Lime Down
Solar Park

Environmental Statement

Volume 3, Appendix 3-1: Substations and Battery Energy Storage System Description

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Appendix 3-1: Substations and Battery Energy Storage System Description

1.1 Introduction

1.1.1 Battery storage is a developing technology therefore the Battery Energy Storage System (BESS) layout and final specification is subject to detailed design. For the purposes of environmental assessment, a BESS with an export capacity of up to 500 MW is assumed with a maximum area of 5.5 ha located in Lime Down D. The 400 kV Substation area is assumed to be up to a maximum of 4.25 ha also located in Lime Down D. There are up to four 132 kV Substations up to a maximum of 0.9 ha located in Lime Down A, Lime Down C, Lime Down D and Lime Down E. The description provided below is an assumed maximum basis to allow assessment.

1.1.2 The location of the BESS(s) and substations are shown in **ES Volume 2, Figure 3-1: Indicative Site Layout Plan [EN010168/APP/6.2].**

1.2 Battery Energy Storage System

BESS Area

1.2.1 The BESS Area would contain the following equipment and systems (refer to Annex A):

- Approximately 270 BESS Containers comprising:
  - Battery system;
  - Battery Management System;
  - Liquid cooling Thermal Management System;
  - Fire and gas detection systems:
  - Explosion protection systems:
  - Fire Suppression System (optional); and
  - Power supply distribution system.
- Up to 90 Inverters and 45 Medium Voltage (MV) transformers;
- 33000 V Ring Main Units;
- Power and control cabling; and
- A main control / Supervisory Control and Data Acquisition (SCADA) system for supervision and management of the BESS.

BESS Containers

Batteries

1.2.2 The Scheme anticipates using the Sungrow 'ST5015UX-3H 314 Ah' BESS Containers or similar. Other battery products may be used, however the Sungrow 314Ah provide a maximum envelope for the purposes of landscape and visual assessment and represents a reasonable worse case for the purposes of the noise assessment.

1.2.3 The BESS Container would enclose 314 Ah cells arranged as follows. This would comprise six racks integrated in a 416S12P (twelve parallel pairs x 416 series connections) module. The proposed arrangement reaches a total battery capacity of 5015 kWh per unit.

1.2.4 A Battery Management System would monitor and control the batteries voltage, current, temperature, energy absorption and release, thermal management, and faults. The Battery Management System for each BESS Containers also manages external communication the Energy Management System which monitors and manages the charge and discharge of the overall the BESS.

Thermal Management System

1.2.5 Each BESS Battery Container automatically controls the internal temperature of the enclosure to keep equipment in the operational temperature range (-30℃ to 50℃) with an integrated Thermal Management System controlled by the Battery Management System which regulates the battery system operating temperature. The Thermal Management System is composed of the liquid cooling unit used to control the batteries' temperature.

Fire Suppression System

1.2.6 The BESS the Scheme uses would provide fire and explosion control through:

- Fire and gas detection system to National Fire Protection Association (NFPA) 855 (Ref 1) and NFPA 69 (Ref 2) standards (The current 2023 version of NFPA 855 is due to be updated in 2026 and the Applicant will ensure that the requirements set out in the updated document are implemented for the Scheme);
- Ventilation and flammable smoke exhaust to prevent deflagration; and
- BESS water based fixed suppression system (automatic or dry pipe).

1.2.7 The fire detection system includes heat, smoke, and flammable gas detectors to warn of fire and explosion risk. Should gas detection system be triggered, the exhaust ventilation system, will be turned on to remove the flammable gasses from the BESS Container.

1.2.8 Indicative distances between BESS Containers have been developed in line with the relevant Fire Authority, National Fire Chiefs Council (NFCC) Guidance and NFPA 855 (2023) standards (Ref 1). These are set out within the **Outline Battery Safety Management Plan (BSMP) [EN010168/APP/7.21]** which includes 3.5 m between BESS blocks and 0.9 m between adjacent and back-to-back BESS Containers. These distances will be defined at detailed design in line based on Full Scale Fure Testing (LSFT) of the selected BESS system with input from relevant consultees (namely Dorset Fire and Rescue Service) so as to effectively control fire and allow access for firefighting services.

