STATERA
BALANCING THE GRID

EAST CLAYDON STORAGE LIMITED

SITE SELECTION PROCESS

December 2023

1 INTRODUCTION

1.1 Purpose of the report

1.1 This report has been prepared by Statera Energy Limited in respect of a proposed battery energy storage system ("BESS") facility at Rookery Farm, Granborough, Buckinghamshire, MK18 3NU. This report has been prepared to summarise the site selection process for the Proposed Development and explain why the East Claydon Site has been selected in preference to other potential locations.

1.2 Primary objective of the scheme

1.2 As the UK transitions to a low carbon future, renewables, particularly offshore wind and solar will become the dominant forms of electricity generation, providing a cheaper, cleaner and greener outlook for future generations.

1.3 The weather dependent nature of renewables means they are inherently intermittent and balancing this intermittent generation on the grid is becoming ever more challenging.

1.4 In order for the UK to achieve its Net Zero targets, far more energy storage, using a variety of technologies, that address different storage duration challenges is required in the UK. These different energy storage solutions are essential to the continued rollout of renewable energy and key to realising the ambitious targets set by the UK Government of achieving a Net Zero economy by 2050 as well as decarbonising the electricity system by 2035.

1.5 BESS facilities provide a means of allowing electricity from the grid to be imported and stored at times of low demand/high generation, which can then be exported back into the grid at times of higher demand / system stress.

1.6 System frequency is also a continuously changing variable that is determined and controlled by the second by- second (real time) balance between system demand and total generation. If demand is greater than generation, the frequency falls while if generation is greater than demand, the frequency rises. If the transmission system is not maintained within the required frequency tolerance system stress can result in widespread power supply issues and damage to network infrastructure.

1.7 BESS are a key part of this energy strategy and provides National Grid (NG) with balancing services to help accommodate the increasing level of renewable energy generation.

1.8 By importing excess renewable energy from the grid and storing it, batteries can capture energy that would otherwise be lost / unutilised.

1.9 During situations when primary power sources (e.g., traditional power stations) are interrupted, BESSs can bridge the gap in production, thus avoiding potential blackouts. It should be noted that the UK electricity network is wholly interconnected and issues in one geographic location can have far reaching implications on the network. Accordingly, BESSs offer additional capacity to deal with system stress and any variations in grid frequency at both a local and national level.

1.10 As has been recognised by NG's System Operability Framework (SOF)[1]: "Faster response is more effective and so less response is needed if speed can be

[1] chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.nationalgrideso.com/document/273801/download

increased." BESSs are able to respond more rapidly than other types of balancing services, as they have no start-up delays. As such BESSs can balance the real-time requirements of the national grid more efficiently.

1.11 The Proposed Development has come forward following the Government's reform of the Nationally Significant Infrastructure Project ("NSIP") process through the Infrastructure Planning (Electricity Storage Facilities) Order 2020 (the "Storage Order") aimed at reducing barriers to investment and delivery of large BESS over a 50 MW capacity.

1.12 The Government considers that larger capacity BESS developments are crucial to meeting the countries overall Net Zero 2050 target. As well as its target to decarbonise the power system by 2035, this will require a substantial growth in renewable energy generation, along with electricity storage to balance the intermittent generation from renewables, and stability services to keep the national grid stable.

1.13 To be most effective in contributing to the country's targets, the proposals need to be of a large capacity (i.e., over 50MW) and located in an area where there is a significant need for new capacity to support renewable energy generation.

1.14 These factors have driven the site selection process and the scale and types of technology proposed.

2 SITE SELECTION

2.1 Transmission versus Distribution grid connection

2.1 To understand the locational requirements of the Proposed Development, it is important to explain the difference between the various parts of the electricity network in the UK. This principally comprises two aspects: the transmission network and the distribution network. The Proposed Development seeks to provide support to the transmission network, as the transmission network needs large volumes of system services to meet its System Security & Quality of Supply Standards legal requirements.

2.2 Within England, transmission is classed as 275kV and 400kV, whereas distribution is classed as 132kV and below e.g., 11kV, 33kV, 66kV and 132kV.

2.3 The transmission networks move large volumes of electricity at a national level from where it is generated to the main regional substations. For efficiency purposes and due to the long distances involved, this is done at high transmission voltages (275kV and 400kV). By contrast, distribution networks take electricity from the transmission system and deliver it to the regional factories, schools, houses etc. This is done at lower voltages ranging from 11kV, 33kV, 66kV and 132kV, as distances are shorter, and the volume of electricity required is lower.

