Chapter 3 Site Selection and Design Evolution

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List of Abbreviations

Abbreviation	Description
AIL	Abnormal Indivisible Loads
AILAA	Abnormal Indivisible Load Access Assessment
AOD	Above Ordnance Datum
BESS	Battery Energy Storage System
CAA	Civil Aviation Authority
dB	Decibels
DS	Design Statement
EIAR	Environmental Impact Assessment Report
ECU	Energy Consents Unit
GDLs	Garden and Designed Landscapes
GIS	Geographic Information Systems
GWDTE	Groundwater Dependent Terrestrial Ecosystems
ha	Hectare
HES	Historic Environment Scotland
IEF	Important Ecological Features
IOF	Important Ornithological Features
Km	Kilometres
kWH	Kilowatt hour
LVIA	Landscape and Visual Impact Assessment
MoD	Ministry of Defence
MW	Megawatt
OEMP	Operational Environmental Management Plan
PAC	Pre-Application Consultation
PAN	Planning Advice Note
PV	Photovoltaic
RVAA	Residential Visual Amenity Assessment
SAC	Special Area of Conservation
SBC	Scottish Borders Council

SEPA	Scottish Environment Protection Agency
SG	Supplementary Guidance
SM	Scheduled Monument
SNH	Scottish Natural Heritage
SPP	Scottish Planning Policy
SSSI	Sites of Special Scientific Interest
WAsP	Wind Atlas Analysis and Application Program
ZTV	Zone of Theoretical Visibility (ZTV)

Glossary

Abbreviation	**Definition**
The Applicant	Fred. Olsen Renewables Limited
EIA Regulations	The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017
Environmental Impact Assessment	Environmental Impact Assessment (EIA) is a means of drawing together by the developer, in a systematic way, a description of the development and information relating to of the likely significant environmental effects arising from a proposed development.
Environmental Impact Assessment Report	A document reporting the findings of the EIA and produced in accordance with the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017
Natural Power	The lead consultant EIA co-ordinator is: Natural Power Consultants Limited
Proposed Development	The proposed Lees Hill Renewable Energy Park as described in Chapter 4 of this EIAR
Proposed Development Site	The project development area within the site boundary as shown in Figure 1.2.

3. Site Selection and Design Evolution

3.1. Introduction

3.1.1. The purpose of this chapter is to identify the steps and alternatives that have been considered in the site selection and design evolution of the proposed Lees Hill Renewable Energy Park (hereafter referred to the Proposed Development) described in Chapter 4 of this EIAR (Volume 2). This chapter demonstrates how the design and layout of the Proposed Development evolved through the iterative design and EIAR process. A process which included the initial site selection, the identification of various constraints and site-specific factors, consideration of candidate turbines most likely to be available and viable at the time of construction, consideration of stakeholder feedback and the identification of key design criteria. The Proposed Development is considered to strike the best balance between minimising environmental impacts, maximising renewable electricity generation and contributing to net zero targets.

3.1.2. Although not required for applications submitted under Section 36 of the Electricity Act 1989, a Design Statement (DS) has been provided in support of the application. Planning Advice Note (PAN) 68: Design Statements explains the process on the undertaking of a DS. The DS being submitted in support of the application follows the guidance in PAN 68 and provides an explanation to the design process which has been undertaken to arrive at the final layout being presented for determination.

3.1.3. This chapter refers to the following Chapters (Volume 2) and Figures (Volume 3a):

- Chapter 4: Project Description;
- Chapter 5: Statutory and Policy Framework;
- Chapter 6: Landscape and Visual Impact Assessment;
- Chapter 12: Traffic and Transport;
- Chapter 13: Aviation and Other Considerations;
- Figure 1.1: Site Location;
- Figure 1.2: Site Layout;
- Figure 3.1: Site Constraints; and
- Figure 3.2: Layout Design Evolution – (Iterative turbine layouts).

3.2. Consideration of Alternatives

3.2.1. Paragraph 5(2)(d) of The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 requires that the Environmental Impact Assessment Report (EIAR) includes a description of reasonable alternatives studied by the Applicant. The alternatives considered were those which are relevant to the development and its specific characteristics. Further considerations included an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment.

3.2.2. As noted in PAN 1/2013: Environmental Impact Assessment:

"*Whilst the Directive and the Regulations do not expressly require the Applicant to study alternatives, those alternatives which are in any case considered as part of the project planning and design process must be assessed, and an outline of the main alternatives studied by the Applicant included in the EIAR. The EIAR must also give an indication of the main reasons for the choice made, taking into account the environmental effects*".

3.2.3. The Applicant has considered a number of alternative layouts for the Proposed Development through an iterative design process described below. The finalised layout of the Proposed Development is shown in Figure 1.2: Site Layout.

3.3. The Site Selection Process

3.3.1. This chapter of the EIAR sets out the approach to site selection across Scotland and in respect of the site in particular. The DS also contains information on the site design evolution process.

3.3.2. The Applicant has an ongoing search regime seeking sites across Scotland which may have potential for renewable energy development. The search regime culminates in a range of sites that progress to a desk-based and/or site visit feasibility study. The purpose of this study is an assessment of individual sites for potential to accommodate a range of development solutions. The feasibility studies can cover a large number of sites. The rigorous feasibility studies result in the sites which offer the least potential to accommodate development not progressing any further. The short-list of remaining sites included the Proposed Development Site.

3.3.3. Sites which provide a positive outcome in the feasibility study are progressed to in-depth assessment and eventually, if appropriate, to an application to the relevant determining authority.

