Gate Burton
ENERGY PARK

Gate Burton Energy Park Environmental Statement

Volume 3, Appendix 2-A: BESS and Substation Description
Document Reference: EN010131/APP/3.3
January 2023

APFP Regulation 5(2)(a)
Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Gate Burton Energy Park Limited

1. BESS & Substation

1.1 Introduction

1.1.1. Battery storage is a developing technology therefore the BESS layout and final specification is subject to detailed design. For the purposes of environmental assessment, a Storage System with a storage capacity of 500MWh is assumed with a maximum area of 200m x 180m. The substation area is assumed to be up to a maximum of 220m x 130m. The description provided below is an assumed maximum basis to allow assessment.

1.1.2. The location of the BESS and substation is shown on **ES Volume 2: Figure 2-4 [EN010131/APP/3.2]**.

1.2 BESS

1.2.1. The BESS will comprise the following equipment and systems:

- Up to 256 individual battery modules/containers with liquid cooling units;
- Up to 60 4MVA 33000/700V transformers;
- Up to 60 Power Conversion cubicles (AC/DC converters);
- Up to 60 Local Control cubicles;
- Up to 60 33000V Ring Main units;
- Power and control cabling;
- A main control/SCADA control point for the supervision and management of the battery storage equipment; and
- Operational metering CT and VT systems providing continuous data to the Energy Management System.

1.2.2. The battery modules will be arranged in groups of four served by one Ring Main unit, a 4MVA transformer and Power Conversion cubicle. Each group will be interconnected to four groups to provide a 20MVA capacity connection back to main switchboard.

1.2.3. 12-15 groups will be provided for to give an import/export capacity of 140/250MW. The power conversion systems are arranged and capable of both exporting and importing reactive power if required, in accordance with the specific suppliers PQ performance diagram. The performance requirements and operational envelope to be implemented will be agreed at the detailed design stage.

1.2.4. Proposed arrangement uses LFP 280Ah cell type in a 416S10P configuration to reach a total battery capacity of 3,727 kWh per unit. For this design, the turnkey Energy Storage System solution [ST3727KWH(L)-3450UD-MV] includes a [ST3727KWH(L)] BESS and a [Sungrow 3450UD-MV] Power Conversion Station (PCS)]. The PCS can operate across all four quadrants in terms of reactive power up to power factors of 1 leading to 1 lagging.