2.4 Figure 1 shows that the national transmission system covers all of England, Scotland and Wales.

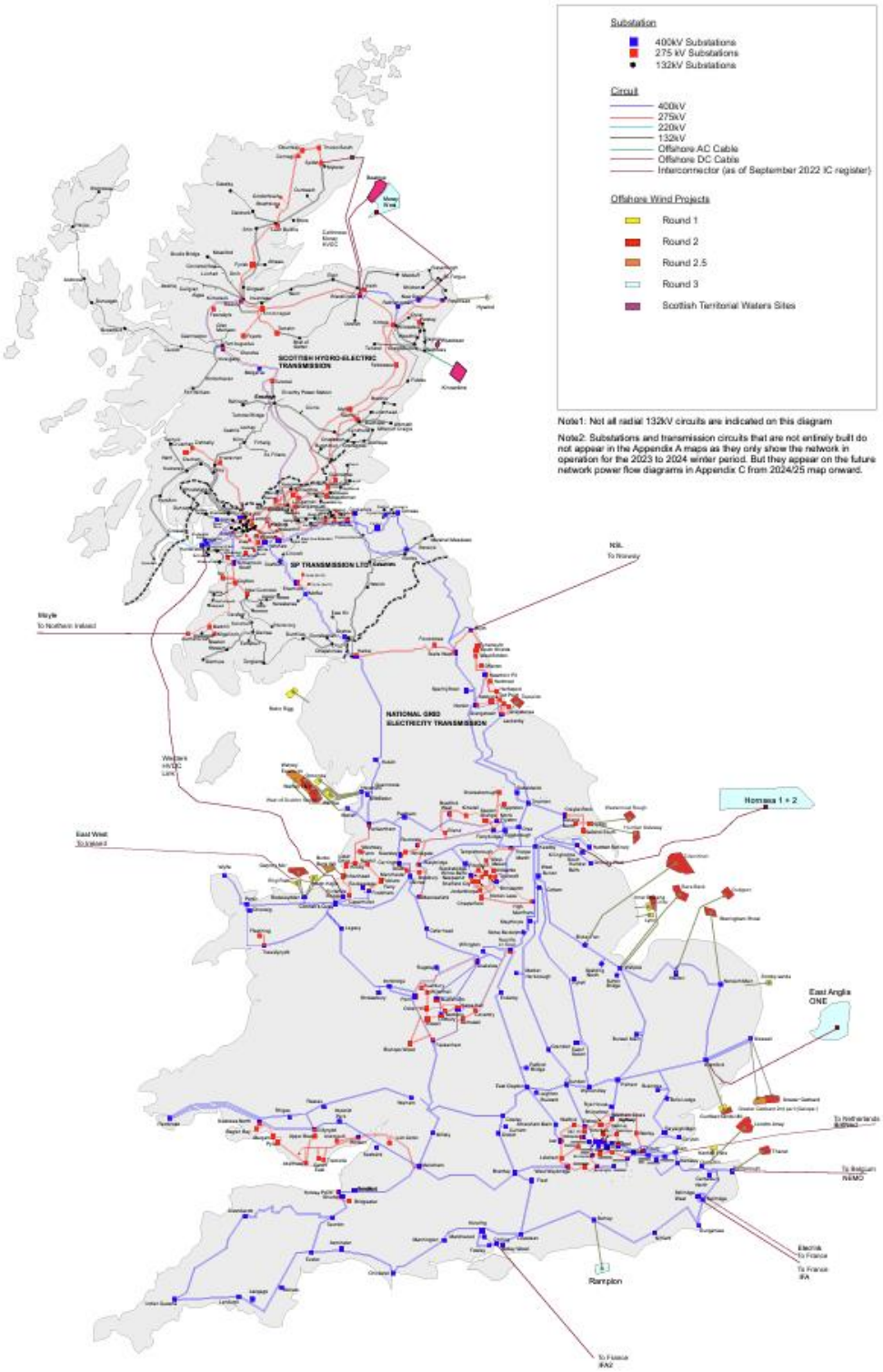

Figure 1: Map of the GB existing transmission system[2]

[2] chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.nationalgrideso.com/document/294511/download

2.5 Connecting directly to the NG transmission system (275kV / 400kV) means large volumes of MW (active power) and MVAr (reactive power) can be imported and exported, along with providing large volumes of MWs (Inertia), Hz (frequency) and kA (fault current) to support the transmission network, making transmission connection the only connection method for large scale BESS.

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2.7 By contrast, a distribution connection does not have the capability to support all the key requirements needed by National Grid to meet their legal requirements under the System Security & Quality of Supply Standards.

2.8 Figure 2 compares the grid services that can be provided when connecting to the transmission rather than the distribution grid system.

