 65MWp, located approximately 1.6 km west of Forfar, within the Angus Council administrative area. administrative area. The site also includes a 30MW BESS, which will store excess energy generated by the solar PV array and release it during periods of high demand or low generation.

1.1.3 The power generation of a solar farm is dependent on solar irradiance. Therefore, it cannot adjust generation to demand. For the decarbonisation of the UK power system the requirement of technologies that can respond to fluctuations in supply and demand the role of BESS is becoming fundamental. The capabilities of a BESS involve amongst others storing electricity to support the grid during peak hours, enhancing energy security and reducing reliance on fossil fuels. This helps balance supply and demand more efficiently, particularly with the growing use of renewable energy sources).

2.0 Battery Technology and System Description

2.1.1 The proposed 35MW BESS scheme will likely involve Lithium-ion (Li-Ion) batteries as they are currently dominating the UK market. Lithium-Ion batteries provide longer lifespans, higher energy densities compared to other technologies, higher roundtrip efficiency and system costs have been falling over the last decade.

2.1.2 A typical Li-Ion BESS consists of key components that are responsible for storage and energy management. The battery cells are organised into modules and packs where electricity is stored. The Power Conversion System (PCS) involves a bi-directional inverter that controls the flow of energy between Direct Current (DC) storage and Alternating Current (AC) grid power. The Battery Management System (BMS) is responsible for the safety of system operation, by monitoring variables such voltage, current, temperature and State of Charge (SoC). The Energy Management System (EMS) is responsible of the optimisation of the charging and discharging processes, to enhance performance and longevity. Safety systems, including fire suppression and monitoring, ensure safe operational conditions and minimise risks such as fires, thermal runaway, or system failures.

3.0 Risk Mitigation and Management

3.1.1 Li-Ion BESS have safety aspects that need to be addressed to ensure safe operation. It should be noted that safety incidents for BESS are rare and potential fire events are normally driven by a “thermal runaway” event. This involves a condition where the heat generated inside a battery exceeds the ability of the BESS cooling system to dissipate that heat potentially

resulting in a fire event or explosion. There are key points to consider for risk mitigation and management:

- **BESS Operational requirements:** The system operation shall be monitored through the BMS and EMS to ensure optimal performance and identify any potential issues at an early stage.
- **BESS Maintenance requirements:** Preventative maintenance for BESS requires scheduled, proactive actions to minimise the risk of plant failures, extend system lifetime and enhance system performance. This will lead to reduced unplanned downtime, fewer reactive repairs, less frequent component replacements, and improved plant reliability and system efficiency.
- **Fire Suppression Systems (FSS):** The FSS are fundamental to detect, control, and extinguish fires before they propagate, especially under a potential thermal runaway scenario. A rapid response from the suppression system helps prevent fire spreading to other cells or modules.
- **Project Design:** The design shall allow for proper spacing between BESS units, inclusion of enclosures with suitable thermal resistance allowances, the allocation of water tanks with proper water volume sizing and storage containers with deflagration vents. This will contribute to the potential reduction of fire propagation under a potential thermal runaway event.
- **Design & Installation Standards and Regulations:** The BESS shall be designed and installed according to recognised national and international standards and guidelines (please refer to **Section 4.0**).
- **Water Supply:** The design shall integrate fire hydrants and/or static water tanks depending on the site conditions and presence of a fire main. Positioning water access points close to the BESS is essential for effective firefighting and ensuring personnel safety.
- **Drainage Systems:** Incorporating a Sustainable Drainage Systems (SuDS) design is crucial for managing water runoff from potential thermal runaway events, protecting the environment, and preventing contamination of water sources.
- **Site access:** Ensuring adequate access for the Fire and Rescue Service (FRS) is essential, so firefighters do not have to enter the BESS site or drive through a vapor/gas cloud to reach the operation scene. It is therefore recommended to have an alternative access point taking account of the likely wind direction.

3.1.2 The development of an Outline Battery Storage Safety Management Plan (OBSMP) at an early project stage and a Battery Storage Safety Management Plan (BSMP) at detailed design work stage that includes an emergency response plan.

