Design Principles Statement

Thurrock Flexible Generation Plant

Application document number A8.4

APFP Regulations reference 5(2)(q)

Quality Management

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Approval for issue

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THURROCK POWER
A Statera Energy company

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1 INTRODUCTION

1.1 Purpose of this document

1.1.1 This Design Principles Statement has been prepared as part of the application by Thurrock Power Ltd (the Applicant) for a Development Consent Order (a DCO), that has been submitted to the Secretary of State (the SoS) for Business, Energy and Industrial Strategy (BEIS), under section 37 of the Planning Act 2008 (as amended) (the PA 2008), in respect of the proposed development (the Application).

1.1.2 Thurrock Power proposes to develop a flexible generation plant on land north of Tilbury Substation in Thurrock. The flexible generation plant will provide up to 600 megawatts (MW) of electrical generation capacity on a fast response basis, together with up to 150 MW of battery storage capacity.

1.1.3 Schedule 1 of the draft DCO (application document A3.1) identifies the development for which development consent is being applied for and for which this Design Principles Statement has been prepared.

1.1.4 A DCO is required for the proposed development as it falls within the definition and thresholds for a Nationally Significant Infrastructure Project (an NSIP) under sections 14 and 15(2) of the PA 2008.

1.1.5 Regulation 5(q) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 states that applications must be accompanied by any other documents considered necessary to support the application.

1.1.6 This Design Principles Statement is intended to serve two purposes.

1.1.7 Firstly, it provides an overview of the design evolution and site constraints, showing examples of masterplan layouts that were considered by the applicant, and demonstrating that the indicative design makes the best use of available space while avoiding unnecessary additional land-take.

1.1.8 Secondly, it describes the principles of design that have informed the indicative layout and elevation drawings (application document references A2.7 and A2.8). The indicative drawings will be subject to further design and approval by Thurrock Borough Council prior to construction.

1.1.9 It is proposed that the final design will have regard to the general principles described in this document and to any further specific design points that may be agreed with Thurrock Borough Council. One design point concerning the colour palette of cladding has been discussed in pre-application consultation and is recorded here.

1.2 Thurrock Power Ltd

1.2.1 Thurrock Power is a subsidiary of Statera Energy Limited, a private British company that develops, builds and operates flexible electricity generating plant in the UK.

1.2.2 Statera Energy was established with the aim of delivering increased flexibility for the UK electricity system to assist in the transition to a low carbon economy in the expectation that renewable energy sources, such as solar and wind, will become the dominant form of generation of the future.

1.2.3 Thurrock Power will be a fully integrated developer, owner, and operator of the proposed Thurrock Flexible Generation Plant.

1.3 The Proposed Development

1.3.1 In overview, the proposed development comprises the construction and operation of:

- reciprocating gas engines with rated electrical output totalling 600 MW;
- batteries with rated electrical output of 150 MW and storage capacity of up to 600 MWh;
- gas and electricity connections;
- creation of temporary and permanent private access routes for construction haul and access in operation~~, including a causeway for barge deliveries~~; and
- designation of exchange Common Land and habitat creation or enhancement for protected species translocation and biodiversity gain.

1.3.2 This Design Principles Statement concerns the ‘main development site’ on which the gas engines, batteries and associated gas and electrical equipment would be constructed.

1.4 Site Description

1.4.1 The proposed development site is located on land south west of Station Road near Tilbury, Essex. The British National Grid coordinates are TQ662766 and the nearest existing postcode is RM18 8UL. It is within the administrative area of Thurrock Borough Council and lies in the Thurrock Green Belt.

1.4.2 The application boundary and location of the proposed development are shown in the Location and Order Limits Plans, application document A2.1.

1.4.3 The main development site for the generating plant and battery storage facility currently comprises open fields crossed by drainage ditches and three overhead power lines with steel lattice electricity pylons. Land for access routes ~~(including causeway for barge deliveries during construction)~~ and connections to the gas and electricity grid within the Order Limits comprises farm land, previously developed industrial sites, and the north bank of the River Thames.

2 SITE CONSTRAINTS

2.1.1 The main development site presents various constraints that influence the scheme layout, principally:

- the existing overhead powerlines that will influence which areas of the site can be constructed upon and how structures are oriented;
- the ecological value of existing ditches to the site boundary;
- the flat topography of the site and surrounding landscape means that any tall structures will be clearly visible both close to the site and further away;
- the location of the site in relation to the Tilbury Substation;
- the available site area and adjacent land uses.

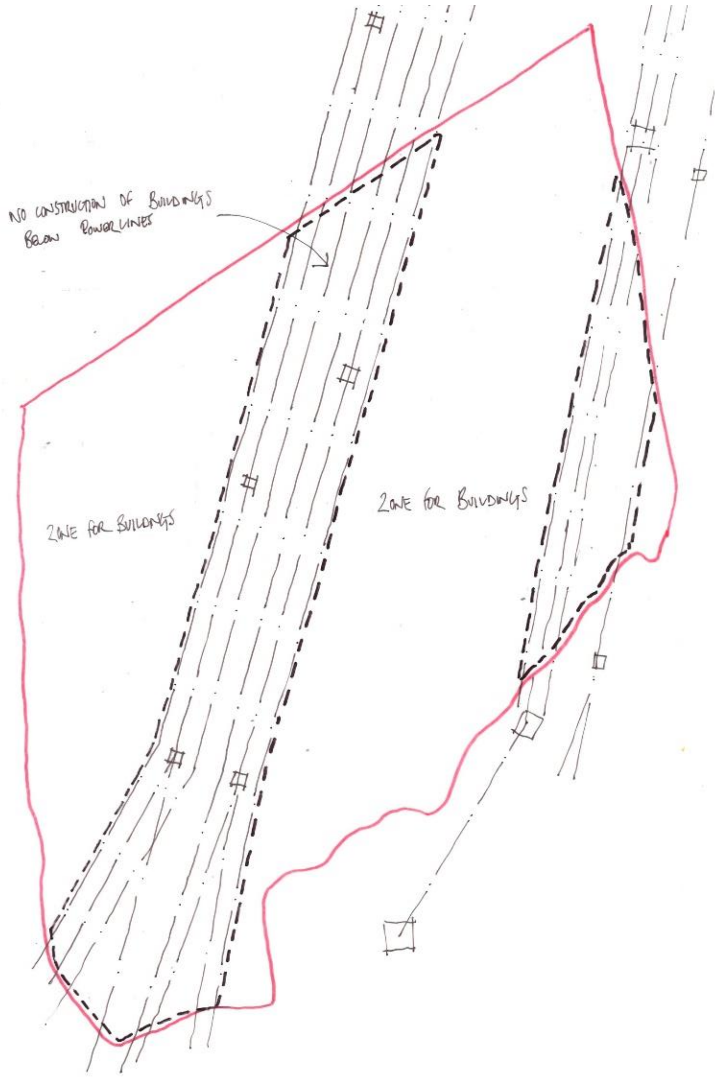


Figure 1: Sketch showing areas below powerlines

2.1.2 A large section of the site footprint is located below existing high-voltage powerlines as identified in Figure 1. It is undesirable to construct buildings within these zones due to limitations of the use of cranes both during construction and routine maintenance. These areas would therefore be more suited to access roads, low level soft landscaping and ponds for water run-off attenuation, therefore minimising 'wasted' land between overhead pylons where taller structures cannot be erected.

