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Agenda

Extraordinary Planning Committee Meeting

Date: Wednesday, 28 February 2024
Time 7.00 pm
Venue: Council Chamber, Swale House, East Street, Sittingbourne, ME10 3HT*

Membership:

Councillors Mike Baldock (Chair), Andy Booth, Simon Clark, Kieran Golding, James Hall, Mike Henderson, James Hunt, Elliott Jayes (Vice-Chair), Peter Marchington, Claire Martin, Charlie Miller, Julien Speed, Paul Stephen, Terry Thompson, Angie Valls, Karen Watson and Tony Winckless.

Quorum = 6

Pages

Information about this meeting
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(d) Anyone unable to use the stairs should make themselves known during this agenda item.

2. Apologies for Absence

3. Declarations of Interest

Councillors should not act or take decisions in order to gain financial or other material benefits for themselves, their families or friends.

The Chair will ask Members if they have any disclosable pecuniary interests (DPIs) or disclosable non-pecuniary interests (DNPIs) to declare in respect of items on the agenda. Members with a DPI in an item must leave the room for that item and may not participate in the debate or vote.

Aside from disclosable interests, where a fair-minded and informed observer would think there was a real possibility that a Member might be biased or predetermined on an item, the Member should declare this and leave the room while that item is considered.

Members who are in any doubt about interests, bias or predetermination should contact the monitoring officer for advice prior to the meeting.

Part B reports for the Planning Committee to decide

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Issued on Wednesday, 21 February 2024

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Chief Executive, Swale Borough Council,
Swale House, East Street, Sittingbourne, Kent, ME10 3HT

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SWALE BOROUGH COUNCIL

PLANNING SERVICES

Planning Items to be submitted to the Planning Committee

28 FEBRUARY 2024

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ABBREVIATIONS: commonly used in this Agenda

CDA	Crime and Disorder Act 1998
GPDO	The Town and Country Planning (General Permitted Development) (England) Order 2015
HRA	Human Rights Act 1998
SBLP	Swale Borough Local Plan 2017

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INDEX OF ITEMS FOR EXTRAORDINDARY PLANNING COMMITTEE – 28 FEBRUARY 2024

ITEM

23/503812/SUB	**GRAVENEY**	**Land At Cleve Hill**

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EXTRAORDINARY PLANNING COMMITTEE – 28 FEBRUARY 2024

Report of the Head of Planning

REFERENCE NO – 23/503812/SUB		
PROPOSAL Submission of Details to Discharge Requirement 3 of The Cleve Hill Solar Park Order 2020 - Battery Safety, Phase 2		
SITE LOCATION Land At Cleve Hill Graveney Kent ME13 9EE		
RECOMMENDATION Delegate to the Head of Planning to approve the Battery Safety Management Plan subject to Requirement 3 of the Development Consent Order.		
APPLICATION TYPE Approval of details relating to a requirement of a Development Consent Order		
REASON FOR REFERRAL TO COMMITTEE The Head of Planning Services has referred the application to Planning Committee given the large number of representations received and the significant concerns raised.		
CASE OFFICER Andrew Byrne		
WARD Boughton And Courtenay	**PARISH/TOWN COUNCIL** Graveney With Goodnestone	**APPLICANT** Cleve Hill Solar Park **AGENT** Envams Ltd
DATE REGISTERED 17/08/2023	**TARGET DATE** 10/01/2024	
BACKGROUND PAPERS AND INFORMATION: 23/503812/SUB | Submission of Details to Discharge condition 3 - Battery Safety, Phase 2 | Land At Cleve Hill Graveney Kent ME13 9EE (midkent.gov.uk)		

Common Abbreviations used in this report

DCO - The Development Consent Order made on 28th May 2020 authorising the construction of the solar park and energy storage facility.
NSIP – Nationally Significant Infrastructure Project
BESS – Battery Energy Storage System
BSMP – Battery Safety Management Plan
KFRS – Kent Fire and Rescue Services
HSE – The Health and Safety Executive
NFCC Guidance – The National Fire Chiefs Council Battery Energy Storage Systems (BESS) Guidance

1. SITE LOCATION AND DESCRIPTION

1.1 The site at Cleve Hill is a substantial area of land amounting to 491.2 Ha across the Nagden, Cleve and Graveney marshes on the coastline of The Swale. Other than a small section in the north east that falls within the administrative boundaries of Canterbury, the site is located in the parish of Graveney with Goodnestone.

1.2 Permission has been granted for a large-scale solar park on the site. This was approved by the Secretary of State as a Nationally Significant Infrastructure Project in 2020. A Development Consent Order (DCO) (2020 No.0000) was made on 28th May 2020, and came into force on 19th June 2020 and sets out the works comprising the authorised development, and a series of rights, requirements and provisions relating to the development.

1.3 The development is currently under construction.

2. PLANNING HISTORY

2.1 18/503041/NSIP Consultation - Construction and Operation of Photovoltaic (PV) Electricity Generating and Storage. Development Consent Order made 28/05/2020

2.2 20/505493/SUB - Submission of Details to Discharge Requirement 10 of The Cleve Hill Solar Park Order 2020 - Archaeological written scheme of investigation. Approved 04.01.2021

2.3 21/506832/SUB - Submission of Details to Partially Discharge Requirements 8 and 14 of The Cleve Hill Solar Park Order 2020 - Fencing and other means of enclosure and Protected species to avoid impacts on water voles. Approved 24.02.2022

2.4 22/502676/SUB - Submission of Details to Discharge condition 8 – Phases of development. Approved 12.08.2022

2.5 22/502680/SUB - Submission of Details to Discharge Requirement 16 of The Cleve Hill Solar Park Order 2020 - Local skills, supply chain and employment. Approved 20.07.2022

2.6 22/503198/SUB - Submission of Details to Discharge Requirement 10 of The Cleve Hill Solar Park Order 2020 – Archaeology. Approved 12.08.2022

2.7 22/503259/SUB **-** Submission of Details to Discharge Requirement 12 of The Cleve Hill Solar Park Order 2020 - Construction Traffic Management Plan**.** Approved 09.09.2022

2.8 22/503313/SUB **-** Submission of Details to Discharge Requirement 2 Detailed Design and Requirement 8 Fencing**.** Approved 12.08.2022

2.9 22/503315/SUB - Submission of Details to Discharge Requirement 9 Surface and foul water drainage. Approved 12.08.2022

2.10 22/503361/SUB - Submission of Details to Discharge Requirement 11 - Construction Environmental Management Plan - of The Cleve Hill Solar Park Order 2020. Approved 09.09.2022

2.11 22/503467/SUB - Submission of Details to Discharge Requirement 5 of The Cleve Hill Solar Park Order 2020 -Landscape and Biodiversity Management Plan. Approved 12.08.2022

2.12 22/503471/SUB - Submission of Details to Discharge Requirement 13 - Special Protection Area Construction Noise Management Plan. Approved 09.09.2022

2.13 22/503472/SUB - Submission of Details to Discharge Requirement 15 - Operational Noise, Phase 1. Approved 12.08.2022

2.14 22/503473/SUB - Submission of Details to Discharge Requirement 7 -Public rights of way diversions. Approved 12.08.2022

2.15 22/503474/SUB - Submission of Details to Discharge Requirement 14 - Protected Species. Approved 05.09.2022

2.16 23/503805/SUB - Submission of Details to Discharge Requirement 15 - Operational Noise, Phase 2. Approved 13.10.2023

2.17 23/503809/SUB - Submission of Details to Discharge conditions 2 and 8 - Detailed Design and Fencing, Phase 2. Pending Consideration

3. PROPOSED DEVELOPMENT

3.1 The Development as authorised in the DCO is for up to two generating stations with a combined gross electrical output capacity of over 50 megawatts. The DCO splits the development into 9 main elements, listed as Work No.1 to Work No 9. For the purposes of this report the key elements are summarised as follows.

3.2 Work No 1 authorises a ground mounted solar photovoltaic generating station – i.e the solar array and related inverters, transformers and circuits.

3.3 Work No 2 authorises **either**
a) An energy storage facility with gross storage capacity over 50 Megawatts comprising energy storage and other related works; **or**
b) An extension of the ground mounter solar photovoltaic generating station in Work No.1

3.4 The bold text is used to highlight to Members that Work No 2 is authorised as either an energy storage facility or as an extension to the solar array authorised under Work No 1. It is a matter for the applicant whether they develop the site in accordance with option a) or option b).

3.5 Work No 3 authorises a substation with related development to connect works No 1 and No 2 with the existing substation at Cleve Hill (i.e. to enable the energy created by the solar farm to enter the National Grid).

3.6 The applicant proposes to construct an energy storage facility as authorised under Work No 2 (a). Energy storage is defined in the DCO as “equipment used for the storage of electrical energy”. The energy would be stored in a 150 MW / 300M Wh battery facility. The application states that the site design allows for this storage to be expanded to up to 350 MW / 1400 MWh in the future, although this does not form part of the current proposal.

3.7 Schedule 1, Part 2 of the DCO sets out a series of requirements that the development must adhere to, which are similar to planning conditions. This includes requirements for various further matters of detail to be submitted for approval by the relevant planning authority.

3.8 The battery storage facility is proposed to be contained within a large compound area to the south of the site and adjacent to the existing electricity substation. The detailed location and

design of the wider compound, incorporating an earth bund, flood protection, switchgear building, and electrical compound has been approved by the Council under 22/503313/SUB. The compound is sited approximately 100 metres to the north of a collection of buildings at Cleve Hill Farm and which include some employment premises. The closest residential dwellings are those at Crown Cottages, to the south of the buildings at Cleve Hill Farm and approximately 220m from the compound.

3.9 The battery storage facility would be located within the approved compound and would comprise of 96 enclosures, each containing 40 x Lithium Ferro Phosphate battery modules measuring 6058mm x 2438mm x 2896mm. The enclosures would be arranged in a uniform manner on the west side of the compound. The design and layout of the enclosures within the compound relating to the battery energy storage system is subject to a separate requirement under the DCO.

3.10 Requirement 3 of the DCO relates specifically to the requirement to submit a battery safety management for approval, and states –

3. *(1) Work No. 2(a) must not commence until a Battery Safety Management Plan ("BSMP") has been submitted to and approved by the relevant planning authority.*

(2) The BSMP must prescribe measures to facilitate safety during the construction, operation and decommissioning of Work No.2(a) including the transportation of new, used and replacement battery cells both to and from the authorised development.

(3) The BSMP must accord with the outline battery safety management plan.

(4) The relevant planning authority must consult with the Health and Safety Executive and Kent Fire and Rescue Service before determining an application for approval of the BSMP.

(5) The BSMP must be implemented as approved.

3.11 This application seeks approval for a Battery Safety Management Plan in accordance with Requirement 3 of the DCO.

4. CONSULTATION

4.1 Members will note that Requirement 3 specifically states that both the Health and Safety Executive and Kent Fire and Rescue Services must be consulted on the BSMP. Given this specific requirement, the responses from these organisations are set out in full below.

Kent Fire and Rescue Services

Original comments (dated 6th October 2023)

4.2 *The plans provided show development of a Battery Energy Storage System (BESS) to comprise Lithium-ion batteries.*

4.3 *Please be aware that the principles discussed within this planning consultation should not be used as precedent for justification for future developments. Each BESS is unique and should be evaluated on its own merit.*

Planning Decision

4.4 *Kent Fire Rescue Service (KFRS) has no authority to approve or decline planning permission for BESS (Battery Energy Storage Systems) sites. This decision, in the majority of cases, lies with the Local Authority, or National Infrastructure Planning. KFRS will endeavour to provide consultation during this process, however there is no statutory requirement to do so.*

Information requested and received will be able to support our observations during planning process, but also provide a basis for design/build stage. For this reason, KFRS would encourage early engagement and continued dialogue throughout the planning stage, design & build and occupation process. Additional information is therefore requested at this stage.

Consultation Observations

4.5 *Thank you for providing the additional information as requested in our previous correspondence. The plans and reports provided have been reviewed. Subject to adhesion to the comments made during the consultation including that of the Battery Safety Management Plan and associated water hydrant plan, it appears the risks outlined both within NFCC guidance and our previous meetings have been suitably mitigated within the design. I therefore do not require any supplementary information and have no additional comment to make at this stage.*

Air Quality Report

4.6 *Please be aware an air quality report was provided although it has not considered as part of this consultation as it is outside the scope of KFRS to make comment.*

Fire Safety Advice

4.7 *Further advice and guidance on all fire safety matters for business and residential premises is available on our website www.kent.fire-uk.org/business*

Important points about this consultation

4.8 *Currently, no British Standard (BS) or Approved Document (AD) specifically addresses the installation of BESS. Importance is therefore placed on evidence-based justification to support the design. In lieu of this the following guidance has been adopted to provide the basis for our observations.*

*• National Fire Chiefs Council (NFCC) published guidance: Grid Scale Battery Energy System Planning, Guidance for FRS – published April 2023**

**Please note that this detailed document should not be considered as a fully comprehensive specification; but should be used to provide a framework for consultation. Each BESS site should be assessed individually and addressed on a case-by-case basis.*
The contents of this guidance utilise academic study, international standards, case studies and industry guidance to support professional judgement.

<u>Further Comments (dated 19/12/23)</u>

4.9 *Having reviewed the updated information referenced in the email below, as well as having seen the comments and recommendations made by Paul Gregory, I can confirm that KFRS remain satisfied with the proposals and that our position remains unchanged. Please let me know if you require any further detail.*

<u>Further comments (dated 16/01/24)</u>

4.10 In response to specific queries and concerns raised by officers and third parties, KFRS provided further advice in relation to testing, design, use of suppression systems, site access, spacing between BESS units, distance to site boundaries and occupied buildings, risk management, emergency response plans, recovery plans, and adequacy of water supply. This detailed response is attached as Appendix 1 to this report and Members will note that KFRS are satisfied with the details provided. The response also refers specifically to NFCC Guidance and states –

4.11 *I would like to turn to the function of the National Fire Chiefs Council (NFCC) Battery Energy Storage Systems (BESS) guidance. BESS installations are classed as infrastructure. KFRS has no authority to approve or decline planning permission for BESS sites. This decision, in the majority of cases, lies with the Local Authority, or National Infrastructure Planning. KFRS will endeavour to provide consultation during this process, however there is no statutory requirement to do so. The NFCC guidance has been developed as a way of promoting consistency around fire service requirements at BESS sites. It is not a requirement for fire services to provide rigid adherence to the guidance, as each BESS site will be different and therefore should be assessed in its own context. KFRS has had good engagement from Cleve Hill Solar Ltd and has used the NFCC guidance as an initial basis for discussions. KFRS makes safety issues associated with lithium-ion batteries, including BESS, a high priority. We have spent significant time understanding these issues and, in this case, applying that understanding to the Cleve Hill BESS site. We remain satisfied with the proposals detailed in the Cleve Hill BSMP (December 2023, revision B).*

The Health and Safety Executive

(Response undated but received by the Council on 11/10/23)

4.12 *Thank you for your recent correspondence about the Battery Safety Management Plan for Cleve Hill Solar Park. Although the Development Consent Order indicates that HSE should be consulted in relation to a Battery Safety Management Plan (BSMP), HSE does not provide comment on such plans. HSE is a consultation body, for the purposes of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 and section 42 of the Planning Act 2008, providing public safety advice in respect of proposed NSIPs.*

4.13 *HSE's role as a statutory consultee in the planning process is set out on the Planning Inspectorate website. HSE has agreed with the Planning Inspectorate that Advice Note 11 Annex G will be amended to further clarify the position regarding BSMP.*

4.14 *For large scale BESS, there are statutory requirements for dutyholders to notify the Fire and Rescue Service to inform their emergency response planning. It would be for the Home Office or the local Fire and Rescue Services to provide further information on this.*

4.15 *The Health and Safety at Work Act places legal duties on employers to manage risks to employees and anyone else who may be affected. There is a robust regulatory regime to cover the risks associated with BESS. Of relevance are the Dangerous Substances and Explosive Atmospheres Regulations 2002 which set out minimum requirements for the protection of workers and others from fire and explosion risks; the Electricity at Work Regulations 1989 which require precautions to be taken against the risk of death or personal injury from electricity in work activities; and The Management of Health and Safety at Work Regulations 1999 which require risks to be assessed and appropriately managed.*

4.16 *The fundamental principle of health and safety law is that those who create risks are best placed to control them. Designers, installers, and operators all have a duty to ensure this is the case. HSE expects the dutyholder to assess the specific situation and implement necessary control measures, to manage the risks identified.*

4.17 Officer note – as is evident from the above response, the HSE advise that they do not comment on such plans. Officers have contacted the HSE (by email dated 10/01/24) to seek further clarification on this, but no further response has been received. In addition,

officers have also contacted the Planning Inspectorate (as the Examining Authority) to raise concern that the HSE are specifically required to be a consultee under the DCO, but are unable to provide comments. The Planning Inspectorate state that they are unable to advise on this matter and would encourage the Council to seek its own advice.

4.18 **The Port of London Authority** has no comments to make on the application

4.19 **KCC Highways** do not raise any highway implications related to the proposal.

5 REPRESENTATIONS

5.1 Although there is no requirement to carry out a formal notification process with such applications, given the known high level of concerns raised by the local community regarding the battery storage, notification letters were sent to parish councils and local residents.

5.2 **Graveney with Goodnestone Parish Council** – Object to the application. The parish council response received on 26th September 2023 is a substantial document and can be viewed in full on Public Access using the link at the top of this report. It includes the following summary of their objections –

Of the various plans that fall within the scope of this DCO, the Battery Safety Management Plan is clearly the most technically demanding but it is also the one that carries the risk of precipitous impact to human life and the environment should a material risk crystallise. Battery technology is changing and advancing at reasonable pace; indeed, a number of characteristics of this plan have been changed, including the battery chemistry itself. Data and evidence points are emerging about the real-world consequences of inadequate safety plans and these learnings must clearly be considered, requiring the highest level of specialised technical expertise and input in order to fully evaluate the suitability of the safety measures proposed. We are aware that, to date, some of this data has yet to be provided to the consulted experts that have requested it and this will undoubtedly have had a bearing on their considerations. We urge that proven safety of the community, its habitants, wildlife and environment are the paramount factors in the decision-making process together with realistic and very thorough plans that would be put into execution should a major issue occur. These requirements must be placed higher than either timescale or cost. Pending the above, we therefore object, in the strongest possible terms, to the discharge of these requirements.

