Clune Wind Farm

Technical Appendix 3.5

Clune BESS Fire Risk Statement

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Revision History

Issue	Date	Name	Latest changes
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1 Introduction

This document forms the Clune BESS fire risk statement. The document indicates how the project has been developed to address fire risk in several ways. It contains key mitigation measures against the risk of fire ignition and propagation within the battery energy storage system (BESS) site.

Battery technology and associated understanding of fire risk is continually evolving within the industry. As such, this document sets out key principles and mitigation measures based on the current understanding of battery fire risk but does not include a detailed Fire Risk Management Plan. A detailed Fire Risk Management Plan would be developed during detailed design, following battery selection.

2 Project Description

2.1 General project information

Renewable Energy Systems Ltd (RES) is developing a 100MW BESS facility as part of the Clune Wind Farm Development. The BESS will consist of 64 no. battery storage enclosures (BSEs), power conversion systems (PCSs), transformers, electrical infrastructure, foundations, access track, crane hardstanding, and spares storage containers. The grid connection will be via an onsite 132kV substation, which services both the wind farm and the BESS.

2.2 Battery selection

The proposed battery technology for the development is anticipated to be lithium iron phosphate (LFP). LFP has better thermal stability and enters thermal runaway at higher temperatures compared to some other battery chemistries. This is demonstrated by the UL 9540A test results of RES' preferred battery system which show that, at a unit level following deliberate initiation of thermal runaway:

- No flaming outside the initiating battery rack was observed.
- Surface temperatures of modules within the target battery rack adjacent to the initiating battery rack do not exceed the temperature at which thermally initiated cell venting occurs.
- Wall surface temperature rise does not exceed 97°C above ambient.
- Explosion hazards were not observed during the test.

Data from UL9540A testing can also be used to inform detailed design of the site and safety systems.

Each BSE has an approximate capacity of 1.56MW / 3.12MWh and footprint of approximately 6.1 x 2.4m. The exact battery form factor will be determined during detail design phase.

3 Design Factors

3.1 Fire response strategy

It is the intention that the site would be self-sufficient during a potential battery-based fire event and would not require fire service intervention to prevent fire spread or any other significant risks to people or property. Key principles of the NFCC Grid Scale Battery Energy Storage System planning – Guidance for FRS, 2023 ("the NFCC Guidance") are addressed through the mitigations identified within this report, as these pertain to the fire risk management strategy set out below.

The overarching fire risk management strategy would adopt the following controls:

1. Implement measures that result in a very low risk of fire ignition and any suitable environment for sustaining fire.
2. Implement measures that result in a very low risk of fire propagation and spread within a fire source (e.g. BSE).
3. Ensure fire spread between significant elements of the project is not expected, through application of design standards and use of calculations / modelling as necessary.
4. Include adequate provisions to allow the fire service to monitor a fire event, intervening only if there is a failure of the controls above.

Due to the risks associated with lithium-ion fires, transformer fires, and high-power equipment, there are significant safety benefits to minimising fire service intervention and consequential firefighter hazard exposure.

During detailed design, following battery product selection, a project specific Fire Risk Management Plan will be developed, in liaison with the Fire Service and with due consideration of the NFCC Guidance. This Fire Risk Management Plan will include:

- A fire risk appraisal that details how the fire response strategy above will be achieved, including the identification and design of any further mitigations required to achieve the strategy above.
- An emergency response plan.

3.2 Mitigation Measures

The following points define the key preliminary design mitigations against the risk of fire ignition and propagation within the BESS site.

3.2.1 Equipment spacing

The site has been developed to include adequate spacing between the battery storage enclosure (BSE) to mitigate against the risk of fire spread in the event of a fire within one BSE. The site layout aligns with applicable NFPA 855 spacing criteria as well as the spacing recommendations outlined in FM Global Property Loss Prevention Datasheet 5-33 (Interim revision Jan 2024). The layout allows minimum distance of 3m between batteries enclosures and any other infrastructure.