2.1.3 The sketch plan also clearly highlights two linear zones that run north-south which would be suitable for locating the various structures that will be required including engines houses, stacks and the battery farm.

2.1.4 The linearity of the two zones also lends towards the repetitive nature of the gas reciprocating engines, which ideally should be positioned in rows in order to make the most efficient use of the space and also pipework and ducting routes.

2.1.5 The positioning of the stacks will again be influenced by the powerlines. It is required that stacks are located a distance of at least 1.5 times their height away from any powerline. This offset provides a clear zone with a suitable factor of safety built in should there be an event that causes a stack to fall.

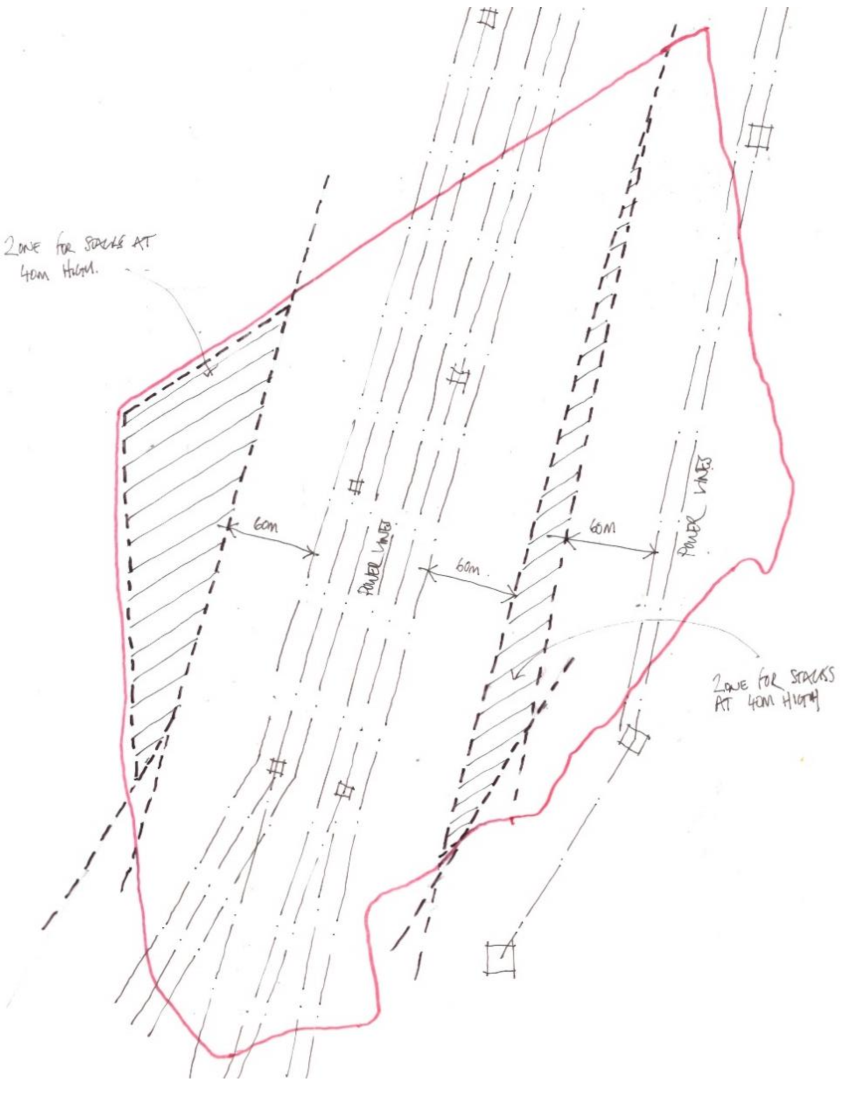


Figure 2: Potential stack locations

2.1.6 The proposed stacks have a height of 40m and therefore a 60m offset will be required. Figure 2 gives an idea of how this looks on the site plan and identifies two quite limited areas for locating the stacks.

2.1.7 However, the zone again runs north south and therefore allows the stacks to be orientated similarly, reducing the visual mass when viewed from higher ground to the north, or from the coast path and river to the south.

2.1.8 Consultation early on with National Grid Asset Protection identified the requirement for a 15m clear zone to the base of all electrical towers to avoid potential impacts on their foundations during construction and to allow for routine maintenance of the towers when required.

3 DESIGN EVOLUTION

3.1 Concept Layout

3.1.1 The concept sketch below, Figure 3, identifies the initial site layout in response to the various site constraints previously highlighted.

