

Kirkby BESS Project

Technical Note: BESS Function and Noise Output Review

DOCUMENT REFERENCE: PRJ00040-KRBY-BMES-ENG-NTE-001

Document Control

SIGN OFF		
Name (Role)	Signature	Date
Sushitha Reddy Yellola BESS Project Engineer	Sushitha 	29 th Jan 2026

DOCUMENT CONTROL					
Document Number					
Document Title		Technical Note: BESS Function and Noise Output Review			
Rev.	Date [dd mmm yyyy]	Description	Prepared	Checked	Approved
1	16/01/2026	First Issue	SRY	CM, ARW, RH	

Contents

Document Control	2
1 Introduction	4
2 Overview of BESS operating principles	4
3 Duration of a single charge-discharge cycle	4
4 Maximum number of charge-discharge cycles per day	5
5 Maximum Daily Operational Duration and Implication for noise	5
6 Conclusion	6

1 Introduction

This Technical Note has been prepared in support of the operational noise assessment (titled Baseline Noise Survey Report, SLR, March 2025) submitted for the proposed Kirkby Battery) submitted for the proposed Kirkby Battery Energy Storage System (BESS), together with the subsequent technical responses provided to Knowsley Council and Environmental Health Officers. The note is intended to supplement those submissions by providing clarification on the operational duty cycle of the BESS and how this informs the assumptions adopted within the noise assessment and its subsequent updates.

The submitted noise assessment, prepared by SLR Consulting Limited, considered the potential operational noise effects of the BESS under worst-case operating scenarios in accordance with BS 4142. Subsequent correspondence from Environmental Health Officers raised concerns regarding night-time operation, the potential audibility of steady mechanical plant in a quiet rural context, and the interpretation of predicted rating levels relative to background sound levels. In this context, it is important that the Local Planning Authority has a clear understanding of how a utility-scale BESS operates in practice, particularly with respect to the duration and frequency of operation across a 24-hour period.

BESS do not operate continuously in the same manner as conventional industrial or generation plant. Instead, operation occurs in discrete charge and discharge cycles, which are constrained by the installed energy capacity of the system, manufacturer design limits, cooling system performance requirements, and equipment warranty conditions. These constraints place a definitive upper limit on the number of hours per day during which the BESS can operate at full output and, consequently, on the duration for which associated noise-generating plant can operate.

The purpose of this Technical Note is to demonstrate that the proposed Kirkby BESS cannot operate on a continuous 24-hour basis and, as a result, cannot emit operational noise continuously throughout the day or night. The note quantifies the duration of individual battery charge–discharge cycles, establishes the maximum number of cycles that can be undertaken within any 24-hour period, and derives the resulting maximum daily operational duration of the BESS.

2 Overview of BESS operating principles

Operation of the BESS occurs in discrete charge and discharge cycles. During active charging or discharging, power conversion equipment and associated auxiliary plant, including cooling systems, operate to facilitate energy transfer. When the BESS is not charging or discharging, the system operates in an idle or low-activity state with reduced auxiliary demand.

Publicly available operational data for installed BESS in Great Britain, including analysis published by independent market analysts such as Modo Energy, indicates that BESS assets typically operate through a limited number of discrete charge–discharge cycles per day rather than sustained continuous operation. BESS assets typically undertake in the order of approximately one to two full equivalent charge–discharge cycles per day across the GB fleet. This information is provided as contextual evidence only and does not define or constrain the operational profile of the proposed Kirkby BESS.

Operation is governed by the installed energy capacity of the battery system and defined State of Charge operating limits. Charging ceases once the maximum permitted State of Charge is reached, and discharging ceases once the minimum allowable State of Charge is reached. From an operational noise perspective, noise-emitting plant associated with the BESS is active during defined charging or discharging periods and reduced during idle or low-activity states. This provides context for the interpretation of operational noise effects under BS 4142, which considers noise impact during periods of operation but not operating duration or frequency.

3 Duration of a single charge-discharge cycle

The proposed Kirkby BESS is a two-hour duration BESS, defined by the relationship between its installed energy capacity (MWh) and rated power output (MW). A single full charge–discharge cycle therefore comprises a charging phase and a discharging phase, each of finite duration, governed by system power limits and control settings.

