

Breackerie Wind Farm

Environmental Impact Assessment Report Volume I Chapter 4: Design Evolution

October 2023

CONTENTS

Version Control Sheet.....Error! Bookmark not defined.

4 DESIGN EVOLUTION **1**

Introduction1

Design Strategy1

Site Selection Methodology and Alternatives.....1

First Iteration – Initial 22 Turbine Layout5

Second Iteration – 21 Turbine Scoping Layout6

Third Iteration – Interim 15 Turbine Layout7

Fourth Iteration – Interim 14 Turbine Layout9

Fifth Iteration – Final 13 Turbine Layout10

Summary of Design Evolution.....11

4 DESIGN EVOLUTION

Introduction

- 4.1 This chapter describes the site selection and iterative design process that has concluded with the final design as described in Chapter 3.

Design Strategy

- 4.2 The overall design layout principle of the proposed development has been to achieve a coherent and compact design, which minimises direct and indirect adverse effects on the local and wider landscape, while balancing commercial considerations and maximising energy production. Figure 3.1 shows the final infrastructure design layout submitted as part of this application.
- 4.3 A key reason for the selection of this site was due to its undulating nature formed through its surrounding hills. The summit of Tirfergus Hill (260m AOD) to the north is out with the site boundary, while the summits of Cnoc na Gabhar (239m AOD) and Cnoc Odhar (277m AOD) to the east, as well as Achnaslishaig Hill (307m AOD) to the south and The Slate (384m AOD) to the north-west all lie within the site boundary, permitting a partially screened design. This was taken into account throughout the design process.
- 4.4 The site boundary, whilst larger than turbine envelope, was drawn to allow flexibility in layout, infrastructure and for potential habitat management if required.

Site Selection Methodology and Alternatives

- 4.5 The overall approach to wind farm site selection is to identify areas of land where the siting of a wind farm would result in minimal environmental effects, be free from overriding technical constraints, and be economically viable. This involves:
- A review of the planning context for renewables in Scotland and at the local authority level;
 - A Geographical Information System (GIS) constraints analysis;
 - Analysis of wind speed data;
 - Consideration of proximity to potential electricity connection points; and
 - A review of suitable site access points and related transportation issues.
- 4.6 In reviewing the option of alternatives, the proposed development is the result of GIS 'sieve' mapping, whereby alternate areas for development have been scoped out as less suitable. This chapter describes this initial selection process, as well as the iterative design process which demonstrates the alternate plans considered before arriving at the proposed layout illustrated in Figure 3.1.
- 4.7 The site location shares significant characteristics within the *Upland Forest Moor Mosaic* LCT to the north of Campbeltown that demonstrate 'opportunities' for wind farm

development. These relate to the simple landform and forested hills which are sparsely populated and remote from the coastline. The design process has therefore considered the local landscape character, scale, form, and the effects on views and visual receptors in the surrounding area.

GIS Constraints Mapping

4.8 A GIS 'sieve mapping' exercise was carried out in order to further inform the search process. This involved identifying and mapping constraints to wind farm development in order to identify potential sites. The various constraints considered as part of the site selection exercise for the Proposed Development included but were not limited to:

- Radio and microwave signal – using known constraints to identify areas which could be affected by existing radio and microwave signals;
- Aviation interests – including local licensed aerodromes and visibility to radars, both military and civilian;
- Hydrological, geological and hydrogeological constraints – including effects on groundwater, water resources and local geology;
- Landscape designations – including National Parks, special landscape areas, and local landscape designations;
- Ecological designations – including Ramsar sites, Special Protection Areas, Special Areas of Conservation and Sites of Special Scientific Interest;
- Cultural heritage designations – including Gardens and Designed Landscapes, Registered Battlefields, World Heritage Sites, Listed Buildings, Properties in Care, Conservation Areas and Scheduled Ancient Monuments;
- Potential Grid Connection points - the capacity of the local grid network to accept the likely output from a proposed wind farm is critical to the technical feasibility of a development. The connection voltage and the distance from the wind farm can have a significant effect on the commercial feasibility of a development proposal; and
- The pattern of settlement – with buffers provided around residential properties and settlements.

Wind Speed Data

4.9 The predicted wind resource in any given location is an important consideration in identifying potentially suitable wind farm sites. The electricity that can be generated by a wind farm is directly linked to wind speed. Wind speed generally increases with height above ground level and the amount of electricity generated increases disproportionately with increases in wind speed. This in turn affects the carbon emission savings and the commercial viability of a site. Potential wind farm sites are therefore reviewed in relation to a number of publicly available data sources in the first instance, including the NOABL wind speed database¹.

¹ The NOABL wind speed database was created by the Department of Trade and Industry and provides annual mean wind speeds on a kilometre grid square basis.