Ancillary service	Distribution	Transmission
Capacity market (MW)	✓	✓
Frequency support (Hz)	✓	✓
Reactive power (MVAr) transmission voltage support	X	✓
Inertia (MWs) Grid stability support	X	✓
Fault current (Ka) Grid stability support	X	✓

Figure 2: Ancillary services availability for Distribution v Transmission connections

2.9 Before the Energy White Paper (CD105)[3] was issued in December 2020, the majority of BESS developments were kept under the 50MW limit to avoid having to seek consent via the longer and more costly NSIP process. The Government realised that this cap was holding back much needed large scale BESS development, and so decided to remove the cap to facilitate the delivery of large-scale BESS schemes, which led developers to target transmission, rather than distribution grid connections.

2.10 As a result of cost and complexity, a 50MW grid connection (and up to 100MW) is normally connected at a distribution network level, whereas large >100MW+ BESS are connect to the transmission network, as only the higher rated (275kV and 400kV) grid has the capacity to manage the large volumes of power flows.

[3] chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://assets.publishing.service.gov.uk/media/5fdc61e2d3bf7f3a3bdc8cbf/201216_BEIS_EWP_Command_Paper_Accessible.pdf

2.2 Key selection criteria

2.11 To meet the primary objectives of the scheme, the following key selection criteria were applied:

- **Located in a region where there is a need for voltage and power flow support** – this is important to replace generation from traditional coal and gas plants and manage voltage issues arising from the increasing generation from renewable energy sources
- **Connection to the National Grid transmission networks 275/400kV** – In order to deliver the greatest benefit, connection to the transmission system is required. The 275/400kV network is generally used to transmit energy from its source to areas of demand. To maximise the benefits of the Proposed Development, it is important to connect large scale BESS to a 275/400kV grid substation. The 275/400kV transmission network often suffers from voltage and stability issues. BESS help to address these issues.
- **Three or more 275kV and 400kV circuits** – National Grid designs the network for an n-1 condition e.g., assuming a single outage of any one circuit, thus a substation with two circuits will only be considered to have one-circuit (for load flow purposes) as the second circuit will be considered switched-out. However, a substation with three circuits, using the n-1 condition, will have two circuits for load flow considerations, thus having more delivery capability to the grid system. As the Proposed Development delivers large volumes of services to the grid, after load flow evaluation, three or more circuits are required to accommodate these large service volumes and maximise the benefit to the transmission network.
- **Available grid connection by 2030** – to enable the Government to reach its 2035 net zero carbon electricity target.
- **Located within a heavily constrained transmission area** – to provide the greatest level of support to the national grid, the project should be located within an area of the national grid transmission network which is heavily constrained due to high loaded circuits.

2.12 Along with meeting the primary objectives there are a number of site-specific considerations also taken into account when locating the Proposed Development, these are set out below:

- **Adjacent to an existing National Grid substation** – to reduce the amount of overhead cabling or trenching linking to the substation and minimise electrical losses through the connection.
- **Site size large enough to accommodate 500 MW BESS infrastructure** – to optimise the capacity of the connection and to encourage investment to support the commercial viability of the scheme;
- **Acceptability of environmental and planning constraints (e.g. Green Belt, agricultural land classification, ecological/landscape designations, heritage assets, flood risk, etc.)** – due to the location near substations, the potential sites will be located away from urban areas and will have some planning and/or environmental constraints. These will need to be understood and balanced to ensure the substantial benefits of the scheme can be delivered, whilst minimising and mitigating any potential harm;

- **Physical and visual separation from residential properties and settlements** – to reduce any potential adverse impacts to amenity and local character; and
- **Ease of access to the site for construction** – to reduce impacts to the local highway network and to reduce the construction timescale to help achieve 2026 grid connection.

2.3 The location searches.

Step 1 – Identifying future national needs.

2.13 In the next decade the GB Electricity Transmission System will face growing needs in a number of regions.

2.14 Required transfers across Scottish boundaries are expected to almost triple from today to 2030.

2.15 Required transfers across North Wales boundaries are expected to quadruple between 2027 and 2032 to a maximum of 11 GW. Large amount of generation, including new offshore wind generation is expected to connect in this region.

2.16 In the East Anglia region, growth in low-carbon and renewable generation over the next decade will continue, potentially reaching a total installed capacity of over 13GW by 2030, up from 5.5GW today.

2.17 Interconnector and storage capacity is anticipated to exceed or match transmission connected generation in the South of England by 2020/ This will cause network flows in the region to be heavily dependent on interconnector flow condition and could bring large swings in power transfer which will need to be carefully managed.