BESS Control

1.2.9 The BESS Containers control systems would be connected via fibre optic cables to the main BESS control system at the BESS Area, and in turn via a communications link (ethernet) to a nominated off-site command and control point. The operatives here will provide instructions as required to the battery system/s.

1.2.10 The Energy Management System for the BESS Area would be configured to operate in conjunction with the Energy Management / Control system for the Scheme to provide an overall coordinated solution.

Foundations

1.2.11 The foundations would most likely be a concrete piled foundation. Depending on type of soil and presence of clay. Foundation depth can vary up to 4 m. The final depth of the foundations will be determined by site investigations.

1.3 Substations

1.3.1 The substations would contain the following equipment and systems (refer to **ES Volume 3, Appendix 3-3: Illustrative Drawings [EN010168/APP/6.3]** for layouts and elevations):

- 400/132/33 kV power transformers and associated switchgear bays;
- Circuit breakers, disconnectors and earth switches;
- High-level and low-level busbars;
- 400 kV, 132 kV and 33 kV cable connection systems; and
- Current transformers, voltage transformers, earthing transformers and auxiliary apparatus as required.

400 kV Substation

1.3.2 For the purposes of assessment it is assumed that the 400 kV Substation would be configured with 5 transformer bays and 1 feeder bay. At this stage it is

envisaged that a single busbar arrangement with no bus-section or bus-coupler will meet the overall functional objectives of the site. Two 400/132 kV transformers will provide the 132 kV supplies for the locally connected 132 kV substations outgoing 132 kV circuits. Two 400/33 kV transformers will provide the 33 kV supplies for locally connected BESS via a main 33 kV switch room.

1.3.3 The essential auxiliary supplies required for the protection and control equipment would be sourced (under normal conditions) from auxiliary windings provided on the earthing transformers connected to the main 400/33 transformers. An alternative supply from a Distribution Network Operator source for when the National Grid supplies are unavailable and/or for commissioning will also be provided, as well as the facility to connect an onsite standby diesel / hydrogen generator.

132 kV Substations

1.3.4 The132 kV Substations will connect to 400 kV Substation in Lime Down D (refer to paragraph 1.3.2) via dedicated up to 132 kV feeder cables. These smaller substations will comprise of one or two 132/33 kV transformers and their associated switchgear bays. These transformers will provide the 33 kV supplies for locally connected Solar PV systems. The 132 kV Substations would also be interconnected to the 400 kV Substation for protection and control purposes.

Substation Protection and Control

1.3.5 Protection systems for the Existing National Grid Melksham Substation to Lime Down grid connection, the 400 kV substation busbars, the main power transformers, the 132 kV circuits and the main 33 kV switchboard would align with those provided at typical transmission substation sites.

