



# Sanquhar

## Wind farm Project - Renewable Energy



### The Sanquhar Wind Farm - Scotland

Powersystems high voltage (HV) power engineering team were responsible for the design, installation, testing and commissioning of the electrical infrastructure to connect Sanquhar Wind Farm to Scottish Power's 33kV transmission network.

The wind farm consists of 9 Vestas 3.6 MW turbines which generate a total of 32.4MW of clean, green and locally sourced energy. The wind farm is located on Black Hill approximately 7km southwest of Sanquhar in Dumfries and Galloway, Scotland. Powersystems have been highly immersed in connecting wind energy in this area of Dumfries and Galloway, having completed the electrical infrastructure for nearby wind farms, such as Blackcraig, Whiteside, Windy Standard II, and are currently engaged in constructing HV infrastructure for Windy Rig Wind Farm.

Sanquhar Wind Farm was financed in an economically strategic manner by selling the electricity directly to a large consumer, rather than selling it to retailers in the open market. The electricity is sold directly to Nestle, the world's largest food and drink company, and the wind farm produces enough to power half of Nestle's UK and Ireland factories, offices and warehouses, the equivalent electricity to power 30,000 homes. This means that all of Nestle's UK and Ireland operations are supplied from 100% renewable sources, and the wind farm gives them extra capacity to on sell back to the grid.

### Project facts and figures

- ▶ Number of wind turbines: 9
- ▶ Wind turbine capacity: 3.6 MW
- ▶ Totalled Installed capacity: 32.4 MW
- ▶ Connection Voltage: 33 kV
- ▶ Length of onsite 33 kV cabling: 28 km
- ▶ Length of onsite fibre optic cabling: 9km



### Powersystems partnerships

Community Windpower partnered with a number of specialist contractors to construct the wind farm, including AMD and Roadbridge Civil Engineering to construct the wind farm tracks and turbine foundations, Natural Power to provide due diligence and engineering consultancy services, Vestas to supply the wind turbines, and Powersystems as the high voltage specialist electrical balance of plant contractor. Because Community Windpower and Powersystems have partnered with Vestas and Natural Power on many previous wind farm projects, this meant the teams were well engaged right from the project inception.

The wind farm point of connection was slightly unusual in that Scottish Power Transmission (SPT) were able to offer a 33 kV connection, which is a lower voltage that normally would be in the domain of Scottish Power Distribution. However, since a transmission connection was available in much shorter timescales than a distribution connection would have been, it made sense to opt for a connection with SPT. Powersystems, having previous experience of connecting wind farms to Scottish Power Transmissions' 132 kV network, were very familiar with SPT's rigorous connection standards and the Grid Code requirements. Consequently, Powersystems engineers were able to quickly design the HV infrastructure and protection and control systems to provide a National Grid transmission standard connection at the atypical voltage of 33kV.





## Powersystems partnerships (continued)

Powersystems engineers worked closely with Community Windpower and Vestas to produce the required compliance documentation known as the UDFS which demonstrates to National Grid that the wind farm has the ability to meet the stringent Grid Code standards with respect to reactive power, voltage control, fault-ride through, and frequency response that are all required for a transmission-connected site.

## Scope of works and major design considerations

One of the major design challenges was a crossing a 150m deep valley which swept right through the middle of the site separating half of the turbines from the main substation. The civil contractor did an exceptional job designing and constructing a winding wind farm track to cross the valley and slowly climb back up the other side with wide enough bends to allow turbine blades to be transported. Unfortunately this meant that if the 33kV cables also followed this track it would have added an additional 10km of cabling.

Community Windpower asked if instead of following the wind farm tracks we could install cables directly across the valley, that is, without tracks, 150m down and 700m across a 25° incline! When they first suggested this we were taken aback by the size of the challenge that the terrain offered, but engineers from Powersystems and our civil partner Roadbridge rose to the challenge. Roadbridge came up with a safe method to install cable ducting down a 25° incline with no hard surface for their excavators to stand on, and Powersystems designed and installed suitable cable anchor points along the crossing to ensure the cables would not slide down the ducts, as the incline was so steep the cables would have slid away without supports presenting a serious health and safety risk. The cables were successfully installed using a mechanically driven cable drum trailer in May 2017.

By finding a way to install the 33kV cables “off-piste”, Powersystems were able to save Community Windpower over 10km of cabling, as well as significantly reduce the electrical infrastructure losses by shortening the cable lengths.

The major items of electrical plant that Powersystems designed, supplied, installed, and commissioned were:

- ▶ 3-panel 33 kV switchboard
- ▶ 50 kVA auxiliary transformer
- ▶ 50 kVA auxiliary generator
- ▶ Substation SCADA system
- ▶ 33 kV and fibre optic cables to 9 wind turbines
- ▶ Substation and wind turbine earth system installation and testing
- ▶ Scottish Power Transmission interface protection
- ▶ All necessary substation building fit-out works comprising lighting and small power with intruder, CCTV and fire alarm systems

## What the client wanted

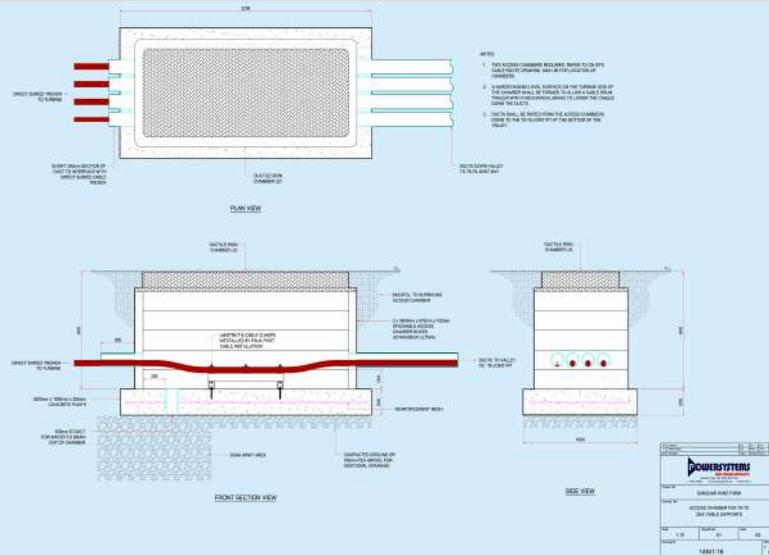
Another major project challenge was the delay to the Scottish Power Transmission 132 kV overhead line works which prevented the grid from being energised on time. This meant that the 9 Vestas wind turbines that were being erected in August 2017 had no means of generating and were prevented from carrying out reliability testing, a key test requirement before the turbines are handed over to the client. Community Windpower was facing a five month delay in getting their turbines commissioned and operational.

## How Powersystems have helped

To overcome the lack of grid, Powersystems engaged Aggreko generators whom we had previously worked with at Aikengall II Wind Farm to provide a generator and load bank system to act as a temporary grid which the turbines could generate on to.

Powersystems connected the wind farm to Aggreko’s temporary generator system and energised the site in December 2017, allowing crucial reliability testing to take place five months before the grid became available in March of 2018. Powersystems also designed and installed temporary metering to prove to the regulator that the wind farm was fully-commissioned and operational prior to the grid being available.

Below: Specially designed cable chamber for supporting cables across the valley



For more information

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