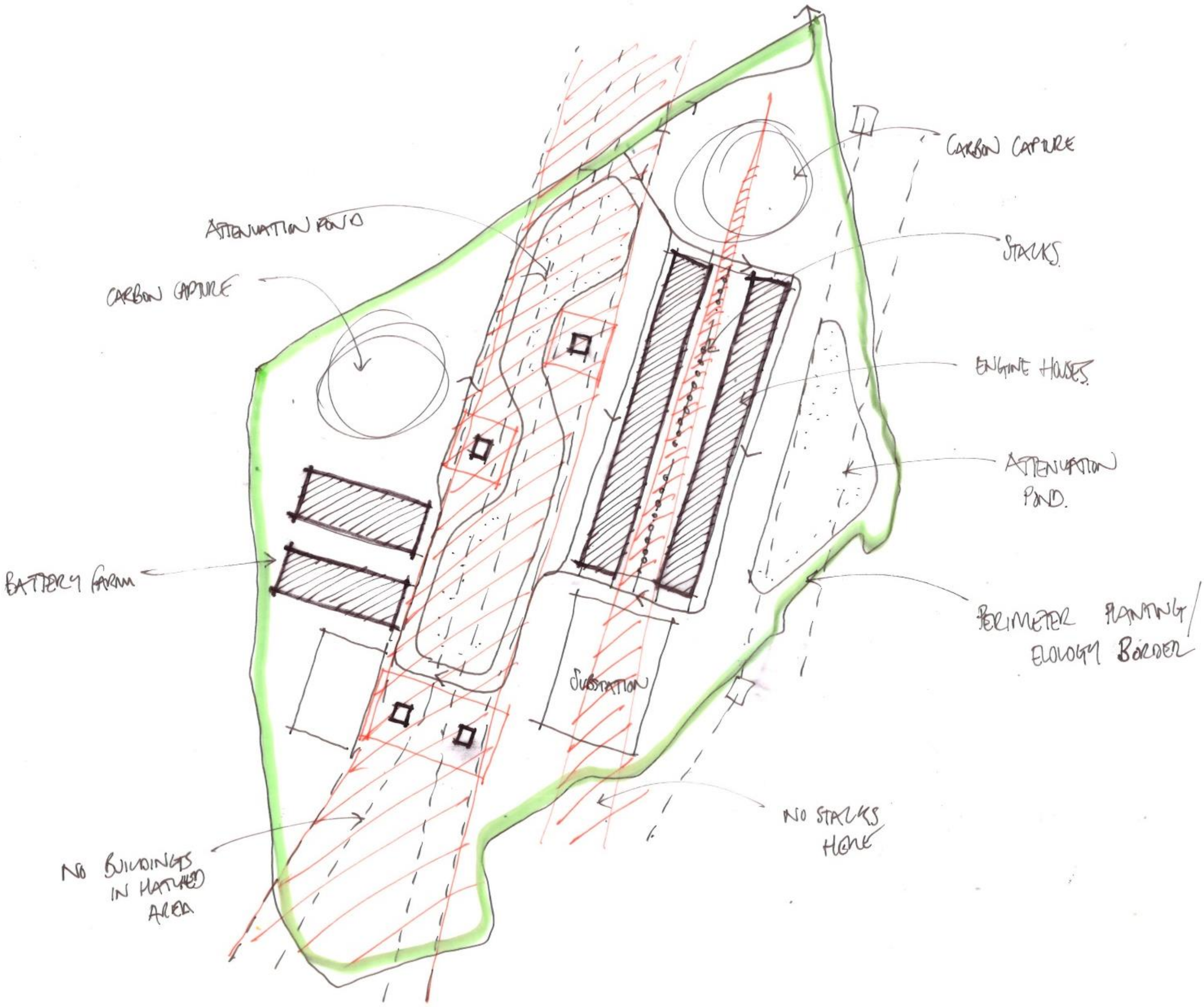


Figure 3: Concept site sketch

3.1.2 The linearity of the powerlines and the developable areas that area created by the clearance zones around them lends to a north south oriented scheme in two distinct zones which can be separated by soft landscaping below the electrical lines. The two zones correspond well with the proposed development which comprises two main elements with their associated equipment – power generation with the gas reciprocating engines and power storage with the battery system.

3.1.3 As previously identified, it is logical to locate each of the customer substations (serving the gas engines and batteries) as far south as possible within the site to minimise the length of the HV electrical connection to Tilbury Substation

3.1.4 It then follows that the engine houses and batteries should be located adjacent to their associated customer substations if possible, i.e. immediately north of the substations. Engine houses are positioned to the east where the linear site footprint lends to their repetitive nature, as the stacks that accompany them can be positioned neatly in the space created when offsetting the powerlines by the clear 60m safety zone.

3.1.5 The smaller battery houses or containerised units are then located to the western site where they can be positioned to make best use of the more irregular space available, as the layout of the smaller battery houses or containers is more flexible than the larger gas engines.

3.1.6 The incoming gas compound has been located adjacent to the entrance in the north nearest to the incoming gas connection pipeline, again to reduce the extent of the connection required.

Figure 4: Indicative carbon capture layout

3.1.7 The carbon capture equipment (CCR) has been positioned in the remaining available land parcels to the north and north-west. These two areas are irregular in footprint which lends itself to the CCR, which is reasonably flexible with how it can be laid out in plan, as shown in Figure 4 (from the Carbon Capture Readiness Report, application document A7.6). The CCR area at the north-west of the site makes most efficient use of the available land between the proposed development and consented Tilbury2 development adjacent to the west.

3.1.8 A key aspiration at the concept site layout stage, defining where to locate the main elements of the development and the land-take necessary, was to locate the scheme as close as possible to the existing Tilbury Substation to the south of the site. This is to minimise the grid connection distance and minimise sprawl in the Green Belt by being as close to the existing built-up industrial development as possible. As shown in the following design evolution section, this has been achieved largely within the site area sketched at the concept stage and retains a substantial corridor of open land between the main development site and railway to the north.

3.2 Design Evolution

3.2.1 A simple zonal plan of the site is indicated in Figure 5. The final scheme layout still essentially reflects this high level plan, however the scheme has evolved as the design has developed.