3.3.4. Factors influencing the suitability of a site included the following:

- Indicative wind speeds as estimated by the ETSU NOABL UK wind speed database;
- The quality of wind flow;
- The separation distance to inhabited buildings;
- The lack of designated landscapes within the site;
- The potential to locate infrastructure away from designated areas;
- The proximity of the Proposed Development Site to the grid;
- Feasibility of grid connection;
- Service provider infrastructure;
- Environmental sensitivity;
- Extant Planning Policy direction;
- Area topography, including gradients, shading and aspect, exposure, watercourses and land use;
- Landscape character;
- Access feasibility;
- Cumulative impact of other renewable energy developments;
- Proximity to civil and military airspace, including MOD test facilities; and
- Landowner willingness to accommodate infrastructure.

3.3.5. The outcome of the above process indicated that the Proposed Development Site would be a technically and environmentally appropriate location to develop a wind farm.

3.3.6. At the time the potential for Lees Hill to accommodate a wind farm development was being assessed, the prevailing national policy direction was Scottish Planning Policy (SPP) (June 2014). SPP provided support for wind development in principle and encouraged local authorities to guide developments towards appropriate locations. [1]

3.3.7. Paragraph 154 stated that planning authorities “should support the development of a diverse range of electricity generation from renewable energy technologies – including the expansion of renewable energy generation capacity”.

[1] *SPP was superseded by NPF4 in February 2023. However the policy assessment carried out at the time is relevant to the site selection and design process.*

3.3.8. SPP further clarified that the planning system should: "*support the transformational change to a low carbon economy, consistent with national objectives and targets, including deriving:*

- *30% of overall energy demand from renewable sources by 2020;*
- *11% of heat demand from renewable sources by 2020; and*
- *the equivalent of 100% of electricity demand from renewable sources by 2020"'.*

3.3.9. Paragraph 155 of SPP also stated that "*development plans should seek to ensure an area's full potential for electricity and heat from renewable sources is achieved, in line with national climate change target"*".

3.3.10. Paragraph 161 highlighted the requirement for planning authorities to define a "*spatial framework identifying those areas that are likely to be most appropriate for onshore wind farms"*. SPP stated that spatial frameworks must be based on the following criteria (set out in SPP Table 1, Page 39):

- *"Group 1: Areas where wind farms will not be acceptable – National Parks and National Scenic Areas;*
- *Group 2: Areas of significant protection: - Recognising the need for significant protection, in these areas wind farms may be appropriate in some circumstances. Further consideration will be required to demonstrate that any significant effects on the qualities of these areas can be substantially overcome by siting, design or other mitigation. – Group 2 areas include World Heritage Sites; Natura 2000 and Ramsar sites; Sites of Special Scientific Interest; National Nature Reserves; Sites identified in the Inventory of Gardens and Designed Landscapes; Sites identified in the Inventory of Historic Battlefields; areas of wild land as shown on the 2014 SNH map of wild land areas; carbon rich soils, deep peat and priority peatland habitat; and an area not exceeding 2 km around cities, towns and villages identified on the local development plan; And*
- *Group 3: Areas with potential for wind farm development: - Beyond groups 1 and 2, wind farms are likely to be acceptable, subject to detailed consideration against identified policy criteria".*

3.3.11. The site did not lie within any 'Group 1' areas or 'Group 2' areas, or within any national or international designations for ecology, ornithology or cultural heritage.

3.3.12. A review of the Carbon and Peatland 2016 online map resource[2] indicates that the site lies within areas of:

- "Mineral Soil" [3] - Peatland habitats are not typically found on such soils (Class 0); or
- "Class 4" [3] – Area unlikely to be associated with peatland habitats or wet and acidic type. Area unlikely to include carbon-rich soils.

3.3.13. Within the Scottish Borders Local Development Plan Policy ED9[4] was the 'lead' policy at the time for the assessment of renewable energy developments. Policy ED9 sets out a list of considerations which were taken into account when assessing the development potential of the Proposed Development.

3.3.14. This Policy was supported by the Renewable Energy Supplementary Guidance (SG) (2018)[5]. This SG sets out further detailed assessment criteria and a wind turbine spatial framework to

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[2] *Scotland's Environment [Online] Available from - Map | Scotland's environment web (Accessed: 14/11/2023)*

[3] *Scotland's Soils Carbon and Peatland 2016 Map [Online] Available at– Carbon and peatland 2016 map | Scotland's soils (environment.gov.scot) (Accessed: 14/11/2023)*

[4] *Scottish Borders Council Volume 1: Policies [Online] Available from – Volume 1: policies | Scottish Borders Council (scotborders.gov.uk) (Accessed: 14/11/2023)*

[5] *Renewable_Energy__Adopted_Version__(1).pdf (Accessed 20/11/2023)*

support Policy ED9 when assessing applications for renewable energy development. Again the policy direction in the Renewable Energy SG (2018) informed the design evolution of the Proposed Development.

3.3.15. In conclusion the rigorous site selection criteria and taking full cognisance of the extant planning policy direction available when the site selection criteria were being applied have provided a strong justification for the Proposed Development Site being progressed to the next stage of the design process.

3.4. Progressing Site Design

3.4.1. To progress the chosen Proposed Development site, the design process aimed to have a layout that maximised the output of renewable energy whilst limiting the potential for environmental impacts during construction and operation. Factors influencing the suitability of the layout include:

- Suitable aspect and gradients within solar area to optimise generation outputs;
- Wind resource and quality of wind flow to optimise generation outputs;
- Minimising impact of shading on solar PV generational output by applying adequate buffers from turbines and vegetation;
- Suitable separation distance from dwellings so that unacceptable impacts related to potential noise, shadow flicker and residential visual amenity can be avoided;
- Topography of the Proposed Development Site is compatible with the construction and operation of a commercial scale wind farm and suitable for ground mounted solar and battery storage;
- Existing land uses including minimising impact on the most productive agricultural ground;
- Avoidance of watercourses and water bodies;
- Avoiding direct impacts on cultural heritage assets;
- Avoiding areas of deep peat;
- Avoiding ecologically sensitive habitats;
- Residential amenity;
- Landscape and visual impacts; and
- Stakeholder feedback.

