

## 2 Design Evolution and Alternative Layouts

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## 2. Design Evolution and Alternative Layouts

### 2.1 Introduction

2.1.1 This chapter provides a description of the site selection process and design iterations that were undertaken prior to arriving at the final design which is described in Chapter 3.

### 2.2 Background

2.2.1 The site is in the ownership of William Mitchell & Sons Ltd and Mitchell Energy Ltd of Hazelside Farm, Glespin (hereafter referred to as the Landowner), with the exception of part of the access road from the M74 motorway which is owned by Hargreaves Surface Mining Ltd.

2.2.2 The Landowner was approached by a number of wind farm developers in and around 2008/9 regarding the potential to develop a wind farm on their part of the former Dalquhandy Opencast Coal Site. In 2009 the Landowner agreed to enter into an Option Agreement with Community Windpower Limited (CWP) who initially proposed to develop a 17 turbine wind energy project on the site (previously referred to as Douglas West Community Wind Farm) and to work with the local communities in Coalburn and Douglas to develop a community benefit package for both villages.

2.2.3 A Scoping Report for a 15 turbine wind farm was issued by CWP in 2012 and it is understood that initial discussions were held with the Local Authority, statutory and non-statutory consultees and both communities at that time. A Scoping Opinion was subsequently issued by South Lanarkshire Council (SLC) in June 2012 (further detail on this is provided in Chapter 4).

2.2.4 The project did not progress any further at that point due to protracted negotiations with Scottish Coal over the access road of which that company previously owned part. During the intervening period, the Landowner invested in a farm-scale renewable energy company, called 3R Energy, which specialises in farm-scale wind turbines, biomass boiler and CHP systems. In 2013 the Landowner acquired 3R Energy and relocated the business to Lanark Auction Market where 3R Energy is now based. Building on the success of 3R Energy as a farm-scale business, the Landowner decided to develop the project at Douglas West independently and to work with the local communities in Douglas and Coalburn to deliver tangible benefits to the local area.

2.2.5 A planning application was submitted in July 2015 for a renewable energy development (the Consented Development), comprising 15 wind turbines, up to 126.5 m blade tip height, and a Wood Fuel Drying Facility. Consent for the application was granted in February 2016 (Appendix 1.1) and two subsequent Non-Material Variation Submissions to increase the tip height to 131 m and rotor size to 113 m (CL/15/0273/1), and relocate the substation and construction compound (CL/15/0273/2) have also been consented (Appendix 1.2).

2.2.6 Following the submission of the 2015 Application the UK Government announced it would end all financial support for onshore wind generation in the UK. As a result, projects which could not become commercially operational by 31 March 2017 would be reliant solely on electricity generated and sold to the wholesale power market. Consequently, the Applicant has sought to optimise the Consented Development to maximise energy production, within acceptable limits, to ensure that the Revised Development is viable subsidy-free.

## 2.3 Site Selection

### ***Community Windpower***

- 2.3.1 As noted above, the initial site selection process was undertaken by CWP as part of a UK wide search and assessment of potential wind farm sites to progress and develop into operational wind farms. The search process involved an initial desk-based assessment being undertaken to identify potential areas for wind farm development.
- 2.3.2 Following initial studies, areas were either selected for further examination or rejected as unsuitable. This process identified a large number of sites throughout Scotland as suitable for further investigation and potential development. These favoured sites were assessed against a list of selection criteria, any site failing to meet this selection criteria or which conflicts with the criteria in a way that could not be successfully resolved, were removed from the site selection process.
- 2.3.3 The Revised Development site was identified as one of the most appropriate and best locations for a wind energy development as it was positive and successful in relation to meeting the initial site selection criteria.
- 2.3.4 Table 2.1 shows the levels of acceptability applied to the CWP site selection criteria during the selection process. The results of the assessment for the site are reported in Table 2.2.