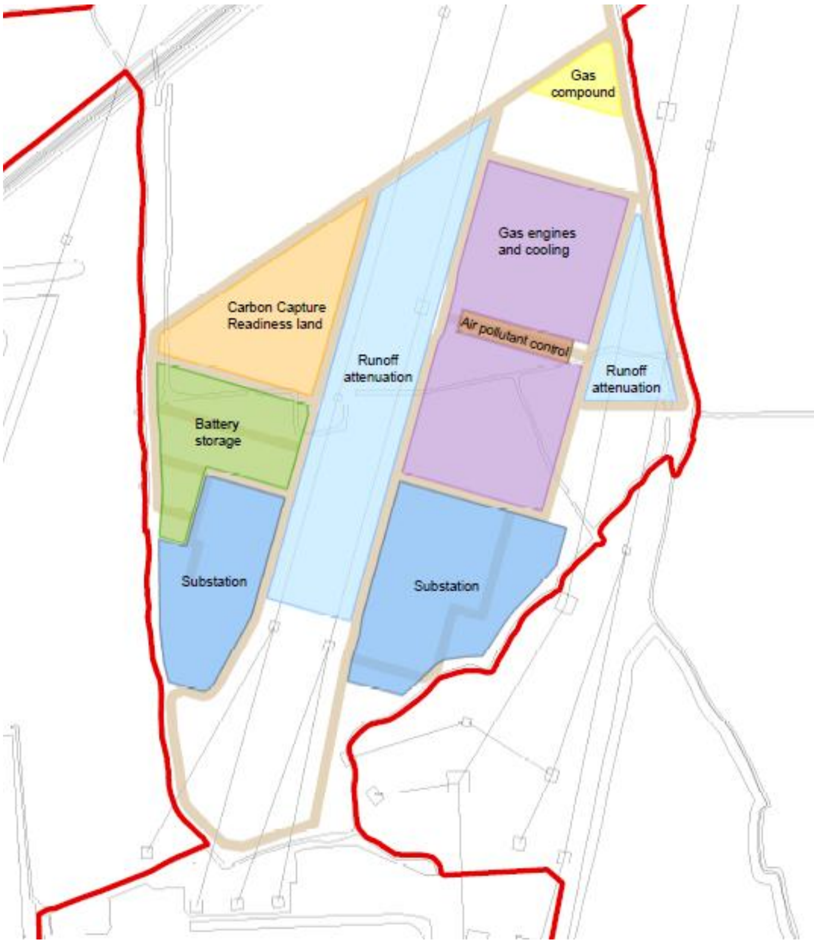


Figure 5: Sketch of site zones

3.2.2 Figure 6 on the next page shows one of the first site layouts. The layout responds well to the constraints that the site presents and follows the concept sketch, however it became apparent that there was insufficient space for the carbon capture equipment to the north as well as access issues to the engine houses as a result of the location. In addition access routes and substations required rationalising.

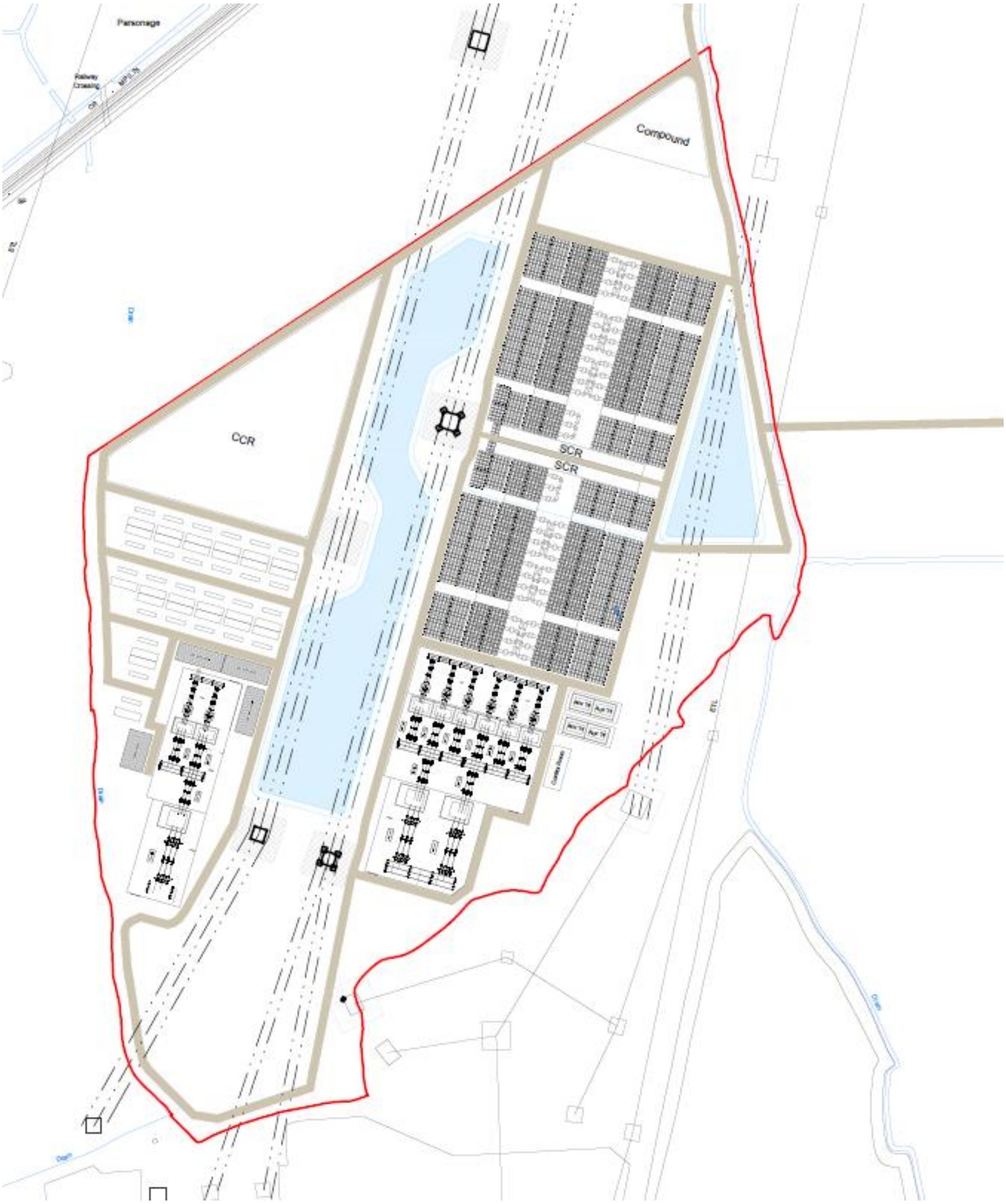


Figure 6: Early site layout

3.2.3 Various options were investigated in an attempt to free up additional space for the carbon capture equipment and to provide better access for maintenance to the engine houses, in particular the requirement for craning engines in or out of buildings if required. The image below shows a solution which frees up additional space overlaid over the previous option. Space is gained by reducing the number of engines houses and the access routes between them. The radiators are also relocated to allow access to the front of each engine house.