1.2.5. Batteries and inverters would be replaced approximately every 15 years.

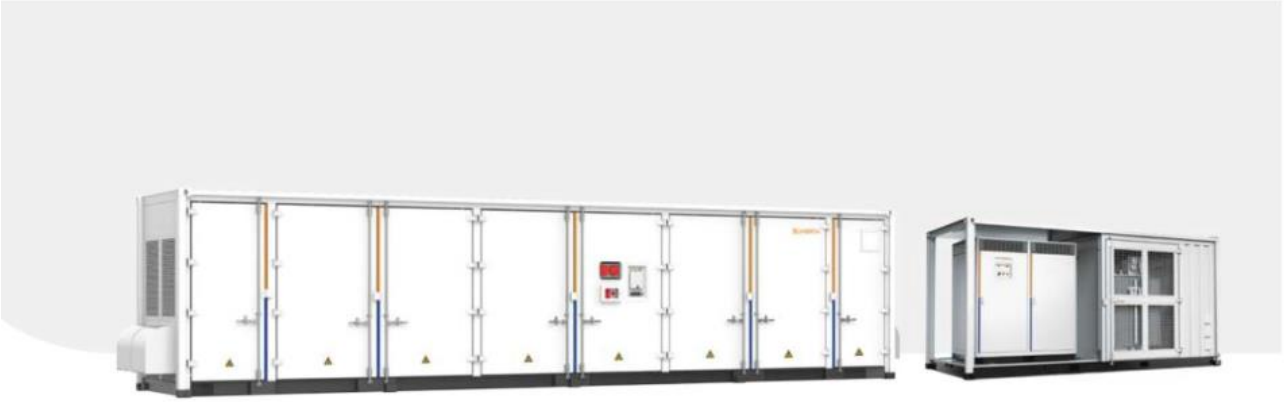


Figure 1 Proposed Power Conversion Station (PCS) Sungrow ST3727KWH(L)-3450UD0-MV

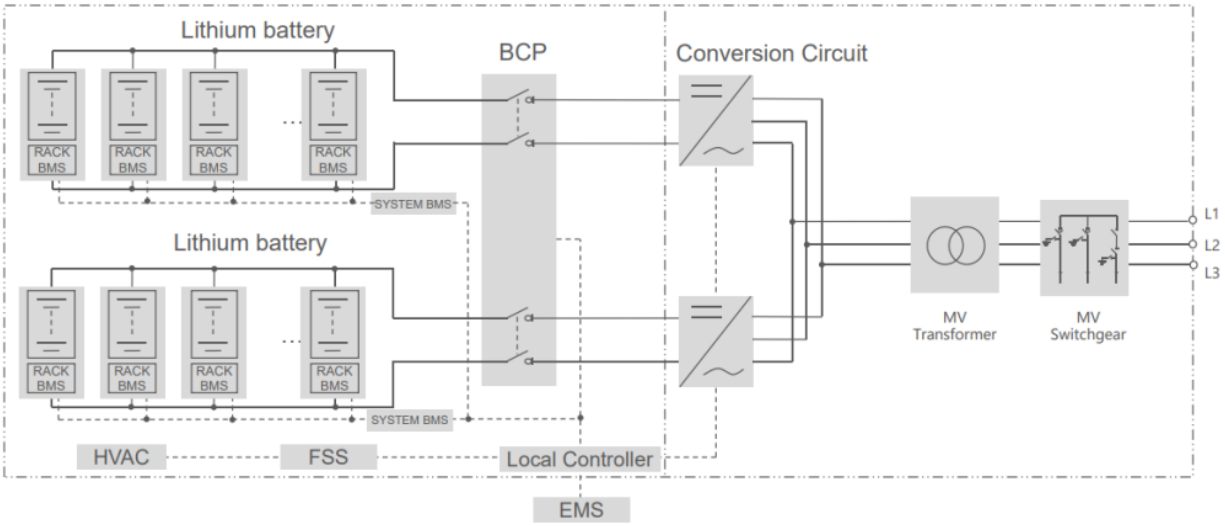


Figure 2 Circuit Diagram of Sungrow ST3727KWH(L)-3450UD-MV Solution

Table 1 Power Conversion Station dimensions

Description	Dimensions
Dimensions (W x H x D) (mm)	6,058 x 2,896 x 2,438 (PCS) 12,192 x 2,896 x 2,438 (Battery Unit)
Weight (T)	16.0 (PCS unit with mV Transformer) 45.5/15.5 (battery unit with/without)
Battery capacity (BOL) (kVAh)	3,727
Battery voltage range (V)	1,123.2 – 1,497.6
Reactive power compensation	Four quadrant operation
Transformer rated power (kVA)	3,450
LV/MV Voltage	0.69 kV / 10-35kV
DC Voltage Range	679V-1500V

Foundations

1.2.6. The foundations will most likely be a concrete piled foundation similar to that shown in Figure 3. Depending on type of soil and presence of clay. Foundation depth can vary up to 2m.