**Table 2.1 – Site Selection Criteria Assessment Acceptability Scores**

<b>Good</b>	Minimal negative impact or potential positive impact from a wind farm proposal.
<b>Moderate</b>	Potential negative impact from a wind farm proposal. Further investigation and consultation required. Reduction of potential impact through mitigation measures.
<b>Poor</b>	Serious potential threat to a wind farm proposal. Further consultation needed. Mitigation measures required to be designed and discussed.

**Table 2.2 – Selection Criteria and Levels of Acceptability for Douglas West Community Wind Farm (as previously proposed)**

<b>Criteria</b>	<b>Comments</b>	<b>Acceptability</b>
Available Area for Wind Turbines	Over 330 hectares (ha) with the potential to accommodate up to 17 turbines.	Good
Wind Resource	Wind speeds in the region of 7.3 m/s at 45 m above ground level.	Good
Ministry of Defence (MoD)	Previous consultation with the MOD stated no concerns.	Good
Proximity and Suitability of Grid Connection Point	Grid connection point with sufficient capacity available.	Good
Access on Site	Existing tarmac access road into site direct from motorway junction. Small number of new internal access tracks will required to be built. Land has a suitable gradient.	Good
Transportation Route	Well maintained access route to the site and across the main body of the site. Easy access to trunk road network, namely the M74.	Good
Planning Policies at National, Regional and Local Level	National, Regional and Local policy positively provide for renewable energy development. The site is not located within an area of greenbelt or an area of international or national natural heritage designations	Good

Criteria	Comments	Acceptability
International Designated Areas	Not located within a SPA, SAC, RAMSAR site or World Heritage Site.	Good
National Designated Areas	None.	Good
Regional Designated Areas	Site is located adjacent to and partially within the Douglas Valley Special Landscape Area.	Good/ Moderate
Proximity to Residential Properties	Nearest single residence outwith 750 m from likely turbine locations.	Good
Presence of Existing and Consented Wind Farms	A number of operational and consented wind farms are located in the surrounding area.	Good
Existing Land Use	The site is currently used as rough grazing land, much of which was previously opencast for coal.	Good
Communication Signals	Number of consultation responses stating that communication links are not affected.	Good
Historic Environment	There are some heritage features of interest located on site, although there are no archaeological sites of national importance present within the site boundary.	Moderate

2.3.5 The site selection criteria Acceptability Assessment scored the Revised Development site ‘Good’ against the vast majority of the criteria (13), with only one criterion being scored as ‘Moderate’ and one as ‘Good/Moderate’.

2.3.6 Having fully evaluated the results of the selection criteria and process, CWP were of the opinion that a wind energy development at the Revised Development site was an excellent option.

### **3R Energy**

2.3.7 3R Energy took control of the development in late 2014 following negotiations with CWP as previously mentioned. 3R Energy is a local renewable energy company that employs local people and specialises in wind turbine, CHP and biomass boiler technologies. 3R Energy recognised the potential of the site to deliver renewable energy from wind and to use some of the energy generated by the wind turbines on site to dry wood chip on a commercial scale to support the expansion of both the wind and biomass divisions of 3R Energy’s business. A wind energy development at the site also had the potential to provide significant financial contributions to local communities in Coalburn and the Douglas Valley at a time when there is a reduction in community benefits in the area historically provided by opencast mining activities.

2.3.8 3R Energy amended the development to comprise a 15 turbine wind energy development and an accompanying wood fuel drying facility on the former Dalquhandy Opencast Coal Site Disposal Point (DP). The two components of the project were originally linked and together comprised an integrated renewable energy project. This development was granted consent in February 2016 (the Consented Development).

### **Douglas West Wind Farm Ltd**

2.3.9 The Applicant, Douglas West Wind Farm Ltd (a partnership between 3R Energy and Blue Energy, refer to Chapter 1) has sought to optimise the Consented Development following the announcement in 2015 by the UK Government to cease all financial support for onshore wind generation in the UK. As a result, the Applicant has redesigned the Consented Development to account for the removal of UK onshore wind subsidies and the requirement for the project to be viable solely on electricity generated and sold to the wholesale power market.