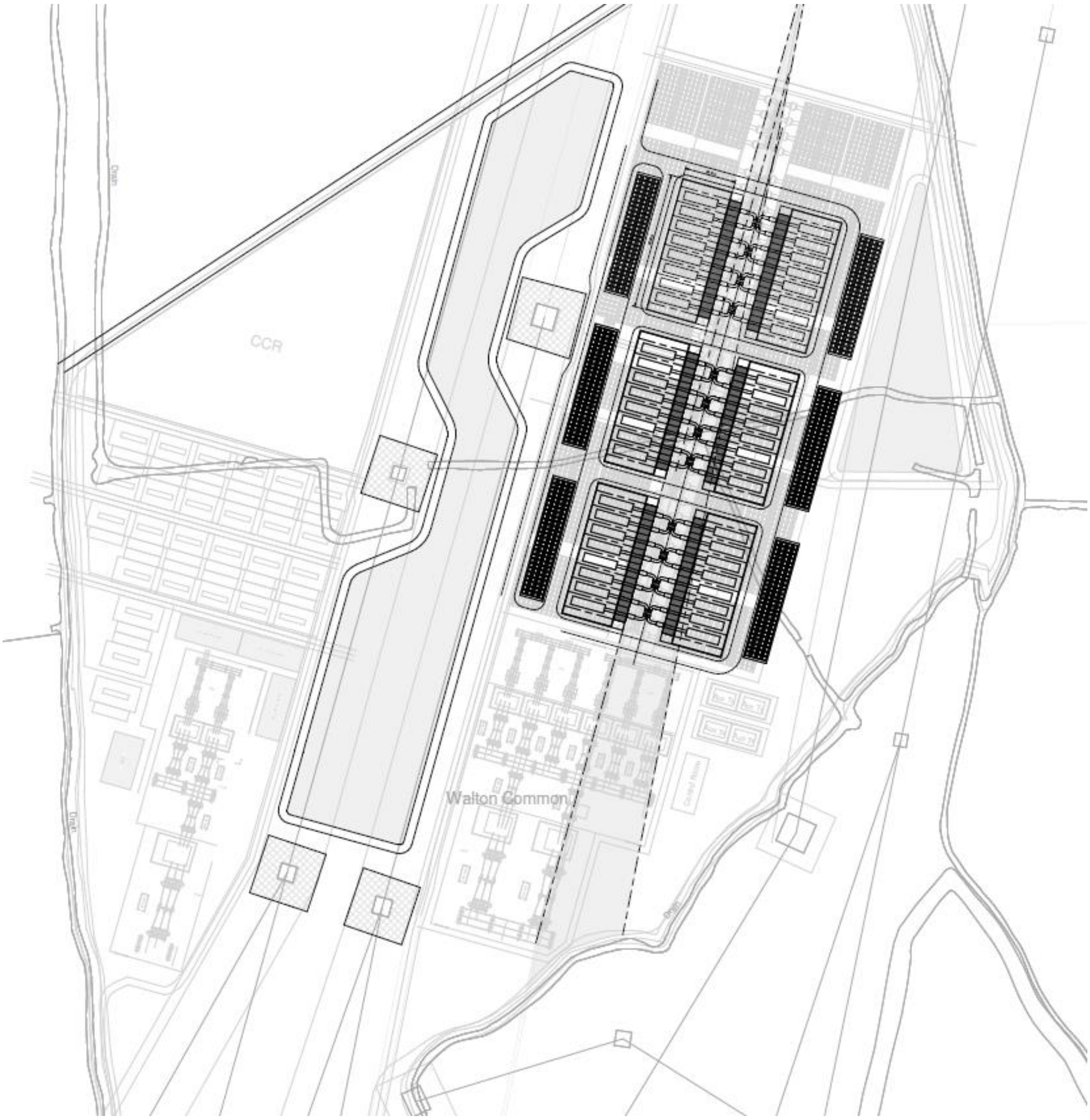


Figure 7: Simplification of engine houses

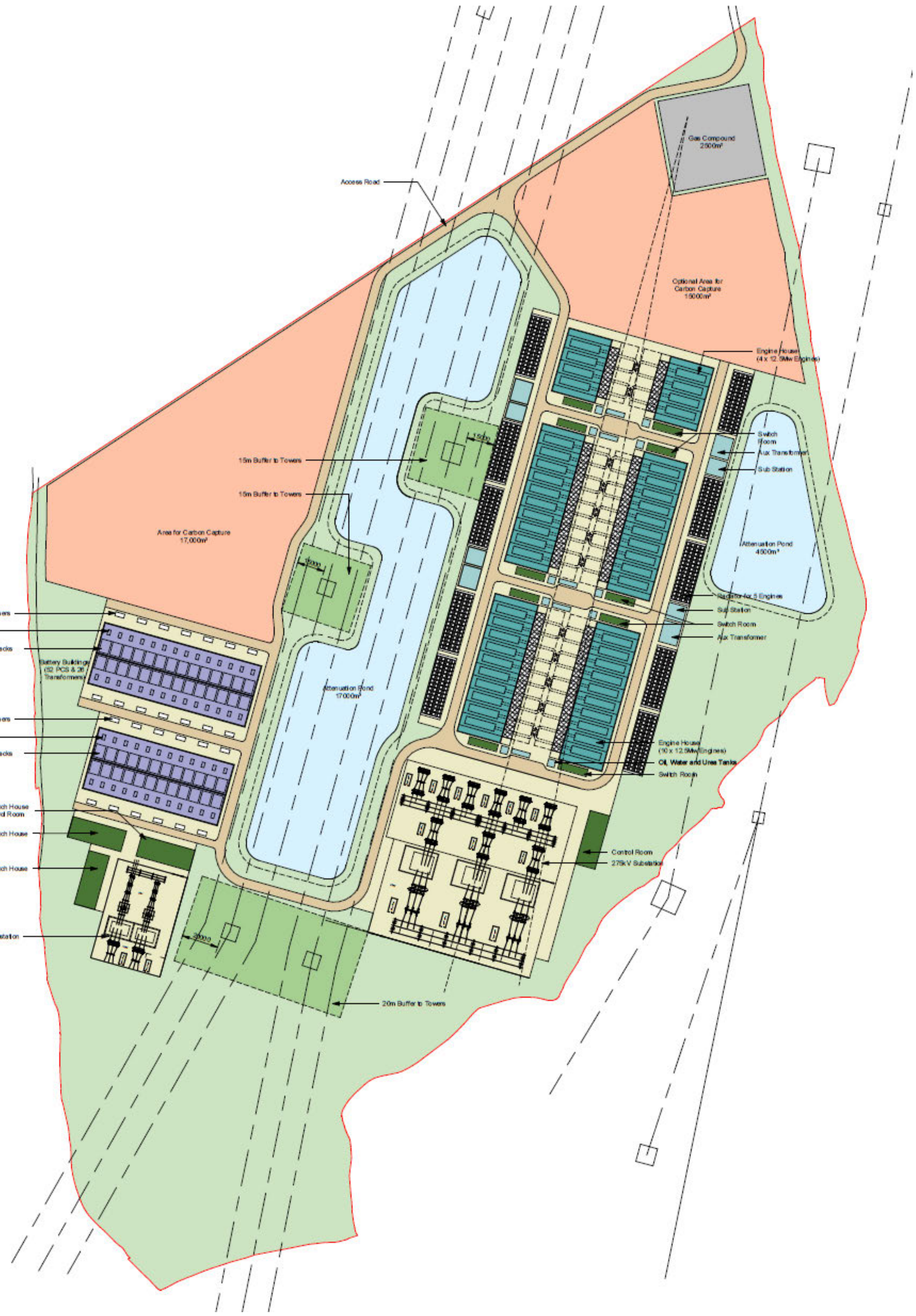


Figure 8: Later scheme option

3.2.4 Further rationalisation of the high voltage substation layouts and access routes is shown above as well as options for installing the batteries within larger battery house structures rather than the containerised solution. Soft landscaping is also proposed to the southern part of the site to retain reptile habitat, which is not suited for the development's buildings due to the low clearance of the powerlines as they connect down into Tilbury Substation.

3.2.5 A 5m undeveloped zone inward of the site boundary ditches is provided in this layout to protect water vole habitat from disturbance.

3.2.6 Figure 9 shows one of the final four illustrative site layouts for the application (see plans in application document A2.7). Four options were designed to accommodate two potential choices of gas engine sizes (either 48 engines of around 12.5 MWe capacity or 33 engines of around 18.5 MWe) and the choice of containerised batteries or battery buildings. As noted above, the CCR area in the final indicative designs also makes use of a small land parcel available between the proposed development site and Tilbury2 development.

Figure 9: One submitted illustrative design option

3.3 Stack Layout

3.3.1 The stack height will ultimately be set in accordance with the environmental permit requirements, based on air pollutant dispersion modelling, but will be no greater than 40m. Various options have been investigated in an attempt minimise the visual impact of the stacks, which could total up to 48 in number.

