Mid Moile Wind Farm

Environmental Impact Assessment Report
Chapter 4: Design Evolution

December 2021

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4 DESIGN EVOLUTION

Introduction

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

Site Selection Methodology and Alternatives

4.2 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;
- Proximity to potential electricity connection points; and
- Suitable site access and transportation.

4.3 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

4.4 Information on the planning context for renewables in Dumfries and Galloway (DGC) 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

4.5 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 was 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 MoD Low Flying Areas, local licensed aerodromes and visibility to radars, both military and civilian;
- Hydrological, geological and hydrogeological constraints – including effects on groundwater, water resources, local geology, Groundwater Dependent Terrestrial Ecosystems (GWDTEs) and soil bodies.

- 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;
- The pattern of settlement – with buffers provided around residential properties.

Wind Speed Data

4.6 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 is 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].

Access Suitability

4.7 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

4.8 Following a site search based on this methodology and criteria, the Site was selected due to a number of factors, including:

- Underlying landscape capacity – A full appraisal is provided in Chapter 6.
- 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 nationally or locally designated landscapes;
- Residential separation distances – the Site is able to provide separation distances in excess of 1,000 m from the nearest residential properties while having potential for a high installed capacity;

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

- Transport infrastructure – the Site benefits from suitable access to the road network for abnormal routes to Site as well as the potential to utilise existing tracks for construction internal new tracks as well as using existing track.

Design Evolution

4.9 The land available for development at the Site is relatively expansive and generally free from on-site constraints and therefore, the design was mostly a process of refining the layout and reducing impact on landscape and visual amenity grounds rather than fundamental design changes.

4.10 The design process took place over a number of months and the Proposed Development has been progressively refined during this time to take account of the information arising from pre-application consultation with stakeholders, and the findings of the EIA process. As a result, the design and EIA process has been 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.

4.11 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 forestry, watercourses and critical slope gradients have also been avoided where possible;
- A residential buffer / stand-off distance of at least 1,000 m from off-site non financially-involved properties;
- Distance between turbines and proximity to 'obstructions'. To minimise the turbulent interaction between turbines they should be spaced in a suitable manner to minimise wind wake effects;
- Environmental constraints – Vol II Figures 4.1- 4.3 provide a snapshot of some of the desktop analysis that helped in the design evolution. 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 and the overall development with the scale of the landscape and the strategic pattern of wind farm development.

4.12 The position 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. Some of the principal design stages are discussed below.

First Design Iteration (Pre-scoping layout)

4.13 Detailed information on environmental constraints had not yet been collated. Therefore the initial turbine positions were developed on the basis of engineering information using standard turbine spacing to estimate the number of turbines that could be

accommodated within the land available and applying a minimum buffer separation distance to the nearest residential properties, watercourses and cogniscient of the SHN Carbon and Peatland Map. The initial layout comprised 25 turbines.

Second Design Iteration (Scoping Layout)

4.14 At this phase of the design, environmental constraints information was available from desk-based studies and some initial environmental survey work. 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).

4.15 The Scoping layout comprised 21 turbines with tip heights of 230m. The initial turbine positions and land available lend themselves to a design that is relatively compact.

4.16 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.

4.17 The Scoping Report and Scoping Opinion are provided at Technical Appendix 1.1 and 1.2.

Third Design iteration (Proposed Development Layout)

4.18 The final layout (Figure 3.1 and Figure 4.3) comprises 15 turbines with tip heights at 200m and 230 m to tip. In addition to the constraints considered at the First and Second Iteration stages, the final design takes account of the following principal considerations:

- Reduction in the proposed tip height of some turbines from 230m to 200m in order to avoid any overbearing effects on the nearest residential properties, improve design fit with the adjacent Glen App turbines, and to provide a better design fit with the underlying landform.
- Reduction in turbine numbers from 21 to 15 in order to position the turbines from the western ridge to provide a greater offset from views eastward toward the Site.
- Adjustment of turbine positions to reduce the impact on heritage assets within the Site.
- Adjustments in turbine positions to maximise offsets from the nearest residential properties.
- Adjustments in turbine positions to achieve a balanced and coherent layout composition from viewpoints around the Site.
- Siting of the construction compound and substation within the lower lying core of the Site, surrounded by retained forestry, to minimise visual prominence.
- Minimising the requirement for forestry felling and the proposed restocking of forestry areas around turbines to minimise the appearance of keyholing.

Summary of Design Evolution

4.19 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.

4.20 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.