3.5. Design Constraints

3.5.1. The following section provides an overview of the various factors which are relevant to the design of the Proposed Development.

3.5.2. Figure 3.1: Site Constraints highlights constraints within the surrounding area that fed into the design process.

3.5.3. A Scoping Report was submitted to the Scottish Government in July 2022 by Natural Power on behalf of the Applicant (TA1.1: Scoping Report). At that time, it was envisaged the Proposed Development would comprise up to 7 wind turbines, up to 200 m in blade tip height, ground-mounted solar array and up to an additional 60 MW of battery storage. Combined total installed capacity of up to 100 MW with an additional 60 MW of battery storage. The feedback from scoping and the following considerations have informed the final layout and design of the Proposed Development:

Policy Context

3.5.4. A high-level review of legislation, national and local planning policy has been provided in Chapter 5: Statutory and Policy Framework (Volume 2) an assessment of such material is

provided in the accompanying Planning and Sustainable Place Statement, as well as in the individual EIAR chapters. The iterative design process factored in such policy context.

Wind Resource

3.5.5. Initial long-term wind resource estimates were derived from multiple sources including measurements collected near the Proposed Development Site.

3.5.6. Detailed assessments have been undertaken using Wind Atlas Analysis and Application Program (WasP) modelling software by the Applicant in order to better understand the local wind regime. Natural Power Analytics and Advisory team supported the assessment with some of the wind resource assessment. This has led to an improved understanding of the specific complex flow regime that results from the terrain and forestry surrounding the Proposed Development. The turbulence intensity, wind shear, inflow angle and veer across the Proposed Development Site were assessed in order to inform the design process (along with all relevant physical, environmental and technical constraints). The process was undertaken iteratively in order to arrive at the appropriate number, size and location of turbines for the Proposed Development to minimise project risks (turbine performance / operational issues) and maximise project efficiency and energy yield output.

3.5.7. The site has been designed with a comprehensive understanding of the onsite wind regime. In addition, wind energy assessments indicate that the Proposed Development Site has excellent wind resource allowing for more efficient energy generation with less infrastructure.

Solar Resource

3.5.8. The suitability of the topography within the Proposed Development Site, in relation to gradient and aspect, offered the opportunity to incorporate solar area into the design. This aimed to maximise the overall generational output of the Proposed Development.

Battery Energy Storage System (BESS)

3.5.9. The design process for BESS was undertaken iteratively in order to arrive at the appropriate sizing in relation to the Proposed Development. Through this process the required BESS equipment specification, number of, and location within the Proposed Development Site were determined to minimise project risks and maximise project efficiencies and benefits whilst optimising the renewable energy output of the Proposed Development.

3.5.10. This is achieved by utilising the BESS' ability to absorb excess energy generated during times of low demand and thereby minimising curtailment of the wind turbines and solar PV array and shift this renewable energy to a high demand period when it can be released to the grid to minimise the need to dispatch carbon-based energy generators to meet demand and lower the overall cost of energy to the end consumer.

3.5.11. In addition to optimising the wind energy utilisation the BESS can provide additional valuable ancillary services to the grid operator to help stabilise the grid and enable more renewable generation to be developed and dispatched by relieving stresses and congestion from the local distribution and wider transmission grid.

3.5.12. The BESS will have a minimal footprint within the Proposed Development Site blending in with the Proposed Development and shielded by the surrounding landscape.

Grid Connection

3.5.13. The grid connection is currently expected to connect the project at Eccles substation, approximately 11 km southeast of the Proposed Development. The connection date is expected to be around 2030 and would be subject to a separate application for consent under Section 37 of the Electricity Act 1989.

3.5.14. The proximity to Eccles substation was key in considering the location of the Proposed Development Site.

Access

3.5.15. An access study was carried out in February 2021 to determine the feasibility of the proposed public access route. The access study assessed the route suitability and identified potential constraints from port of entry at Rosyth to the entrance of the Proposed Development Site. The Abnormal Indivisible Load (AIL) report was prepared at the time for a wind turbine using a candidate turbine with a blade of approximately 75 m in length. The study assessed the delivery of wind turbine components and carried out a detailed swept path assessment along the identified route. The access study was used to inform the initial feasibility study of the Proposed Development. The AIL concludes that a viable access was achievable and a preferred route was selected from the M90, M8 and A720 trunk roads before either taking the A68 to gain access to the Proposed Development Site from the east or continuing further east on the A1 seeking and gaining access to the north of the Proposed Development Site.

3.5.16. Since 2021, the candidate model of turbine has changed and therefore an updated access assessment was produced by Natural Power based on 81.1 m blades. This updated access assessment confirms that the proposed wind turbines can be delivered to the Proposed Development.

3.5.17. An Abnormal Indivisible Load Access Assessment (AILAA), including swept path analysis at particular locations has been prepared and demonstrates the viability of the proposed AIL route (see Technical Appendix 12.2: AILAA, Volume 4). Street furniture (i.e. road signs, lighting columns, traffic lights, telegraph poles and bollards) have been identified from aerial imagery and included on the Swept Path Analysis (SPA) drawings. A bellmouth junction will provide access onto site from B6456. In addition, areas of overrun and oversail are required to facilitate abnormal load deliveries.