5.3 **Hernhill Parish Council -** *Object to the application (response received 28/09/23), on the basis that there was not sufficiently robust information provided and planning details in relation to an emergency response strategy, which was a concern given the size and scale of the battery needed for such a large solar farm and could have serious implications if anything should go wrong in and around the battery storage site.*

5.4 **Dunkirk Parish Council** *- Object to the application (response received 3rd October 2023) also noting the detailed comments provided by CPRE and the Faversham Society raising concerns of any accidents on its parishioners. The objection is due to there being insufficient detail backed up by technical reports and responses in relation to a safety plan. For a battery facility of this size, there*
also needs to be a detailed evacuation plan which would require involvement from KCC and Highways for which there currently do not appear to be any responses. There is also potentially a flooding impact due to the amount of water that would be required to mitigate any fire, which will require addressing. In addition, there is the potential for munitions' danger caused by blast damage to the Richard Montgomery Wreck, which also needs addressing.

5.5 **Dunkirk Parish Council** (further response received 17th January 2024, following submission of a revised BSMP) - *continue to object to this application. The original comments made by the Parish Council on the 3rd October still stand. Since those comments additional information has become available. Particularly including the comments made on the 4th January by the Barrister Group on behalf of The Faversham Society in light of the applicant's amended Safety Management Plan. Dunkirk Parish Council support the comments made in that letter by the Barrister Group and the continued concerns raised concerning the poor quality of the Battery Management Plan submitted that fails to address previous concerns raised.*

5.6 **Boughton under Blean Parish Council** – *Object (response received on 2nd November 2023) - the application as submitted does not contain enough detailed information to make an informed decision and the Parish Council requests that further information be made available before Swale Borough Council makes any consideration for a decision on the application. The application has not provided for an evacuation plan/policy in relation to an emergency response, which is of significant concern to the surrounding areas extending beyond Graveney to Boughton under Blean.*
There is no consideration within the supporting documentation for the ecological damage in the surrounding area in the event of a battery fire, including potential flooding and pollution of water.
There are concerns with regard to the volume of water available in the event of a battery fire. The supporting documentation notes that there is enough water to cool the batteries but does not evidence that there is enough water to be able to put out a fire.
There are highway safety concerns regarding a response time for emergency services to travel toward a battery fire at the site, given that the highway infrastructure consists of rural lanes which are narrow in part and surrounding main roads, offset by the volume of traffic that would exit the area at the same time. A build-up of traffic resulting in being in a static location at the time of a fire could pose a threat to personal health.
The Parish Council endorses the views as submitted by the Faversham Society.
The Parish Council requests that Swale Borough Council give consideration to delaying making a decision until there is appropriate legislation in place.
The Parish Council requests that if Swale Borough Council is mindful to make a decision, that the matter is taken to the Planning Committee for further consideration before a decision is made.

5.7 91 representations objecting to the scheme were received following the first consultation exercise. This includes representations from various groups and societies including GREAT (Graveney Rural Environmental Action Team), The Campaign to Protect Rural England (CPRE) and The Faversham Society as well as from individual households. The representations can be viewed in full on Public Access using the link at the top of the report. The comments are summarised as follows –

- The current proposal is substantially different to that presented to the examination / inquiry
- This is an extremely complex safety matter and Swale Borough Council should seek expert advice from a recognized authority
- The BESS is opposed on the grounds of the risk of fire or explosion for what would be one of the largest such installations in the world.
- Li-ion batteries are well known for fires and explosions, including circa 65 fires and explosions in grid-scale BESS across the world to date, primarily in installations less than 2 years old.
- As well as fires, confirmed vapour cloud explosions have occurred in locations including Liverpool, Belgium and Arizona

- Lithium Ferro Phosphate batteries have a worse risk of Vapour Cloud Explosion than other battery types
- The batteries would be contained within modular cabinets rather than shipping containers, with greater challenges to suppress fire and a greater risk that cabinets would be allowed to “burn out”, with increased likelihood of fire spreading to nearby cabinets and of explosion
- Lack of legislation or regulation relating to Lithium-ion batteries
- Lithium-ion batteries may be liable to a requirement for Hazardous Substances Consent before planning approval. No evidence that the applicant has applied for such consent.
- Failure to accord with new national guidance for Fire and Rescue Services on Grid Scale BESS
- Lack of adequate spacing between cabinets
- The BSMP significantly underestimates the amount of water required to deal with battery fires appropriate to the scale of the Cleve Hill Solar Park
- The application does not deal with unanswered questions from KFRS
- Endangerment to the lives of people in the village of Graveney and surrounding area
- Worst-case scenarios and modelling has not been used
- Impact upon the health and safety of local residents
- Lack of information regarding the evacuation of villagers and the primary school
- Impact of narrow roads being blocked
- The development requires an Industrial Installations Permit from the Environment Agency, and this should be obtained before the BSMP is approved
- Future expansion of the BESS of up to 350MW/1400 MWh contravenes the DCO which allowed a maximum of 700 MWH
- Lack of consultation with Kent Police
- Unacceptable for the HSE not to provide comments
- Contravention of Modern Slavery Act
- Lack of regulation in battery manufacture
- The number of battery containers is unclear
- Lack of information relating to on-site emergency presence, number / type of fire extinguishers in mobile emergency stations, container specification to house defective modules, the location of temporary replacement battery storage areas
- Lack of information to deal with thermal runaway
- Lack of appropriate access in the event of an emergency
- Evidence of battery fires relating to e-scooters and electric cars demonstrates lack of safety
- Cleve Hill will be the largest BESS in the UK and requires full and exact disclosure of all facts, which are lacking in the BSMP
- The applicant has an alternative option to use the area for solar array rather than energy storage
- Lack of a construction emergency response plan or an operational emergency response plan
- The findings of the Hoare Lea Battery Failure Plume Assessment are questionable
- Lack of detailed information on fire suppression and detection
- Capacity of outlet tanks to deal with firewater runoff is not specified
- Concern regarding remote monitoring
- Lack of minutes of consultation meetings
- Lack of input from key agencies
- Impact on vulnerable people in the event of a fire / explosion, including school children, the elderly, and people in the local community who live in unconventional accommodation such as caravan parks and farm workers
- Lack of funding and resources for local hospitals to cope in an emergency
- Road capacity, and impact of additional traffic from significant development on the ability

of emergency vehicles to access the site
- Proximity of site to the populations at Faversham, Seasalter and Whitstable
- The Council must seek professional advice on the application
- Impact on ecology and SPA/RAMSAR site
- Inadequate measures in relation to cyber security / cyber attack
- Key information is missing from the BSMP
- Lack of protocol detail
- Transportation route of batteries to and from the site, including recycling / removal of defective batteries
- Lack of emergency / escape plans for villagers
- Impacts upon local infrastructure, including railways lines, the Swale Estuary, the Thanet Way, and Saxon Shore Way
- The suggested future expansion of the BESS would make this an entirely different application and would require significant redesign of the site layout and bund, and significantly increase the potential for thermal runaway incidents and explosions.
- LFP batteries are more subject to explosion risk than other types. No explosion hazard analysis has been provided by the applicant.
- No evidence that full account has been taken of the forensic engineering analysis available, including the sites at Arizona, Liverpool, Moorabool and Beijing. This is expected in the NFCC Guidance.
- Likelihood of a single cell failure in the BESS increases in proportion to total size. This is a greater risk on a large system such as Cleve Hill, as is the maximum possible scale of a BESS accident.
- The BSMP and Hoare Lea report are inadequate to judge the dangers and risk to life of airborne pollutants from a possible BESS fire.
- The proposed aerosol type automatic fire suppression system is not specified and could be dangerous

5.8 Following the submission of a revised BSMP, a further notification process was undertaken and 26 further representations were received, including representations from GREAT and from barristers representing the Faversham Society. The comments received are summarised as follows –
- Concern regarding appointment of the consultant used by the Council and the independence and level of expertise set out in the consultant's report
- Issues remain unresolved, including the need for measures relating to increased risk of explosions from LFP batteries, the need for Hazardous Substances Consent, container spacing, possible future expansion of the BESS, failure to consider world-wide experience of BESS failures under the NFCC Guidance, failure to consider the possibility of multiple simultaneous fires, failure to consider or reference the Atkins Report in respect of airborne hazards, serious undersizing of fire water, failure to provide details of fire suppression system
- Redacted information within the consultant's report
- The re-notification has taken place over the Christmas period and lack of time for responses to be made
- Concerns raised by third parties including The Faversham Society have not been addressed
- The decision on Cleve Hill battery storage has relevance and significance for other BESS developments elsewhere in the country
- The BSMP remain incomplete and lacking detail
- The revised BMSP still fails to accord with NFCC Guidance
- The report draws almost exclusively on American experience and not developments close to population centres as is the case here

- The BESS is a business model to sell energy at higher prices
- The use of Lithium-ion batteries goes against advice from many experts

6. ASSESSMENT

6.1 It is important that Members are clear about the nature of the application under consideration. The solar park at Cleve Hill has been approved by the Secretary of State, and as part of that approval (i.e through the granting of a DCO), the option of installing an energy storage system on the site has also been authorised. The specific location of the energy storage system within the area identified as "Work No 2 and 3" to the north of Cleve Hill Farm accords with the works plan certified by the Secretary of State. Although the detail of these works are subject to Requirements within the DCO, the principle of both the solar farm and provision of an energy storage system within the solar farm in the location as shown is already authorised under the DCO. It is not within the Council's powers to refuse an energy storage facility on the site as that is permitted under the DCO. What Members are specifically tasked to consider is the acceptability of the Battery Safety Management Plan, as has been submitted pursuant to Requirement 3 of the DCO.

6.2 It is well documented that the topic of battery storage and safety was of significant concern to the local community during the NSIP examination process. The Examining Authority's report assesses the issue of safety and security in Chapter 8.7, with particular focus on battery safety. The report concludes (paragraphs 8.7.65 and 8.7.67) that safety risks can be managed and mitigated. Likewise, the Secretary of State's Decision letter and Statement of Reasons sets out their position on safety and security. The relevant sections of both the Examining Authority's Recommendation Report and the Secretary of State's Decision letter and Reasons are provided as Appendices 2 and 3.

6.3 Members will appreciate that the matter of battery storage and safety, particularly for an installation on the scale of Cleve Hill Solar Park is a highly specialist topic. For this reason, the Council has employed a specialist battery storage and safety expert, BST&T Consultancy Services, to advise on the Battery Safety Management Plan submitted to the Council under Requirement 3 of the DCO. In addition, and as a key expert consultee on fire safety, the advice from Kent Fire and Rescue Services has been given significant weight in the assessment of this application. The inability of the HSE to provide advice is clearly unhelpful.

6.4 Following review and advice from BST&T Consultancy Services, the BSMP has been amended to provide further clarification and additional detail. The report from BST&T Consultancy Services on the revised BSMP is attached in full at Appendix 4 to this report, as is the CV for the consultant. It advises that:

- The review was undertaken against the criteria set out in Requirement 3 of the DCO
- The BSMP accords with the outline BSMP and incorporates the latest safety standards and best practice guidelines
- The BSMP prescribes measures to facilitate safety during the construction, operation and decommissioning of Work No.2(a), including transportation of new, used and replacement battery cells to and from the authorised development
- That requested information has been provided to KFRS and that KFRS raise no objection to the BSMP
- The BESS manufacturer CATL has certified and tested the EnerC+ system to all requisite current safety and test standards. The final UL 9540 certification of the BESS enclosure is expected to be obtained in Q1 2024.

- The EnerC+ BESS system and fire and explosion protection systems conform to NFPA 855 (2023) standards and incorporate additional levels of monitoring and controls which are considered to be best practice.
- The site design and BESS system conform to UK National Fire Chiefs Council guidelines (2023), any deviations from these guidelines are agreed with KFRS
- The developer will undertake additional site-specific risk analysis reviews once the contractor is appointed, these include site specific consequence modelling for first responders, HAZOP / Hazid operations peer review, Fire Protection System sign off, etc. This post-consent, pre-construction work is normal, and in line with current industry expectations and best practice.

6.5 A number of concerns regarding the report have followed since it was put in the public domain. The following points provide clarification in relation to these concerns –

- The Faversham Society originally recommended Professor Christensen as a consultant for the Council to use. Professor Christensen was unable to undertake the work, but he recommended 2 consultants, one being BST&T Consultancy Services
- BST&T Consultancy Services have confirmed that they do not have a conflict of interest in carrying out this work. Whilst they do work for developers, they have not worked for the developer involved with the Cleve Hill Solar Farm.
- The BST&T report has been published in unredacted form following criticism that redacted elements were contained in part of the report first published online.
- The BST&T report identifies amendments recommended to the applicant by BST&T and incorporated into Revision B of the BSMP. Whilst such dialogue and amendments were undertaken directly between BST&T and the applicant (rather than via the planning officer), officers do not raise concern at this given the highly technical and specialist nature of battery safety and management.

6.6 A number of common themes have also been raised by third parties in objection to the BSMP, and further commentary on this is provided below.

6.7 Lack of a detailed evacuation plan for the local community and school – the BSMP is primarily for the identification, assessment and management of risks on the site. The BSMP stipulates that the developer and operations and maintenance contractor will liaise with local emergency services to plan and review the Emergency Response Plans (ERP). Officers are satisfied following advice from BST&T Consultancy and KFRS that the preparation and review of these Emergency Response Plans provides an appropriate method to address off-site evacuation in an emergency event

6.8 Insufficient Firewater storage – KFRS advise - "*The NFCC guidance states 1,900 lpm for a minimum of 2 hours. The BSMP states that this will be delivered via on site tanks and a hydrant network. This ensures enough water is immediately available to implement a boundary cooling strategy and confine the fire to the unit of origin. Over the 2-hour period we are able to, should we need, bring in additional water supplies from further afield. There is no requirement for 4 hours in the guidance and we do not feel that there is a need to impose such a requirement".*

6.9 Flooding and ecological damage from contaminated water – The BSMP sets out that the compound comprises an impermeable bunded area and that firewater would be held within penstock outlets within the compound, which can then be treated or safely removed.

6.10 Inadequate information on testing of the batteries – KFRS advise *"Page 8 (3.7, para 31) details the specifications of the batteries to be used. This includes reference to the compliance standards for the batteries at both cell, module, and container levels. The NFCC guidance makes reference to compliance with UL9540A and this has been confirmed within*

the BSMP." Table 3 (P21) of the BSMP lists the BESS compliance standards. The BST&T report confirms that the CATL EnerC+ system is certified and tested to all requisite safety and test standards.

6.11 Lack of detail on design of the BESS – KFRS advise "*The BSMP provides suitable information on page 8 regarding the type of product being installed, size, number of modules and racks, and automatic systems for us to be able to make an informed assessment of the type of installation being proposed."*

6.12 Adequacy of suppression system – KFRS advise *"Gaseous suppression systems have become standard on many BESS. There is value in these systems if used to extinguish fires not involving cells (e.g. wiring) and to prevent heat from these fires causing cells to enter thermal runaway. They are not effective on cells in thermal runaway. Our (and the NFCC's) concern lies around the potential to create a delayed vapour cloud explosion that deploying these gaseous systems in the wrong circumstances can have. The system is designed to ensure discharge of the suppression system will only take place in the event of an electrical fire and not a thermal runaway event. There are manual overrides to activate or isolate the system. Additionally, the units are fitted with deflagration venting to NFPA 69 standards to reduce the risk from a vapour cloud explosion. We are satisfied that this system will not adversely affect our chosen fire fighting strategy."* The BST&T report also confirms that the BESS enclosure integrates a dry pipe sprinkler system which can operate in conjunction with the gas exhaust system which could further reduce the risks of a deflagration occurring during a thermal runaway event.