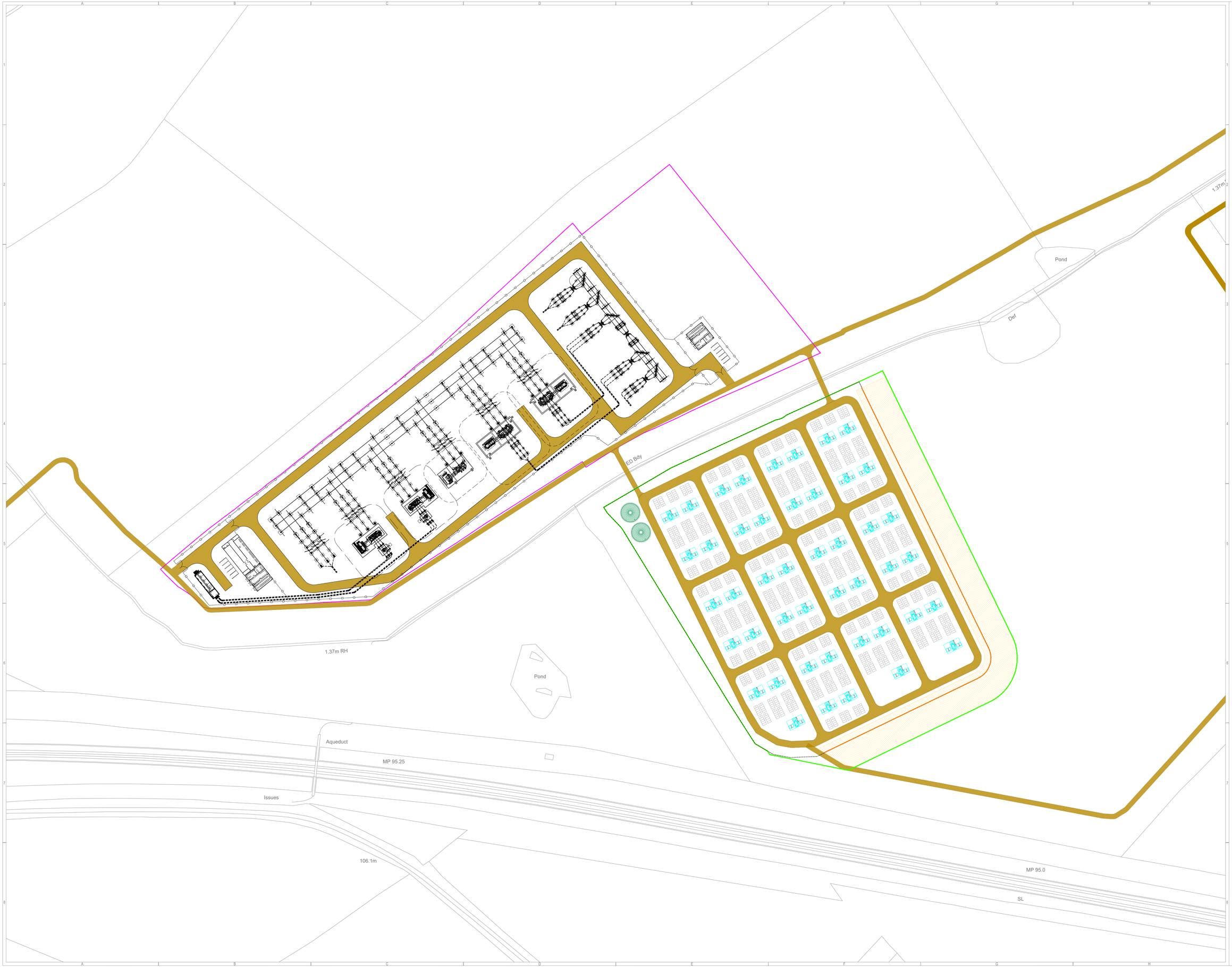
1.3.6 The main substation control system will reside at the 400 kV Substation site and be configured for on-site and off-site control operations. The system will monitor and control all the assets from the interface with National Grid at the existing National Grid Melksham Substation site to the outgoing circuits on the main 33 kV switchboard at the 400 kV Substation site. There will be limited interfaces with the 400 kV Substation and the BESS which will have their own dedicated control and energy management systems.

1.4 References

Ref 1 National Fire Protection Association (NFPA) (2023) NFPA 855 Standard for the Installation of Stationary Energy Storage Systems.

Ref 2 National Fire Protection Association (NFPA) (2024) NFPA 69 Standard on Explosion Prevention Systems.

Annex A Illustrative BESS Area Layout



General Legend:

	BESS Area
	Substation Area
	BESS Unit
	PCS
	Water Tank
	Fence
	Access Track
	Bund
	Acoustic Barrier

Project:	Lime Down Solar Park
Project Location:	Land at Hullavington, Malmesbury, Wiltshire, SN14 6EU
Ownership:	Lime Down Solar Park Ltd
Document Title:	The BESS Area
Sheet format:	A1 "841 x 594"
Scale:	1:1000
Document amendments:	
Comments:	
Company:	Island Green Power UK Limited Unit 25.7, Coda Studios 189 Munster Road, London SW6 6AW

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