3.5.18. More information is included in Technical Appendix 12.1: Preliminary Traffic Management Plan and Technical Appendix 12.2: AILAA (Volume 4) appended to EIAR Chapter 12: Traffic and Transport (Volume 2).

Land Use

3.5.19. The Proposed Development Site lies at Lees Hill located to the south of the Lammermuir Hills. The valley side rises relatively gently from the west to east to a height of approximately 265 m Above Ordnance Datum (AOD). The land is a sparsely inhabited landscape and existing settlement takes the form of dispersed cottages, farms and estate buildings.

3.5.20. The primary land use within the Proposed Development Site is mixed agricultural uses. There is also an active stone quarry on the Proposed Development Site towards the north of the site boundary. The Proposed Development Site is intersected by a number of minor watercourses. There are scattered areas of forestry across the Proposed Development Site.

3.5.21. Landowners have been consulted during the design iteration process in particular with relation to reducing impacts on their most productive agricultural ground and establishing appropriate areas for habitat management.

Proximity of Dwellings

3.5.22. Residential amenity has been considered throughout the design iteration process as the design has sought to minimise potential impacts on the nearest dwellings, both in terms of visual amenity and noise impact. There are 24 dwellings within 2.5 km of the Proposed Development and these have been considered in Technical Appendix 6.6 Residential Visual Amenity Assessment (RVAA) (Volume 4) in Chapter 6: Landscape and Visual Impact Assessment (Volume 2). A noise assessment has been undertaken and is reported on in Chapter 11: Noise

(Volume 2). The combined effects of the potential visual amenity and noise impacts has been considered in the synergistic effects section of Chapter 15: Synergistic Effects and Summary of Mitigation (Volume 2).

Landscape and Visual

3.5.23. The effects on landscape and visual amenity were considered from the outset of the site selection and design process, and was considered to be key to project progression.

3.5.24. A Chartered Landscape Architect, experienced in undertaking siting, design and assessment of renewable energy developments in accordance with best practice guidance, has worked closely with the project team from the outset. The role of the Landscape Architect consisted of reviewing the siting and design of the wind turbines, solar panels and associated infrastructure in order to minimise, as far as practical, the potential effects on landscape and visual amenity.

3.5.25. The first step of the Landscape and Visual Impact Assessment (LVIA) was to establish the extent of the study area. In accordance with NatureScot guidance (2017), for turbines in excess of 150 m in tip height, a 45 km study area is recommended. This was offset from the outermost turbines of the Proposed Development. Solar infrastructure, being a maximum of 3 m in height requires a smaller study area, of up to 5 km.

3.5.26. Initially, a seven-turbine layout using turbine tip heights of 200 m and 176 ha of solar area was developed across the Proposed Development Site (Design 1, Figure 3.2). Zone of Theoretical Visibility (ZTV) mapping was analysed to gain an appreciation of the theoretical visibility of these turbines and solar area within the 45 km study area and 5 km study area respectively.

3.5.27. A ZTV map has been produced to illustrate the potential extent of visibility of the Proposed Development based on the layout at tip height, hub height and solar area (Figures 6.1, 6.3 and 6.4 respectively Volume 3a). Consideration has also been given to other wind farms that are operational, consented or currently the subject of applications for consent or in scoping in the context of the potential for cumulative effects.

3.5.28. For the cumulative assessment, an initial study area of 60 km was identified in accordance with the relevant guidance (SNH, 2012). Following a review of likely relationships between wind farms, this was refined to 25 km from the outermost turbines and data was collected for sites currently in operation/under construction, consented, submitted applications and in scoping which would likely be experienced in conjunction with the Proposed Development.

3.5.29. Landscape and Visual Impact has been considered throughout the design of the Proposed Development which resulted in the deletion of a turbine and reduction in solar area minimising the impact on visual receptors. Further detail is provided in EIAR Chapter 6: Landscape and Visual Impact (Volume 2).

Ecology and Ornithology

3.5.30. A desk study and baseline ecology surveys were conducted between 2020-2023. The purpose of the desk based study and ecological surveys was to assess connectivity of the Proposed Development with designated sites. Additional assessment included collision modelling and disturbance of receptor species within the Proposed Development Site. The Proposed Development Site includes a small portion of the Langtonlees Cleugh Site of Special Scientific Interest (SSSI). This SSSI lies in the far eastern section of the Proposed Development Site boundary. The Proposed Development has been designed to increase the distance from the designated area to avoid any direct impacts to the SSSI.

3.5.31. The design of the project was able to avoid sensitive habitat and species and the resultant layout was considered unlikely to impact on designations or have a significant impact on any target species, and as such the Proposed Development was considered potentially suitable for wind, solar and BESS development, subject to further detailed assessment.

3.5.32. An Outline Operational Environmental Management Plan (OEMP) to further minimise effects and impacts on bats and fish is included within Volume 4 Technical Appendix 7.3. It is considered that implementation of these mitigation and habitat enhancement measures will reduce the likelihood of impacts on Important Ecological Features (IEFs) and Important Ornithological Features (IOFs) at the appropriate biogeographical scale.

3.5.33. Potential effects upon ecology and ornithology are fully assessed in the EIA and the findings are presented in Chapter 7: Ecology and Chapter 8: Ornithology (Volume 2).

Hydrology, Geology and Hydrogeology

3.5.34. Hydrologically, the site lies within the watershed of the River Tweed which discharges into the North Sea at Berwick Upon Tweed. In addition, the site lies within the catchments of tributaries of the Langton Burn and Fangrist Burn and the Whiteadder Water which all ultimately flow into the River Tweed Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI).