6.13 Site access for emergency vehicles – KFRS advise *"In addition to the main vehicular access gate, the site is provided with pedestrian access gates. In the very unlikely event of us not being able to use the main access gate, we do have the capability of providing a fire fighting capability utilising portable pumps and equipment via the pedestrian access gates. Page 7, para 26 of the BSMP states "Access roads and vehicular access gates have been sized to ensure the largest vehicle required to enter and exit the facility unrestricted post construction. The layout also ensures unrestricted access to the local fire department in a fire event". We will work with Cleve Hill Solar Ltd to ensure this is achieved for our range of fire engines. Having examined the layout of the proposed carriageways within the site, and the layout of the local road network, we do not foresee an issue with access and movement for our vehicles. We have procedures for marshalling our fire engines effectively to ensure that any locations with restricted access are well planned for. We will work with the site throughout to ensure that access is available and we will test these arrangements."*

6.14 Unit spacing between battery modules – KFRS advise *"The spacing guidelines in the NFCC guidance relate to distances between BESS units in order to reduce the risk of unit to unit propagation. The BSMP states that distances between these units will be greater than or equal to 6 metres (para 22). This is a requirement that is often challenged by developers and far exceeds other international requirements but which, in this case, we are pleased to have seen Cleve Hill Solar Ltd accept."*

6.15 Distance from BESS units to occupied buildings and site boundaries – KFRS advise *"Mitigation includes deflagration venting and mechanical fan extraction. These greatly reduce the risk of a vapour cloud explosion. Additionally, the location of the site away from population centres, as well as features like the site bund, reduce the risk considerably. We are satisfied with the distances proposed."*

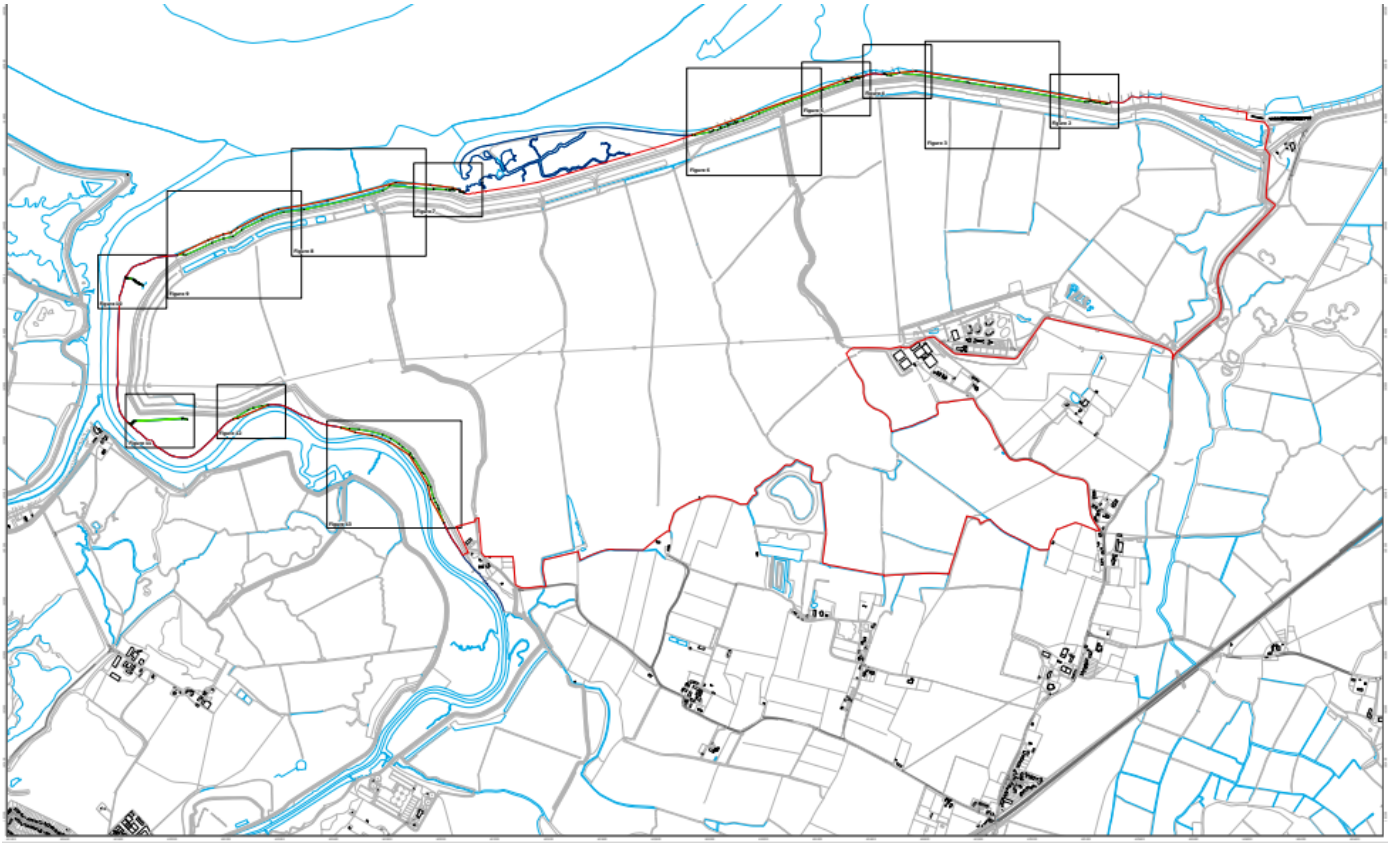
6.16 The need for Hazardous Substances Consent - The Control of Major Accident Hazards Regulations 2015 (COMAH) apply to dangerous substances as classified by the Classification, Labelling and Packaging Regulations 2008. The Government has made clear that Lithium-ion batteries are considered to be articles, rather than substances, and are therefore outside of

the scope of the COMAH. In any event, it is considered that any future need to obtain further consents should not prevent approval of the BSMP as planning decisions should assume that these regimes will operate effectively (paragraph 194 of the NPPF).

7 Conclusion

7.1 Officers recognise the significant concerns that have been raised against this application for approval of a Battery Safety Management Plan. Officers have taken advice from a specialist consultant on this highly technical topic and also given significant weight to the detailed comments and advice received from KFRS. On the basis of this advice it is considered that the BSMP as revised is acceptable and that this detail pursuant to Requirement 3 of the DCO is approved.

RECOMMENDATION – That the Battery Safety Management Plan pursuant to Schedule 1, Part 2, Requirement 3 of the Cleve Hill Solar Park Order 2020 is APPROVED



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Kent Fire & Rescue Service together

To
Marie King (GREAT)
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Contact
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matthew.deadman@kent.fire-uk.org

Our ref

Your ref

Date
16 January 2024

Dear Maire and Andrew

Cleve Hill Battery Safety Management Plan

I am writing in response to your emails regarding the above, on the 3rd and 9th of January respectively.

You were writing in response to Kent Fire and Rescue Service's (KFRS) confirmation to William Allwood (SBC Planning) that we were satisfied with the arrangements laid out by Cleve Hill Solar Park Ltd in their Battery Safety Management Plan (BSMP).

To answer your questions clearly, I have collated them in table form as an addendum to this letter.

I would like to turn to the function of the National Fire Chiefs Council (NFCC) Battery Energy Storage Systems (BESS) guidance. BESS installations are classed as infrastructure. KFRS has no authority to approve or decline planning permission for BESS sites. This decision, in the majority of cases, lies with the Local Authority, or National Infrastructure Planning. KFRS will endeavour to provide consultation during this process, however there is no statutory requirement to do so. The NFCC guidance has been developed as a way of promoting consistency around fire service requirements at BESS sites. It is not a requirement for fire services to provide rigid adherence to the guidance, as each BESS site will be different and therefore should be assessed in its own context. KFRS has had good engagement from Cleve Hill Solar Ltd and has used the NFCC guidance as an initial basis for discussions.

KFRS makes safety issues associated with lithium-ion batteries, including BESS, a high priority. We have spent significant time understanding these issues and, in this case, applying that understanding to the Cleve Hill BESS site. We remain satisfied with the proposals detailed in the Cleve Hill BSMP (December 2023, revision B). Additionally, the review of the BSMP by BST+T provides additional independent scrutiny. I hope this letter provides you with the assurance you need.

Yours Sincerely

Kent Fire & Rescue Service | together

Comment	Response
1. Testing Page 4 of the NFCC Guidance states "Details of any evidence-based testing of the system design should be requested". It is not evident in the BSMP that this has been requested or reviewed.	Page 8 (3.7, para 31) details the specifications of the batteries to be used. This includes reference to the compliance standards for the batteries at both cell, module, and container levels. The NFCC guidance makes reference to compliance with UL9540A and this has been confirmed within the BSMP.
2. Design Page 4 of the NFCC Guidelines states "Design features should be made clear." However, the detailed design documentation submitted does not include this level of detail.	The BSMP provides suitable information on page 8 regarding the type of product being installed, size, number of modules and racks, and automatic systems for us to be able to make an informed assessment of the type of installation being proposed.
3. Suppression systems Page 5 of the NFCC Guidelines states "Whilst gaseous suppression systems have been proposed previously, current research indicates the installation of water-based suppression systems for fires involving cell modules is more effective." However, the battery units all include a pre-fitted gaseous suppression system which can only be discharged once, so the common occurrence of subsequent re-ignition would occur in an unprotected unit.	Gaseous suppression systems have become standard on many BESS. There is value in these systems if used to extinguish fires not involving cells (e.g. wiring) and to prevent heat from these fires causing cells to enter thermal runaway. They are not effective on cells in thermal runaway. Our (and the NFCC's) concern lies around the potential to create a delayed vapour cloud explosion that deploying these gaseous systems in the wrong circumstances can have. The system is designed to ensure discharge of the suppression system will only take place in the event of an electrical fire and not a thermal runaway event. There are manual overrides to activate or isolate the system. Additionally, the units are fitted with deflagration venting to NFPA 69 standards to reduce the risk from a vapour cloud explosion. We are satisfied that this system will not adversely affect our chosen fire fighting strategy.

4. Site access Page 7 of the NFCC Guidelines states: a) "At least 2 separate access points to the site to account for opposite wind conditions/ direction." This has not been included in the design with only one access point available. b) "Roads / hard standing capable of accommodating fire service vehicles in all weather conditions." As you may be aware, the holding area for lorries off the A299 has been closed for a couple of months now as the road surface in there was not capable of supporting HGVs. How can you ensure this will not be the case on site? c) "Turning circles, passing places etc size to be advised by FRS depending on fleet." There is no reference to this in the BSMP or detailed design, nor any detail of passing places etc in the design documentation.	In addition to the main vehicular access gate, the site is provided with pedestrian access gates. In the very unlikely event of us not being able to use the main access gate, we do have the capability of providing a fire fighting capability utilising portable pumps and equipment via the pedestrian access gates. Page 7, para 26 of the BSMP states "Access roads and vehicular access gates have been sized to ensure the largest vehicle required to enter and exit the facility unrestricted post construction. The layout also ensures unrestricted access to the local fire department in a fire event". We will work with Cleve Hill Solar Ltd to ensure this is achieved for our range of fire engines. Having examined the layout of the proposed carriageways within the site, and the layout of the local road network, we do not foresee an issue with access and movement for our vehicles. We have procedures for marshalling our fire engines effectively to ensure that any locations with restricted access are well planned for. We will work with the site throughout to ensure that access is available and we will test these arrangements.
5. Access between BESS units and unit spacing Page 7 of the NFCC Guidelines states "A standard minimum spacing between units of 6 metres is suggested unless suitable design features can be introduced to reduce that spacing. If reducing distances a clear, evidence based, case for the reduction should be shown." Section 3.3, point 21, of the BSMP includes a distance between battery enclosures and power conversation system blocks of just >=3 metres, with no evidence that this has been reviewed.	The spacing guidelines in the NFCC guidance relate to distances between BESS units in order to reduce the risk of unit to unit propagation. The BSMP states that distances between these units will be greater than or equal to 6 metres (para 22). This is a requirement that is often challenged by developers and far exceeds other international requirements but which, in this case, we are pleased to have seen Cleve Hill Solar Ltd accept.

Kent Fire & Rescue Service together	
6. Distance from BESS units to occupied buildings and site boundaries Page 7 of the NFCC Guidelines states "an initial minimum distance of 25 metres is proposed prior to any mitigation such as blast walls." Section 3.3, point 23 of the BSMP includes a distance of >=20 metres, with no evidence that this has been reviewed.	Mitigation includes deflagration venting and mechanical fan extraction. These greatly reduce the risk of a vapour cloud explosion. Additionally, the location of the site away from population centres, as well as features like the site bund, reduce the risk considerably. We are satisfied with the distances proposed.
7. Risk Management Plan Page 9 of the NFCC Guidelines states "A Risk Management Plan should be developed by the operator, which provides advice in relation to potential emergency response implications." No such plan has been included with the BSMP.	The BSMP includes emergency response protocols for both during construction (p. 12) and operation (p. 19). Furthermore, the BSMP states that these are the minimum arrangements that will be in place, with further detail being provided once the project's operational teams are appointed. We are satisfied with these arrangements at this stage.
8. Emergency Response Plan Page 9 of the NFCC Guidelines states "An Emergency Response Plan should be developed to facilitate effective and safe emergency response." No such plan has been included with the BSMP.	Much of the information advised within the NFCC guidance document relating to Emergency Response Plans is included elsewhere in the document (for example details of water supplies, suppression systems, site plan, alerting through fire alarm monitoring). We would anticipate gathering additional data through our site-specific risk information process (during construction). We anticipate the site will provide a more detailed emergency response plan once a contractor has been appointed.

9. Recovery Page 10 of the NFCC Guidelines states "The operator should develop a post-incident recovery plan that addresses the potential for reignition of ESS and de-energizing the system, as well as removal and disposal of damaged equipment." No such plan has been included with the BSMP.	Page 23, section 7.3 details the arrangements to be put in place in the event that modules are defective and need to be removed from the site. We would anticipate this would include any modules defective as a result of impacts from a fire. At this stage we are satisfied with the assurances detailed but we will continue to work with Cleve Hill Solar Ltd to refine these arrangements.
Concern has also been raised that a 2 hour water supply is inadequate for the installation proposed in the event of fire, and should be 4 hours minimum.	The NFCC guidance states 1,900 lpm for a minimum of 2 hours. The BSMP states that this will be delivered via on site tanks and a hydrant network. This ensures enough water is immediately available to implement a boundary cooling strategy and confine the fire to the unit of origin. Over the 2-hour period we are able to, should we need, bring in additional water supplies from further afield. There is no requirement for 4 hours in the guidance and we do not feel that there is a need to impose such a requirement.

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The Planning Inspectorate
Yr Arolygiaeth Gynllunio

The Planning Act 2008

CLEVE HILL SOLAR PARK

Examining Authority's Report
of Findings and Conclusions

and

Recommendation to the Secretary of State for
Business, Energy and Industrial Strategy

Examining Authority

David M H Rose BA (Hons) MRTPI, Panel Lead

Andrew Mahon BSc MBA CMLI CEnv MIEMA MCIEEM

Helen Cassini BSc (Hons) DipTP MRTPI

28 February 2020

Conclusions on Water Environment

8.6.55. Taking all relevant documents and policies into account, we conclude that, subject to the implementation in full of the relevant measures identified in the construction, operational and decommissioning management plans, as summarised in the Mitigation Route Map [REP7-025]:

- the Proposed Development is compliant with the WFD;
- the Proposed Development is policy compliant in relation to flood risk;
- the management of coastal change and associated risks have been adequately addressed; and
- the construction, operational and decommissioning impacts and risks to the water environment have been addressed and the overall effect of the Proposed Development on water quality is likely to be slightly positive: we consider this to be a neutral factor in our subsequent planning balance.

8.7. SAFETY AND SECURITY

Policy Considerations

National Policy Statements (NPSs)

8.7.1. The NPSs are silent on battery energy storage systems.

The Development Plan

8.7.2. No relevant development plan policies have been drawn to our attention.

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

8.7.3. The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended) under Regulation 5, part 4 states that:

The significant effects to be identified, described and assessed ..... include, where relevant, the expected significant effects arising from the vulnerability of the proposed development to major accidents or disasters that are relevant to that development'.

The Applicant's Case

8.7.4. The principal Application document of relevance was:

- [APP-047]: Environmental Statement – Miscellaneous Issues Chapter.

8.7.5. Documents subsequently submitted into the Examination by the Applicant relating to battery energy storage included:

- [AS-009]: the Applicant's responses to Relevant Representations (RRs);
- [REP3-021]: written representation on Electrical Safety Regulations and Standards;

- [REP4-051]: written representation - Air Quality Assessment - Battery Fire;
- [REP4-028]: the Applicant's responses to ExQ2 - Appendix 8 - Kent Fire and Rescue Service Meeting Notes - 20 August 2019;
- [REP4-032]: the Applicant's responses to ExQ2 - Appendix 12 – Allianz Risk Consulting - Tech Talk Volume 26: Battery Energy Storage Systems (BESS) Using Li-ion Batteries;
- [REP5-011]: the Applicant's written summaries of oral submissions ISH6 – Environmental Matters; and
- [REP6-021]: Outline Battery Safety Management Plan.

8.7.6. Chapter 17 of the ES [APP-047] recorded that the Proposed Development was not considered likely to cause a significant accident or disaster risk during either the construction or operational phases. However, it acknowledged that:

'there is a potential fire risk associated with certain types of batteries such as lithium-ion, although the facility includes cooling systems which are designed to regulate temperatures to within safe conditions to minimise the risk of fire'.

8.7.7. The ES [APP-047] stated:

'fire detection and suppression features could be installed to detect (e.g. multispectrum infrared flame detectors) and suppress fire (e.g. water base suppression systems) to minimise the effect of any fire. The Development design will include adequate separation between battery banks to ensure that an isolated fire would not become widespread and lead to a major incident'.

8.7.8. In terms of the security of the Proposed Development Site, the ES [APP-047] confirmed that it would be protected by a perimeter fence, closed circuit television, selective use of lighting with sensors and restriction of access to authorised personnel.

8.7.9. The Applicant [AS-009] responded to the RRs by reference to Chapter 17 of the ES [APP-047] and as follows:

- the site operator would ensure that emergency procedures are implemented in consultation with the relevant authorities;
- emergency access arrangements through the protective bund surrounding the battery energy storage system compound would be arranged by the site operator; and
- any waste classified as hazardous waste generated on-site would be controlled by The Hazardous Waste (England and Wales) Regulations 2005.

8.7.10. The Applicant's response [REP3-021] to representations at OFH2 about the alleged risks of battery energy storage systems set out relevant legislation, regulations and standards applicable to such projects.

8.7.11. Further, in light of discussions at ISH2 on the dDCO on how safety measures might be secured, the Applicant's subsequent outline Battery Safety Management Plan [REP6-021] confirmed:

'..... that safety risks related to the Battery Energy Storage System ('BESS') are understood, accounted for and mitigated as far as practicable, in agreement with relevant consultees, and in supplement to the Outline Design Principles document to form the basis for the decision of the relevant local planning authority ('LPA') to discharge Requirement 3' [of the dDCO].

8.7.12. The outline Battery Safety Management Plan had been reviewed by the HSE, with comments received incorporated in the document. A review by Kent Fire and Rescue Service[16], following initial discussion [REP4-028] had also been undertaken which stated:

'Whilst we are not a statutory consultee in relation to this project we will continue to work and engage as this project develops to ensure that Cleve Hill Solar Park Ltd comply with the statutory responsibilities that we enforce.

All risk reduction strategies start with prevention and it is the 'responsible person' for the premises that has responsibility for this as stated in the Regulatory Reform (Fire Safety) Order 2005. We would also expect that our Central Consultation Team (CCT) will become more involved as the appropriate planning applications are submitted and that any applications would conform to any legislation that relates to this type of development and the design of the BESS will reflect prevailing legislative requirements and UK industry recommendations.

Kent Fire and Rescue Service (KFRS) recognises the use of batteries (including lithium-ion) as Energy Storage Systems is a new and emerging practice in the global renewable energy sector. As with all new and emerging practices within UK industry the KFRS would like to work with the developers to better understand any risks that may be posed and develop strategies and procedures to mitigate these risks.

