Fire Risk Statement

Boxted Solar Farm

Ref	04806-8407023

Revision History

Issue	Date	Name	Latest changes
01	01/11/2024	Daniel Rose	First Created
02	20/01/2025	Daniel Rose	Section 3.2.5 updated.

Contents

1 Introduction

This document forms the Boxted fire risk statement with focus on the distributed battery energy storage system (BESS). 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 distributed BESS.

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 equipment selection.

2 Project Description

2.1 General project information

Renewable Energy Systems Ltd (RES) is developing a 20MW solar facility in Suffolk named Boxted. The site infrastructure layout for Boxted is included in Appendix A. The BESS component of the site is distributed through the solar farm at 6 no. inverter locations, each of which comprises a battery storage system, an inverter, a transformer, DC to DC converters, electrical infrastructure, foundations, access track, and crane hardstanding. The grid connection will be via an onsite substation connected to existing overhead lines.

2.2 Battery selection

The proposed battery technology for the BESS portion of 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 a footprint of approximately 6.1 x 2.4m. The exact battery form factor and battery capacity 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). The risk of fire spread between battery storage systems is considered low due to the separation of systems associated with each inverter and the dispersed nature of inverters across the site.
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 site.

3.2.1 Equipment spacing

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 January 2024). The layout

allows minimum distance of 3m between battery enclosures and any other infrastructure. A typical layout for the inverter and storage locations is included in Appendix B.

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 inverter locations and consequently battery storage enclosure locations are selected considering the distances from the solar table arrays whilst achieving maximum possible distances to nearby properties and utilising existing vegetation (hedgerows and trees) where possible to minimise environmental impact. Regarding this design:

- There are no premises nearby site, with the nearest one to site to be more than 200m in distance.
- In line with NFPA 855 (2023), there are no existing or planned bushes or trees within 10m of any BSEs.

3.2.5 Access for emergency services

The Solar Farm has an access route from the B1066 east of the site heading onto an unnamed road. The site will be accessed via a proposed bell mouth junction leading onto proposed site tracks that connects all inverter / battery storage locations, allowing the fire service to access the site during an incident.

Refer to drawing 05009-RES-LAY-DR-PT-007 in Appendix C for the presentation of a swept path analysis undertaken and subsequent turning heads provided for emergency response vehicles. The turning heads for emergency response vehicles are available at all inverter locations apart from one, in which turning can be achieved by continuing along the access track before reaching a turning head.

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

A secondary access point is deemed unnecessary considering the following factors:

- The fire strategy set out in 3.1 states the design philosophy for the site to be self-sufficient during a potential battery-based fire event, not requiring fire service intervention to prevent fire spread. Therefore, it is unlikely fire vehicles will need to access the site.

- In Figure 1, the prevailing wind direction shown in the location's wind rose is approximately 90 degrees from the site access direction denoted by the orange arrow. Therefore, it is also unlikely that access onto the site will be hindered by poor visibility from fire smoke plumes.

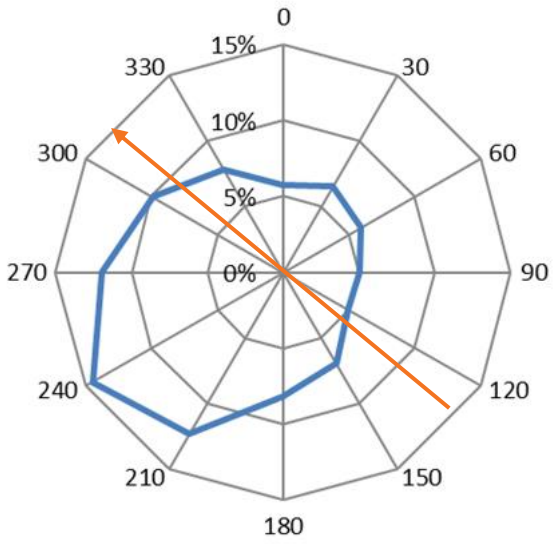

Figure 1: Wind Rose at the proposed Boxted Solar Farm (access direction denoted by orange arrow)

3.2.6 Water Supply

Existing and potential water supplies are located in drawing 05009-RES-LAY-DR-PT-006 in Appendix C. The nearest identified fire hydrant is located at Long Melford Fire Station approximately 5.5km from the site and the River Glem is located approximately 50m northeast of the site boundary.

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 will be designed in line with the NFCC Guidance across three locations.

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.

Appendix A Site Infrastructure Layout

04806-RES-LAY-DR-PT-004	Infrastructure Layout	Rev 02
04806-RES-LAY-DR-PT-005	Infrastructure Layout Enlargements	Rev 02

Appendix B Typical Details

04806-RES-SOL-DR-PT-001	Typical PV Module and Rack Detail	Rev 01
04806-RES-SOL-DR-PT-002	Typical Inverter and Storage Layout	Rev 02

Appendix C Emergency response drawings

04806-RES-LAY-DR-PT-006	Site Water Supply	Rev 01
04806-RES-LAY-DR-PT-007	Emergency Vehicle Onsite Swept Path Analysis	Rev 01