3.5.35. Geologically, the majority of the Proposed Development is underlain by bedrock of the Stratheden Group and Inverclyde Group – interbedded sandstone and argillaceous rocks which are fluvial in origin. No superficial deposits lie on the topographic high of Blacksmill Hill, however the remainder of the Proposed Development Site is underlain by Glacial till comprising of variably sorted boulders, gravel, sand, silt and clay. Areas of discrete or diffusely emerging groundwater may also support plant communities and be considered as Groundwater Dependent Terrestrial Ecosystems (GWDTE).

3.5.36. Preliminary constraints were mapped as part of the screening process to ‘scope out’ potential locations for the wind turbines, solar area and other associated infrastructure. An indicative layout was then established, with appropriate buffer zones places around specific areas of the Proposed Development where significant constraints were identified. These constraints included deep peat deposits, watercourses, flood zones, conservation sites and GWDTE amongst others.

3.5.37. Phase 1 peat depth survey and hydrological walkovers were undertaken in August 2020 as part of the site feasibility and scoping assessments. Further surveys, including a watercourse crossing assessment and a hydrological walkover survey including visiting Private Water Supplies were undertaken. Survey results were then fed into the designing of the Proposed Development.

3.5.38. Potential impacts on watercourses have been taken into account by applying adequate buffers on the constraints mapping and applying these buffers during the designing and final placement of turbines and solar infrastructure.

3.5.39. Potential significant effects upon hydrology, geology and hydrogeology are fully assessed in the EIA and the findings are presented in Chapter 9: Hydrology, Geology and Hydrogeology (Volume 2).

Cultural Heritage

3.5.40. The presence of cultural heritage receptors was investigated within and out with the Proposed Development boundary. There is one designated heritage assets within the Proposed Development Site: Scheduled Monument SM4548 Hen Law, cairn 1550 m WNW of Langtonlees. There are 22 further known non-designated heritage assets recorded within the Proposed Development Site on the Scottish Borders Historic Environment Record. These are all later historic period assets relating to agricultural practices.

3.5.41. There are two Inventory Garden and Designed Landscapes (GDLs) (GDL274 Marchmont & GDL 161 Duns Castle) within 5 km of the Proposed Development, both of which are partially located within the ZTV. There is one Conservation Area at Gavinton, as well as 10 Scheduled

Monuments (including SM4626 Dirrington Great Law cairn and SM4638 Dirrington Little Law cairn), six Category A Listed Buildings (including LB15384 Polworth Church), 44 Category B Listed Buildings, and three Non-Inventory Designed Landscapes (Langton, Whitchester & Longformacus).

3.5.42. A baseline survey was undertaken which identified cultural heritage assets in the Proposed Development Site. These were accounted for during the design evolution and direct effects thus avoided. A full cultural heritage assessment is provided in Chapter 10: Cultural Heritage (Volume 2).

Aviation and Existing Infrastructure

3.5.43. The potential for the Proposed Development to interfere with military and civil aviation assets has been considered. Preliminary analysis was completed for the Proposed Development which indicated radars at Great Dun Fell, Lowther Hill and Brizlee Wood would have a line of sight to the proposed turbines. In addition, the Proposed Development Site is located within a zone classified by the Ministry of Defence (MoD) as a "*regular military low flying area where mitigation may be necessary to resolve concerns"*. In addition, the turbines will be more than 150 m tall and therefore be subject to mandatory lighting requirements of the Air Navigation Order.

3.5.44. These have all been assessed further within the EIA and full details are provided in Chapter 13: Aviation and Other Considerations (Volume 2).

3.5.45. The presence of existing infrastructure such as service pipes and cables, TV transmission and electromagnetic paths were considered.

3.5.46. Geographic Information Systems (GIS) data used within the initial feasibility study indicated there was existing infrastructure within the Proposed Development Site which have been avoided during the design process. Full details are provided in Chapter 13: Aviation and Other Considerations (Volume 2).

3.6. The Consultation Process

3.6.1. The consultation process commenced prior to Scoping in July 2022. In accordance with the Energy Consents Unit – Good Practice Guidance for Applications under Section 36 and 37 of the Electricity Act 1989[6] provided by the Scottish Government, the Applicant undertook initial pre-Scoping meetings with ECU in May 2022 to provide a general introduction to the Proposed Development. Similarly, a meeting was offered with Scottish Borders Council (SBC) but unfortunately declined due to lack of resource. The Scoping Report was submitted in July 2022, after which statutory consultation responses were received. Non-statutory consultees were also engaged during the scoping process; a full list of which can be found within the Gate Check Report (Technical Appendix 1.1, Volume 4). Community consultations also began during the scoping period with the offer of meetings; email and telephone communications; and two rounds of public exhibitions.

3.6.2. The consultation process was carried out to:

- Identify any further key considerations and highlight concerns from statutory consultees;
- Clarify the key points raised during the initial feasibility assessment;
- Promote communication with both statutory and non-statutory consultees and other stakeholders concerning key issues; and

[6] *Scottish Government Good Practice Guidance for Applications under Section 36 and 37 of the Electricity Act 1989 [Online] Available from - Energy Consents Unit: Good Practice Guidance for Applications under Section 36 and 37 of the Electricity Act 1989 - February 2022 (www.gov.scot) Accessed 15/11/23*

- To confirm and agree the proposed methods for survey, evaluation and assessment.