Access Suitability

- 4.10 A desktop exercise was undertaken to ensure that appropriate access was available for the transportation of wind turbine components. Full details are provided in Chapter 13: Transport and Access.

Selection of the Site

- 4.11 Following a site search based on this methodology and criteria, the Site was selected due to a number of factors, including:
- Energy capture – software modelling indicates that the Site offers a strong wind resource with few obstacles or areas of pronounced topography close enough to interrupt wind flow;
 - Environmental designations – the Site is sufficiently removed from any important statutory wildlife designations which could have the potential to constrain wind farm development;
 - Landscape – the Site is sufficiently removed from any important nationally or locally designated landscapes. While there is a local council designation 'Mull of Kintyre Area of Panoramic Quality' (soon to be Mull of Kintyre Local Landscape Area as per the forthcoming Argyll and Bute Local Development Plan 2), it has no published citation or descriptions setting out the reasons for its designation and qualities it aims to protect;
 - Residential separation distances – the Site is able to provide separation distances in excess of 1.2km from the nearest residential properties while having potential for a high installed capacity;
 - Transport infrastructure – the Site benefits from suitable access for turbine component delivery; and
 - Grid connection – the Applicant has consulted with the local Distribution Network Operator to accommodate the electricity generated by the Proposed Development.

Design Evolution

- 4.12 The design process took place over a number of months and the proposed development has been progressively revised and refined during this time to take account of the information arising from pre-application consultation with stakeholders, and the findings of the EIA. As a result, the design and EIA process has been highly iterative and all aspects of the final design, including the location of the wind turbines, crane hard standings, the site access, layout of the access tracks, the locations of the substation and construction compound have been influenced by various technical, environmental and planning considerations.
- 4.13 The design of the proposed development has been optimised to produce a project which balances the use of land available with the overall impact of the development. This is based mainly on the following technical, economic and environmental considerations:

- Ground conditions and existing land use: the layout design minimises the impact to areas of peat. Watercourses and critical slope gradients have also been avoided where possible;
- Residential properties: a residential buffer / stand-off distance of at least 1km from residential properties has been included;
- Distance between turbines: to minimise the turbulent interaction between turbines they should be spaced in a suitable manner to minimise wind wake effects;
- Environmental constraints: The assessment chapters of this EIA Report discuss these considerations and issues; and
- Landscape and visual amenity: Chapter 6 of this EIA Report covers this in depth. The design of the Proposed Development seeks to match the turbines with the scale of the landscape. Due to the location of the site, the landscape and visual aspects of the proposal were key in designing the turbine locations and heights. Computer modelling was used as a tool to aid design and a 3D model/wireframes were generated for views from key locations around the Site.

4.14 The positioning of the turbines, through the design, has been continually altered to account for the proximity of constraints as these have been assessed, and as EIA studies have progressed. Stakeholder consultation has been based on both the milestone iterations detailed below, and a number of other designs between principle iteration stages. The principle iterations are shown in Images 1-6.

4.15 Following the base position illustrated in Image 1, the Applicant sought the professional guidance of landscape architects to assist in developing the layout.

4.16 The inherent nature of wind turbines as tall, modern structures means that the form of the wind farm as a whole is important. The appearance of the wind farm as an object or composition in the landscape has been a key factor in generating the layout. In this respect the design evolution has taken account of the following guidance:

- *SNH Guidance on Siting and Designing Windfarms, Version 3a, 2017*, which aims to achieve a simple, rational and cohesive design that, to a reasonable degree, avoids overlapping turbines and gaps within the visual composition; and
- Landscape constraints, opportunities and guidance for wind farm development within the *Mull of Kintyre Upland Forest Moor Mosaic LCT*, described by the ABLWECS