The responses to the ARC [Allianz Risk Consulting] recommendations set out in the OSMP [outline Safety Management Plan] details the information that we would expect to be provided during the planning application phase, we would then be working with our CCT and Water Services colleagues during the consultation phase to make sure that the Cleve Hill Solar Park conforms to the appropriate legislation and recommendations.'

8.7.13. The Applicant's Air Quality Impact Assessment [REP4-051] responded to representations made by an IP, Dr Erasin, at OFH2, and his more detailed assessment report that had been published in the Faversham News ([REP4-051], Appendix B). The Applicant found the following limitations in Dr Erasin's assessment:

- control measures to eliminate or restrict a fire and its consequences were not accounted for;
- the exposure limit used was 1,333 times lower than the limit recommended in Public Health England guidance;

[16] Kent Fire and Rescue Service has responsibility for responding in the locality of the Proposed Development Site

- the estimated total emission was three times more than the realistic worst-case scenario (assuming the fire suppression system failed, and a fire was allowed to propagate); and
- Dr Erasin's modelled release of hydrogen fluoride was 75 times his estimated maximum with no explanation of the inconsistency.

8.7.14. The Applicant [REP4-051] concluded that Dr Erasin's modelling had led to a substantial over-estimation of potential impacts, in the event of the unlikely scenario of a failure of the fire detection and suppression system, and a lack of emergency response within an hour.

8.7.15. By contrast, the Applicant's modelling [REP4-051], based on data provided by Leclanché[17], had shown that the worst-case concentrations of hydrogen fluoride at the nearest residential properties (some 200m due south of the battery energy storage system compound) would be approximately 5% of the relevant Acute Exposure Guideline Level.

8.7.16. This guideline is the level above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, such effects were not disabling and were transient and reversible upon cessation of exposure.

Planning Issues

Relevant Representations

8.7.17. The RRs included a range of comments on safety concerns associated with energy storage, including: dangers to local residents arising from the potential for major incidents; risk of fire; and potentially hazardous waste arising from the disposal of end of life batteries.

8.7.18. By way of example, Faversham Town Council [RR-274] expressed concern about battery storage as an emerging technology and the lack of clarity in the Application.

8.7.19. The Faversham Society [RR-486] recorded strong objections:

- the safety of batteries has not been adequately addressed;
- such a large installation has no track record in the UK;
- lithium-ion batteries can catch fire and explode;
- it is not clear who would be responsible for assessing the safety of the installation; and
- uncertainty about access arrangements for emergency vehicles and the replacement of the batteries as the shortest-life components.

8.7.20. GREAT [RR-770] also drew attention to battery explosion, fire risk and potential terrorism activity.

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[17] Consulted by the Applicant as '*a world leading provider and manufacturer of high-quality energy solutions, principally based on lithium-ion cell technologies.*'

Local Impact Reports

8.7.21. The Local Impact Reports were silent on potential safety implications.

Other representations to the Examination

8.7.22. At OFH2, we heard further representations on behalf of The Faversham Society, who subsequently requested an ISH on batteries and related technology. Supplementary points raised, as augmented by the additional submission for Deadline 3 [REP3-071], included:

- the lack of any National Policy Statements or guidance on energy storage;
- The HSE had established a battery safety and energy storage test facility and a shared research programme – no results had been published;
- Allianz Risk Consulting guidance indicated 'BESS using lithium-ion batteries are susceptible to thermal runaway and have been involved in several serious fires in the last few years.'
- significant and expensive battery fires had occurred in Hawaii, Arizona, Wisconsin and Belgium (where fire detection and suppression equipment had failed to contain the fire) and the causes remained unknown;
- there were currently no formal guidelines for the protection of battery energy storage systems and knowledge gaps on fire behaviour; fire test data for large format batteries; limited incident data; no data on methods of thermal runaway protection; spacing of units and access for emergency services; and no guidance on post fire response and recovery procedure; and
- the Allianz document set out advice in relation to early consultation with the fire service; and guidance on: construction; location; materials; equipment; design; ventilation; temperature control; gas and smoke detection; fire protection and water supply; and maintenance - but neither the Application nor the dDCO contained any reference to these safety issues.

8.7.23. We also heard from Dr Erasin at OFH2, who provided a summary of his submissions by Deadline 3 [REP3-059]. His principal points were:

- technical studies showed that, in the event of fire, lithium-ion batteries release high concentrations of toxic and harmful hydrogen fluoride gas;
- in the absence of any information in the Application, it had been necessary for him to extrapolate emissions, derive a domestic exposure limit for hydrogen fluoride based on work exposure limits, and adopt a generic wind dispersion model;
- the expected hydrogen fluoride concentrations would exceed the derived domestic exposure limits by a factor of 2,444 (at a distance of 4.5km); a factor of 1,333 (at a distance of 7.8km); and a factor of 55 (at a distance of 10km);
- there would be a foreseeable and significant human health risk endangering the population at Seasalter, Graveney, Faversham and Whitstable; and

- a safety zone of at least 15km from any population should be adopted.

8.7.24. Dr Erasin [REP3-059] also pointed to an environmental risk from copper leachates from the batteries in the event of a catastrophic flood.

8.7.25. CPRE Kent [REP3-060] echoed the need for an ISH and concerns about the limited science and experience of battery energy storage systems and the risk of serious incidents occurring.

8.7.26. At OFH3, Dr Erasin [REP5-034] spoke about the likely costs of decommissioning the Proposed Development and estimated that the disposal cost for the batteries would be around £40m. He also repeated his earlier concerns about hydrogen fluoride emissions in the event of a fire and maintained his recommendation of a 15km exclusion zone from any population. He was also concerned that the Applicant might wish to use vanadium redox flow batteries, which he considered to be an unacceptable risk in view of their constituent components.

8.7.27. Following ISH6, GREAT made further representations [REP7-098] expressing concern about the Applicant's failure to ensure early engagement with Kent Fire and Rescue Service which had precluded its registration as an IP and subsequent contribution to the Examination.

8.7.28. From documents obtained by GREAT [REP7-098] through a Freedom of Information Request, we were told that some correspondence between the Applicant and Kent Fire and Rescue Service, and also with the HSE, had not been made available to the Examination.

8.7.29. Moreover, Kent Fire and Rescue Service had told Graveney and Goodnestone Parish Council ([REP7-098], Appendix D) that in the event of a fire a decision might be taken to allow a controlled burn strategy. GREAT's concern was that Kent Fire and Rescue Service had not been provided with sufficient information.

8.7.30. Further, GREAT [REP7-098] highlighted that the battery energy storage system would be some seven times larger than the current largest battery installation in a remote part of Australia, there is a greater risk of battery energy storage fires in coastal and mountain areas, waste batteries have been known to cause serious fires, and fires have occurred across the range of battery usage.

8.7.31. Faversham Town Council's Deadline 7 representation [REP7-073] expressed apprehension about the size of the battery energy storage system, fire risk and toxic gases, and insisted that independent expert advice be sought.

8.7.32. The Faversham Society also made further representations at Deadline 7 [REP7-090]. In addition to those issues raised above, it sought a Security Considerations Assessment if the Application for development consent were to be granted and considered that a final decision on whether the Proposed Development should proceed should not be taken until explicit information had been provided.

8.7.33. We exercised our discretion to accept a further submission from The Faversham Society [AS-061] shortly before the close of the Examination. This introduced the publication by the Arizona Regulator of the Commissioner's determination of the 2012 Flagstaff, Arizona battery energy storage system fire, and a more recent fire and explosion in Surprise, Arizona. The Faversham Society drew out a number of points from the Commissioner's conclusions:

- the manner in which fire can spread from one container to another contradicts the Applicant's assertion that multiple containers are no more of a fire hazard than a single container;
- a serious risk of large-scale explosion was identified as lithium-ion batteries were extremely volatile if they come into contact with water - in view of the scale of the Proposed Development, a fire would result in very severe and potentially catastrophic consequences;
- the Commissioner recommended that any large-scale battery energy storage system should be built in isolation as an explosion could potentially flatten buildings at some distance;
- the Commissioner's findings reinforced the concerns expressed by the local community during the Examination of the Proposed Development, and those of Dr Erasin, in relation to chemistries that included compounds which released hydrogen fluoride in the event of fire or explosion; and
- the Commissioner set down stringent requirements for the protection of fire-fighters, none of which had been acknowledged by the Applicant or by Kent Fire and Rescue Service.

8.7.34. The Faversham Society [AS-061] concluded:

'Given the absence of National Planning Statements on BESS, it is important that the Examination is guided by authoritative sources with experience of BESS projects. We would urge that the attached ACC Determination is the most thorough and up-to-date such source currently available.

This Determination by the Arizona State Commission clearly reinforces the view of the Faversham Society and others, expressed in evidence to the Examination, that the risks associated with Lithium-ion batteries are unacceptable at any scale and especially when close to habitation. It is clear that a proposal for a Battery Energy Storage System close to Faversham, which will be over five times the size of the current largest in the world, poses unparalleled risks and must be regarded as recklessly dangerous and totally unacceptable.'

8.7.35. In response, the Applicant [REP17-007] suggested that The Faversham Society's Additional Submission [AS-061] misrepresented the position in that The Faversham Society had relied on a single document from an ongoing investigation that had received further documents from a variety of parties including Tesla. Tesla's statement pointed out:

'Also, the NFPA 855 Energy Storage Standard, which is a new NFPA standard for the installation of energy storage systems, is in its final stages of development and is expected to be approved by the end of

2019. NFPA 855 is designed to mitigate hazards based upon various battery technologies and it imposes a high bar for safety based on historical precedent and documented technology safety claims.

To avoid future events like those that occurred ..... the Commissioner should ensure that all new energy storage systems meet the requirements of the new NFPA 855 standard and the 2021 IFC code. These new codes and standards stipulate the use of ventilated detection, suppression, and other safety features ..... which would have prevented [the Arizona] storage systems from being deployed as designed'.

8.7.36. The Applicant [REP17-007] confirmed that the NFPA 855 standard was included in the outline Battery Safety Management Plan [REP6-021]. This would provide a robust and deliverable mechanism for ensuring that the safety of the facility was designed into the proposals from the outset in consultation with the HSE and Kent Fire and Rescue Service and secured in Requirements 3 and 20 of the dDCO. It should also be noted that, in the latest Arizona fire, the battery modules themselves had not exploded.

8.7.37. The Applicant [REP17-007] affirmed that its air quality assessment was reliable. It also confirmed that suppression measures would be tailored to the specific selected technology and to the requirements of Kent Fire and Rescue Service.

8.7.38. Overall, the Applicant [REP17-007] disagreed that the material supplied by The Faversham Society [AS-061] was the most thorough and up-to-date source currently available. Further, it urged that it was of little relevance to the Proposed Development and greater weight should be given to the expertise and experience of Leclanché in battery energy storage systems. Moreover, the outline Battery Safety Management Plan [REP4-045] indicated that more detailed UK guidance was emerging and it was expected that the regulatory requirements would be more developed by the detailed design stage and the submissions of details to discharge Requirement 3 of the dDCO.

8.7.39. Finally, the response of the US Energy Storage Association to the Arizona Commissioner [REP17-007] summarised the wider context of the information submitted by The Faversham Society:

'According to Wood Mackenzie Power and Renewables, at the end of 2018, 1 gigawatt of battery-based energy storage projects were operational in the United States across more than 20 states. Nearly 95% of these systems use lithium-ion battery technology ..... Grid battery energy storage systems are professionally designed and installed and are built to stringent safety standards with state-of-the art monitoring systems .....'.

ExA Response

Battery energy storage system safety

8.7.40. In light of the representations made, we decided to include the topic of battery safety in ISH6 on Environmental Matters [EV-023] and [REP5-011]. We heard from IPs, including those who had raised concerns

previously, the Applicant, and also from Leclanché. The Applicant explained that Leclanché's representatives appeared by invitation of the Applicant in an independent capacity, insofar as the company was not commercially or contractually linked to the Proposed Development, to answer questions concerning energy storage. Whilst we recognise Leclanché's field of expertise and the open manner in which our questions were answered, we do not regard their presence to be truly independent insofar as the company is a provider of energy storage systems.

8.7.41. It was clear to us that, from the starting point of the Applicant's limited information about battery energy storage [APP-047], the Examination process had already elicited a substantial amount of additional information. However, there was nothing to suggest that this had satisfied the legitimate concerns expressed by IPs.

8.7.42. We heard [REP5-011] that Leclanché had experience of installing battery energy storage systems in Central Europe and North America but not on a comparable scale to the Proposed Development. However, Leclanché stated, in general terms and without specific reference to the Proposed Development, that installations take the form of containerised modules with the same safety practices and mechanisms applied irrespective of scale. We were also assured that the safety distances between containers was calculated at design stage so as to prevent propagation in the event of a fire breaking out.

8.7.43. Leclanché informed us that it was aware of the reported fires affecting battery energy storage systems and also the content and recommendations of the Allianz report [REP4-032]. We were also advised that all of the fires had occurred in the construction phase of the battery energy storage system. As a consequence, lessons had been learned, designs had been improved, and it was anticipated that most governments would adopt the latest International Standards and those prescribed by Underwriters Laboratories.

8.7.44. In view of the apparent heightened risk of fire during the construction phase, we asked for clarification about how the fire prevention and protection measures would be incorporated and commissioned. We are reassured [REP5-011] that each unit would have a pre-installed system and it would be fully operational before the energisation of the batteries. Moreover, each module would be equipped with shock sensors, so that any damage during transit could be identified, and each battery would be tested for voltage and insulation integrity.

8.7.45. We also explored the ongoing protection of the battery energy storage facility and were advised [REP5-011] that the containers would have an enhanced external coating to reflect the site's coastal location. In addition, regular inspection would be undertaken to ensure that the units, and the equipment therein, remained safe over the operational life of the Proposed Development. Inspections could also be undertaken at the discretion of the Fire and Rescue Service and the HSE.

8.7.46. In response to our question about how possible battery leakage might be detected, we were told [REP5-011] that the energy management system would be able to sense leaks and instigate an automatic shutdown before consequential damage. We are content that any leakage occurring before detection would be small in scale, and confined within the affected container, and it would not pollute the outside ground.

8.7.47. The outline Battery Fire Safety Management Plan [REP4-045] sets out the minimum information to be included at detailed design stage and, in turn, in the application to discharge Requirement 3 of the Recommended DCO. It provides for the following:

- a statement of compliance with applicable legislation;
- a detailed design drawing to show separation between modules and safe access for fire appliances;
- a statement of design responses to fire risk explaining how the risk of fire spreading has been addressed in the design of the installation;
- battery specification to include chemistry, size and format;
- fire detection and suppression systems specifications;
- standard operating procedures and guidelines providing for maintenance during operation and the replacement of battery modules;
- installation and operation protocols to manage a fire during construction or during operation or decommissioning; and
- any other information required by Kent Fire and Rescue Service.

8.7.48. In turn, Requirement 3 of the Recommended DCO requires the approval of a Battery Safety Management Plan (BSMP) which must, amongst other things, *'prescribe measures to facilitate safety during the construction, operation and decommissioning of Work No.2(a) including the transportation of new, used and replacement battery cells both to and from the authorised development'* and *'the relevant planning authority must consult with the Health and Safety Executive and Kent Fire and Rescue Service before determining an application for the approval of the BSMP'.*

8.7.49. Whilst some of the generic measures outlined during the examination of this issue are not expressly provided for in the above, we are satisfied that the outline Battery Fire Safety Management Plan, in expressing the minimum information required, does not preclude more detail being sought by the local planning authority or by Kent Fire and Rescue Service, should it be found to be necessary, when an application is submitted in accordance with Requirement 3 of the Recommended DCO.

8.7.50. In terms of the concerns about air quality and the risk of gaseous escape in the event of fire, we recognise that Dr Erasin [REP3-059] and [REP5-034] was at a comparative disadvantage in that his calculations are substantially based on extrapolation. As a consequence, we find material shortcomings in his assessment. Although we gave Dr Erasin the opportunity to respond to the Applicant's critique [REP4-051] of his methodology and conclusions, no further representations were made.

8.7.51. We believe that the Applicant's assessment [REP4-051] has the advantage of primary data, the use of industry standard software to model dispersion, and comparison with relevant thresholds. We are also satisfied that the Applicant's modelling is highly conservative, and it provides clear demonstration that there would be no material threat to health at the nearest residential properties, or in the wider locality, in the event of an outbreak of fire.

8.7.52. We have had careful regard to GREAT's Deadline 7 representations [REP7-098]. We are satisfied that engagement with Kent and Fire Rescue Service, albeit delayed, has provided vital understanding which the Applicant has used to inform the outline Battery Safety Management Plan.

8.7.53. Although Kent Fire and Rescue Service was too late to register as an IP, in the absence of a RR, it was advised [OD-004] that we had discretionary powers to allow a non-IP to submit a WR and also attend Hearings and speak. We are satisfied that Kent Fire and Rescue Service was not precluded from direct participation in the Examination.

8.7.54. Similarly, while we note the claim [REP7-098] that the Applicant has not provided us with all of the correspondence in its dealings with the HSE and Kent Fire and Rescue Service, we believe that we have a sufficient understanding of their individual positions at the close of the Examination.

8.7.55. In relation to GREAT's [REP7-098] concern about any fire being allowed to burn itself out, reference to the source letter from Kent Fire and Rescue Service ([REP7-098], Appendix D) confirms:

'In broad terms and prior to a decision relating to any on-site fire suppression systems, KFRS would extinguish a fire on the site by applying large volumes of water. Alternatively, if no life risk were present, then a controlled burn strategy may be considered and employed in order to try to minimise the possible environmental pollution that may be caused with fire water run-off.'

8.7.56. Further, irrespective of GREAT's [REP7-098] concern about the inadequacy of information available to Kent Fire and Rescue Service, the same letter states:

'..... KFRS has procedures in place for a response to incidents involving batteries ..... whilst these procedures cover incidents involving any type of electrical storage battery they need to be considered alongside site specific risk information ..... as such and in line with other industrial sites in Kent and Medway, KFRS would work with the site operators to ensure site specific information is available if an emergency occurs ..... rest assured that our firecrews would deal with any such incident with the same level of skill and dedication that they bring to any incident regardless of size, risk or complexity.'