3.6.3. Natural Power and the Applicant considers consultation with the community to be a crucial part of the development process and will engage with the local community throughout the application process. As this is a Section 36 application there is no formal requirement to follow the procedures for major developments under the Planning etc. (Scotland) Act 2006, however this application will follow the processes and standards set by the legislation and best practice guidelines (PAN 3/2010 - Community Engagement).

3.6.4. There were two rounds of public exhibitions across 2022 and 2023, scheduled to contribute to the design evolution process, the first round was held in October 2022 across three days (19th, 20th and 21st October 11 am - 7pm across five venues: Gavinton, Westruther, Longformacus, Greenlaw and Duns Village Halls. The second round was in September 2023 and held over three days: Monday 4th, Tuesday 5th and Wednesday 6th September across five venues: Duns, Westruther, Gavinton, Greenlaw and Longformacus. These exhibitions showcased the Proposed Development and provided a chance for the public to learn more about the proposal and provide feedback.

3.6.5. All information presented at the October 2022 and September 2023 public exhibition was also made available on the project's website, which gave those members of the public who were not able to attend the in-person exhibitions further opportunity to learn about and provide feedback on the Proposed Development.

3.6.6. The Pre-Application Consultation (PAC) Report provides full details on the consultation process and the DS details how responses informed the design of the Proposed Development.

3.7. Design Evolution

3.7.1. This section describes the design alternatives for the Proposed Development and discusses how the site design and layout continued to evolve throughout the EIA Process. The layout of the Proposed Development was designed under the guidance, requirements and considerations of the Applicant, specialist contributions from within Natural Power and from other expert contractors. The site design process was also guided by the findings of the baseline surveys, by the recommendations of the specialist consultants and by issues raised by statutory and non-statutory consultees, as well as relevant planning policy.

3.7.2. The aim of the siting and design process was to arrive at a design that would minimise environmental effects, be technically feasible, and economically viable using the best available techniques and engineering principles. The design optimised the Proposed Development for the generation of low carbon and low-cost electricity to contribute to national targets to decarbonise energy sources. As noted above, the design process included the selection in number and size of turbines, placement of turbines and solar area, tracks and other associated infrastructure whilst taking account of topographical, landscape and visual, cultural heritage, ecology, ornithology and hydrology concerns.

3.7.3. The location of individual turbines, solar area and battery energy storage system **(**BESS) was guided by the technical requirements for construction and operation including the potential manufacturer's warranty requirements, slope angles and the nature of the topography in which the turbine and solar arrays are to be located. Siting was also guided by the results of the baseline studies and scoping exercise, with particular attention given to the likely landscape and visual effects, residential amenity and the hydrology and peat resource at the Proposed Development.

3.7.4. Computer modelling of wind resource and constraints was used as a tool to aid the development of the designed layout. Additionally, wirelines were generated for views from sensitive locations around the Proposed Development and used to 'test' the design in key views from the surrounding area.

3.7.5. A number of different site layouts were devised and, following extensive investigation and consultation, an optimum layout was chosen through numerous design iterations. The site layout design evolution has been illustrated in Figure 3.2 (Volume 3a) which shows the evolution from the Scoping layout (Design 1) through to the Design Freeze (Design 4) as shown in Figure 1.2: Site Layout (Volume 3a).

3.7.6. The remainder of this chapter highlights the site design considerations and the key stages in the site design evolution, illustrating the iterative process that has resulted in the Proposed Development. Through each of the design iterations considered, key technical and environmental constraints and design criteria have been applied.

Influence of the Policy Context

3.7.7. The full range of predicted impacts have been considered throughout this EIAR. A review of legislation and planning policy has been provided in Chapter 5: Statutory and Policy Framework (Volume 2) and an assessment of such material is provided in the accompanying Planning and Sustainable Place Statement., A review was undertaken of design guidance documents and other standard texts on renewable energy development such as the NatureScot (then Scottish National Heritage (SNH)) guidance on 'Siting and Designing Windfarms in the Landscape' (Version 3a August 2017). These are considered further in Chapter 6: Landscape and Visual Impact Assessment (Volume 2).

Design Strategy Principles

3.7.8. The design strategy for the key elements of the Proposed Development has considered the following objectives:

- To maximise site efficiency and low carbon electricity production;
- To provide a turbine, solar and BESS layout with simple form, which reflects the scale of and relates to the landscape character of the Proposed Development and its surroundings;
- To avoid areas of constraint where practical;
- To avoid an overly complex and visually confusing layout;
- To achieve a balanced composition of the turbines against the landscape and skyline from key viewpoint locations;
- To give due consideration to turbine proportions; and
- To reflect the pattern of nearby existing and proposed wind farms as far as practical.

3.7.9. The current economic climate is driving greater efficient in electrical generation within a competitive energy market. Turbine manufacturers are responding to this by reducing the manufacture of turbines under 180 m and in this context as well as the site specific characteristics of the Proposed Development, turbines of up to 200 m tip height are considered as the candidate turbine. The inclusion of turbines up to 230 m to blade tip was considered in the design evolution. However, due to the increase of significant landscape and visual effects and the required separation distances required, larger turbines could not be accommodated.

3.7.10. Wind farm design with turbines up to 200 m tip height is reflective of Scottish Government aspirations for demonstrably better energy yields from consented sites. This scale of turbine with larger rotor diameters is capable of maximising the wind energy output for this site and represents a candidate turbine which is expected to be deliverable and be viable.

Constraints to Proposed Development

3.7.11. The main environmental considerations on site which have influenced the final design of the Proposed Development are:

- Noise;
- Gas pipeline;

- Telecoms link;
- Ecological habitats;
- Watercourses;
- Cultural heritage assets;
- Residential amenity; and
- Landscape and visual.