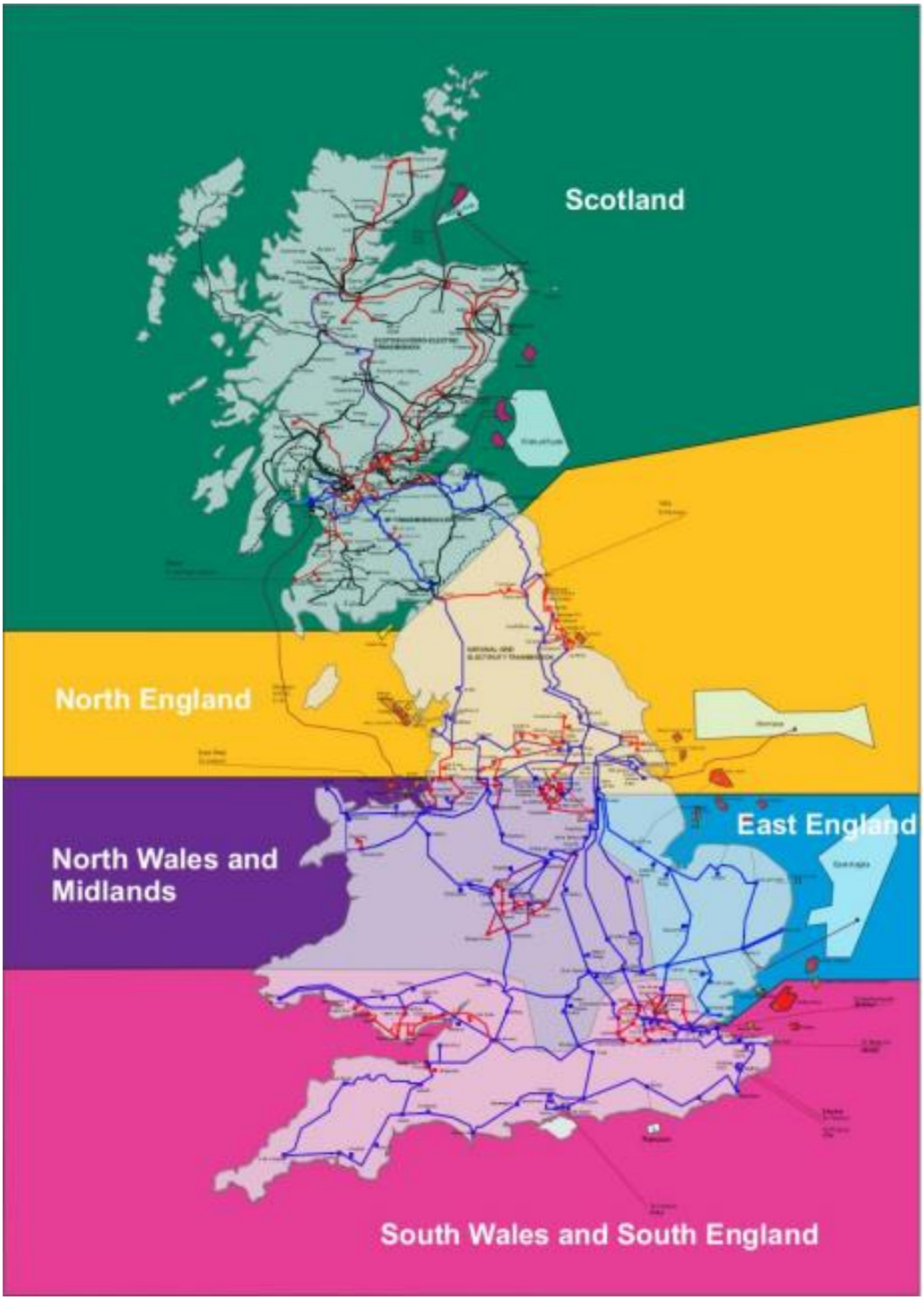

Figure 3: Extract from National Grid Electricity Ten Year Statement (2022) showing the National Electricity Transmission System (NETS) spilt into regions.

2.18 As we continue the transition towards a low carbon economy, renewable energy is ever more prominent as the lowest cost form of electricity generation for consumers. At the same time renewable energy is helping to ensure security of electricity supply for the United Kingdom while providing a cleaner, greener outlook for future generations.

2.19 With a higher proportion of our energy sourced from renewables, it is becoming increasingly challenging to balance the UK electricity system because of the intermittency of wind and solar output. For example, in summer months on bright, windy days it is not uncommon for too much electricity to be generated, whereas on cloudy wind-less days in winter months there may be a shortfall. In each case, National Grid, acting as the System Operator, will need to take balancing actions to ensure that supply meets demand.