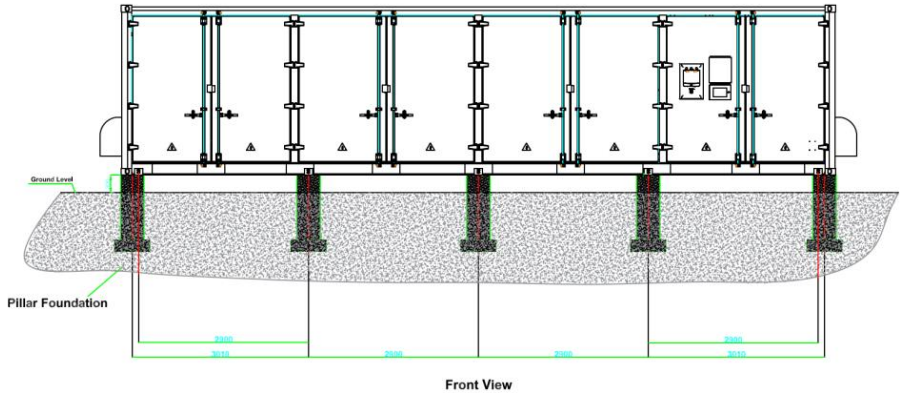


Figure 3 Foundation with BESS container

Cooling System

1.2.7. For the cooling requirement, rooftop cooling capacity are installed for each separated room. Temperature and climate management are analysed in order to design cooling capacity required. Liquid cooling Energy Storage System are under preliminary design [Sungrow ST2236UX and ST2752UX] using LFP cell type and will likely be available ready for construction.

Figure 4 Example rooftop cooling system

Fire Suppression System

1.2.8. Novec1230 extinguishment system is designed according to international standards UL2166, ISO12094 and IMO848/1267. Below is an example of a 100MW/100MWh battery storage area system as installed in the UK. Distances between storage container can vary from 2.0m to 7.0m. This will be confirmed during detailed design and in liaison with the Fire Authority. Refer also to the **Outline Battery Safety Management Plan [EN010131/APP/7.1]**.

Figure 5 Example BESS storage area and 100MWH Storage Capacity

BESS Protection and Control

1.2.9. BESS are provided with their own Energy Management/Distributed control system for the control and monitoring of the individual battery systems, their power conversion units, interface transformers and switchgear.

1.2.10. Each battery group of 4 modules/containers is usually arranged with its own Local Control unit taking in data from/and providing data to, the power conversion unit for that group, the batteries themselves and their cooling systems. Each of the Local Controllers are connected via fibre optic cables to the main BESS control system at the BESS site, and in turn via a communications link to a nominated off-site command and control point. The operatives here will provide instructions as required to the Battery system/s.

1.2.11. The Energy Management system for the BESS site would be configured to operate in conjunction with the Energy Management/Control system for the Solar Park to provide an overall coordinated solution. The Solar Park control arrangement would not be dissimilar to that provided at the BESS site.

1.3 Substation

1.3.1. The Low Carbon 400kV AIS substation will be configured with 4 transformer bays, 1 feeder bay and a spare 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. The essential auxiliary supplies required for the protection and control equipment would be sourced (under normal conditions) from auxiliary windings provide on the earthing transformers connected to the main 400/33 transformer supply from a DNO source when the National Grid supplies are unavailable as well as a facility to connect a standby diesel / hydrogen generator.

Substation Protection and Control

1.3.2. Protection systems for the National Grid Cottam-Low Carbon feeder, the 400KV substation busbars, the main power transformers and the main 33KV switchboard would align with those provided at typical transmission substation sites.

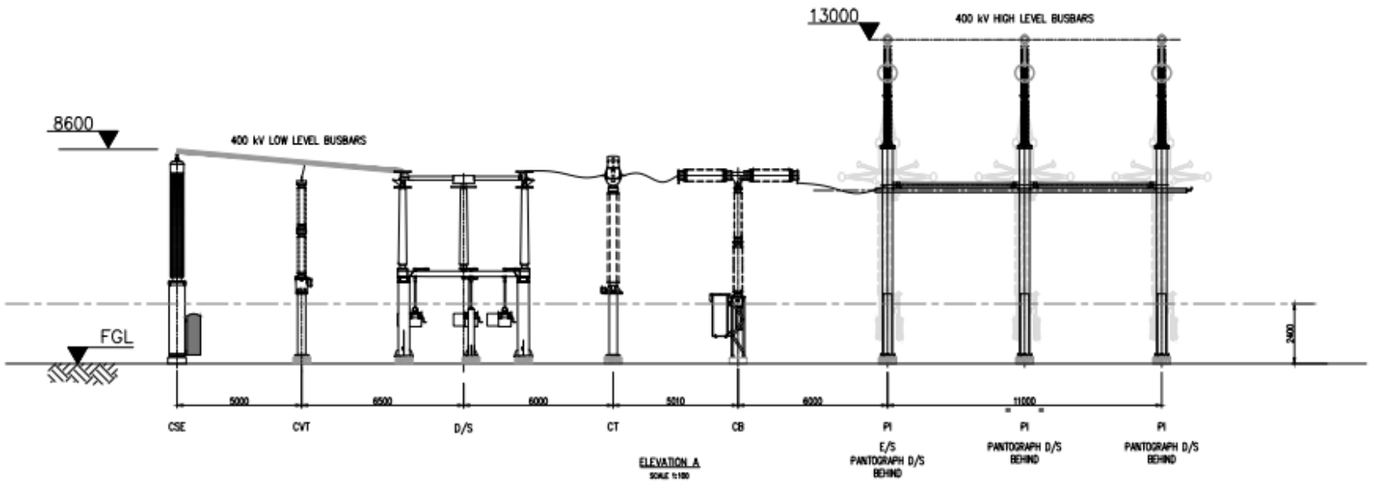
1.3.3. The substation control system will reside at the Low Carbon 400KV site and configured for on-site and off-site control operations. The system will monitor and