Public Consultation

3.7.12. The following principles of effective public engagement have been followed as described in PAN 3/2010: Community Engagement:

- Access to information;
- The opportunity to contribute ideas;
- The opportunity to take an active part in developing proposals and options;
- The opportunity to be consulted and make representations on formal proposals and policies; and
- The opportunity to receive feedback and be informed about progress and outcomes.

3.7.13. The Applicant has liaised with the local community, ensuring that communities were given additional information if required and ensuring that all queries from community councils, community groups and members of the community were answered and followed up if required."

3.7.14. Details of exhibitions and other stakeholder engagements can be found in the accompanying PAC Report submitted with the application for the Proposed Development.

Iterative Design Process

3.7.15. The iterative design approach aimed, as far as practically possible, to avoid and then mitigate significant effects through the careful siting and design of the Proposed Development, which was repeatedly assessed and amended, balancing different environmental issues and consultee concerns expressed during early consultation. This embedded mitigation design process has also considered advice contained within SNH's (now NatureScot) current guidance 'Siting and Designing Wind Farms in the Landscape' (Version 3a August 2017). The iterative process led to over 15 revisions of the layout; the four key design stages are presented below.

Design 1: Scoping Layout (July 2022)

3.7.16. As detailed in Section 3.5.3, the design process began with a layout consisting of up to seven turbines, tip heights of up to 200 m, 176 ha of solar area and up to 0.5 ha of BESS (Design 1, Figure 3.2, Volume 3a).

Scoping Reponses (August 2022)

3.7.17. Design 1 was presented to the ECU, SBC and consultees in the scoping report in July 2022. A copy of this can be found in Technical Appendix 1.1, Volume 4. The full Scoping Opinion was issued by the ECU on 2nd September 2022 and is provided in Technical Appendix 1.2 (Volume 4) of this EIAR and contains a copy of all the consultee scoping responses. This consultation helped identify and clarify key issues, promoted dialogue with both consultees and stakeholders, and confirmed methods for survey, evaluation and assessment going forward. The consultee responses were reviewed in partnership with the specialist sub-consultants in order to make sure all relevant issues identified were assessed as part of the Proposed Development survey work and were addressed in the relevant EIAR chapters.

3.7.18. In addition to the formal scoping and consultation, further discussions took place with SBC, Historic Environment Scotland (HES), Scottish Environmental Protection Agency (SEPA), NatureScot and Civil Aviation Authority (CAA) to agree on specifics of survey methodologies

and potential mitigation should the Proposed Development gain consent and to update these consultees on progress.

Public Consultation (October 2022)

3.7.19. Detailed analysis of written feedback from the first round of public consultations can be found in the PAC Report. Key concerns raised in design terms, in summary, related to the size, visual impact, proximity and relationship of turbines and solar area to dwellings and communities, but also possible impacts to ecology, ornithology and noise.

Design Review Day #1 (December 2022)

3.7.20. The first formal design review day was held in December 2022 between the Applicant and specialist consultants from relevant departments of expertise including; ecology and ornithology, hydrology, civils design, landscape and visual, wind analysis, noise, cultural heritage and traffic and transport. The aim of the design review day was to review the layout following receipt of the scoping opinion, consultee responses and collection of more desk study and site survey data.

3.7.21. Ahead of the design review day consultants reviewed the proposed layout from scoping (Design 1) which included assessing the proposed turbine locations and solar area together with preliminary infrastructure locations.

Design 2: Post Scoping Consultation and Surveys (December 2022)

3.7.22. Based on the comments received from scoping, design review day #1, public consultation and further survey work, amendments by the Applicant led to Design 2. Changes that were made are summarised below:

- Reduced solar area from 176 ha to 70 ha:
  - Residential Amenity: to accommodate landowner and community requests. Limits the solar area to the central area of site, leaving area within southern and northern parts of Proposed Development Site to remain unaltered by PV solar panels; and
  - Landscape and Visual: concentrated the solar area away from public roads reducing the public view and impact on visual receptors. In addition, this helps to reduce the potential effects from glint and glare.
- Turbine 7 was removed due to a number of factors:
  - Noise: properties to the east of turbine 7 could exceed cumulative noise limits by approximately 4.1 decibels (dB). In addition, the level of curtailment required to meet the limits would make the turbine unviable; and
  - Residential Amenity: reduced potential impact on visual receptors for properties to the east e.g. Old Langtonlees as well as the potential effects from shadow flicker.

3.7.23. The revised turbine number and locations are set out in Table 3.1 below:

Table 3.1: Design 2 layout changes

Turbine	Original Easting	Original Northing	Turbine	Design 2 Easting	Design 2 Northing
1	372540	651904	1	372540	651904
2	372151	652250	2	372151	652250
3	371884	652685	3	371884	652685
4	371793	653349	4	371793	653349

5	372508	653873	5	372508	653873
6	372477	653302	6	372477	653302
7	372757	652873	Deleted	N/A	N/A

Source: Natural Power

Design 3: Design Chill (June 2023)

3.7.24. Based on further correspondence with technical teams, the Applicant amended the layout to produce Design 3. Changes that were made are summarised below:

- Turbine 1 moved slightly north to accommodate keeping hardstanding and earthworks within landownership boundary;
- Turbine 2 moved north-northwest to accommodate location of hardstanding and earthworks;
- Turbine 3 moved north east to accommodate boundary over sail;
- Turbine 4, no change
- Turbine 5, no change
- Turbine 6, no change
- Solar area was further reduced to accommodate the extent of the Blanket sphagnum bog located within central area of site. This reduced solar area to 69.83 ha.

3.7.25. Each alteration was reviewed in detail by the specialist team to ensure that changes were avoided constraints and did not undermine mitigation work done to date.