Services that can be provided:

- *Frequency response* – The balance between supply and demand of electricity is reflected in the grid frequency (50Hz in the UK), and it is National Grid's role as system operator to keep the system in balance. If supply exceeds demand, the frequency rises above 50Hz, if demand exceeds supply, frequency falls below 50Hz. Most electrical devices require frequency to be in a certain range – if frequency goes outside of this range for a prolonged period of time the UK can encounter black-outs or electrical devices, such as televisions or computers, will turn off to protect themselves. Our batteries can respond in sub second times to dynamically balance supply and demand on a second-by-second basis, providing a valuable tool to National Grid in helping to "keep the lights on".

- *Renewables integration* – Due to their nature, batteries can both supply energy when demand outstrips supply, but also absorb energy when supply exceeds demand (such as excess wind or solar), meaning this energy is not wasted, but stored to release when required.

- *Capacity Market* – If a major power plant, such as a large nuclear reactor or large gas generator, fails during the depths of winter, this could potentially lead to blackouts across the country unless other generation can be brought online to replace the power lost by the failed plant. Capacity Market participants provide these back-up services.

2.20 BESS's facilities open the door for more solar and wind power to be added to the grid while maintaining grid stability, enabling a green low carbon future. This does not necessarily mean more renewables in the immediate area/region but nationwide.

2.4 The B9 Boundary - Midlands to South of England

Step 2 – Identifying the Region with the greatest need for voltage and power flow support

2.21

2.22 The B9 boundary separates the northern generation zones and the southern demand zone.

2.23 Developments on the east coast and the East Anglia regions, such as the locations of offshore wind generation connection and the network infrastructure requirements, will affect the transfer requirements and capability of boundary B9.

2.24 In all four scenarios set out by National Grid, the requirements gradually increase to above the boundary capability for B9. The increase is more than last year showing a need for additional boundary capability in the future for three out of the four scenarios.

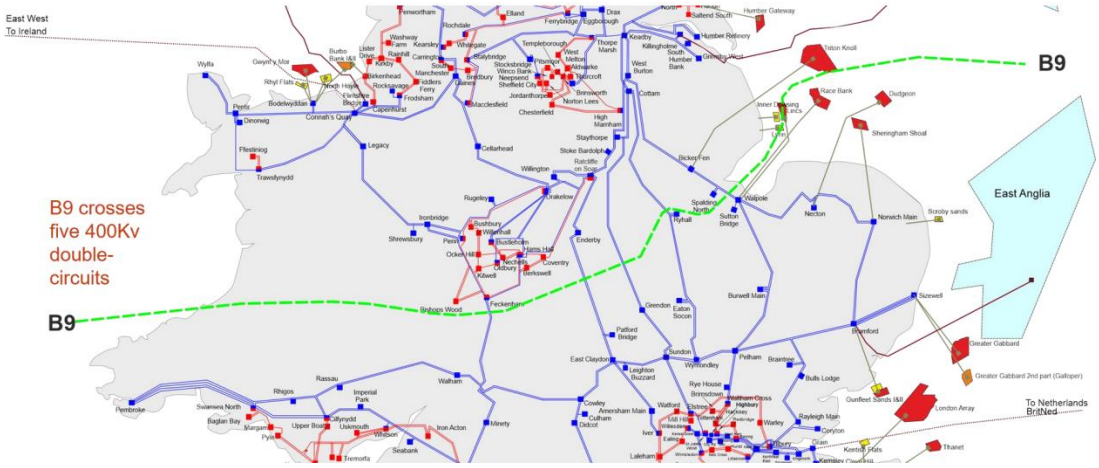

Figure 3. *Extract from National Grid 2023 ETYS B9 Boundary – Midlands to South of England*

2.25 BESS provide a combination of fast responding electricity storage and generation to help balance the intermittent nature of renewables and the growing demand of the UK population. They work best located to the centres of demand, providing stability, resilience, and energy security to the UK's electricity system.

2.26 Considering the key messages in Step 1 and the significant amount of existing and new generation highlighted in Step 2, the B9 boundary area was identified as being the part of the National Grid with the great need in the coming decade.

2.5 How did we select the East Claydon National Grid substation?

Step 3 – Identifying regional strain

2.27 The following requirements are particularly important when selecting the most suitable grid connection point (substation) with the Southwest region:

- Connection into the National Grid 400kV network.
- Availability of 400kV circuits.
- Located within a heavily constrained transmission area.
- Potential to secure a pre-2030 grid connection.

