

From: Robin Barlow [mailto: [REDACTED]]
Sent: 20 December 2015 18:40
To: North Wales Wind Farm Connection
Subject: Submission Deadline 9

I would now like to submit a written version of my Open Hearing presentation with some revisions (having heard the hearing on 8th December that I missed)

Yours faithfully

Robin Barlow

Your reference: 10031190

This email was scanned by the Government Secure Intranet anti-virus service supplied by Vodafone in partnership with Symantec. (CCTM Certificate Number 2009/09/0052.) In case of problems, please call your organisations IT Helpdesk.

Communications via the GSi may be automatically logged, monitored and/or recorded for legal purposes.

North Wales Wind Farm Connection

Deadline 9 Representation based on my Open Hearing Dec 9th Statement

Robin Barlow BSc(Physics), PhD(Theoretical Physics) (Your reference: 10031190)

Essentially what I have learned from the exchanges with SP Manweb is that they only use designs approved by the UK electricity industry and that at 132KV there are only a limited number of these structural designs

1. Trident but not carrying an earth
2. HDWP as proposed for this project, does carry an earth
3. Steel Towers again with earth
4. Undergrounding of all circuits.

Some flexibility is allowed in that for example several connector options are available with each design.

My concern has been the visual impact of the HDWP and I have tried to find solutions to mitigate against different aspects of its design - the twin poles, the superstructure and cable size. Firstly by routing the earth differently and secondly by reducing the load on the posts by minimising the weight of the connectors. If successful the Trident solution could be used. Even for me though, the use of undergrounding is really the only acceptable solution in the Welsh countryside and I believe cost effective following Dyfrig Hughes's analysis.

Back to the mitigation.

The Connector

With the withdrawal of the 2 smaller windfarms the required capacity of the lines has been reduced from 170MVA (80+45+22+23) to 125MVA (80+45) ie reduced to 0.73 of the original amount. SP Manweb should now reduce the size of the conducting connectors correspondingly. They could use the 20mm diameter POPLAR instead of the 25mm diameter UCAS resulting in a capacity reduction according to the industry standard figures of 0.756 (summer rating). Ie the POPLAR is more capable of carrying the new load than UPAS was capable of carrying the old load. These figures are taken from

EDS 01-0045 OVERHEAD LINE RATING This standard details the Electricity Networks Association Engineering (ENA) Recommendation P27 Current Rating Guide for UK Power Networks Overhead Lines.

Approved Date: 12/06/2013 valid until 30/04/2016

A 20% reduction in diameter is a 20% reduction in the visibility of the "wires", **extremely** significant for visibility and skylining. This cable is approved and used by SP Manweb. And if, SP Manweb at a later date wanted to increase the capacity it could implement Dynamic Thermal Ratings as trialled by them in 2013 but not yet approved. Or alternatively use HTLS connectors from the start: a solution they are apparently going to trial elsewhere and which has been approved for use in the UK. Both these alternatives have been flagged by me earlier. Also, HTLS have an even lower diameter and lower visibility for the same power.

The Earth

The earthing issue is important because it makes the difference between using HDWP and Trident. It is not the twin poles of HDWP that is the big visual element (Mr Westmorland-Smith always emphasises the poles). It is the huge superstructure !

The reason quoted for not earthing at the Clocaenog substation is the extremely high ground resistance (another might be the cost advantage of having an earth rather than a conductor carry the telemetrics to St Asaph).

It is correct that the ground resistance at Clocaenog is extremely high as a cursory view of the British Geological Society's map "DiGMap-Plus: resistivity" shows.