Supplier technical proposals for the Kirkby BESS define a bounded State of Charge operating window, typically in the order of 10–90%, within which charging and discharging are permitted. These limits are implemented within the Battery Management System to

control battery degradation and thermal performance and to define the usable energy capacity of the system. Charging must cease once the upper State of Charge limit is reached, and discharging must cease once the lower limit is reached.

As a result, a complete charge–discharge cycle has a defined and finite duration that is fixed by system design parameters and cannot be extended beyond the two-hour design envelope without operating outside the intended operating conditions of the BESS

4 Maximum number of charge-discharge cycles per day

The number of charge–discharge cycles that the BESS can undertake within any 24-hour period is constrained by system design requirements, thermal management capability, and manufacturer warranty conditions. These constraints apply irrespective of commercial dispatch or trading strategy. The installed batteries will have the capability of operating up to 3 full charge–discharge cycles per day. The asset is expected to operate typically in the order of 1.5–2 cycles per day to ensure operational quality and to stay within the warranted operating envelope.

In addition, the cooling system is designed and rated on the basis of this maximum cycling frequency. The cooling system performance requirements specify that a minimum rest period of at least 30 minutes is required between successive charge–discharge cycles to prevent excessive thermal loading. These rest periods are an inherent part of the system design and are required to maintain battery temperatures within acceptable limits.

The Battery Management System (BMS) and Energy Management System (EMS) enforce these constraints by limiting the frequency and sequencing of charge–discharge events in accordance with the applicable battery and cooling system requirements. As a result, the BESS cannot undertake an unrestricted or continuous sequence of charge–discharge cycles within a 24-hour period.

5 Maximum Daily Operational Duration and Implication for noise

For a two-hour duration BESS, a full charge–discharge cycle comprises up to two hours of charging and up to two hours of discharging. A single full cycle therefore equates to approximately four hours of active operation. On the basis of two full charge–discharge cycles occurring within a 24-hour period, the total duration of active charging and discharging is approximately eight hours. Where successive cycles occur, a minimum rest period of at least 30 minutes is required between cycles, resulting in a minimum of 0.5 hours of mandatory downtime. The overall cycle-based operating window associated with two cycles is therefore approximately 8.5 hours within any 24-hour period, with the remaining time necessarily comprising non-operational or low-activity states.

This operational profile is materially different from that of continuously operating industrial plant. Any night-time operation is inherently time-limited and associated with discrete charging or discharging events, separated by periods of inactivity or reduced activity. In addition, cooling system operation is influenced by ambient temperature, and typical night-time temperatures in the UK are lower than the conservative ambient conditions under which BESS equipment is designed and tested. As a result, cooling system operation during night-time conditions is expected to be less intensive than under design-case conditions.

With respect to tonal characteristics, any tonal or readily identifiable components associated with the BESS arise from specific items of plant, such as power conversion equipment or cooling systems, during periods of active operation. These characteristics are therefore inherently intermittent and only occur during defined charging or discharging events. During idle or low-activity states, including mandatory rest periods between cycles, these plant items are either inactive or operating at reduced duty, and associated tonal characteristics are not present. This operating behaviour is consistent with the assumptions adopted in the submitted BS 4142 assessment, which considers tonal audibility during periods of operation but does not assume a continuous tonal noise source throughout the night-time period.

The submitted noise assessment appropriately considers worst-case operational noise levels during periods when the BESS is operating in accordance with BS 4142. The operational constraints described above demonstrate that the assessed noise condition does not represent a steady, continuous noise source persisting throughout the entire night-time period.

6 Conclusion

This Technical Note has clarified the operational duty cycle of the proposed Kirkby BESS in support of the submitted operational noise assessment. The BESS operates in discrete charge–discharge cycles and is subject to inherent design, thermal, and control constraints that limit both the duration and continuity of operation within any 24-hour period.

As a result, the BESS cannot operate as a steady, continuously running source of mechanical noise throughout the day or night-time period. Operational noise is limited to defined charging and discharging events, interspersed with periods of reduced activity or inactivity. This operational context is relevant to the interpretation of the submitted BS 4142 assessment results and directly addresses the Environmental Health Officer's concerns regarding the potential audibility of steady night-time mechanical noise at nearby receptors. In addition, any tonal or readily identifiable noise characteristics associated with the BESS arise only during defined periods of active operation and are not present during idle or low-activity states, such that tonal audibility does not occur on a continuous basis throughout the night-time period.