- 2.3.10 3R Energy had previously offered three local community groups (St.Brides Centre Douglas, Coalburn Miners Welfare and the Rural Development Trust) a stake in the Consented Development through a part-ownership arrangement which was to be backed by Scottish Enterprise. This arrangement is no longer viable following the UK Government's removal of support for onshore wind projects in the UK. However, in recognition of this offer discussions are currently ongoing between the Applicant, the local community groups and South Lanarkshire Council regarding new community benefit arrangements which recognise these earlier discussions and seek to put in place revised arrangements that maximise the benefit from the project to the local community within the constraints of the new economic climate for onshore wind in the UK. Refer to Chapter 13 (Socio-Economics) for further details.
- 2.3.11 In respect of the technical aspects of the project, the Applicant has undertaken further assessment to refine the Revised Development based on additional site surveys, detailed environmental and technical assessment as well as consultation exercises. This is discussed further in Section 2.5 below.

## 2.4 Alternative Sites

- 2.4.1 Environmental Impact Assessment (EIA) legislation requires the consideration of alternatives and an indication of the reasons for selecting the site advanced, except, as noted in Planning Advice Note (PAN) 58, where limited by constraints of commercial confidentiality.
- 2.4.2 As noted above, the Revised Development site was part of an extensive search for potential wind farm sites by CWP. It involved a desk-based assessment utilising secondary data and a Geographical Information System (GIS) to identify constraints at a particular site. Sites that were not deemed suitable at a given time (i.e. 'the alternatives') were disregarded.
- 2.4.3 3R Energy considered a number of alternative layouts for the Consented Development and included provision to make on-site use of some of the power generated by the wind turbines to dry wood chip on a commercial scale. This is explained further in Section 2.5 below.
- 2.4.4 The Applicant has further revised the scale and layout of the Consented Development to account for the change in UK funding, and to make the site viable in its own right. This has resulted in the layout of the Revised Development. The site is considered an appropriate and viable location for a wind energy project due to:
- good average wind speeds, with the potential to achieve substantial electrical generation from a renewable energy source;
  - easily accessible with the principal access route requiring minimal upgrading;
  - in close proximity to a viable grid connection point; and
  - can positively contribute towards regional and national renewable energy targets.

## 2.5 Design Process

- 2.5.1 As part of the EIA process design iterations were prepared and considered for both the turbine locations and on-site infrastructure, including access tracks, construction compounds and substation locations. In order to propose a development layout which is considered to represent the most appropriate design; potential environmental impacts and their effects, physical constraints, and health and safety considerations were taken into account. Information was collated from desktop information, field surveys, scoping opinions, local planning policy, planning conditions attached to the Consented Development and recent case law. This information provided the baseline from which site issues and sensitivities could be identified and highlighted for further detailed assessment and given

priority in influencing the layout iterations of the Revised Development. The design evolution process is described in detail below.

### ***Design Principles***

- 2.5.2 Current best practice guidance provides a framework for the consideration of key design issues including turbine size, layout composition, wind farm design in relation to landscape character and designing for multiple wind farms (SNH, 2017).
- 2.5.3 The following principles were adopted during the design iterations made by the Applicant since taking on the project to ensure that the final design of the Revised Development was the most suitable for the site:
- the Revised Development should avoid inconsistent turbine spacing, such as relatively large gaps, outliers or excessive overlapping turbines to minimise visual confusion and ensure a balanced / compact array from key views;
  - the careful positioning of turbines to ensure coherent connection with the consented Dalquhandy Wind Farm (and ensure that the turbines appear as a continuous array / 'one development');
  - the turbines remain set-back from the northernmost edge of the site, and do not come any closer to the settlement of Coalburn than the Consented Development turbines or the adjacent Dalquhandy Wind Farm;
  - the turbines remain set-back from the eastern edge of the site that borders the Douglas Water Valley;
  - retain spatial separation from the closest isolated residential dwellings in the surrounding area;
  - the establishment of a formal footpath network linking Douglas and Coalburn through the site, maximising the benefit from the existing infrastructure on site; and
  - other environmental constraints and associated buffers are to be respected.