3.2.2 Protection systems

Each BSE will have a dedicated fire protection system, comprising flammable gas detection and venting, fire detection and alarm, and an automatic fire suppression system. Additionally, key battery health and environment parameters will be continuously monitored with alarms sent to a control centre. Automatic electrical disconnection will be enacted by the battery management system should operational temperature, current or voltage limits be breached. There will be levels of alarms prior to protection limits which warn the operator of proximity to safe operating limits. BSEs will be fitted with deflagration venting and explosion protection appropriate to the hazard.

3.2.3 Access to battery storage enclosure

All BSEs will be accessed via external doors only, i.e. no internal corridor to eliminate the risk of people being inside an enclosure during a fire or thermal runaway gas venting incident.

3.2.4 Location of BESS facility

The location of the facility has been selected considering the distances from existing nearby premises. There are no premises nearby site, with the nearest one to the BESS site location to be approximately 1.25 km in distance. A distance of at least 6.1m is achieved between BSEs and the site boundary, in line with NFPA 855 (2023), and there are no existing or planned bushes or trees within 10m of any BSE.

3.2.5 Access for emergency services

Emergency services will access the BESS compound using the proposed wind farm track network, which has multiple access points from the surrounding road network. As shown in Figure 1, two emergency access routes are available for emergency services: using the proposed wind farm access from the U2856 (black route) and from an alternative direction using existing site tracks (purple).

