

CHAPTER 5 - SITE DESIGN

Design Development

- 5.1 The design of the turbine layout is an iterative process, starting with the physical characteristics of the site, in particular topography and wind regime, and the required spacing between each turbine, within the overall landholding. The layout and number of turbines has then evolved to accommodate the constraints on the development, and within those constraints to optimise the potential output. The general factors affecting the size and layout of turbines include:
- ecological constraints;
 - landscape and visual effects;
 - economic efficiency;
 - technical feasibility (access and grid capacity); and
 - noise.
- 5.2 The EIA process involved continual refinement and improvement of the design taking into account information about the potential environmental effects. Therefore, with regard to the EIA regulations, alternatives were rigorously considered in the iterative approach to the design of the wind farm.
- 5.3 The final layout of the site has to consider many factors in its design, as meeting the requirements of one concern may affect other parameters. For example, moving a turbine further away from one neighbour/constraint could move it too close to another neighbour/constraint, conflicting with the minimum distances required between turbines to avoid turbulence and 'wake' effects.
- 5.4 The site specific objectives for the wind farm design can be summarised as:
- Technical Objectives:
 - siting of turbines in areas of good wind resource;
 - siting of turbines with adequate separation between turbines to minimise wake effects and hence maximise generation;
 - achieving suitable gradients for turbine foundations, access tracks and substation and control buildings; and
 - minimising the overall length of access tracks and cable routes (above and below ground).
 - Environmental Objectives:
 - providing power with minimum additional environmental impact;

- siting of turbines to avoid statutory designated sites and areas identified as an 'absolute ecological constraint', and minimising impact on areas of high ecological importance (identified during field survey);
- optimising layout of turbines to take into consideration landscape character and visual impact;
- minimising impact to existing land uses (agricultural and amenity);
- avoiding designated sites of archaeological importance and on areas of undesignated archaeological interest or potential interest;
- minimising noise impacts on potential receptors;
- avoiding interference with electro-magnetic links; and
- avoiding surface and groundwater resources and minimising indirect effects on these resources.

Design Process

- 5.5 The layout has evolved over eight principal iterations which tested different layouts with up to 49 turbines (see **Figure 5.1**). The objective of each iteration was to maximise the energy yield while minimising the environmental effects. The principal factors that were taken into account when refining the layout from the maximum of 49 turbines were:
- the constraints imposed by the Tactical Training Area (Low Flying);
 - ecological constraints including the Afon Gwy (River Wye) SAC and SSSIs, the impact of turbines on Curlew (*Numenius arquata*) and Snipe (*Gallinago gallinago*), and the location of deep peat and other Biodiversity Action Plan Priority Habitats;
 - noise effects on nearby properties;
 - turbine spacing to reduce the wake effects; and
 - visual impact.

Final Design

- 5.6 The final layout, which is assessed in this Environmental Statement (ES), consists of 27 turbines and is shown on **Figure 2.1**. The main ecological constraints to the design, as listed in **Paragraph 5.5** above, are shown on **Figure 5.2**.
- 5.7 Within the overall land holding, covering over 2,000ha, the application area covering approximately 584ha represents the most suitable part where the turbines would be located at the greatest distance from the Plynlimon SSSI and away from the Afon Gwy (River Wye) SAC and SSSI. The turbines and ancillary structures have been located in areas already disturbed by tracks and the Rally Complex activities. By virtue of the Rally Complex, the site also has a large proportion of the infrastructure required for a wind farm already in place.

- 5.8 Further micro-siting of the turbines may be required following detailed design of the project. Therefore, it is proposed that there is a 50m tolerance on the proposed position of the turbines. Because of the varied habitat, soils and geology on-site, particularly boggy ground, which can be difficult to accurately map, a wider tolerance than the more usual 30m is being applied for. This is to ensure that there is sufficient tolerance to be able to site turbines away from sensitive habitats and features.
- 5.9 The assessment of significance in this ES takes into account the mitigation already incorporated into the scheme both during the design process and including the measures employed during construction to prevent significant effects on the environment.
- 5.10 In essence, the final design seeks to achieve the best possible compromise between the technical and environmental issues. Further details and plans of the wind farm infrastructure are provided in **Chapters 2 and 6**.

Energy Yield

5.11 The final layout has been assessed for energy yield by Anemos Jacob GmbH. Wind speed and direction data, obtained from approximately 34 months of data from the meteorological mast on the application site, was used for the analysis. Long term calculations were based on approximately 10 years of data recorded at the Trawsgoed met station, situated approximately 19.7km to the south-west of the site. Using Vestas V90 as a basis, the predicted energy yield for 27 turbines of hub height 80m and rotor diameter 90m, is summarised in the **Table 5.2** below.

Turbine	Generator Size (kW)	Wind farm capacity (MW)	Gross energy output (GWh/y)	Net energy output (GWh/y) (taking all losses into account, P50)	Losses (%)					Net capacity factor (%)
					Wake	Electrical	Non-availability	blade contamination	Others	
Vestas V90	3000	81	262.9	237.4	5.8	2	4	1	1	37

5.12 The losses highlighted above account for wake effects, on-site electrical losses, non-availability, blade contamination and miscellaneous losses such as icing related losses amongst others. The proposed wind farm energy production and capacity factor figures are based on net production, with hysteresis and air density related losses also being taken into account within the power curves utilised.

Consultations

- 5.13 Extensive consultation was carried out during the design development. This occurred throughout the life of the project design and environmental assessment. Full detail on the consultation process is set out in the **Consultation Report (Document Reference: MYG-AD-5)**.
- 5.14 Comments from the consultations have been incorporated into the design layout where appropriate. Specific comments are summarised and addressed under individual chapters.
- 5.15 In addition, consultation was carried out with a number of community and town councils and the public via public exhibitions held in 2006, 2011 and 2012, and through issue of Statement of Community Consultation (“SOCC”). Further information is provided in the **Consultation Report (Document Reference: MYG-AD-5)**.