8.7.57. Overall, if development consent is granted, further details of the proposed installation would need to be submitted to Swale Borough

Council and relevant consultees. We are thus satisfied that this process would secure all of the necessary information required by Kent Fire and Rescue Service, including access arrangements for fire appliances and access to water supplies, to ensure an appropriate response in the event of an incident occurring. Moreover, there is nothing to suggest that the service would be ill-equipped to deal with any incident as alleged by Faversham Town Council [REP7-073].

8.7.58. We understand the Applicant's [REP5-011] desire for flexibility in its eventual choice of battery storage energy system, particularly as battery energy technology is the subject of ongoing development and improvement. Whilst noting Dr Erasin's [REP5-034] concern about vanadium redox flow systems, we consider that it would be inappropriate for the Recommended DCO to restrict the eventual choice of technology.

8.7.59. In this regard, all of the processes, regulations and safety legislation, referred to above will have equal applicability irrespective of the composition of the battery storage energy system, and the onus would be on the Applicant to satisfy the appropriate authorities in seeking to discharge Requirement 3 in the Recommended DCO. In this regard both Kent Fire and Rescue Service and the Health and Safety Executive are named as parties which the local planning authority must consult before determining an application for the approval of the Battery Storage Management Plan.

Security

8.7.60. We have considered local concerns about the proposed security arrangements for the site which The Faversham Society [REP7-090] describe as derisory in relation to the risk of terrorism. The Applicant has confirmed [REP17-007] that it would not be in its interest for the site to be at risk of a terrorism or other security event that threatens its operation. We are satisfied that the measures proposed in the ES ([APP-047] Chapter 17, section 17.3.6) would act as a reasonable deterrent and it would be a matter for the Applicant or site operator to keep their effectiveness under review.

8.7.61. While we acknowledge that the fear of criminal activity is capable of being a material consideration, no party has provided tangible evidence to show that additional measures, over and above those proposed, are necessary.

8.7.62. On the matter of insurance, the Applicant informed ISH6 [REP5-011] that it was in negotiations with insurers, the level of public liability was to be determined, and construction would not commence without having insurance in place. We regard these to be commercial considerations and not material to the determination of the Application.

Finally, we note the guidance in NPS EN-1 on security considerations. This sets out the role of DECC (now BEIS) and the pre-application notification procedure for energy NSIPs which enables any national security implications to be identified and addressed. There is nothing

before us to indicate that the Proposed Development is considered to be potentially 'critical' infrastructure raising national security concerns.

Conclusions on safety and security

8.7.63. In essence, the sustained and robust representations concerning the safety of the battery energy storage system flow primarily from the scale of the Proposed Development, the uncertainties of an emerging technology, incidents leading to major fires, and the proximity of the local population. We well understand these concerns.

8.7.64. However, there is raft of legislation and guidance in place and regulatory bodies have a role to play in the design, regulation, approval and ongoing supervision of the battery energy storage system. The Battery Safety Management Plan secured by Requirement 3 of the Recommended DCO would be a component contributor.

8.7.65. Overall, we are confident that risk will be managed and mitigated through the safeguards and checks during final design, installation and thereafter in operation. It would be open to any of those approving bodies to seek independent expert advice at that stage, should they consider it necessary.

8.7.66. In terms of site security, whilst the measures proposed might be viewed as minimal, we have not been provided with any evidence to lead us to conclude that more stringent security measures are necessary and in any event site security is primarily a matter for the Applicant and operator to determine in consultation with other relevant agencies.

8.7.67. Having thoroughly examined public concerns about the safety and security of the battery energy storage system, we are satisfied that, by the close of the Examination, the Applicant has provided a sound and enforceable basis of managing and mitigating safety risk and there is no compelling evidence to the contrary.

8.7.68. Overall, we are content that the information and analysis provided to us satisfies the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 in respect of major accidents and disasters.

8.7.69. We find nothing of weight to carry into the overall planning balance.

8.8. EXA'S RESPONSE AND CONCLUSIONS ON OTHER IMPORTANT AND RELEVANT CONSIDERATIONS

8.8.1. Taking all other relevant submissions, documents and policies drawn to our attention into account, we are satisfied that no other matters have arisen which affect the identification in the preceding chapters and sections of this report of the planning matters that require to be balanced by the SoS or taken into account in the DCO decision.

9. FINDINGS AND CONCLUSIONS IN RELATION TO HABITATS REGULATIONS ASSESSMENT

9.1. INTRODUCTION

9.1.1. This chapter sets out our analysis, findings and conclusions in relation to the Habitats Regulations Assessment (HRA). This will assist the Secretary of State for Business, Energy and Industrial Strategy (the SoS) to perform the duties of a competent authority under the Habitats Regulations[18].

9.1.2. Regulation 63 of the Habitats Regulations states that if a proposal is likely to have a significant effect on a European site[19] (either alone or in-combination with other plans or projects), then the competent authority must undertake an appropriate assessment of the implications for that site in view of its conservation objectives.

9.1.3. Consent for the Proposed Development may only be granted if, having assessed the effects of the Proposed Development on European sites, the competent authority's appropriate assessment concludes that the integrity of European sites would not be adversely affected, subject to Regulation 64, a consideration of overriding public interest.

9.1.4. Throughout the Examination process, we were mindful of the need to ensure that the SoS has the information that may reasonably be required to carry out the necessary duties as competent authority. We sought evidence from the Applicant and the relevant Interested Parties (IPs), including Natural England as the statutory nature conservation body, through our Written Questions (ExQ1) [PD-004], Further Written Questions (ExQ2) [PD-008], a Rule 17 request for further information [PD-009] and at Issue Specific Hearings (ISH) [EV-011 and EV-023].

9.1.5. We produced a Report on the Implications for European Sites (RIES) during the Examination, with support from the Planning Inspectorate's Environmental Services Team [PD-010]. The purpose of the RIES was to compile, document and signpost information provided in the DCO application and submitted by the Applicant and IPs during the Examination (up to and including Deadline 6). The RIES was issued to ensure that we had correctly understood HRA-related, factual information

[18] The Conservation of Habitats and Species Regulations 2017 (the Habitats Regulations).

[19] The term European sites in this context includes Sites of Community Importance (SCIs), Special Areas of Conservation (SACs) and candidate SACs (cSACs), Special Protection Areas (SPAs), possible SACs (pSACs), potential SPAs (pSPAs), Ramsar sites, proposed Ramsar sites, and any sites identified as compensatory measures for adverse effects on any of the above.

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Your ref: EN010085

28 May 2020

Dear Mr Brennan

PLANNING ACT 2008

APPLICATION FOR THE CLEVE HILL SOLAR PARK ORDER

1. Introduction

1.1 I am directed by the Secretary of State for Business, Energy and Industrial Strategy ("the Secretary of State") to advise you that consideration has been given to the report dated 28 February 2020 of the Examining Authority ("the ExA") – a panel comprising David Rose (Lead Member), Andrew Mahon and Helen Cassini – which conducted an examination into the application ("the Application") submitted on 15 November 2018 by Cleve Hill Solar Park Limited ("the Applicant") for a Development Consent Order ("the Order") under section 37 of the Planning Act 2008 ("the 2008 Act") for the Cleve Hill Solar Park and associated development ("the Development").

1.2 The Application was accepted for examination on 14 December 2018. The examination began on 30 May 2019 and was completed on 30 November 2019. A number of changes were made to the Application during the examination. The details of these changes were made available to interested parties and were examined by the ExA.

1.3 The Order, as applied for, would grant development consent for the construction, operation, maintenance and decommissioning of an electricity generating station comprising a solar farm with the option of an additional energy storage facility with a total capacity of around 350 megawatts ("MW"). The Development would be located in Kent approximately 2km from Faversham and 5km from Whitstable within the jurisdiction of Swale Borough Council. The Development would include:

with this arrangement. The Secretary of State considers that the ExA's conclusions are robust and that this is a matter which does not weigh against the grant of consent for the Development.

Safety and Security

4.148 EN-1 does not make specific reference to battery storage nor are there any relevant Development Plan policies. However, paragraph 3.3.31, EN-1 states... "The Government expects that demand side response, storage and interconnection, will play important roles in a low carbon electricity system.....".

4.149 The Applicant's Environmental Statement concluded that it was unlikely the proposed Development would cause a significant accident, but it acknowledged there were risks, principally in relation to possible fires in the battery storage facility. However, the Environmental Statement set out mitigation measures in the facility that would detect and suppress fires. [ER 8.7.6]

4.150 In relation to security of the proposed Development, the Applicant stated it would be protected by perimeter fencing, CCTV, lighting with sensors and restrictions on who would be able to access the site. [ER 8.7.8]

4.151 The Applicant's Environmental Statement sets out various measures that could be taken to minimise risks of an accident occurring. The Applicant also provided an outline Battery Safety Management Plan which has been reviewed by the Health and Safety Executive and Kent Fire and Rescue Service. The Applicant's Air Quality Impact Assessment considered possible outcomes in the event of a battery fire. The Assessment was criticised by one of the Interested Parties, Dr Erasin, who was concerned about the potential release of poisonous gases in the event of a fire in the battery storage facility. The Applicant responded to say that Dr Erasin's concerns were overstated. [ER 8.7.10 et seq]

4.152 The Secretary of State notes that there were a number of concerns from Interested Parties about the safety of the battery storage facility. These concerns were exacerbated by the new technology that the battery storage facility represented. [ER 8.717 et seq]

4.153 The Faversham Society expressed strong concerns about the safety of the batteries that would be utilised in the proposed Development's energy storage facility, stating that: there had been no proper testing of this matter; there was no track record of such large installations in the UK; lithium-ion batteries can catch fire and explode; it was not clear who would be responsible for assessing the safety of the installation; and there was uncertainty about access arrangements for emergency personnel. [ER 8.7.19]

4.154 The Graveney Rural Environment Action Team also raised concerns about the safety of the energy storage facility in respect of the possibility of explosion, fire and the threat of terrorism. [ER 8.7.21]

4.155 The ExA notes that the Local Impact Reports from Swale Borough Council, Canterbury City Council and Kent County Council were all silent on the subject of the safety of battery storage facilities. [ER 8.7.21]

4.156 Later in the Examination, the Faversham Society, raised a number of additional issues in respect of battery storage technologies including that there had been a number of significant battery fires where suppression systems had failed and the cause of the fires was

unknown. In addition, the Society expressed concerns that neither the Application nor the Applicant's draft Order addressed battery storage safety concerns and that there was no established guidance for dealing with battery fires. [ER 8.7.22]

4.157 One of the Interested Parties, Dr Erasin set out concerns about the effects of a fire in lithium-ion batteries with the possible release of toxic fumes – specifically, hydrogen fluoride gas – with potential serious risks for the populations in the vicinity of the proposed Development with Seasalter, Graveney, Faversham and Whitstable being named specifically. Dr Erasin suggested that there should be a 15km safety zone from any population around the battery storage site. [ER 8.7.23] Dr Erasin also raised the possible environmental risk of copper leaching from the solar panels. [ER 8.7.24]

4.158 Dr Erasin made further submissions to the Examination to suggest that it would cost around £40 million to dispose of the batteries as part of any decommissioning of the proposed Development and to express concern about the possible use of Vanadium Redox flow batteries which he considered posed an unacceptable risk given their constituent parts. [ER 8.7.26]

4.159 The Graveney Rural Environment Action Team made representations about the lack of early engagement from the Applicant with the Kent Fire and Rescue Service which had led to the Service not being registered as an Interested Party to the Examination of the Application. The Graveney Rural Environment Action Team also raised the point that some correspondence between the Applicant, Kent Fire and Rescue Service and the Health and Safety Executive had not been disclosed to the Examination. The Graveney Rural Environment Action Team also highlighted that the proposed battery storage facility at the proposed Development would be seven times larger than the current largest similar facility in the world. It also highlighted that battery energy storage fires were more likely to occur in coastal and mountain areas and that they had occurred across a range of battery usage.

4.160 Faversham Town Council raised concerns about the scale of the battery storage element and about fire and toxic risk. [ER 8.7.31]

4.161 The Faversham Society provided another submission towards the close of the Examination which was accepted at the discretion of the ExA setting out the conclusions in a report into two fires at battery storage facilities in Arizona which reinforced the Society's views of the dangers of the proposed storage facility that formed part of the proposed Development. [ER 8.7.32 et seq]

4.162 The Applicant responded setting out its reasons why the Faversham Society's arguments were wrong and that suitable mitigation measures were built-in to the proposals for the battery storage facility at the proposed Development. [ER 8.7.35 et seq]

4.163 In its response, the ExA stated that it had held a special session on battery storage issues in one of the Issue Specific Hearings during the Examination to reflect the level of interest in and concern about the topic. The session heard from Interested Parties who had concerns about the battery storage facility as well as from a company, Leclanche, which appeared at the invitation of the Applicant in an independent capacity. (The ExA considered that Leclanche, while accepting it had no commercial or contractual ties to the proposed Development, could not be counted as truly independent as it provides energy storage systems.) [ER 8.7.40]

4.164 The ExA considered that the Examination hearings provided a lot of additional information about the battery storage facility, though it acknowledged that that might not be sufficient to satisfy the concerns of Interested Parties. [ER 8.7.41]

4.165 Leclanche had installed battery storage systems world-wide but not on the scale as the one that would form part of the proposed Development. However, the company explained that the principles for incorporating safety features into these designs were well-established and applied irrespective of scale. Leclanche said lessons had been learned from battery fires, including those in Arizona, and noted that all of the fires had started at the construction stage of the development cycle. [ER 8.7.43]

4.166 In light of the information about fires during construction, the ExA probed about the safety features that would be installed to prevent such incidents and was reassured about the measures that would be incorporated into the battery storage facility at the proposed Development. The ExA also noted the protective measures that would be in place during the operation of the proposed Development and that inspections could be undertaken by the Health and Safety Executive and Kent Fire and Rescue Service.
[ER 8.7.44 et seq]

4.167 The ExA asked about battery leakage and was told that the management systems would be able to detect leaks and initiate automatic shut down. The ExA was content that any leakage would be small and confined within the affected container. [ER 8.7.46]

4.168 The ExA noted that the outline Battery Fire Safety Management Plan set out the minimum information that would need to be included at the detailed design stage for the proposal. The ExA also notes that Requirement 3 of the Order it recommended to the Secretary of State requires the approval of a Battery Safety Management Plan which would set out minimum requirements for safety matters. The ExA was happy that in setting out minimum requirements for information, the relevant local planning authority or Kent Fire and Rescue Service would be able to ask for more information to allow them to fulfil their duties. [ER 8.7.47 et seq]

4.169 In terms of the risk of the escape of gases from the battery storage facility, the ExA concludes on the basis of the information provided by the Applicant that there would be no material threat to health arising from a battery fire at the proposed Development. [ER 8.7.50 et seq]

4.170 The ExA was satisfied that the Applicant's engagement with the Kent Fire and Rescue Service, while late in the application process, has provided "vital understanding which the Applicant has used to inform the outline Battery Safety Management Plan". The ExA allowed the Kent Fire and Rescue Service to take part in hearings during the Examination as a non-Interested Party. In respect of the claim made by the Graveney Rural Environment Action Team that not all of the Applicant's correspondence with Kent Fire and Rescue Service and the Health and Safety Executive had been provided to the Examination, the ExA stated it had an understanding of their respective positions. The ExA noted the concern by the Graveney Rural Environment Action Team that any battery fire might just be allowed to burn itself out but was satisfied with Kent Fire and Rescue Services' position that it would determine how to respond to any situation on the ground by way of a number of possible options. The ExA also considered the concern from the Graveney Rural Environment Action Team about the adequacy of the information available to the Kent Fire and Rescue Service and noted that the Service had written

to indicate it would deal with situations based on experiences elsewhere and by working with the site operator. [8.7.52 et seq]

4.171 In addition, in the event that the Order was made, then the local planning authority and relevant consultees would need to be given details of the proposed installation. The ExA was satisfied, therefore, that this process would make available all the information that the Kent Fire and Rescue would need to be able to fight a fire in the battery storage facility. [ER 8.7.57]

4.172 The ExA notes concerns about the battery storage technology that might be employed at the proposed Development but decided that it would not be appropriate to limit the choice of systems that the Applicant might want to deploy and so had not included any provision to limit flexibility in the Order that it recommended to the Secretary of State. The ExA considered that the relevant processes, legislation and safety requirements would apply to all battery technologies. Similarly, the Applicant would need to satisfy a range of consultees before a Battery Safety Management Plan could be agreed. [ER 8.7.58 et seq]

4.173 As far as security of the site of the proposed Development is concerned, the ExA considered the concerns raised by Interested Parties but was satisfied that measures proposed to protect the site were reasonable. Notwithstanding that point, the ExA acknowledged that fear of criminal activity is capable of being a material consideration in the determination of the Application. However, it went on to conclude that no party had provided any evidence that measures additional to those proposed by the Applicant were necessary. [ER 8.7.60 et seq]

4.174 The ExA noted guidance in National Policy statement EN-1 about security considerations but concluded that there was no indication that the proposed Development would be considered to be critical infrastructure with security implications. [ER 8.7.62]

4.175 The ExA's overall conclusions on safety and security were that there were a large number of representations about this issue which flowed from the scale of the proposed battery storage facility, the fact that it was a new technology, the risk of major fires and the proximity of the battery storage facility to local populations. The ExA acknowledged those concerns. However, it took comfort from the legislation and guidance and the Battery Safety Management Plan which would be subject to consultation with relevant bodies and the ExA was, therefore, confident that the risks could be managed or mitigated appropriately. As far as site safety was concerned, the ExA noted that the measures proposed by the Applicant might be viewed as minimal but there was no evidence before it that anything else was needed – there was a sound basis for managing and mitigating site safety risks. The ExA's overall conclusion on this matter, therefore, was that there was nothing of weight to carry into the overall planning balance.

Secretary of State's Conclusion

4.176 The Secretary of State notes that the safety and security of the Development generated many concerns from Interested Parties to the Examination who were worried about the potential health risks of a fire or explosion within the battery storage facility that formed part of the proposed Development. In addition, the Secretary of State notes that the ExA's analysis of this matter was informed by a range of views and considerations, including from the Kent Fire and Rescue Service. He considers, therefore, that its consideration is robust and wide-ranging. While noting the strength of feeling among local people about this matter (since the receipt of the ExA's Report, a considerable number of representations have been received about the impacts of the Development, with many citing the safety of the battery storage unit as a key

issue), the Secretary of State does not see any reason to disagree with the conclusions reached by the ExA.