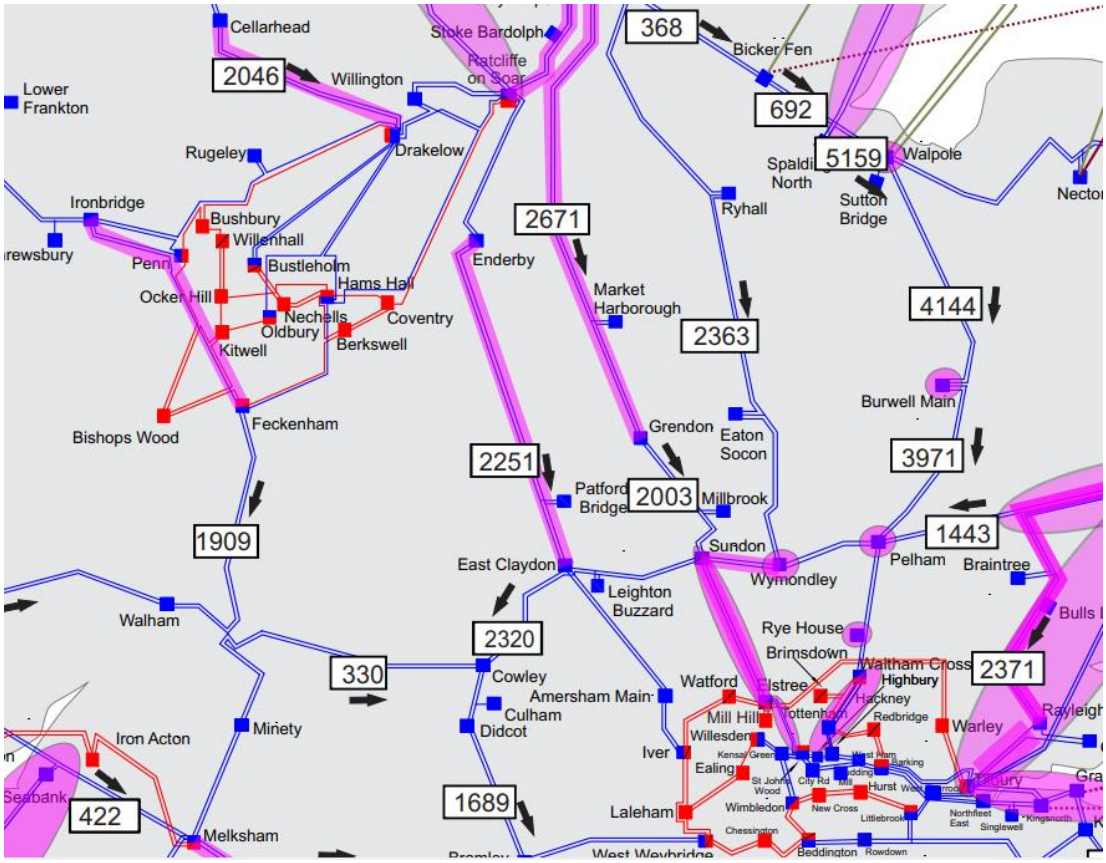

Figure 4 - Extract from National Grid 2023 ETYS Appendix C showing the expected 2030/31 National Grid system

2.28 Figure 4 shows that East Claydon is a substation that National Grid has indicated needs a new circuit/network changes by 2030/31.

Availability of a 400kV circuit

2.29 The East Claydon National Grid substation has a 400 kV circuit, which has enough capacity to allow large power flows. The provision of BESS at this location will help manage the future strain on the NG Southwest area by providing large amounts of MW (active power for use by the consumer), MVAr (reactive power for voltage support), MWs (Inertia for system stability) Hz (for grid regulation) and kA (fault current for system stability).

2.30 The Substation can accommodate the transfer of large amounts of electricity to and from the Proposed Development at a viable cost, which will provide valuable support to the grid, protecting customers at times when high demand places stress on the local and national electricity network.

Available grid connection

2.31 The applicant holds an agreement with National Grid Electricity Transmission (NGET) to connect its BESS to East Claydon GSP substation. This agreement states

a connection date in Q3 2026. For NGET to facilitate the connection it is required to expand the existing substation which is subject to its own consenting and land optioning requirements.

2.32 There are various obligations on both NGET and the applicant to develop and progress the project to keep the proposed connection date. i.e., the applicant is required to prove it is developing the project which includes obtaining a planning permission.

2.33 Should the Council be minded to approve the application, the applicant is requesting a 5-year implementation condition instead of 3 years. If a consent was granted in 2023, 3 years would expire in 2026 presenting a very tight construction programme based on a grid connection in Q3 2026. Notwithstanding this, there is always the risk that NGET (outside of the applicants' control) delays the connection date. If this were to happen there is an even greater disconnect between the implementation date and the grid connection date.

2.34 The National Planning Practice Guidance indicates that a "longer time period may be justified for very complex projects where there is evidence that 3 years is not long enough to allow all the necessary preparations to be completed before development can start". This applies to the proposed development given a delay at National Grid's end could render it impossible for the developer to make sufficient preparations (e.g., large equipment orders; contractor appointments) to construct development within 3 years of being granted consent.