3.3.2 Individual exhaust stacks (one per engine) and several clusters of stacks serving multiple engines have been considered. Figure 10 indicates how locating stacks individually will create a ‘sea’ of stacks that may be more visually apparent, even though each stack is individually less visible than a clustered stack with greater diameter. A layout with individual stacks would also require the buildings to be staggered in order to keep the stacks within the clear zone between the overhead power cables. Grouping the stacks into 4-6 at a time would create more order, allowing them to be placed in a single line of fewer apparent structures, thereby potentially reducing their visual impact even though each is thicker and more substantial in appearance. Either option is within the design envelope defined for the assessment of visual impacts in the Environmental Statement.

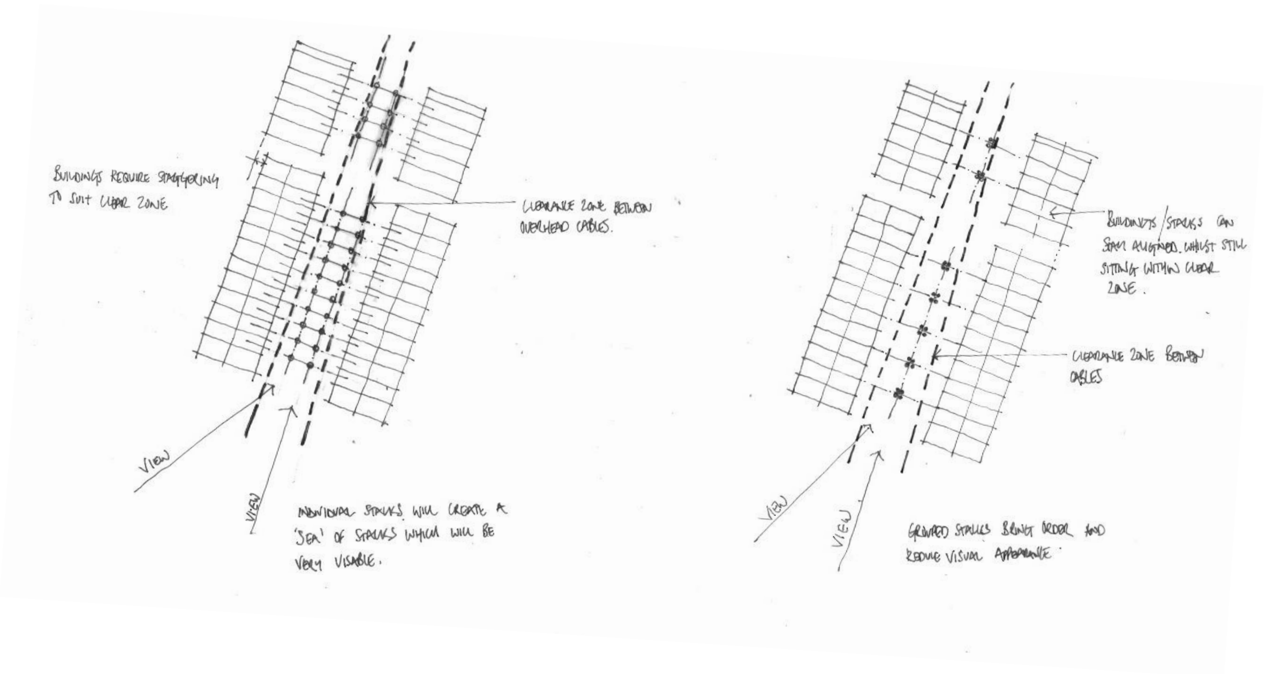


Figure 10: Sketch showing option for grouping stacks

3.4 Elevation treatment

3.4.1 The Illustrative Cross Section Plans (application document A2.8) show indicative elevations for the gas reciprocating engine houses and battery storage houses or containers. Buildings forms are proposed to be simple, with pitched roofs and considered façade treatment.

3.4.2 At this stage, the gas reciprocating engine houses and battery houses are proposed to be clad in a profiled metal cladding system. In consultation, Thurrock Council has recommended[1] that the colour pallette agreed for major buildings of the nearby Tilbury2 development could be adopted for Thurrock Flexible Generation Plant. The Tilbury2 palette is a certified document (Schedule 11 of the Tilbury2 Order) with ref. no. PoTLL/T2/EX/160 and is reproduced in Figure 11, below.