Public Consultation (September 2023)

3.7.26. Detailed analysis of written feedback from the second round of public consultations can be found in the PAC Report.

Design 4: Design Freeze (December 2024)

3.7.27. Following consultation with HES regarding the impact of Turbine 2 on the setting of the scheduled monument known as Dirrington Little Law, cairn on summit of (SM4638), Turbine 2 was relocated 100 m to the north of its intended original location.

3.7.28. The relocation of Turbine 2 aimed to mitigate potential adverse impacts upon SM4638 Dirrington Little Law, cairn on summit of as viewed from HER 57449 Twin Law, Twinlaw Cairns., such that it would not directly backdrop SM4638. This results in a layout that has been assessed against any perceived adverse impacts upon the cultural significance of heritage assets. This assessment concludes the impacts have been minimised as far as reasonably possible, to a magnitude that is not significant in EIA.

3.7.29. Access tracks were added in accordance with design engineers, landowner requests and constraints including topography and location of watercourses and gas pipelines. The track was concentrated to the west of site, avoiding agricultural land on the east. This also provided a greater buffer distance between properties on the east and access tracks to the west and limited watercourse crossings.

3.7.30. A Borrow Pit Assessment (EIAR Technical Appendix 9.3, Volume 4) identified three areas that were suitable for borrow pits. Borrow Pit 5 is the preferred borrow pit area as it is an extension to the current active quarry on site.

3.7.31. Site access was determined in accordance with landowner and design engineer requests. The site access track follows field boundaries and ensures the track reaching site infrastructure is reduced to minimise environmental impact.

3.7.32. This concluded the design process, and the Proposed Development was frozen at 6 turbines approximately 0.5 ha for battery storage and 69.83 ha of solar PV area. Figure 1.2 (Volume 3a) contains a detailed site layout with associated infrastructure for the Proposed Development after design freeze. This final layout is considered a well-balanced design from key viewpoints and receptors, whilst also giving due consideration to other key environmental constraints and sensitives, as well as construction limitations and is the layout which is applied for and this EIAR describes.

Table 3.2: Design Freeze Layout

Turbine	Easting	Northing	Max Tip Height (m)
1	372540	651914	200
2	372162	652293	200
3	371900	652691	200
4	371793	653349	200
5	372508	653873	200
6	372477	653302	200

Source: Natural Power

3.7.33. The final maximum tip height is proposed at up to 200 m for all turbines. At this stage of a project the final turbine selection isn't known and therefore a possible range of turbines that could fit the maximum turbine height criteria is selected. The turbine candidate selected for assessment purposes only is Vestas V162. Further information on turbine dimensions is discussed in Chapter 4: Project Description (Volume 2) and included in EIAR Figure 4.1 (Volume 3a). It is expected that detail of final turbine dimensions and appearance will be a requirement of a condition to be agreed with SBC prior to commencement of construction.

3.8. Environmental Benefits

3.8.1. The essential benefits of using wind and solar energy for the generation of electricity are that it is renewable, safe and does not release any gaseous emissions into the atmosphere during operation. It also provides diversity and security of supply which remain part of the Government's energy policy.

3.1.1 The Proposed Development is expected to have a generating capacity of the proposed wind turbines between 37 – 45 megawatts (MW) subject to final wind turbine procurement, up to 60 MW of solar array and 60 MW of BESS. A 100 – 200 MW development requires consent under Section 36 of the Electricity Act (1989) in accordance with The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017. It will help to support many climate action plans, emission reduction targets and contribute towards future electricity demands in the UK by creating enough electricity to meet the average annual domestic needs of between 32,101 – 39,042 and 17,200 average UK households from turbine and solar respectively (wind based on annual GB average domestic household consumption, quoted by the Department of

Business, Energy and Industrial Strategy, of 3,509 kWH per year, 2022[7] and solar from the National Statistics publication Digest of UK Energy Statistics (DUKES)[8]).

3.8.2. When generating electricity, the Proposed Development would offset the generation of a similar amount of electricity that would otherwise be generated by conventional power stations. The carbon reduction generated by the Proposed Development would be between 51,327 - 55,560 tonnes per annum[7] based on a generating capacity of 97 – 105 MW (subject to final wind turbine procurement). The Proposed Development would contribute towards international and national targets for the generation of renewable energy and reductions in greenhouse gas emissions.

3.8.3. In addition, the carbon dioxide offset would make an important contribution towards the government target to reduce carbon dioxide emissions by 100 % by 2045. The Proposed Development would also offset emissions of the other greenhouse gases from conventional power stations; in particular coal fired generating plant. These gases including sulphur dioxide and oxides of nitrogen cause environmental problems such as acid rain.

3.8.4. Onshore wind and solar farms, particularly those close to areas of electricity demand, provide an important contribution towards making Scotland and the UK more energy self-sufficient. If constructed, the Proposed Development would help improve this self-sufficiency and narrow the energy supply gap.

3.9. Conclusion

3.9.1. The Proposed Development has been subject to a detailed and iterative design process. Alternative layouts and access routes have been considered. The final design has sought to balance the technical requirements of the Applicant with the environmental considerations highlighted by consultees and the public during early consultation. The residual impacts of the design process are considered in the technical EIAR chapters.

[7] *RenewableUK Wind Energy Statistics Explained [Online] Available at - Statistic - Explained – RenewableUK (Accessed 22/02/2024)*

[8] *Department for Energy Security & Net Zero (DESNZ) Load Factors for renewable electricity generation [Online] Available at DUKES_6.3.xlsx (live.com) (Accessed 22/02/2024)*