Other Matters

Appointment of the Examining Authority

4.177 There were a number of complaints about the appointment of David Rose as Lead Member of the Examining Panel. The complaints arose because Mr Rose had been the Examining Inspector in an application for consent for the London Array Electricity Substation which sits on a site within the boundary of the proposed Development. Mr Rose recommended that consent should be granted for the substation and the Secretaries of State for Trade and Industry and Communities and Local Government agreed with the recommendation.

Secretary of State's Conclusions

4.178 The matter raised by the complainants is not one for the Secretary of State – the appointment of examiners to conduct Examinations into applications for development consent under the Planning Act 2008 is a matter for the Planning Inspectorate to determine.

Parameters of the Cleve Hill Solar Park

4.179 The ExA drew the Secretary of State's attention to its view that, while the proposed Development was well defined by reference to the descriptions in the Environmental Statement and in other documentation submitted with the Application, there was a possibility that the 'as built' project could expand beyond those definitions. The ExA, therefore, recommended that additional wording – which it provided – should be added to the Order to prevent any potential for project expansion beyond what had been assessed in the Examination. The ExA did not ask for comments on its proposed wording before the close of the Examination but suggested that the Secretary of state should do so.

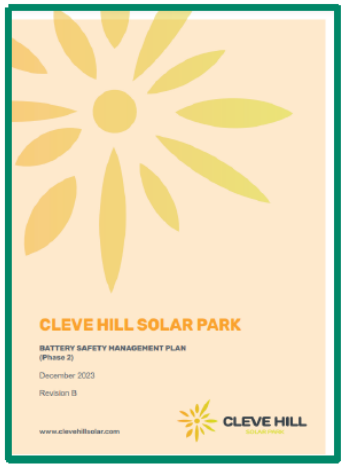
Secretary of State's Conclusion

4.180 The Secretary of State considered the ExA's comments on this matter and decided that the views of the Applicant (and others) should be sought on the proposed wording. A consultation letter was issued on 6 April 2020 covering this and other matters with a form of words for inclusion in any Order that the Secretary of State might issue. The Applicant replied indicating it was content with the inclusion of the proposed wording. Other respondents indicated that they felt the parameters of the proposed Development were too widely drawn. However, they made no comment on the specific wording proposed. Having considered the consultation responses, the Secretary of State considers it is necessary and adequate to prevent any potential for project expansion beyond what has been assessed in the examination and has, therefore, incorporated the proposed wording into the Order that he has decided to make.

The Ability of Swale Borough Council to Monitor and Enforce conditions in any Order that Might be Granted

4.181 A number of Interested Parties during the Examination and several parties in the wake of the Secretary of State's receipt of the ExA's Report (including in responses to the

Approval of revised Battery Safety Management Plan and Air Quality report Executive Summary



BST&T has conducted a thorough review of the Cleve Hill Solar Park (CHSP) Battery Safety Management plan (BSMP) including the Air Quality Battery Failure Plume Assessment and has agreed content revisions with Cleve Hill Solar Park Ltd (CHSPL), Envams, Hoare Lea and Kent Fire & Rescue Service (KFRS).

The review was undertaken on the understanding that:

(1) Work No. 2(a) must not commence until a Battery Safety Management Plan ("BSMP") has been submitted to and approved by the relevant planning authority.

(2) The BSMP must prescribe measures to facilitate safety during the construction, operation and decommissioning of Work No.2(a) including the transportation of new, used and replacement battery cells both to and from the authorised development.

(3) The BSMP must accord with the outline battery safety management plan.

(4) The relevant planning authority must consult with the Health and Safety Executive and Kent Fire and Rescue Service before determining an application for approval of the BSMP.

(5) The BSMP must be implemented as approved.

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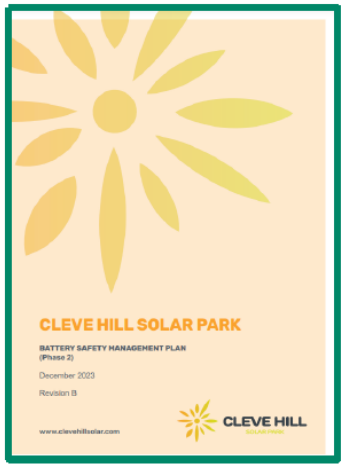
BST&T Conclusions:

1. **The BSMP accords with the outline BSMP and incorporates the latest safety standards and best practice guidelines.**
2. **The BSMP prescribes measures to facilitate safety during the construction, operation and decommissioning of Work No.2(a) including the transportation of new, used and replacement battery cells both to and from the authorised development.**
3. **The developer has provided all requested information to Kent Fire & Rescue Service (KFRS)**
4. **Kent Fire & Rescue Service (KFRS) has been fully consulted by the developer and will send a note of approval of the BSMP to Swale Borough Council**
5. **The BESS manufacturer CATL has certified and tested the EnerC+ system to all requisite current safety and test standards. The final UL 9540 certification of the BESS enclosure is expected to be obtained in Q1 2024. For the avoidance of doubt, this upcoming certification is part of a normal ongoing compliance process and is not a legitimate reason to delay approval of the BSMP.**
6. **The EnerC+ BESS system and fire and explosion protection systems conform to NFPA 855 (2023) standards and incorporate additional levels of monitoring and controls which are considered to be best practice.**
7. **The site design and BESS system conform to UK National Fire Chiefs Council guidelines (2023), any deviations from these guidelines are agreed with KFRS**
8. **The developer will undertake additional site-specific risk analysis reviews once the contractor is appointed, these include site specific consequence modelling for first responders, HAZOP / Hazid operations peer review, Fire Protection System sign off, etc. This post-consent, pre-construction work is normal, and in line with current industry expectations and best practice.**



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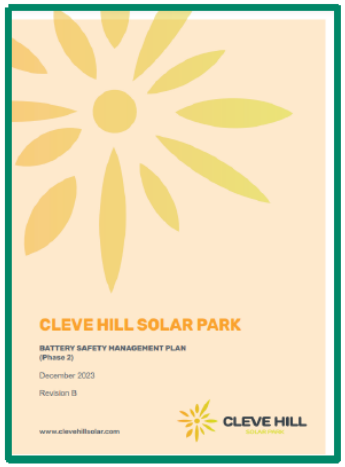
To assist in the safety review the following additional test and safety documentation which cannot be shared in the public domain was provided by CHSPL to BST&T under a Non-Disclosure Agreement:

1. CATL EnerC+ BESS Hazard Mitigation Analysis (HMA) report by Jensen Hughes (USA) which was conducted to NFPA 855 (2023) standards.
2. CATL EnerC+ Fire Protection Assessment for NFPA 69 Compliance (explosion prevention standard) report by TLB Fire Protection Engineering, Inc. (USA) which was conducted to NFPA 855 (2023) standards utilising Computational Fluid Dynamics (CFD) modelling.
3. CATL EnerC+ UL 9540A (2019), 4th Edition: Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems. The EnerC+ system was compliant with all test requirements at Unit Level testing, cell and module level data was used to compile the NFPA 69 Compliance report.
4. CATL Interface of BESS Specification document (in depth analysis of system components).
5. Hazid / Hazop developer risk analysis for BESS fire or explosion scenarios.

Key standards that are met by the CATL EnerC+ BESS system selected for CHSP which are in line with expectations for BESS systems supplied by Tier one manufacturers include:

1. UL 9540 certification (full enclosure certification to be obtained in Q1 2024)
2. UL 1973 certification
3. BS EN IEC 62619 certification
4. NFPA 855 conformance
5. NFPA 69 conformance (explosion prevention)
6. UN 38.3 certification



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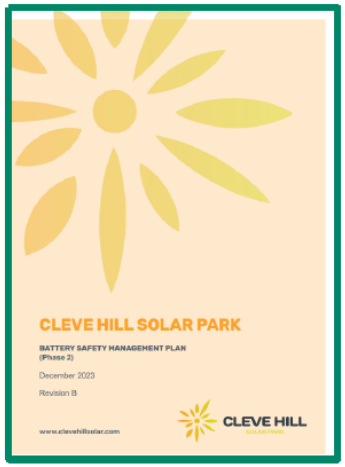
The following amendments have been suggested to CHSPL and incorporated in Revision B of the BSMP:

1. Expansion of decommissioning content
2. Clarification to Fire Suppression content and check that system conforms to HMA recommendations
3. Inclusion of commitments to Cybersecurity standards and best practice
4. Additions to Emergency Response Planning detail
5. Exclusion zone radius increased to comply with the latest NFPA 855 (2023) recommendations
6. Clarification to include data analytics into Energy Management System (EMS) / Battery Management System (BMS) systems and controls
7. Confirmation that Factory Acceptance Testing (FAT) and Site Acceptance Testing (SAT) for BESS equipment will be to BS EN IEC 62933-5-2 standards or equivalent
8. Confirmation that UN 38.3 certification is required for replacement battery systems or components
9. Commitment to integrate multi-sensors to provide alerts for any potential battery abuse that takes place during BESS system transportation
10. Revised Air Quality Battery Failure Plume Assessment Report to ensure conservative modelling inputs

Summary of key safety measures and hazard mitigation incorporated in the CHSPL BESS and considered best practice:

1. Discharge of the aerosol fire suppression system shall be limited to only true “electrical” fault fires shall not trigger in the event of a Thermal runaway, this shall be managed by the fire alarms control logic and be validated by additional analytics provided by the BMS and EMS, this final system design shall be validated by an appointed British Approvals for Fire Equipment (BAFE) accredited specialist to ensure its compliance to the standards named. The Fire suppression system includes a manual and emergency deactivation button located externally to the BESS enclosure to allow manual deactivation in an emergency and deactivation by engineers when entering or opening the container to perform inspections and/or maintenance activities.
2. Data analytics and comprehensive programmable logic controllers (PLC) integration of key monitoring and detection functions into EMS / BMS, this provides significant early warning safety alerts and system shut down capabilities and allows for greater protection against false discharge of fire suppression systems



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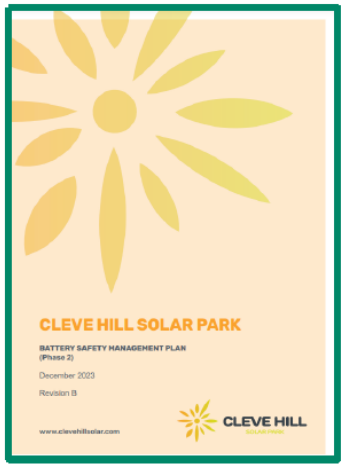
Summary of key safety measures and hazard mitigation incorporated in the CHSPL BESS and considered best practice *(continued)*:

3. BESS fire protection products conform to both NFPA and BS EN standards
4. Carbon Monoxide detectors are integrated to provide additional safety alerts for first responders
5. Adoption of 6 metre spacing which exceeds NFPA 855 (2023) recommendation between BESS enclosures because full scale free burn testing had not been conducted to establish heat flux levels (not stipulated in any standard)
6. Compliance with all requests made by Kent Fire & Rescue Service (KFRS) and KFRS approval of revised BSMP
7. The revised Air Quality Battery Failure Plume Assessment Report analysed free burn test data from similar LFP BESS systems and concluded that levels of Hydrogen Fluoride (HF) used in the modelling were conservative i.e. at greater emission levels than recorded in other plume studies.
8. The revised Air Quality Battery Failure Plume Assessment Report considers production of Nitrogen Oxides, Hydrogen Chloride and Hydrogen Cyanide and concludes that levels are likely to be significantly lower than HF so are not included in the Plume Assessment. This conclusion tallies with previous LFP BESS system Plume Analysis reports previously reviewed where emissions of all three gases has totalled <25% of HF volume. There should be a high level of confidence that emission data listed for local respondents and the report Conclusions are both conservative and credible.
9. The NFPA 69 Compliance Report compliments the Air Quality Report to confirm that in gas venting thermal runaway scenarios defined by NFPA 855 (2023) the gas exhaust system will maintain explosive gases below 25% of the lower flammable limit minimising explosive risks. This minimises risks for first responders and reduces peak levels of any toxic gas emissions.



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2.3.1.1 Listing Codes and Standards

The following codes and standards were considered in this hazard mitigation analysis. Specifically, failure modes identified in NFPA 855 were considered in the analysis. Fire protection requirements for Energy Storage Systems documented in NFPA 855 were used to inform the evaluation of the battery system. Table 2-2 provides an overview of the codes used for this evaluation and their relationship to other codes and requirements.

Table 2-2: Best Practice Codes and Standards

Code or Standard	*Commentary / Compliance*
2021 IFC – International Fire Code, Electrical Energy Storage Systems Chapter 1207	Chapter 12 – Energy Systems is applicable to the SBB system.
NFPA 855, "Standard for the Installation of Stationary Energy Storage Systems," (2023 Edition)	NFPA 855 matches the *applicable* failure modes required by the IFC.

Table 2-3: Definition and Purpose of UL 9540A Test Levels

Type	*Definition*	*Test Purpose*
Cell	The basic functional electrochemical unit containing an assembly of electrodes, electrolytes, separators, containers, and terminals.	Establish an effective method for forcing a cell into thermal runaway in a repeatable manner.
Module	A subassembly that is a component of a BESS that consists of a group of cells or electrochemical capacitors connected either in series and/or parallel configuration (sometimes referred to as a block) with or without devices and monitoring circuitry.	Assess the module's ability to contain thermal runaway.
Unit	A frame, rack, or enclosure that consists of a functional BESS that includes components and subassemblies such as cells, modules, battery management systems, ventilation devices, and other ancillary equipment.	Assess the ability of the unit to contain thermal runaway to the initiating unit and prevent a fire from spreading to adjacent target units.
Installation	BESS installed for use.	Assess the effectiveness of firefighting measures on the BESS level.

CATL EnerC+ BESS system key standards & testing

1. Jensen Hughes provide specialist BESS design risk analysis and reporting; the Hazard Mitigation Analysis (HMA) follows NFPA 855 (2023) guidelines. BST&T considers this to be a very thorough safety audit.
2. Jensen Hughes highlighted 8 major safety recommendations which this report compares against safety and testing documentation provide by CHSPL.
3. The CATL EnerC+ is tested and listed to UL 9540 (gold standard).
4. The CATL EnerC+ has completed UL 9540A 4th Edition (2019) to Unit level, complying with the latest UL test protocols and requirements.
5. The CATL EnerC+ gas exhaust system conforms to NFPA 69 standard of ventilating the BESS enclosure of any explosive gases produced during thermal runaway. NFPA 69 standard requires efficient ventilation of the BESS enclosure to ensure explosive gas levels remain under 25% of the Lower Flammable Limit (LFL).
6. The CATL EnerC+ Enclosure integrates smoke, gas and heat detection products which comply with NFPA 855 (2023). CHSPL will also install carbon monoxide sensors in compliance with NFCC guidelines which is to be considered best practice.

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Jensen Hughes methodology for Hazard Mitigation Analysis

2.4 HMA FAILURE MODES, CONSEQUENCES, AND RECOMMENDATIONS

The HMA aids in identifying and mitigating hazards created with the BESS technology. This section addresses the failure modes identified NFPA 855 which is in general agreement with industry best practice.

The failure modes listed in the NFPA 855 Standard for the Installation of Stationary Energy Storage Systems Section 4.4.2 (and echoed in this report Sections 2.4.1 through 2.4.3) were evaluated. Only single failure modes are considered for each mode. The evaluation includes a written description of the failure mode, the barriers in place to prevent the event, and the consequence of the event. This written evaluation is supported by a generic bowtie evaluation. It should be noted that this is a consequence-based analysis, and the likelihood of the event is not considered. The following are the failure modes listed in the 2023 edition of NFPA 855:

- A thermal runaway or mechanical failure condition in a single ESS unit
- Failure of an energy storage management system or protection system that is not covered by the product listing failure modes and effects analysis (FMEA)
- Failure of a required protection system including, but not limited to, ventilation (HVAC), exhaust ventilation smoke detection, heat detection, fire detection, fire suppression, or gas detection

Thermal Runaway definition and scenarios for BESS systems

2.4.1 Thermal Runaway or Mechanical Failure in Single ESS Rack, Module, or Unit

2.4.1.1 Description

Thermal runaway is the condition when an electro-chemical cell increases its temperature through self-heating in an uncontrollable fashion. This phenomenon typically progresses to a point at which the cell's heat generation is higher than the rate it can dissipate, potentially leading to the release of flammable gas, fire, or explosion. Once thermal runaway has started in a cell, it cannot be stopped. Thermal runaway can produce a significant amount of volatile gas that causes increased pressure within the cell housing and eventually leads to forceful venting [13]. If there is sufficient oxygen and a competent ignition source, these cell vent gases may ignite and progresses when the cells heat generation is at a higher rate than it can dissipate, potentially leading to the release of flammable gas, fire, or explosion. Once thermal runaway has started in a cell, it cannot be stopped. ignite.

Thermal runaway can be caused by physical damage (puncture, crushing), electrical issues (deep discharge, overcharging), exposure to elevated ambient temperatures, and manufacturer defects (imperfections, contaminants).

Cells in thermal runaway can cause adjacent cells to also undergo thermal runaway in a phenomenon known as thermal runaway propagation. Cell may cause thermal runaway in adjacent cells through one of several heat transfer mechanisms: 1) conductive heat transfer via direct contact between cells 2) overcurrent caused by damaged circuitry 3) impingement of hot or flaming vent gases. Cells may also cause thermal runaway in adjacent cells due to the effects of the cell depressurization (thermally from the fireball or mechanically from the force), or due to the original cell swelling and deforming adjacent cells.

Sustained Cell-to-Cell thermal propagation can lead to four primary hazardous scenarios:

1. Rapid ignition of flammable gases, sustained propagation, and resultant full-scale fire.
2. Multiple cells venting flammable gases without sufficient temperature for ignition.
3. Multiple cells venting flammable gases but delayed ignition leading to a deflagration or explosion.
4. Multiple cells venting flammable gases without sufficient temperature for ignition until after flammable gas concentrations have exceeded the Upper Flammable Limit (UFL). This condition can create a hazard known as 'backdraft' or 'flashover' in which opening the container and introduction of fresh oxygen can cause a deflagration.

