Glenvernoch Wind Farm

Environmental Impact Assessment Report
Volume I
Chapter 4: Design Evolution

October 2024

Energiekontor UK Ltd
George.oldroyd@energiekontor.com

CONTENTS

FIGURES

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 design layout submitted as part of this application.

4.3 A key consideration for the Proposed Development was the landscape and visual effects, and minimising the adverse effects from sensitive viewpoints. These were taken into account throughout the design process.

Site Selection Methodology and Alternatives

4.4 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.

4.5 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.

Review of Planning Context

4.6 Information on the planning context for renewables in the local planning authority of Dumfries and Galloway was reviewed as part of the site search exercise, focusing on the relevant Development Plans, national policy and other relevant material considerations.

GIS Constraints Mapping

4.7 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, 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

4.8 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 database[1].

4.9 In the case of the Proposed Development, wind speed data gathered from the site was used to assist in the design.

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 11.

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 and meteorological mast wind data indicate 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 nationally or locally designated landscapes;
- 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 Transmission 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 the Scoping Opinion and consultation responses from statutory consultees and key 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 hardstandings, 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 watercourses and areas of deep peat;
- Residential properties: a residential buffer / stand-off distance of at least 1.2km 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 those in the immediate area and the overall development 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.

- 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 Figures 4.1- 4.3.

First Iteration (Scoping Layout)

4.1 At this initial phase of the design, the only environmental constraints information available was from desk-based studies and Phase 1 peat depth data, meaning all turbines were indicatively located outside areas of deep peat (<1m). Wind data had been obtained for the whole of the site and some initial environmental survey work had been undertaken. A series of pre-scoping presentations were undertaken with various stakeholders to introduce the project and the reasoning behind the Scoping layout (Figure 4.2).

4.2 The first iteration was presented at a public exhibition held in September 2023.

4.3 The Scoping layout comprised 18 turbines with tip heights of 200m. The initial turbine positions and land available lend themselves to a design that is relatively compact.

4.4 In accordance with Regulation 12 of the EIA Regulations, Energiekontor sought a scoping opinion on the Scoping layout from the Scottish Ministers on the environmental information to be provided in the EIA Report (EIAR). The request was accompanied by a Scoping Report which set out a summary description of the Proposed Development, identified the issues proposed to be included in the EIAR and proposed an approach to the assessment of effects in each case. The Scoping Report was simultaneously issued to a list of statutory and non-statutory consultees.

4.5 The Scoping Report and Scoping Opinion are provided at Technical Appendix 1.1.

Second Iteration (Post-Scoping Layout)

4.6 Illustrated in Figure 4.3, the second iteration comprised 13 turbines with tip heights at 200m. The second iteration was based on feedback received as part of the scoping process and meetings held with key stakeholders and consultation responses from statutory consultees. The key change to the site layout from the first iteration was a reduction in turbine numbers

from 18 to 13 in order to reduce the significance of visual impact from key viewpoints such as the Southern Upland Way and Bruce's Stone.

4.7 Further consideration was given to designing a layout that limited the potential for the isolation of turbines, resulting in a layout which is fairly evenly spaced when viewed from all directions and key viewpoints.

Third Iteration (Proposed Development Layout)

4.8 The final layout (Figure 3.1) comprises 13 turbines with tip heights at 200m. In addition to the constraints considered at the First and Second iteration stages, the final design takes account of the following principal considerations:

- Adjustments in turbine positions to maximise offsets from the nearest residential properties.
- Following Phase 2 Peat Surveys, turbine positions, access tracks and other on site infrastructure positioned to minimise peat disturbance and maximise offsets from watercourses.
- Siting of the construction compound and substation within the lower lying core of the Site, to minimise visual prominence.

Summary of Design Evolution

4.9 The wind farm layout in its proposed form takes account of stakeholder feedback, and environmental and technical constraints. The final layout does not have notable instances of turbine stacking, large gaps in the layout, or an uneven perception of turbine heights from any of the key viewpoints.

4.10 The overall design layout principle of the Proposed Development has been to achieve a coherent and compact design, which minimises direct and indirect negative impacts to the local and wider landscape, while balancing commercial considerations and maximising energy production.