2.35 Consequently, the 2026 grid connection will contribute towards meeting the Government's net zero targets and also supporting secure and cheaper energy to the public, with these significant benefits resulting from this location.

Figure 5: East Claydon National Grid substation

2.6 How did we select the Site?

Step 4 – Identifying the most suitable site

2.36 In addition to finding the most suitable substation, the following criteria for the site were considered to assess whether there were any suitable sites that could viably connect to the Substation:

- As close to an existing National Grid substation as possible;
- An area large enough to accommodate up to 500W BESS infrastructure;
- Acceptability of environmental and planning constraints (e.g., Green Belt, agricultural land classification, ecological/landscape designations, heritage assets, flood risk, etc.);
- As much physical and visual separation from residential properties and settlements as possible; and
- Ease of access to the site for construction.

2.37 The Proposed Development has been strategically chosen for its location adjacent to the East Claydon substation, which lies northwest of the site. Given the scale of the Proposed Development it is not possible to connect directly into an overhead line. This would be prohibitively expensive and ultimately costly to consumers. It has to connect directly into the substation and therefore the closer to the substation the better. This in turn reduces the length of cables, ensuring an efficient and viable connection to the National Grid, minimising electrical losses, disturbance and costs.

2.38 Short runs of underground grid connection also significantly minimise construction-related disruption and reduce electrical losses making the project more viable.

2.39 The key environmental and planning considerations in the vicinity of the Proposed Development are shown in Figure 6 below.

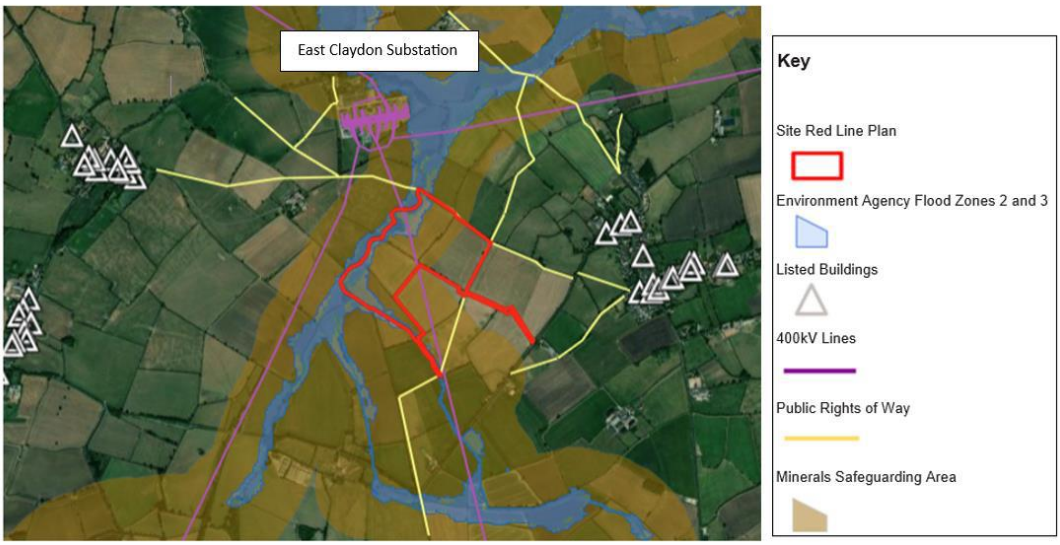

Figure 6 – Key environmental and planning considerations in the vicinity of East Claydon substation

2.40 The Vale of Aylesbury Local Plan (September 2021) indicates that the whole of the site lies within the Granborough Neighbourhood Plan area (made 2022).

2.41 According to The Vale of Aylesbury Local Plan the site is within the zone of influence of two SSSI and 5 local nature reserves, shown in Figure 7 and include.

- Winslow Conservation Area
- Shipton Conservation Area
- Middle Claydon Conservation Area
- North Marston Conservation Area
- Botolph Claydon Conservation Area