3.4.3 Thurrock Power Ltd wishes to work proactively and in consultation with Thurrock Council to develop an external vocabulary that is considered to be best suited to its context in the Green Belt.

3.4.4 It is proposed to minimise the visual mass of the buildings throughout the site by means of horizontal tonal colour banding. Subject to discussion, this could be fading from dark green (RAL 6002) to light green (RAL7032) vertically and then finished with a light grey (RAL 000 90 00) at eaves level similar to that shown in Figure 12 below. The green fade would sit well within the low marsh and grazing context and the light green will provide a neutral tone when viewed against the sky. This treatment would be common to all larger structures on site, with smaller containers being RAL 6002.

GENERAL SPECIFICATION FOR COLOURS AT TILBURY 2

All colours are proposed as standard RAL colours

It is required that a minimum of 2 main cladding colours are used for structures within the Order limits, with a minimum of 1 detail colour used for entrance / loading doors / building entrances / canopies.

Paint finishes will remain necessarily subject to the technical specification and safety needs of the structure, including:
- colours can be locally deviated from the pallet for safety purposes.
- in the marine environment, colours must be the best match to the cladding palette that can be reached within the context of the water and scour protection requirements of those structures.

	MAIN CLADDING PALETTE	DETAIL PALETTE
Above 6.0M* AOD	RAL 000 90 00, RAL 230 80 20, RAL 240 50 20, RAL 7032, RAL 240 60 05	RAL 4009, RAL 4004
Below 6.0M* AOD	RAL 6018, RAL 6037, RAL 6002, RAL 6011, RAL 110 30 20	RAL 070 60 60, RAL 060 50 70

*Note: Marine structures will be coloured depending on specific heights.

Figure 11: Colour Palette

[1] Correspondence with Matthew Gallagher, Principal Planner (Major Applications) dated 09/07/19

Figure 12: Use of colour banding to reduce visual mass

3.4.5 Figure 14 provides an illustration of how colours from the recommended palette and use of banding could be applied to a concept design for building massing within the design envelope parameters for the building dimensions.

3.4.6 This concept design of the buildings has been used to produce illustrative photomontages of the development set in its landscape and visual context, which are shown in the Environmental Statement, Volume 3, Chapter 6: Landscape and Visual Resources. As noted in that chapter, visual and landscape impacts of the proposed development with this type of façade treatment applied would be reduced compared to the worst-case design envelope that has been assessed for the EIA.

3.4.7 The cladding material of the gas engine buildings and battery house building (if applicable) is expected to be conventional insulated Kingspan 1000 wall panels or similar, illustrated below. This type of cladding provides a range of ridged profiles that can be selected.

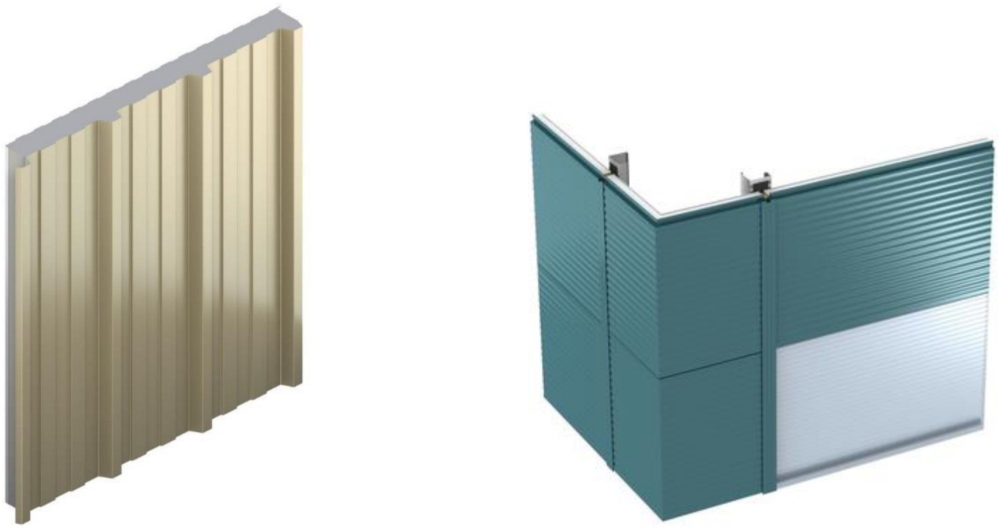
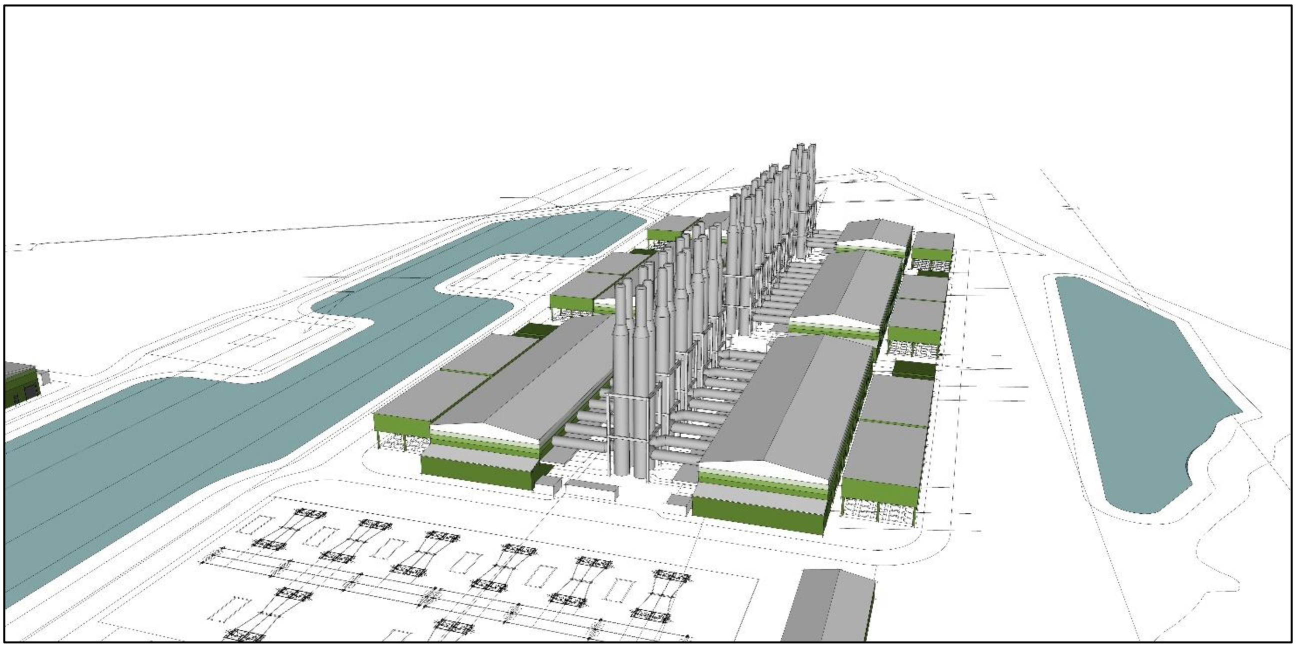


Figure 13: Examples of Kingspan 1000 insulated cladding (image credit www.kingspan.com)

3.4.8 If the battery storage is containerised rather than being housed in buildings, the battery containers will have an appearance similar to conventional shipping containers (i.e. ridged/corrugated steel) painted in a suitable colour from the recommended palette.