### ***Consultation***

- 2.5.4 Consultation with key consultees and stakeholders was a key component in finalising the Revised Development layout.
- 2.5.5 An EIA Scoping Opinion was sought from the South Lanarkshire Council in March 2012 (refer to Appendix 4.1), planning application (CL/15/0273) was positively determined for the Consented Development in November 2016 (refer to Appendix 1.1) and further targeted consultation has been carried out by the Applicant in respect of the Revised Development (refer to Appendix 4.4). Further information on the previous scoping, planning and consultation processes is given in Chapter 4 of this ES.

### ***Identified Opportunities***

#### **Existing Infrastructure**

- 2.5.6 The site already contains significant infrastructure, a legacy from previous opencast coal mining activities both at the site and within the local area.
- 2.5.7 The existing tarmac-surfaced coal haulage road bisects the site in an east / west direction through the northern extent of the site, connecting the main body of the site to the national motorway road

network (M74). The road is in good condition, would require no or little upgrading and provides central access to the Revised Development footprint.

### **Transport**

- 2.5.8 The Revised Development site is easily accessible from the M74, reducing the requirement for mitigation measures on the wider road network.

### **Landscape**

- 2.5.9 Based on its close proximity, the Revised Development has the potential to appear as an extension to the consented Dalquhandy Wind Farm (on the adjoining part of the former Dalquhandy Opencast Site), which would merge together to form 'one' wind farm.
- 2.5.10 The undulating landform and existing woodland within the local area has the potential to provide screening from many vantage points.
- 2.5.11 The Revised Development is located within an area that already hosts wind energy development, and hence would not result in the introduction of turbines to a 'new' landscape area free from wind turbines. Furthermore, the Revised Development turbines would exert limited effect on the views experienced by receptors located to the west as they would be located beyond the Hagshaw Hill / Nutberry Hill / Galawhistle turbines. Noting also that a 15 turbine wind energy development is currently consented at the site (the Consented Development).
- 2.5.12 The turbines themselves would be painted an off white colour with a low reflectivity semi-matt finish (or similar as agreed with South Lanarkshire Council). Such a finish is widely regarded to be the least intrusive in the landscape when seen against the sky in a host of weather conditions typically experienced within the UK.

### **Historic Environment**

- 2.5.13 There are no Scheduled Monuments or Listed Buildings within the site boundary therefore the Revised Development will not have direct effects upon any such designated sites.

### **Geology, Hydrology and Hydrogeology**

- 2.5.14 There are no designated geological sites within the Revised Development site boundary.
- 2.5.15 The northern extent of the Revised Development has recently been disturbed by opencast coal mining activities (refer to Figure 3.1). The soils and hydrology have been greatly altered and thereby have reduced sensitivity to change.

### **Access**

- 2.5.16 The local area also includes an extensive network of footpaths, including Core Paths, which are promoted at a local level (refer to Appendix 3.1, Figure A3.1). Many of these paths have been removed or re-routed through past mining activities at the site.
- 2.5.17 The creation of a new access track network across the site presents an opportunity to formalise the local path network, provide improved recreational facilities in the area (including the creation of a Heritage Trail, refer to Appendix 3.1), and restore connectivity between Douglas and Coalburn communities.



## **Identified Constraints**

- 2.5.18 The main on-site constraints identified below are shown on Figure 2.1.

### **Landscape and Visual**

- 2.5.19 Cumulative visibility with local consented and operational wind turbine development will require careful consideration based on their close proximity to the Revised Development, in particular, in views from the north, east and south east, from where it would be experienced in the foreground. In views from the west, it would be located beyond these cumulative developments and experienced more as a background feature, if visible at all.
- 2.5.20 The southern part of the Revised Development (Turbines 10 to 13) is located within the Douglas Valley Special Landscape Area (SLA).