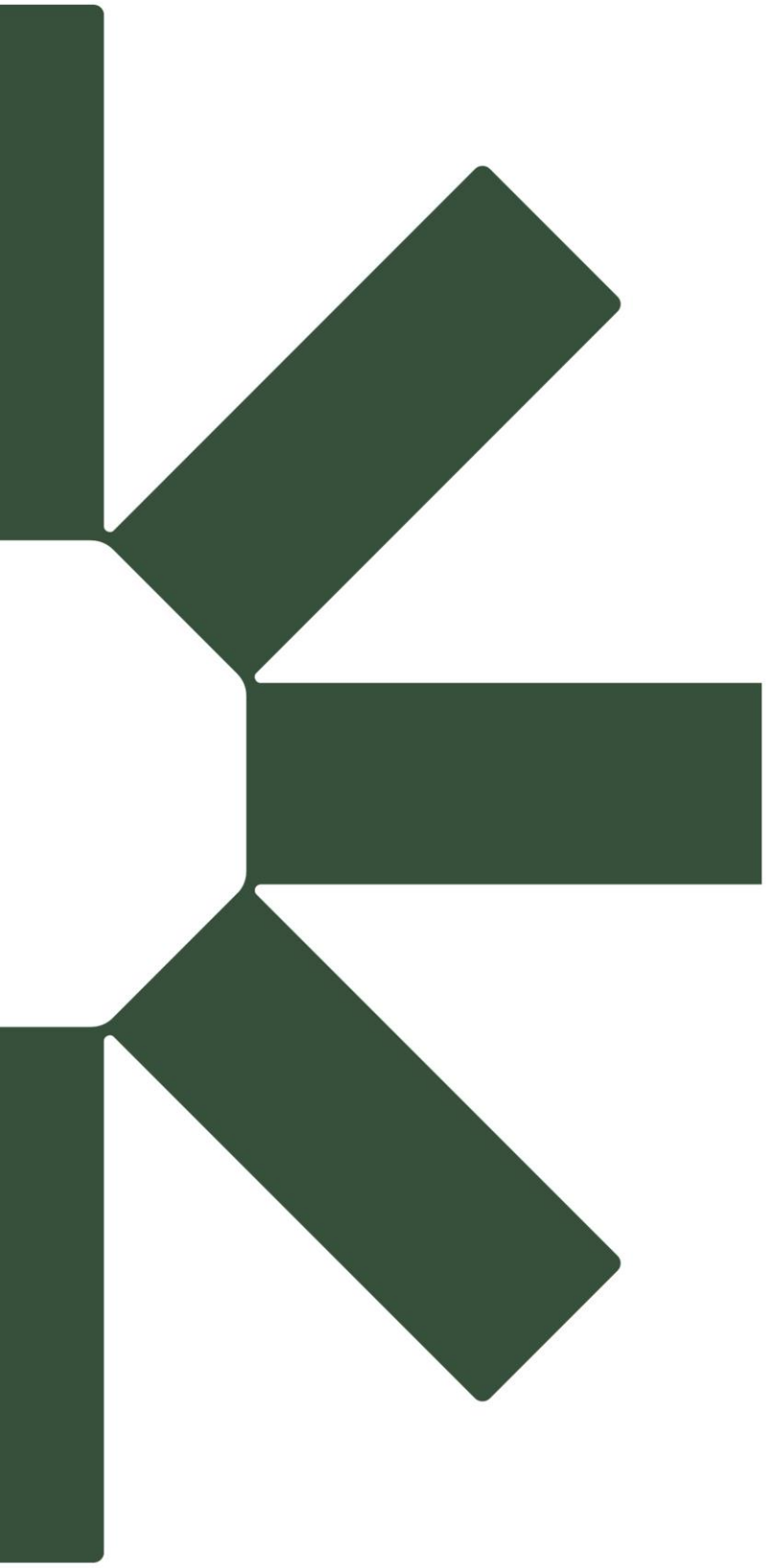
3.1.3 These measures collectively help in minimising the risk and managing the consequences of thermal runaway in BESS.

4.0 Safety Standards for Li-Ion Battery Technology

4.1.1 The compliance with relevant safety standards is essential for mitigating risks such as electrical faults, thermal runaway, fire and explosion. summary list of safety standards to follow when developing large-scale BESS has been included:

- National Fire Chiefs Council (NFCC), Grid Scale Battery Energy Storage System planning – Guidance for Fire and Rescue Services (FRS), Version 1.0, Published April 2023;
- NFCC, Draft Guidance on Grid Scale Battery Energy Storage Systems (BESS), final version to be published in 2025.
- UL 9540 Standard for Energy Storage Systems and Equipment.
- UL 9540A: Tests the system's ability to handle thermal runaway and limit fire propagation within and between battery modules.
- National Fire Protection Agency (NFPA) 855 Standard for the Installation of Stationary Energy Storage Systems.
- International Electrotechnical Commission (IEC) 62619: International standard for rechargeable battery safety in industrial applications, focusing on preventing thermal runaway, overcharging, and electrical safety.
- FM Global Datasheet 5-33: Offers guidelines for fire protection and hazard mitigation specific to Li-ion battery systems, including guidance on suppression systems for large battery arrays.

4.1.2 It should be noted that the listing shown represents a summary of BESS safety standards and that these may be updated or superseded by the time the Proposed Development is ready to be constructed.



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