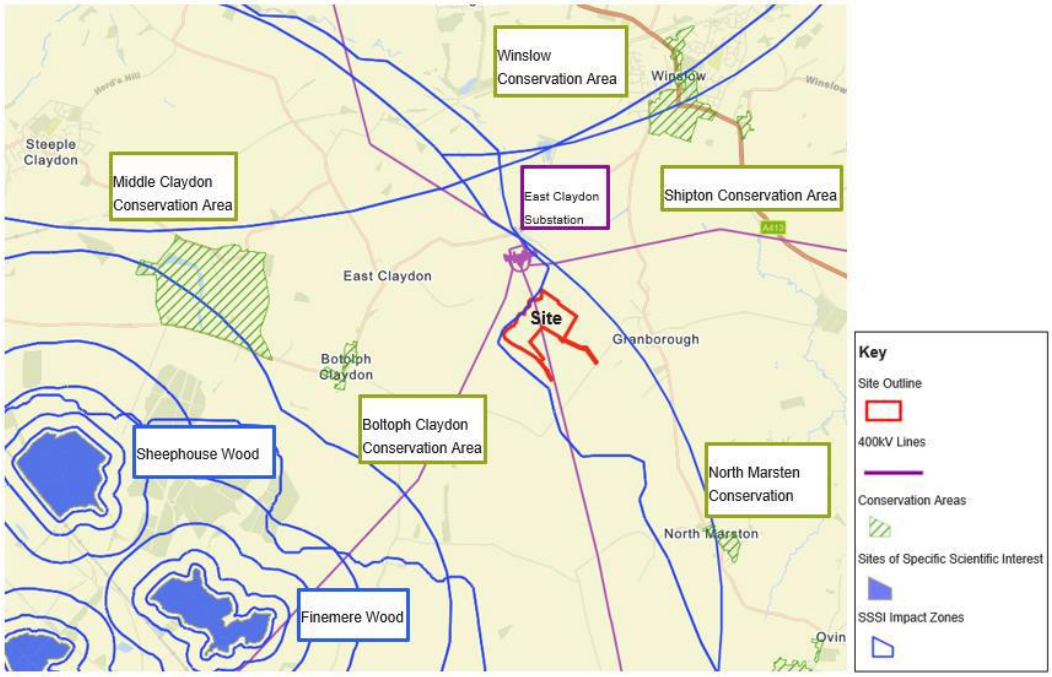

Figure 7 – Key environmental and planning considerations in the vicinity of East Claydon substation

2.42 Nearby residential properties are located at Granborough adjacent to Hogshaw Road some 500m to the west of the site, and at Hogshaw Road immediately opposite the proposed site access. East Claydon substation is some 75m distance at closest point, Sion Hill farm is circa 415m to the east.

2.43 The Proposed Development is situated away from existing settlements. Furthermore, as explained in the Landscape and Visual Impact Assessment, the Site would only be visible from a limited number of publicly accessible viewpoints.

2.44 There are a number of listed buildings within the wider area of the Site, in the villages Granborough, Botolph Claydon and East Claydon, viewpoints from these building have been assessed in Chapter 6 Built Heritage.

2.45 The site is accessed from the south by an access onto Hogshaw Road. Two public rights of way (PRoW) sit adjacent to the site (GRA/2/1 and GRA 2/2), one bounding the site to the north and the other running to the east of the proposal site boundary, these two PRoW routes intersect near to the northeastern corner of the proposal site.

2.46 A significant portion of the site is located within a Mineral's Safeguarding Area (MSA) for clay, silt, sand and gravel.

2.47 The land proposed is currently farmed for arable crop production. The farmer can diversify their current business by supporting this proposal, whilst maintaining the exiting farm business.

2.48 The entirety of Proposed Development is located on grade 3b agricultural land (see the Agricultural Land Classification Report submitted with the Application). The Proposed Development Site comprises 33.2 hectares of farmland and is of sufficient size to accommodate the infrastructure required for the 500MW capacity BESS, as well as the access road, onsite drainage and landscape enhancements.

2.49 The construction program is anticipated to last 18 months, the short construction program enables the 2026 grid connection.

3 CONCLUSION

3.1 Statera has carried out a thorough site selection process to identify a suitable site for the Proposed Development. Each site was assessed against criteria that were specifically identified to ensure that the primary objectives of the scheme could be met.

3.2 The process of site selection began by identifying the future national needs. The NGESO 2022 ETYS 2030/31 power flow map clearly identifies the B9 area as a region needing voltage and power flow support in the coming decade. Developments on the east coast and the East Anglia regions, such as the locations of offshore wind generation connection and the network infrastructure requirements, will affect the transfer requirements and capability of boundary B9. East Claydon substation was identified along with a number of other 400kV substations to need a new circuit/network changes by 2030/31.

3.3 In identifying the most suitable grid connection point (substation) within the Midlands to South of England region, Statera considered the ability to connect to either the National Grid 275kV or 400kV networks, the availability of three or more 275kV or 400kV circuits, the availability of grid connection before 2030, and a location within a heavily constrained transmission area.

3.4 In addition to finding the most suitable substation, Statera also considered the proximity of sites to an existing National Grid substation, a site of sufficient size to accommodate the infrastructure, the acceptability of environmental and planning constraints, the physical and visual separation from nearby properties and settlements and site access for construction.

3.5 For the reasons above the Proposed Development site was selected.