control all the assets from the interface with National grid at the National Grid Cottam site to the outgoing circuits on the main 33KV switchboard at the Low carbon site. There will be limited interfaces with the Battery Storage/Solar Park systems which will have their own dedicated control and energy management systems.

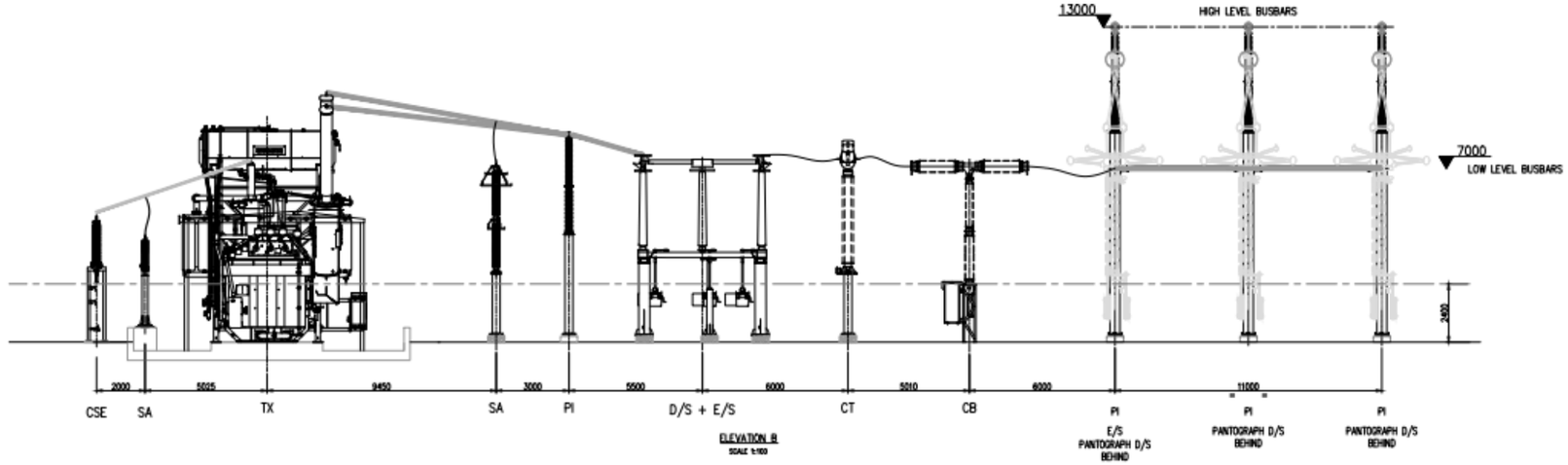
Annex A – BESS and Substation Layout

Annex B – Substation Elevations Views A and B

400kV MINIMUM ELECTRICAL CLEARANCES	
DESCRIPTION	DISTANCE (m)
PHASE TO PHASE CLEARANCE	3.8
PHASE TO EARTH CLEARANCE	2.8
DESIGN CLEARANCE FOR SAFETY (VERTICAL) Dv	5.5
DESIGN CLEARANCE FOR SAFETY (HORIZONTAL) Dm	4.0
INSULATION HEIGHT (PEDESTRIAN ACCESS)	2.4
SAFETY DISTANCE	3.1
MEWP DESIGN CLEARANCE FOR SAFETY (VERTICAL) Dv	7.5
MEWP DESIGN CLEARANCE FOR SAFETY (HORIZONTAL) Dm	6.0