First Iteration – Initial 22 Turbine Layout

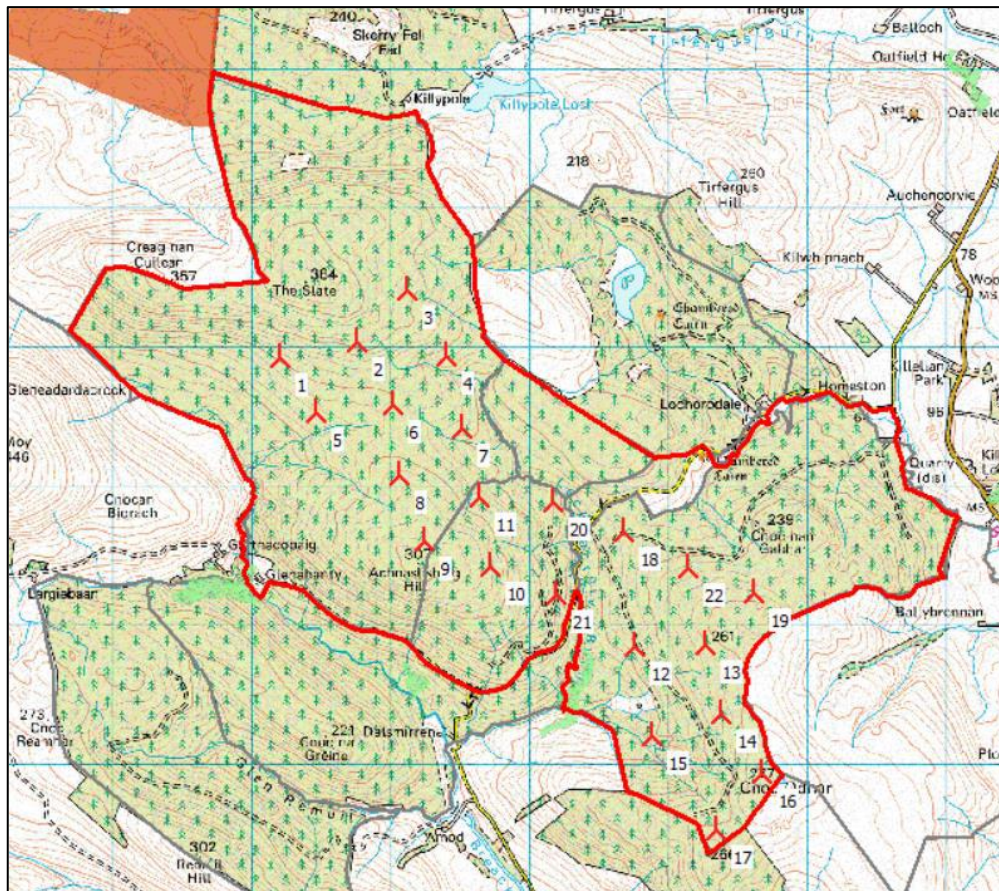


Image 1: Initial 22 Turbine Layout

4.17 The First Iteration consisted of 22 wind turbines, illustrated in Image 1. At this stage, detailed consideration was not given to individual turbines and their buildability and topographical situation, and effectively this represented a maximum development case. Turbine height was not specified at this point. The layout was based on land considered to be potentially available and the following environmental and technical considerations:

- Initial turbine ellipses in 3x3 rotor diameter spacing used to position turbines.
- Applying a residential buffer of 1.2km between wind turbines and residential properties;
- Scheduled Monuments: there are two scheduled monuments within the site boundary. One is wholly contained, and one sits partially within the red line boundary. Turbines and onsite infrastructure have been designed to minimise the impact; and
- Applying a watercourse buffer of 50 m between wind turbines and watercourses.

[illegible]