<http://www.bgs.ac.uk/products/digitalmaps/DiGMapGB-plus/resistivity.html>

But, these appear to be isolated outcrops and the land nearby shows normal resistivity. It appears to me that SP Manweb has not studied this issue of earthing in any depth as their reply at the Specific Issue Hearing on 9th December (session 2) shows: "Don't envisage it to change enormously" (along the route! - at around 5-7 minutes of the recording). Perhaps the substation could have been sited at a location at Clocaenog with lower resistivity? What area is need to be secured for this purpose ? Perhaps an earth could be run from Clocaenog to Denbigh substation, using existing cable paths and enclosed land there found to provide earthing. I personally think that issue requires an independent desk-top study by a qualified external company.

Undergrounding on a Revenue Basis Comparison

We note that SP Manweb is planning to underground only a small section of the line, around 9% or 1.8km at the northern end or equivalent to **10.5-14.5 metres per Megawatt** carried (before and after the fallout of 2 windfarms). We note that other windfarms in Wales have used a much higher proportion of undergrounding per MW carried (ie revenue generated)

- Pen y Cymoedd Wind Energy Project grid connection. A 76-turbine, 228 MW wind farm, in South Wales, between Neath and Aberdare. Work has now started on the project, which will see ABB construct two new substations linked by 9.2 km underground cable connections ie 100% undergrounding or **40 metres a Megawatt** carried
<http://www.abb.com/cawp/seitp202/f3a7cee8ac45c97c44257c3600484c8c.aspx>
- Brechfa : the connection will require approximately 25.3km of 132,000 volt (132kV) overhead line (OHL) ... and approximately 3.3km (now potentially 3.6km) of underground cable ie (12-13%) or **27-29 metres per Megawatt** carried . The range is due to a potential change request submitted recently (<http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN020016/2.%20Post-Submission/Procedural%20Decisions/151207%20EN020016%20Potential%20change%20request%20to%20the%20application.pdf>).

The SP Manweb offer is especially low as a major reason for undergrounding a large part of the northern end is to avoid the "complications" (shall we say) of going under a 440KV national grid line.

North Wales Wind Farm Connection

Addendum to my Deadline 9 Representation

Robin Barlow BSc(Physics), PhD(Theoretical Physics) (Your reference: 10031190)

The Earth

I will keep it to a minimum. Again, to summarise, the reason quoted for not earthing at the Clocaenog substation is the extremely high ground resistance.

The British Geological Society's map "DiGMap-Plus: resistivity" which I referenced in the submission to which this is an Addendum confirms that, but also (I now realise) shows that the location of the Loch Urr 132KV substation is located in a more extensive region of even higher resistivity.

Given that SP Manweb have assured the hearing that the Loch Urr 132KV line does not carry an earth, one has to ask for the reasons and design differences between the two systems. I appreciate that the design proposed by SP Manweb for Clocaenog probably fits in well with their network concepts, but given that a large part of Denbighshire and Conwy countryside is going to be blighted by their solution, they should put some effort into thinking outside the box and outside minimum cost. Thus an explanation please with for example the Soil Resistance, the design of the earth grid potentially out to the enclosure, the earth grid resistance for that grid, the Earth Potential Rise, and the Step and Touch voltages for the two substations.

I have also been informed that on the National Grid 440KV lines the earth is bonded to each tower and this provides multiple paths to earth and thus a lower earth grid resistance. Now this technique is also mentioned in an industry standard for 132KV substation design section 4.4 and elsewhere "Calculate effect of parallel earth paths (....., earthed tower lines.....)"

https://library.ukpowernetworks.co.uk/library/en/g81/Design_and_Planning/Earthing/Documents/EDS+06-0013+Grid+and+Primary+Substation+Earthing+Design.pdf

And, of course, it doesn't need to be a tower: the 132KV earth on the HDWP could be bonded at say the first 50 towers to an Earth cable running down the wood pole into the ground. After that revert to Trident and no earth ! But perhaps, not consistent with the line protection philosophy.

Overall I feel that as with undergrounding SP Manweb have selected their easiest and cheapest solution and have nowhere opened a chink for the consultation/ discussion of variations that would reduce the visibility of the solution. And, I reiterate that an external view of the earthing options is called for.