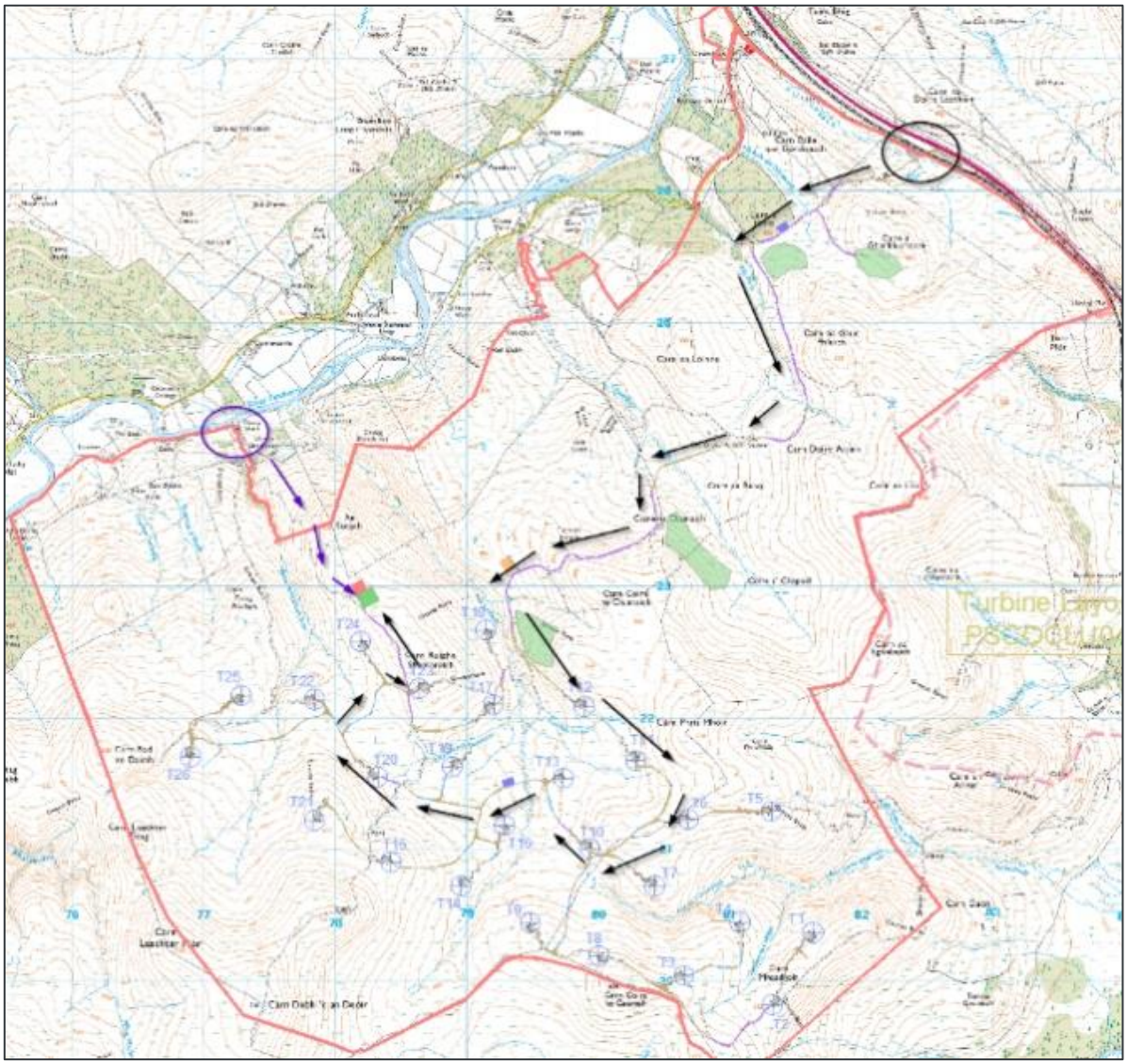

Figure 1: Proposed Emergency Access Routes

The fenced BESS compound provides access corridors to the east and west of each battery array, such that all points of the BSEs are no more than 16m away from a corridor.

Vehicular access to allow the emergency services to safely reach the development during design flood conditions has been considered and achieved.

3.2.6 Water Supply

It is intended that an onsite water supply would not be required to achieve the fire response strategy outlined in 3.1. However, if agreed as necessary in development of the Fire Risk Management Plan, a supply of 1,900 litres per minute for at least 2 hours in line with the NFCC Guidance could be achieved through provision of a tank within the BESS compound.

A nearby potential water supply is identified in Figure 2. Wester Strathnoon Burn is runs 400m to the west of site.

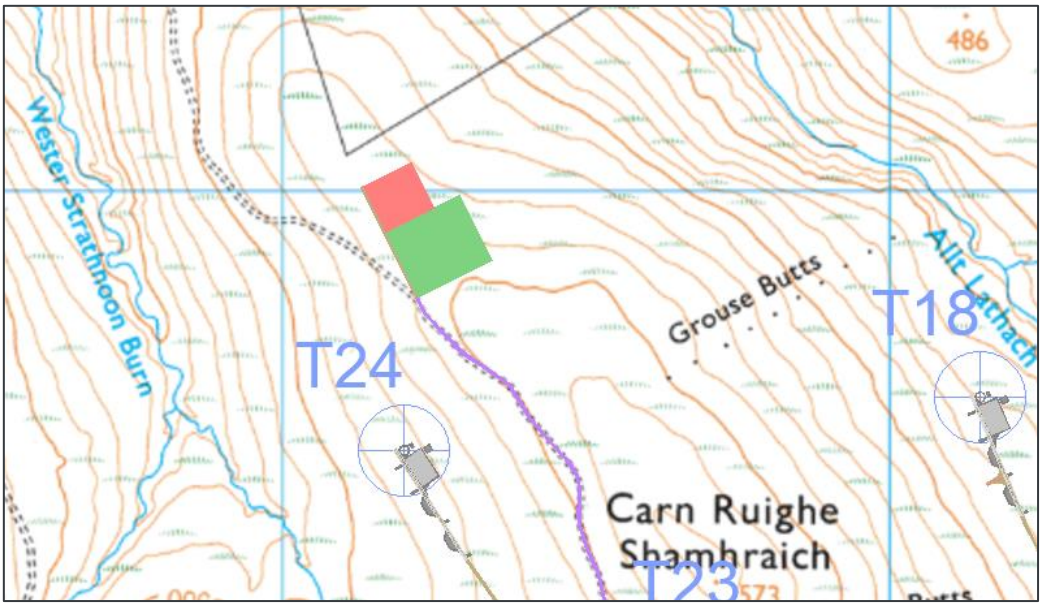

Figure 2: Potential Watercourse Supply

4 Conclusion

During the preliminary design, efforts have been made to mitigate, minimise, and prevent any fire hazard on site by incorporating specific design factors as described in this document. During detailed design and following battery product selection, a project specific fire risk appraisal will be used to verify the strategy presented in this document and an emergency response plan will be developed through liaison with the local fire service.