ELEVATION A
SCALE 1:100



ELEVATION B
SCALE 1:100

REV	DATE	DESCRIPTION	DRN	DES	REV'D APP
A	12.01.23	ORIGINAL	EC	EC	MG

OMNIA Projects
The Catalyst, York Science Park, Baird Lane, Heslington, York YO10 5GA
email: office@omniaprojects.co.uk

INDICATIVE ELEVATION VIEWS
SECTIONS A–A AND B–B

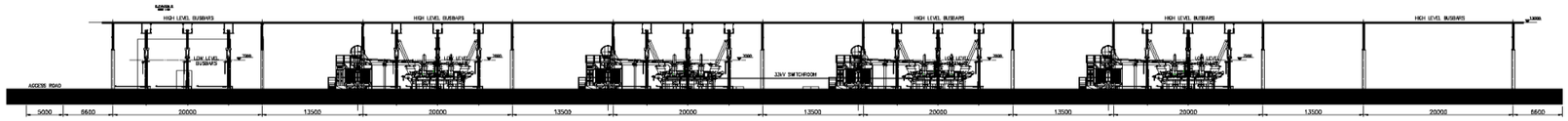
PROJECT NAME	GATE BURTON
CUSTOMER	LOW CARBON
CUSTOMER DRAWING NUMBER	****
STATUS	PRELIMINARY
DRAWING NUMBER	OP-PR01036-LAY001
SCALE	1:100
SIZE	A1
REVISION	A

PRELIMINARY
NOT FOR SITE USE

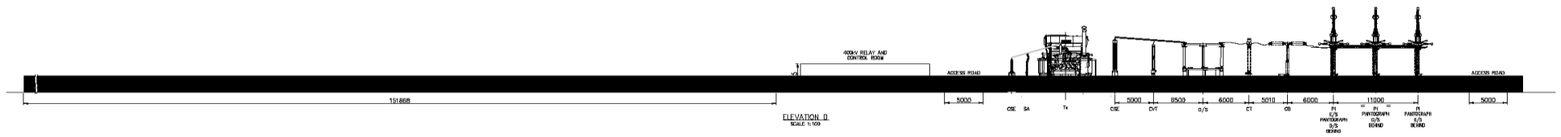
N.T.S. IF PRINTED FROM PDF

Annex C – BESS and Substation Elevation Views C and D

400kV MINIMUM ELECTRICAL CLEARANCES	
DESCRIPTION	DISTANCE (m)
PHASE TO PHASE CLEARANCE	3.4
PHASE TO EARTH CLEARANCE	3.4
DESIGN CLEARANCE FOR SAFETY (VERTICAL) Dse	5.3
DESIGN CLEARANCE FOR SAFETY (HORIZONTAL) Dse	4.8
INSULATOR HEIGHT (PEDESTRIAN ACCESS)	3.4
SAFETY DISTANCE	3.1
MEWP DESIGN CLEARANCE FOR SAFETY (VERTICAL) Dse	7.3
MEWP DESIGN CLEARANCE FOR SAFETY (HORIZONTAL) Dse	5.8



ELEVATION C
SCALE 1:100



ELEVATION D
SCALE 1:100

REV	DATE	DESCRIPTION	DRN	DES	PEER APP
P3	14.12.23	ACOUSTIC FENCE REMOVED	EC	EC	MC
P2	08.11.23	TITLE BLOCK DESCRIPTION AMENDED	EC	EC	MC
P1	28.07.23	PRELIMINARY	EC	EC	MC

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INDICATIVE ELEVATION VIEWS
SECTIONS C-C AND D-D

PROJECT NAME
GATE BURTON

CUSTOMER
LOW CARBON

PRELIMINARY
NOT FOR SITE USE

CUSTOMER DRAWING NUMBER	STATUS
****	PRELIMINARY
OMNIA NUMBER	SCALE / SIZE	REVISION
OP-PR01036-LAY002	1:250 A0	P4