It should be noted that while the backdraft hazard is a complex phenomenon, it was identified as the cause of seriously injuring four firefighters in a BESS thermal propagation event in Surprise, AZ in 2019 and is considered a plausible hazard of this installation.

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Jensen Hughes Hazard Mitigation Analysis (HMA) recommendations

Table 2-12: Safety recommendations resulting from HMA.

No.	Title	Description
1	Emergency response plan – fire suppression	Explore how emergency response planning can be defined to provide cooling (e.g., utilize nearby fire hydrants) to the enclosures with a hose stream in case of thermal runaway. Generally, water is the preferred agent for suppressing lithium-ion battery fires.
2	System testing and documentation	Verify all automatic and manual shutdown protocols for the BMS, EMS, and PCS during commissioning testing. Document the safety features of the BMS, EMS, and PCS to ensure these systems comply with industry best practice.
3	Battery cooling system documentation	For the liquid cooling system, inspection, testing, and maintenance protocols (PM frequency) need to be documented and evaluated for best practices in the industry.
4	Explosion prevention	Verify adequate basis of design, compliance with NFPA 69, and function of gas detectors and mechanical exhaust system during installation/commissioning.
5	Fire protection system	Consider installing the Fire Department Connection (FDC) at least 25 feet away from the container and ensure it is clearly marked with signage. Analyze the proposed site conditions, include fire department response, fire department access road, distance from fire department connection to fire hydrant, and fire flow for the site to meet the demand
6	Site specific analysis	When end user is developing an energy storage site, a site specific analysis should be carried out (e.g., Site hazard mitigation analysis, dispersion modeling, emergency response)
7	Fire Department Connection Location	Consider installing the Fire Department Connection (FDC) at least 25 feet away from the container and ensure it is clearly marked with signage.
8	Smoke and Heat Detection Circuits	Verify that each smoke detector and heat detector has its own dedicated circuit.

2.5 CONCLUSIONS

A hazard mitigation analysis was performed for the CATL EnerC+ BESS to determine compliance with NFPA 855. The failure modes as per NFPA 855 Section 4.4.2 were used to conduct a consequence-based analysis, which determined how well the provided barriers to failure of the safety system would reduce the severity of the hazard. Likelihood of events were not assessed and only one failure was used. Recommendations to address issues were assessed and repeated in the following subsection.

- Jensen Hughes are a highly respected US based engineering company who specialise in fire protection and life safety analysis for BESS systems and BESS sites.
- The HMA is conducted using NFPA 855 (2023) guidelines
- CHSPL will ensure compliance with all HMA safety recommendations.
- BST&T's review of the BSMP and risk analysis data provided by CHSPL concludes that all pre-construction recommendations have been satisfied

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Executive Summary

Jensen Hughes has completed a Hazard Mitigation Analysis of CATL EnerC+ 306 container. The Hazard Mitigation Analysis consists of:

a. A total of eight (8) recommendations listed in section 2.4.1 to address aspects of documentation and installation for safe operation including the following:
   - Emergency fire response plan – Fire suppression
   - System testing and documentation
   - Battery cooling system documentation
   - Explosion prevention
   - Fire protection system
   - Perimeter security
   - Emergency response plan – Coordination
   - Site specific analysis

b. For compliance with NFPA 855 requirements, a dispersion analysis may be recommended based on site specific installation.

This report, assembled with collaboration and design inputs provided from CATL, is a comprehensive product level review. Site level or installation level analysis may be required within certain jurisdictions outside of the scope of this report. The current EnerC+ design and its associated components are analyzed based on inputs and information provided from CATL. All identified non-compliance results are noted in this report.

This report was based solely upon and limited to the available information provided and/or presented in the submittal. Details and/or information not presented or provided on the documentation provided by the Client are not considered a part of this analysis.

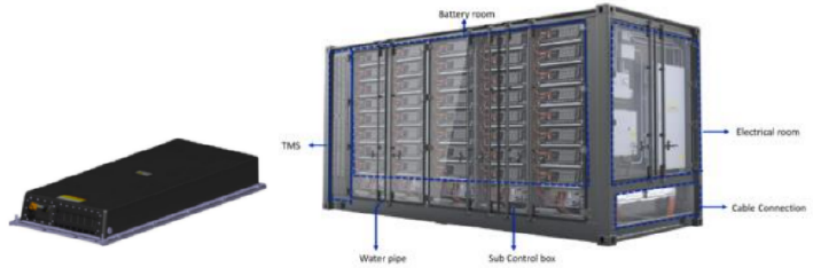

Figure 1: Module and Container Image

The system is monitored by a Battery Management System (BMS). The BMS monitors the battery voltage, current, and temperature. A liquid cooling system is built into the system to manage battery temperatures as determined by the BMS monitoring.

The container is protected with four (4) levels of fire suppression which stars with an alarm warning at the first level, then continues to the second level to utilize the mechanical ventilation system to prevent deflagration, the third level released aerosol to extinguish initial fire occurring in the container, and finally level four consists of water spraying to prevent the spread of fire.

This report analyses the most important recommendations from the HMA:

1. System testing and documentation
2. Battery Cooling System
3. Explosion Prevention
4. Fire Protection System
5. Site Specific Analysis
6. Emergency Response Plan provision

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Core BESS certifications & testing

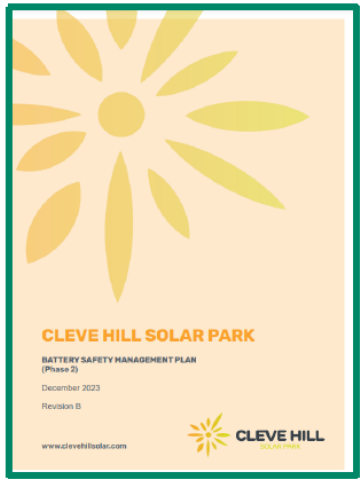
Cell: UL 1973, IEC 62619, UN 38.3 – conforms to key standards

Module: UL 1973, IEC 62619, UN 38.3 – conforms to key standards

Rack: UL 1973 – conforms to key standard

Testing: Compliant with UL 9540A unit level test protocols - UL9540A test method allows for an assessment of the flammability / thermal runaway hazard of the battery system. This testing is required to comply with NFPA 855 (2023) and to obtain UL 9540 system level listing.

BMS: UL 1973, UL 9540 – conforms to key standards and BMS integrates NFPA 855 recommended controls. CHSPL are also integrating data analytics and PLC integrated detection capability, BST&T considers this best practice.



Gas exhaust system: designed to NFPA 69 requirement for BESS
1. The gas detection system shall be designed to activate the mechanical exhaust system when the level of flammable gas detected in the container exceeds 25 percent of the Lower Flammable Limit (LFL).
2. The mechanical exhaust system must stay on until the flammable gas detected is below 25 % of the LFL.
3. The system shall be provided with a minimum of 2 hours of standby power.
4. If the gas detection system fails, the system shall annunciate a trouble signal at an approved central station, or remote station service in accordance with NFPA 72 or at an approved, constantly attended location.

Enclosure: CATL is certifying to UL 9540 and the expectation is that certification will be obtained in Q1 2024

BST&T Conclusion:

- EnerC+ is a tier one BESS system certified to the requisite standards
- CATL needs to provide the final UL 9540 certification of the BESS enclosure, this is expected to be obtained in Q1 2024. For the avoidance of doubt, this upcoming certification is part of a normal ongoing compliance process for a new BESS system and is not a legitimate reason to delay approval of the BSMP.

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2.4.3.2 Mechanical Exhaust System

Description

Failure of the mechanical exhaust system is designed to exhaust gas buildup. This system is activated upon detection of gas from hydrogen gas detection system. Under normal operating conditions mechanical exhaust system is not utilized.

Barriers

Exhaust ventilation system is designed and installed in accordance with NFPA 69.

Consequences

Buildup of flammable gas in container above the lower flammable limit to an explosive concentration can cause an explosion.

Recommendations

1. Verify adequate basis of design, compliance with NFPA 69, and function of gas detectors and mechanical exhaust system during installation/commissioning.

2.4.3.5 Gas Detection System

Description

The gas detection system is used to automatically activate the exhaust ventilation system to remove flammable gas buildup from a thermal runaway event. The documentation available for review indicates that the gas detection system is provided using a UL approved gas sensor which detects hydrogen. Since the gas emitted during a thermal runaway event is primarily hydrogen, it is recommended to use detectors that can detect hydrogen as hydrogen is a gas normally not present in normal conditions but is expected to be generated in high quantities during a thermal runaway event. Two hydrogen gas detectors planned for this design.

Barriers

Periodic inspection, testing, and maintenance of the gas detection system components in accordance with applicable standards, their listing, and manufacturer guidelines to reduce the potential of failure of the gas detection system.

Consequences

If the gas detection devices fail, activation of the ventilation system will not occur potentially resulting in a flammable atmosphere inside the enclosure. This would increase the potential of a deflagration to occur.

Recommendations

None.

BST&T considers that CATL and CHSPL fulfils all HMA recommendations for explosion prevention:

1. A Fire Protection Assessment for NFPA 69 Compliance Report for the EnerC+ BESS has been produced by TLB Fire Protection Engineering, Inc
2. A Computational Fluids Dynamics (CFD) model was utilized to demonstrate the system design successfully reduces the concentration of combustible gases in the container to less than 25 percent of the lower flammability limit (LFL) of the gas mixture recorded in UL 9540A testing.
3. The CFD model conservatively assumes three modules will go into thermal runaway concurrently, to validate gas exhaust performance. The model demonstrates that the average concentration of hydrogen within the BESS is maintained below 25% of the LFL for the duration of the thermal runaway as per the intent of the requirement in NFPA 855 (2023).
4. TLB Fire Protection Engineering, Inc. conclude that according to the information provided, the BESS explosion prevention measures meets the intent of NFPA 69 (2019) standards and the explosion control requirements of NFPA 855 (2023).
5. CHSPL will commission a site-specific explosion prevention review during installation which will validate the NFPA 69 Compliance conclusions, confirm detection system compliance and approve maintenance schedules.

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Cleve Hill Fire Suppression System (FSS)

2.4.3.6 Water-Based Suppression System

Description

A manual dry fire sprinkler system with sprinklers provided in design documentation. The a design density in.3 gpm/ft^2 based over the area of the room is required by 2023 edition of NFPA 855 provided for this enclosure

[18]. A fire department connection for the dry standpipe is required to be provided for local firefighters to attach a water supply connection to cool the container in case of a thermal runaway event.

Barriers

Fire department may not hook up water depending on system installation configuration and emergency response procedures. The fire department connection is directly adjacent to the battery room on the side of the container, and in an event scenario it may be unsafe for a fire fighter to connect a hose due to the fire and explosion hazard in the battery room. This is not a review of a site-specific solution so the site water supply, fire department access, and distances will need to be analyzed for each site. Periodic inspection, testing, and maintenance of the sprinkler system components in accordance with NFPA 25 and applicable standards to reduce the potential of failure of the fire sprinkler system.

Consequences

Failure of fire department attaching water supply may cause a fire in one battery rack to spread to adjacent racks, causing a greater release of flammable gas and additional potential for explosion and fire.

Recommendations

1. Consider installing the Fire Department Connection (FDC) at least 25 feet away from the container and ensure it is clearly marked with signage.
2. Analyze the proposed site conditions, include fire department response, fire department access road, distance from fire department connection to fire hydrant, and fire flow for the site to meet the demand.

BST&T considers that CHSPL fulfils all HMA Fire Suppression System recommendations:

1. KFRS Connections will be located at least 25 feet from enclosures and clearly signed for KFRS response.
2. CHSPL has liaised closely with KFRS to agree key site design requirements for First Responders. NFCC guidelines were used as the foundation of site design and both water provision and BESS enclosure spacing follows these guidelines.
3. Both sprinkler and aerosol FSS conforms to both NFPA and BS EN standards
4. Because aerosol discharge could increase the explosion risk during a thermal runaway scenario: discharge of the aerosol fire suppression system shall be limited to only true “electrical” fault fires shall not trigger in the event of a thermal runaway, this shall be managed by the fire alarms control logic and be validated by additional analytics provided by the BMS and EMS, this final system design shall be validated by an appointed British Approvals for Fire Equipment (BAFE) accredited specialist to ensure its compliance to the standards named. The FSS includes a manual and emergency deactivation button located externally to the BESS enclosure to allow manual deactivation in an emergency and deactivation by engineers when entering or opening the container to perform inspections and/or maintenance activities.

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2.4.3.4 Smoke and Heat Detection System

Description

Three (3) smoke detectors and two (2) heat detectors are provided according to the documentation available. The design documentation indicates that two (2) smoke detectors and two (2) heat detectors are installed in the battery compartment as well as one (1) smoke detector in the electrical compartment. The smoke and heat detectors are a part of the Fire Suppression System (FSS) and connected to the Fire Control Panel (FCP) which will activate the aerosol, ventilation and provide notification of an event (alarm).

Connection of the fire alarm system to a central monitoring station will be required as part of the site-specific evaluations.

Barriers

Periodic inspection, testing, and maintenance of the fire alarm system and components in accordance with NFPA 72 to reduce the potential for failure of the detection system is required. Three (3) smoke detectors and two (2) heat detectors are proposed. In case of a single or multiple detector failure it is expected that the remaining detectors will function properly, as the system will be constantly monitored and will report any troubles, faults, or supervisory alarms to the central monitoring station.

Consequences

In the event that a single smoke detector or heat detector does not activate, notification may not occur or will be delayed until a second smoke detector or heat detector is activated. Due to the constant monitoring, it is not expected that the fire detection system will fail, however it is still probable, which would prevent the notification system from activating.

Recommendations

1. Verify that each detector has its own dedicated circuit
2. Connection of the fire alarm system to a central monitoring station as part of the site-specific evaluations.

BST&T considers that as specified in the BSMP, CHSPL selected detection systems exceed Jensen Hughes Recommendations:

1. All fire detection systems shall all be installed and commissioned to BS EN 54, BS EN 9999, NFPA 885, NFPA 850. Final system design shall be validated by an appointed British Approvals for Fire Equipment (BAFE) accredited specialist to ensure its compliance to the standards named.
2. Each BESS also includes audible and visual notification devices in the event of a fault or alarm condition.
3. Each battery enclosures fire detection system shall be integrated into a dedicated site wide fire monitoring system to allow notification from a centralized location onsite. The site wide monitoring system shall be securely monitored via a dedicated platform and provide automatic remote notification to a certified alarm receiving centre via a dual path signalling solution in the event of an emergency scenario, the system can also provide automatic signally to the local fire departed which shall be offered and provided at their discretion.
4. The site wide monitoring system shall also provide automatic controls to disconnect an affected battery enclosure from its designated Power Conversion System and nearby equipment from the High-Voltage network in the event of an alarm being triggered. Hardwired normally closed safety loops are also to be installed between each battery enclosure and its designated Power Conversion System to provide local disconnection from the High-Voltage network as a second layer of redundancy if a communications fault between the systems was to occur simultaneously.

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2.4.3.7 Manual Firefighting Response

Description

Manual firefighting response by the local fire department is likely going to be a "defensive approach" that focuses on preventing the propagation to neighboring containers and should be outlined in an emergency response plan. The emergency response plan is typically developed with the site operator and in communication with the responding fire department during the permitting stage and finalized after project completion. The enclosure is equipped with an emergency stop that can be used during an incident.

Manual firefighting response is initiated by the central station, triggered by the activation of smoke, heat, or gas detection system. Connection of the fire alarm system to a central monitoring station will be required as part of the site-specific evaluations.

Barriers

+ Emergency response plan
+ Training and site familiarity
+ Proper inspection, testing, and maintenance of firefighting equipment

Consequences

Failure of the manual firefighting response could lead to propagation of a thermal runaway event, total loss of the BESS, and/or possible explosion(s). Lack of an adequate emergency response plan, training and site familiarity may result in harm to emergency responders.

BST&T considers that BSMP comprehensively sets out requirements for Emergency Response Planning, training and site familiarity and inspection, testing and maintenance of equipment. CHSPL will appoint a Construction Emergency Response Team (CERT) which will fully liaise with KFRS to ensure firefighting requirements are met.

The CERT shall be responsible for:

a. Completing the developments construction Emergency Response Plan, including but not limited to

i. Review and further develop the responsibility matrix (RACI) for decision making and protocols for incident response – shared across the facility and response teams.

ii. Review the EMS, BMS and Fire alert / alarm systems and further detail the functions, capabilities and control hierarchy.

iii. Review and further detail the Standard Operating Procedures (SOPS) with specific emphasis on safe shutdown and isolation procedures, emergency response procedures and decommissioning procedures. Review and further detail the developments system monitoring data analytics for real time support in an emergency event.

b. Liaising with the local emergency services and making them aware of the detailed project programme, identify key milestones such as the battery delivery dates, installation commencement, commissioning commencement and any other periods of construction which may pose a higher risk of fire hazards being present.

c. Maintaining regular meetings and periodic reviews of the construction progress ensuring fire safety is maintained.

d. Provide continual updates to the local emergency services and notify them of any changes to key construction milestones, new hazards, or changes to the Emergency Response Plan.

e. Perform real life scenario-based testing to evaluate the effectiveness of the Emergency Response Plan.

f. Ensure the recommendation of the air quality assessment (Plume Analysis) as summarised in section 8.3 and 8.4 of the BSMP document are enforced.

g. Ensure the protocols, guidelines, and standards of the BSMP are followed.

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2.4.3.1 Ventilation (Battery Liquid Cooling)

Description

This failure mode is perhaps better described as failure of the battery cooling system. For the CATL EnerC+ system, thermal management of the battery modules is provided via a liquid cooling system under the bottom of battery that is designed to maintain the battery cells within their operating limits. In the event that a thermal management system fails, the battery cells may be exposed to elevated temperatures (i.e., above the operating temperature range). When this occurs, the cell is not able to dissipate heat efficiently, which, in turn, leads to increased internal temperatures. If the internal temperature rises out of the tolerance of the separator on the cell, the separator can degrade. Aging and long term degradation of the separator is often a precursor to a thermal runaway event.