3.4.9 The gas engine stacks are expected to be unpainted stainless steel.

3.4.10 Other external elements such as pipework and ducts, air intakes and outlets, radiators, storage tanks and substation components are expected to be mainly steel or aluminium, either unpainted (for stainless/galvanised steel) or with a grey-white colour scheme (e.g. 'Goosewing grey' RAL7005, or RAL9002).



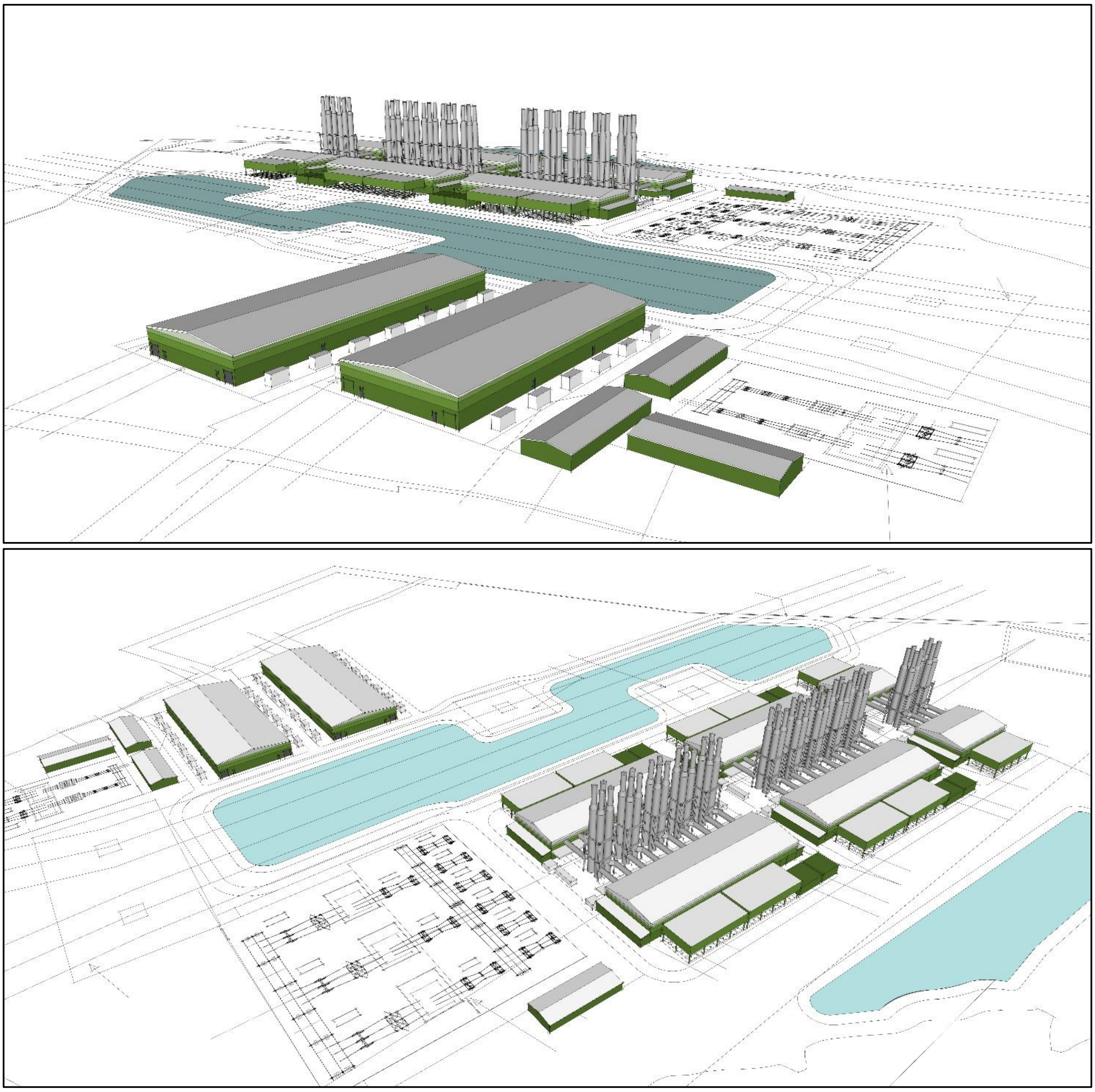


Figure 14: Concept massing model for engine houses and battery storage building

4 DESIGN PRINCIPLES

4.1.1 Based upon the information within this document, it is proposed that the following principles that have informed the illustrative designs submitted with the application will be considered and prioritised for incorporation into the scheme proposals, in consultation with Thurrock Council, in the final detailed design.

- Site layout locating the larger built elements, i.e. customer substations, gas engines and batteries, towards the south of the site and Tilbury Substation insofar as possible, with CCR land primarily in the north of the site.
- Gas engines and exhaust stacks in a linear arrangement oriented approximately north-south, with consideration given to the constraints caused by overhead electrical equipment, and clustered insofar as practicable to reduce visual impact.
- Runoff attenuation, soft landscaping and reptile habitat to make use of space where overhead lines preclude building construction.
- Soft landscaped ecology zones at the site boundary where water vole habitat is retained.
- Colour-banded cladding to building facades, darker greens at the base fading to light grey at eaves level to reduce the appearance of the building heights, drawing from the colour palette recommended by Thurrock Council.

~~RESTRICTIONS ON PUBLIC ACCESS TO THE CAUSEWAY~~

~~Rev. 1, February 2021~~

[DOCUMENT AND DRAWINGS REMOVED]