### **Ecology**

- 2.5.21 A National Vegetation Classification (NVC) survey was conducted (refer to Chapter 7 and Figure 7.3) and identified an area of mire across the southern extent of the site. Cognisance was also given to its level of degradation and ability to recover once a disturbance has occurred.
- 2.5.22 In addition, the NVC identified three areas of highly groundwater dependent terrestrial ecosystems (GWDTEs). These were mapped and considered a constraint to development.
- 2.5.23 Protected species surveys identified areas of constraint and these were also mapped and considered a constraint to development (refer to Chapter 7 and Appendices 7.1 to 7.8), as was a bat protection buffer from the adjacent forestry edge.

### **Ornithology**

- 2.5.24 There is a 12 hectare (ha) habitat enhancement area for black grouse as part of the approved mitigation measures for the Hagshaw Hill Wind Farm Extension located adjacent to the south-western boundary of the site.

### **Historic Environment**

- 2.5.25 A number of local archaeological sites are located within the Revised Development site boundary and there are nationally designated Scheduled Monuments and Category A Listed Buildings within 2 km of the Revised Development site boundary.

### **Geology, Hydrology and Hydrogeology**

- 2.5.26 To ensure that watercourses are not adversely affected, 50 m buffers have been applied to all watercourses on site and within the surrounding area.
- 2.5.27 Previous areas of opencast workings were mapped and turbines located outwith the area of backfill wherever possible.

### **Residential Receptors**

- 2.5.28 To ensure that nearby residential receptors were not adversely affected an initial 750 m buffer was applied to neighbouring residential receptors.

### ***Site Boundary Iterations***

- 2.5.29 The Planning Application boundary was reduced in 2015 to ensure an appropriate stand-off of Revised Development infrastructure to the village of Coalburn to the north of the site and the village of Douglas to the south of the site.
- 2.5.30 It was also amended to remove the land used as part of the Hagshaw Hill Wind Farm Extension Black Grouse Management Plan (refer to Figure 2.1).

### ***Turbine Layout Iterations***

- 2.5.31 Within the 2015 EIA process, there were seven main design iterations to the layout of the Consented Development that are described within the 2015 ES.
- 2.5.32 Changes made to the Consented Development layout were undertaken in the context of maintaining a financially viable development proposal when considered against the financial backdrop that existed for onshore wind developments in the UK at that time.
- 2.5.33 In the same way, and alongside considering all relevant environmental constraints shown in Figure 2.1, technical advice from wind analysts and turbine manufacturers have been a material consideration in arriving at the Revised Development layout, with regards to turbine spacing and placement, ensuring optimum wind energy production at the site and financial viability at today's wholesale price of electricity.
- 2.5.34 The principal changes to the Consented Development have been an increase in the proposed turbine dimensions, to achieve an increase in the power output of each turbine, and an increase in the amount of electricity generated by each turbine. This has as a result meant a decrease in the overall number of turbines from 15 to 13, due to the increase in generating capacity of each machine and a new turbine layout has been designed to take account of the increase in turbine separation distances required.
- 2.5.35 In the context of the revised layout, it is noted that at the time of design-freeze for the Consented Development the MoD were understood to be requiring a low flying corridor between wind farms which sterilised the southern part of the Consented Development site boundary. This is no longer required by the MoD, therefore, there is no longer any technical constraint to turbines being located within this part of the site.
- 2.5.36 In addition, minor changes to the siting of turbines occurred throughout the 2017 design process as new environmental and/or technical information was made available to the design team.
- 2.5.37 As part of the re-design process, landscape advice has been sought to mitigate the landscape and visual effects of the Revised Development as far as is possible, by avoiding inconsistent turbine spacing, large gaps, outliers or excessive overlapping turbines to minimise visual confusion and ensure a balanced / compact array from key views.
- 2.5.38 A summary of the main turbine layout iterations for the Revised Development, and the reasons leading to these changes, is provided in Table 2.3 and illustrated in Figure 2.2.