Image 2: 21 Turbine Scoping Layout

- Energiekontor UK Ltd | October 2023

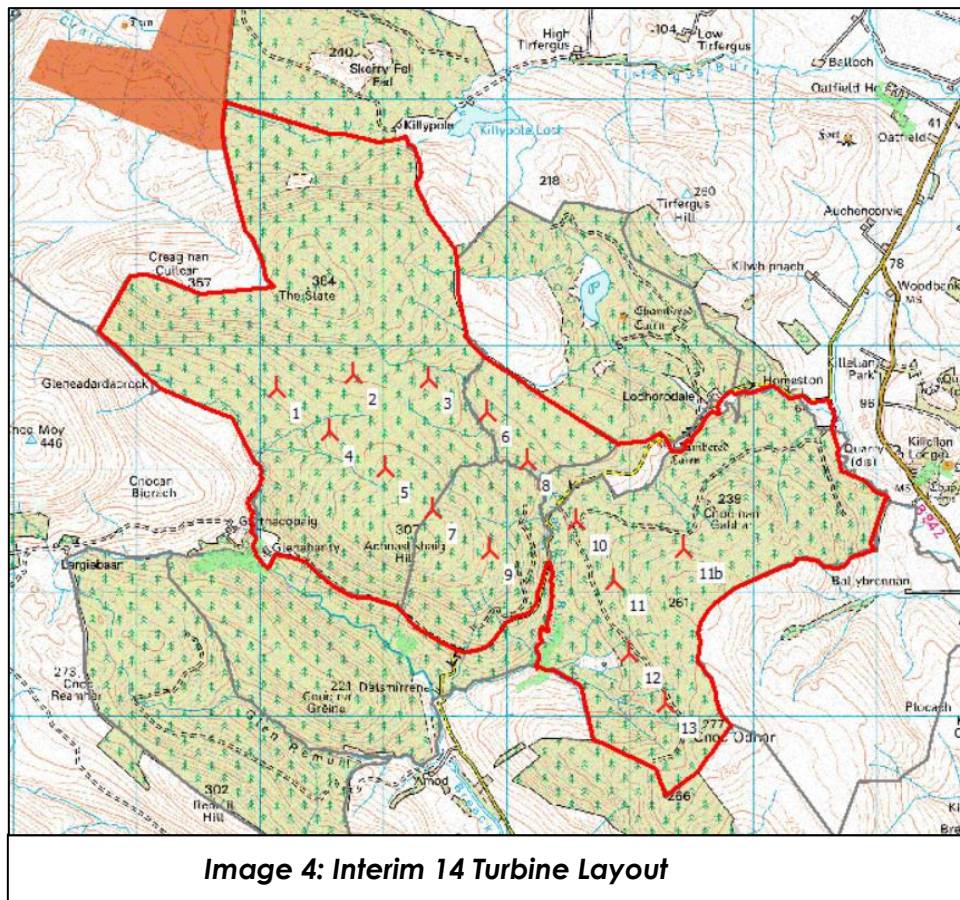
Image 3: Interim 15 Turbine Layout

- Energiekontor UK Ltd | October 2023

site, but that the approximate position of T13 would likely constitute the extent. Turbine 12 in Image 3 was assessed as being too prominent and therefore unacceptable.

- 4.23 The main core of the site, from T1 to 9, was positioned also to allow for the lowest impact from construction of ancillary infrastructure such as turbine compounds and access roads. Owing to the valley that occupies the general area of the Lecknacreive Burn, approximately from the south-east of T2 to the public road, it was judged that access could not come from the Dalsmirren public road dissecting the site even if it was suitable in its present format. The gradients from the centre of turbines 1-9 would be too steep to then surface each turbine, and therefore access was considered in terms of a loop road, maintaining turbine compounds generally as level as possible to minimise cut and fill. Therefore, owing to topography, watercourses and peat, Turbines 1-9 were confirmed subject to Phase 2 peat probing.

Fourth Iteration – Interim 14 Turbine Layout



- 4.24 Further design was progressed in experimenting whether T12 could be taken downhill to the north. In Image 4 this is noted as Turbine 11b. It was found when analysing visual impact, that T11b may begin to encroach upon properties to the east and owing to spacing requirements, there was no possibility of taking this further west. Therefore, it was deleted.

Image 5: Final 13 Turbine Layout

- Energiekontor UK Ltd | October 2023

- Track layout accommodates the abnormal loads associated with turbine deliveries. The exiting 'Dalsmirren' road dissecting the site was deemed unsuitable for abnormals, due to the extensive upgrading that would be required in relation to levels, widths and strengthening. Therefore, turbine deliveries would use the existing forestry track, travelling past Cnoc nan Gabhar;
- Existing tracks can be utilised from site entrance to T13. T10, 11 and 12 are situated adjacent to existing tracks. Due to the topography from the existing forestry track that goes north towards The Slate, it is necessary to maintain gradients by taking a circular route around T1 to T9.
- Watercourse crossings were minimised as far as possible, along with areas of deepest peat. This was agreed with SEPA during pre-application consultation.
- The substation compound was situated to the north-east of the proposed development in order to minimise the footprint of a grid connection corridor that will inevitably travel north to north-east.

Summary of Design Evolution

- 4.29 The wind farm layout in its proposed form takes account of stakeholder feedback received during pre-application discussions, and environmental and technical constraints. In designing a layout which is simple in composition and restrained in size, the final design results in a development which takes into account the constraints associated with the site.
- 4.30 In addition to the opportunities afforded by the Site location, the design and layout of the proposed development provides design mitigation. The 'simple' turbine layout is suitable for the underlying landform and simple landscape character of the *Mull of Kintyre Upland Forest Moor Mosaic* LCT and accords with general SNH guidance *Siting and Designing Windfarms in the Landscape*, Version 3a, 2017 for wind farm development as a simple, balanced and cohesive turbine composition as well as being located within a large-scale, broad and simple LCT. The proposed turbines have been cohesively located, between surrounding low hills to benefit from intervening screening and limit the visibility of the proposed turbines as well as reducing the horizontal and vertical extent of the proposed development from key views and particularly when perceived from the B842 and B843, nearby settlements of Stewarton, Drumlemble and Campbeltown, Westport Beach, and water based users of Campbeltown Loch. The scale of the turbines can be accommodated in this location, creating a simple, cohesive, balanced and clear design and visual composition that minimises excessive 'turbine clutter' in the form of uneven gaps / overlaps and outlying turbines. This has the following design advantages:
- Through design, the proposed turbines have been located within a forested shallow bowl, that limits their overall maximum theoretical visibility from surrounding areas;
 - The proposed development would appear as a clearly recognisable scheme that 'fits' with the scale and simplicity of the local landscape character, such that the aesthetics and visual composition of the turbines (appearing as a simple and

reasonably balanced composition) can be appreciated in their own right where visible; and

- The simple visual composition of the turbines reflects the character of the *Mull of Kintyre Upland Forest Moor Mosaic* LCT and the pattern of other existing and consented wind farm development nearby, to the north of the A83.