Failure of the liquid battery cooling system may occur due to the following causes.

+ The coolant pump fails to operate due to a faulty temperature sensor, a blown fuse or other failure mode associated with the pump.
+ A leak occurs in the system, causing drainage of the coolant.

Barriers

Barriers addressing the failure of the liquid battery cooling system includes:

+ The BMS monitors cell temperatures relative to the manufacturer's specifications including module temperature detection and thermal management. The BMS is designed to detect and correct abnormal conditions, as well as electrically disconnect the battery if the module temperature falls outside these thresholds.
+ Proper inspection, testing, and maintenance of the liquid cooling system. This includes checking/maintaining the coolant levels within the system and its components, inspection of the coolant quality, and ensuring piping integrity.

Consequences

Failure of the liquid cooling system shuts down the operations of the CATL EnerC+ ESS (i.e., the unit trips). It is important to note that the critical cell failure temperatures are typically around 130°C, a level that is unlikely to be reached in the installation environment. Therefore, a loss of coolant should not immediately trigger a thermal runaway. Coolant leakage could cause a short circuit in battery modules or auxiliary equipment resulting in an overheat condition potentially leading to a thermal runaway. The consequences of a thermal runaway event are described in Section 2.4.1.3.

Recommendations

1. Verify all automatic and manual shutdown protocols for the BMS, EMS, and PCS during commissioning testing.
2. Document the safety features of the BMS, EMS, and PCS to ensure these systems comply with industry best practice.

If an EMS failure occurs, the worst-case consequence is a thermal runaway. Hence, the same recommendations as provided in Section 2.4.1.4 apply.

BST&T considers that the BSMP complies with all Ventilation recommendations in the HMA, namely:

1. During operation routine maintenance shall be undertaken of the battery facility. Maintenance shall be conducted in accordance with the manufacturer's guidelines, current relevant standards and industry best practices and as a minimum shall include the tasks as detailed in Table 4 (Standard Routine Maintenance)
2. System data analytics will be integrated into EMS / 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. Site Acceptance Testing (SAT) for BESS equipment will be to BS EN IEC 62933-5-2 standards or equivalent.
4. The Construction Emergency Response Team (CERT) will review the EMS, BMS, PCS and Fire alert / alarm systems and further detail the functions, capabilities and control hierarchy.
5. The monitoring system provides automatic controls to disconnect an affected battery enclosure from its designated Power Conversion System (PCS) and nearby equipment from the High-Voltage network in the event of an alarm being triggered. Hardwired normally closed safety loops are also to be installed between each battery enclosure and its designated PCS to provide local disconnection from the High-Voltage network as a second layer of redundancy if a communications fault between the systems was to occur simultaneously.
6. CATL's Battery Management System (BMS) is designed to monitor key electrical, mechanical, and environmental parameters to ensure the system operates within its designed thresholds. The BMS controls the battery systems, electrical systems and thermal management systems and is interlinked to the systems fire detections and fire suppression systems. The BMS provides early warning notification, fault notifications and disconnection of the battery system in the event of a parameter being exceeded. CHSPL will also PLC integrate detection and alert mechanisms to provide additional safeguards to the BESS system. The BMS samples and records parameters every second and can provide a sub-second disconnection of the system in the event of a fault or parameter exceedance.

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2.4.2 Failure of an Energy Storage Management System (ESMS)

2.4.2.1 Description

The ESMS is defined in NFPA 855 as: "a system that monitors, controls, and optimizes the performance and safety of an energy storage system" (NFPA 855 Section 3.3.8). This definition therefore implies that, at a minimum, the ESMS encompasses the combined performance of the system BMS and EMS. Therefore, this section addresses potential failures in these subsystems.

Each failure can be addressed based on overall function expectations. The EMS includes the module-level, rack-level and unit-level BMS that monitor and balance cell voltages, currents, and temperatures within the manufacturer's specifications and the EMS that monitors and manages the feed and load. Section 9.2.3 of the NFPA 855 2023 Edition requires the energy storage management system to disconnect electrical connections to the ESS or otherwise place it in a safe condition if potentially hazardous temperatures or other conditions such as short circuits, over voltage or under voltage are detected.

+ The Battery Management System (BMS) may fail to provide monitoring and/or control at the cell/module level, resulting in inability to shut down, report adverse conditions, properly monitor, balance or protect the system resulting in adverse conditions.
+ The Energy Management System (EMS) may fail at the rack or system level which results in adverse conditions to the system.

2.4.2.2 Barriers

Barriers to failure of the Energy Storage Management System include:

+ NFPA 855 2023 edition invokes UL 1973 [17]. In the event that the EMS or BMS is relied upon for maintaining the battery cells within their safe operating region, UL 1973 requires that "the Energy management system (EMS) shall maintain cells within the specified cell voltage region from over-charge and over-discharge of the cell voltage, and it shall maintain cells within the specified cell temperature region providing protection from overheating and under temperature operation. Additionally, it shall maintain batteries within the specified battery current region from over charge of current and prevent high-rate discharge exceeding the cell specification. The batteries utilized in the EnerC+ are UL 1973 certified.
+ Generally, the ESMS can remotely shut down the EnerC+ via a control system integral to the container. The EnerC+ can also be shut down locally via emergency stop. In the event of fault detected condition (e.g., over voltage, over current, over temperature, communication, etc.), The high voltage DC circuit is cut off.

2.4.2.3 Consequences

Failure to shut down the system given potentially hazardous temperatures or other conditions such as short circuits, over or under voltage conditions are detected may result in damage to the battery cells. This damage could ultimately lead to thermal runaway event. The consequences of a thermal runaway event are described in Section 2.4.1.3.

2.4.2.4 Recommendations

1. Verify all functions of the BMS and automatic and manual shutdown protocols of the EMS during commissioning testing.

If an EMS failure occurs, the worst-case consequence is a thermal runaway. Hence, the same recommendations as provided in Section 2.4.1.4 apply.

BST&T considers that the BSMP complies with EMS / BMS (ESMS) failure recommendations:

- Key parameters considered for the importance of fire safety monitored by the BMS include but are not limited to:

a. Overall system voltage
b. System State of Health ("SOH")
c. System Stage of Charge ("SOC")
d. Single cell temperatures
e. Single cell voltage
f. Single cell temperature difference
g. Single cell voltage difference
h. Battery System Insulation Resistance
i. Enclosure ambient temperatures
j. Thermal Management System ("TMS") water temperatures

- The BMS provides levels of early warning notifications when parameters are nearing their designed limits, these notifications are automatically generated and shall be monitored by a centralised system so that operational teams can investigate, analyse and provide reactive maintenance to repair or replace defective parts appropriately.
- In the event of a parameter being exceeded the BMS automatically provides fault notification and immediate disconnection of the system from the high voltage AC supply, notifications are automatically generated and shall be monitored by a centralised system so that operational teams can investigate, analyse, and provide reactive maintenance to repair or replace defective parts appropriately.
- The BSMP outlines a risk assessment conducted by CHSPL identified 9 critical steps across six key project stages as listed in Table 2. Step 6, Commissioning Verification process ensures the implemented EMS / BMS (ESMS) control measures are functioning effectively.
- Site Acceptance Tests (SAT) will follow BS EN IEC 62933-5-2 standards and protocols, or equivalent.

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2.4.2 Failure of an Energy Storage Management System (ESMS)

2.4.2.1 Description

The ESMS is defined in NFPA 855 as: "a system that monitors, controls, and optimizes the performance and safety of an energy storage system" (NFPA 855 Section 3.3.8). This definition therefore implies that, at a minimum, the ESMS encompasses the combined performance of the system BMS and EMS. Therefore, this section addresses potential failures in these subsystems.

Each failure can be addressed based on overall function expectations. The EMS includes the module-level, rack-level and unit-level BMS that monitor and balance cell voltages, currents, and temperatures within the manufacturer's specifications and the EMS that monitors and manages the feed and load. Section 9.2.3 of the NFPA 855 2023 Edition requires the energy storage management system to disconnect electrical connections to the ESS or otherwise place it in a safe condition if potentially hazardous temperatures or other conditions such as short circuits, over voltage or under voltage are detected.

+ The Battery Management System (BMS) may fail to provide monitoring and/or control at the cell/module level, resulting in inability to shut down, report adverse conditions, properly monitor, balance or protect the system resulting in adverse conditions.
+ The Energy Management System (EMS) may fail at the rack or system level which results in adverse conditions to the system.

2.4.2.2 Barriers

Barriers to failure of the Energy Storage Management System include:

+ NFPA 855 2023 edition invokes UL 1973 [17]. In the event that the EMS or BMS is relied upon for maintaining the battery cells within their safe operating region, UL 1973 requires that "the Energy management system (EMS) shall maintain cells within the specified cell voltage region from over-charge and over-discharge of the cell voltage, and it shall maintain cells within the specified cell temperature region providing protection from overheating and under temperature operation. Additionally, it shall maintain batteries within the specified battery current region from over charge of current and prevent high-rate discharge exceeding the cell specification. The batteries utilized in the EnerC+ are UL 1973 certified.
+ Generally, the ESMS can remotely shut down the EnerC+ via a control system integral to the container. The EnerC+ can also be shut down locally via emergency stop. In the event of fault detected condition (e.g., over voltage, over current, over temperature, communication, etc.), The high voltage DC circuit is cut off.

2.4.2.3 Consequences

Failure to shut down the system given potentially hazardous temperatures or other conditions such as short circuits, over or under voltage conditions are detected may result in damage to the battery cells. This damage could ultimately lead to thermal runaway event. The consequences of a thermal runaway event are described in Section 2.4.1.3.

2.4.2.4 Recommendations

1. Verify all functions of the BMS and automatic and manual shutdown protocols of the EMS during commissioning testing.

If an EMS failure occurs, the worst-case consequence is a thermal runaway. Hence, the same recommendations as provided in Section 2.4.1.4 apply.

BST&T considers that the BSMP complies with EMS / BMS (ESMS) failure recommendations (continued):

- Key parameters considered for the importance of fire safety which generate automatic disconnection of the system by the BMS include but are not limited to;

a. A Communication fault,
b. SOC under/over limit,
c. System Current over limit,
d. Single cell voltage over/under limit,
e. Rack voltage difference over/under limit,
f. Single cell temperature over/under limit,
g. Rack temperature difference over/under limit,
h. Insulation fault under limit,
i. Auxiliary power fault,
j. Lightning protection device fault,
k. Fire system fault,
l. TMS water temperature over/under limit,
m. TMS fault,
n. Emergency stop button engaged,
o. Emergency stop button fault.

- System data analytics will be integrated into EMS / 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.

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EnerC+ design safety conclusions

Assumptions: This report summarises BST&T's assessment of the BESS design safety features and relies on the accuracy of the information provided by CATL and CHSPL. CHSPL has been very cooperative in providing the data that BST&T has requested, some data received from CHSPL that has been used in the production of this BSMP and safety review has been omitted from this report based on requirements that it remains confidential.

Battery system: CATL's EnerC+ system is tested and certified to UL 1973, IEC 62619 and UN 38.3; BST&T considers this meets the highest industry expectations.

Thermal Management System (TMS): BST&T considers the TMS is in line with typical industry standards for BESS cooling applications and the key features of the cooling system design align with the characteristics of the battery cells. Liquid cooling provides higher levels of safety and performance for BESS systems and CHSPL has PLC integrated additional alerts and data analytics into the BMS to ensure comprehensive safety controls.

Battery Management Systems (BMS) and controls: BST&T considers CATL's BMS architecture aligns with the current industry expectations. CHSPL will also PLC integrate detection and alert mechanisms to provide additional safeguards to the BESS system and integrate data analytics which will provide for the highest level of Thermal Runaway incident prevention.

Explosion Prevention System: BST&T considers that the gas exhaust system is designed to NFPA 69 requirements for BESS. Additionally, discharge of the aerosol fire suppression system shall be limited to only true "electrical" fault fires shall not trigger in the event of a thermal runaway ensuring the gas exhaust system remains in operation. The dry pipe water sprinkler can operate in conjunction with the gas exhaust system which could further reduce the risks of a deflagration event occurring.

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PAUL GREGORY – BATTERY TESTING AND SAFETY CV

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CONSULTANCY SERVICES

BATTERY BACKGROUND

I'm a specialist battery safety and testing consultant whose areas of expertise include: BESS safety & mitigation strategies, battery system validation & abuse testing, BESS explosion test planning, battery system risk assessment & training, operations & battery systems safety audits, suppression system & explosion protection test planning, BESS incident ERP drafting / planning.

My project focus since 2015 has been within renewable energy sectors leading to an interest and specialization in lithium battery technologies. Projects have covered all aspects of the safety spectrum: risk analysis, FDS modelling, scale testing mitigation strategies, passive protection measures and effective bespoke special hazard suppression solutions.

Battery and safety product roadmap experience includes full scale battery abuse testing and certification, design of battery abuse test facilities, identifying and validating BESS safety equipment, test planning / review for fire & explosion tests for a variety of battery application suppression systems. Unique multi-application experience of working in a variety of high energy density lithium battery (both primary and secondary) technologies and applications. I have a detailed understanding of new battery technologies, application performance requirements and key safety and mitigation factors.

Previous project partners and clients:

| EaglePicher | Northvolt | ESPEC | EnerSys | NEC Energy Solutions | LG Chem | Trina Solar | Gridserve | ABB | APi Group | Hiller | Collins Aerospace | Kidde | TUV SUD | Johnson Controls | FAA | IATA | Esterline / Armtec | General Motors | STIF | Scottish Power | Honeywell | Nexceris | Johnson Controls | AECOM | DNV | Gexcon | Metis Engineering | Accure Battery Intelligence | IGP | Low Carbon

SKILLS & ATTRIBUTES

BESS Emergency Response Planning (ERP) & Analysis | Battery technology application & safety research | BESS UL 9540A test data analysis | BESS site design planning | BESS hazard mitigation analysis | BESS design risk assessment | Thermal Runaway & explosive gas detection testing | Strategic planning | Product management | Battery system testing, certification & validation | Project management of multi-disciplinary teams | Market research & product development | BESS Explosion test planning | Operational strategy | Lithium battery technologies (primary and secondary) | BESS fire & explosion safety audits | Lithium battery application hazard mitigation & fire suppression testing and analysis | Lithium battery passive protection product development | Lithium battery safety & training services | BESS safety planning peer review consultant | Detailed knowledge of LIB safety codes and testing requirements (NFPA 855, UL 9540A, UL 1973, UL 9540, IFC, IEC, SAE, etc.) |

BESS PROJECTS	**BESS planning projects:** BESS safety consultant working directly with a variety of clients on grid scale project planning teams (fire safety, air quality, drainage, environment & sustainability). Consultancy services include drafting and peer reviews of BESS fire safety management plans, DCO hearing BESS safety content provision, BESS site design safety analysis & guidance, BESS safety standard & code compliance, Battery system design safety analysis, fire protection system design reviews, BESS explosion prevention system audits & review, BESS fire & explosion test data analysis, BESS site first responder facility provision, BESS incident & emergency response planning with local Fire & Rescue Services. **Lithium-ion Battery (LIB) Working Group, Review Board Member - Lead for test planning and data review (2022, BESS and EVs):** Lead test consultant for a global fire protection & suppression company's large scale battery abuse and suppression testing program. Reviewing ongoing program of performance tests for water and aqueous suppression agents on a wide range of battery systems and chemistries. **Basingstoke & Deane Borough Council – safety consultant to review and evaluate BESS system and site design (2024):** Ongoing project for a scheme that has received planning permission to peer review BESS system design, certifications, and test data. The review will also include site design conformance to NFCC and NFPA 855 guidelines and ensure first responder requirements are fully accommodated. **UL & ISO, Stationary Energy Storage Systems Working Group member:** Member of the BESS first responder working group who are working to devise and implement international ISO safety protocols and signage for BESS emergency incident response. **Consultant for BESS system validation and certification (UL 9540A & 3rd Party):** Lead consultant on key safety code and regulation compliance for BESS system validation and certification (UL 1973, UL 9540, UL 9540A, NFPA 855) for a major European battery manufacturer. Consultant for planning BESS large scale 3rd party fire & explosion testing in conjunction with thermal runaway detection and suppression testing evaluation program. **Battery Production facilities risk assessment and suppression system evaluation testing:** Lead for US project team tasked with comprehensive risk assessment of a major US battery production facilities. Member of working group to establish rigorous test program of suppression system / suppression agent evaluation testing. **Consultant for Solar & BESS systems for utility scale energy / EV charging:** Lead battery safety consultant for a variety of ongoing UK projects, advising on battery safety standards, fire & explosion risk analysis, fire protection system & mitigation analysis / validation, global fire code compliance, BESS site design risk analysis and Emergency Response Plan (ERP) drafting. Responsible for peer reviewing all battery and fire safety performance test results and advising on additional mitigation or retrofit / remedial actions (if required). **Consultant for BESS system safety evaluation:** Lead battery safety consultant responsible for risk assessing the client's partner Battery OEM BESS system and drafting Emergency Response Plans (ERP). This involves comprehensive risk assessments of battery systems and analysis of UL /3rd Party large scale abuse testing to determine if further safety testing should be conducted by the battery

OEM. Establishment of new independent testing protocols to further identify fire and explosive risks which could impact on BESS site design parameters e.g. suppression system design selection, BESS enclosure spacing, BESS electronic control capabilities, gas exhaust design review, HVAC capabilities, etc.

BESS explosion test planning & evaluation consultant: Lead test planning consultant for BESS explosion prevention & explosion protection systems. Currently designing 3rd party test programs for a variety of gas venting and deflagration protection solutions.

Lithium battery fire suppression agent development (2016-2019), North America: Application risk research, strategic planning, regulatory certification & compliance testing, establishing a large-scale battery fire test facility, suppression system hardware development, lithium battery pack risk assessment, Thermal runaway detection and prevention, LIB application suppression system / mitigation solution performance testing, leading battery application working groups to cover all areas of risk assessment, mitigation, passive protection & suppression solutions.

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