**Table 2.3 – Summary of Turbine Layout Iterations**

Design Iteration	Description	Design Principles / Reasons for Change from Previous Iteration
<i>Under the control of Douglas West Wind Farm Ltd</i>		
A (April 2017)	13 Turbines	Optimised layout based on a 130 m rotor diameter and 5 x 3 rotor diameter separation distance between turbines, looking at maximising turbine performance within the Revised Development layout whilst observing environmental constraints. Turbine number reduced from 15 to 13.
B (May 2017)	13 Turbines	Alternative optimised layout based on a 130 m rotor diameter and 5 x 3 rotor diameter separation distance between turbines, looking at maximising turbine performance within the Revised Development layout whilst observing environmental constraints. Turbine number remains at 13, potential for additional turbine within the southern extent of the site.
C (May 2017)	13 Turbines	Decision taken to move forward with the 130 m rotor diameter layout (Layout A). Layout amended to increase stand-off distance between proposed turbine locations and local residential receptors, in particular turbines T06, T09 T10 and T13.
D (June 2017)	13 Turbines	Final optimisation of turbine layout to account for infrastructure and construction constraints, following a site visit by construction engineer.

### ***On-site Infrastructure Layout Iterations***

2.5.39 Following the evolution of the turbine layout design, the design of the access tracks, construction compounds and substation was undertaken. The infrastructure required on the site was designed and arranged in such a way as to avoid the main on-site environmental constraints identified.

#### **Access Tracks and Crane Hardstandings**

2.5.40 It was recognised that there was good highway access to the site which would negate the need for lengthy and visually intrusive new access tracks through the landscape. Additional stretches of access track to reach outlying turbines were designed to:

- minimise the number of water crossings;
- avoid more sensitive habitats;
- avoid cultural and archaeologically designated features; and
- minimise the length of new access track by using existing on-site infrastructure.

#### **Substation and Construction Compound**

2.5.41 The substation and construction compound / laydown area locations have been designed to avoid watercourses and sensitive habitats. Both are positioned on land disturbed as part of previous opencast mining activities (refer to Figure 3.1) and located close to the consented Industrial Area in the east-central part of the site, so as to concentrate the more functional elements of the proposal in one location. The general location for the substation and construction compound / laydown area have been previously agreed under Non-Material Variation approval ref. CL/15/0273/2.

2.5.42 The substation is required to be located on the eastern side of the site to enable the Revised Development's connection to the wider grid network and the Industrial Area (Figure 3.2), as a potential end user of the electricity produced by the Revised Development.

## 2.6 Summary

- 2.6.1 The final layout has been informed by a robust EIA and design iteration process, taking into account potential environmental impacts and their effects, physical constraints, and health and safety considerations. The information used to inform the design iteration process included consultation responses received, extensive baseline data and the impact assessment undertaken.
- 2.6.2 The final turbine layout has been designed to effectively capture the energy from the wind in order to maximise the energy yield from the site, whilst minimising potential impacts on the environment.
- 2.6.3 This ES reports on the final layout selected for the Revised Development. The final layout comprises 13 turbines of up to 149.9 m in height and associated access tracks and crane hardstandings, substation, underground electrical cabling, construction compound / concrete batching and turbine laydown area, and meteorological monitoring mast. The final layout is shown in Figures 1.2 and 3.5.
- 2.6.4 The design team has worked hard to ensure that the environmental effects of the Revised Development are maintained within acceptable limits. It is acknowledged that in practice every wind farm site has some local impact; however, in both a national and regional context the Revised Development site is considered to be an excellent location for a renewable energy development.

## 2.7 References

- Scottish Government (1999). Planning Advice Note (PAN) 58: Environmental impact Assessment.
- SNH (2017). *Siting and Designing Wind Farms in the Landscape*, Version 3