Proposed Development of twenty-five wind turbines

at Straboy, Glenties, Co Donegal

An Bord Pleanala Reference : PL05B.240166

Donegal Council Reference :11/30127

Brief of Evidence : Paul Johnston

Introduction :

I am Paul Johnston, engineering hydrologist, working as a professor at Trinity College Dublin with forty years of experience in wetland hydrology and postgraduate qualifications from Canada, UK and Ireland. I have also worked as technical advisor to An Bord Pleanala and the EPA in previous oral hearings.

I make the following observations relating to the hydrology of the site at Straboy, based on the EIS documentation and related briefs of evidence and my experience of blanket bog hydrology in the west and northwest of Ireland.

In summary, the understanding of the hydrology of the peat resulting from the proposed excavations for the wind turbines and the related area for the deposition of the peat is seriously insufficient for an adequate assessment of any environmental impact to be made.

The hydrology of peat is difficult to assess when it is in its natural state but once excavated, the peat acquires quite different characteristics both at the exposed faces as well as in a re-deposited form. It is this changed character of the peat that has caused well-known failures in the past, such as at Derrybrien in Galway.

Peat repository:

The peaty material excavated from the 25 turbine sites is proposed to be deposited in a two-part site to the south west of the landholding involving a total area of 54,638 m^2 (increased from an original estimate of 36870 m^2 for reasons unclear). How the volume of peat material to be deposited here was derived is a little vague but a maximum figure of 36870 m^3 is given in the evidence of Mr Dan Keohane (18th October 2012). The anticipated depth of deposited peat is up to 1m although the site itself already contains peat up to 4.6m depth on an undulating terrain having a slope of 4-8 degrees. The revised proposal envisages the deposited peat being retained in ‘cells’ bounded by berms constructed of broken rock founded on bedrock (presumably after excavating the existing peat) and covered with a ‘thin layer of mineral soil’. The detail of how much rock is required or the source of the mineral soil is not given. It is not clear what function this construction is supposed to serve. If it is to contain the peat and water so as to provide a means for ‘peat regeneration’, it is extremely unlikely to achieve that objective. Given that the mean annual rainfall as recorded at Glenties

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over 26 years to 2011 is 1665mm, there will be a significant drainage problem involving entrained peat material which will not be solved by conventional settlement ponds or 'siltbusters' as proposed by the developer. Excavated and redeposited peat of the humification values given (max.6) is likely to have a significantly increased permeability compared to its natural state and 'sealing' a rock bund sitting on excavated bedrock with a thin cover of mineral soil suggests that there will be leakage around the site as well as runoff from the surface. Moreover, the potential for slippage of the peat downslope of the site is greatly increased by the presence of the excavation for the bund as well as from the leakage through it.

The control of upslope runoff onto the site appears also to be ad hoc. No analysis of just how much water is likely to be diverted has been given or its potential need for treatment. Just how the excavated peat is to be placed in the repository is also unspecified. The methods used can have serious detrimental effects on the existing peat on the site and therefore affect the drainage characteristics of the site.

More serious, as alluded to by others at this hearing, is the slope of the repository site (4-8 degrees). Although there are 'shelves' within this slope, it remains a slope magnitude of high risk with respect to peat stability, particularly with the amount of water passing through the site. It is worthwhile to make a comparison with the site at Bellanaboy, North Mayo on which the original planning proposal for a gas terminal envisaged placing the excavated peat on an existing, blanket peat covered slope of *less* than 2 degrees. Despite extensive site investigation and analysis, planning was refused partly on the grounds of the problems of controlling drainage and the consequent risk of peat slides and/or erosion. The peat on this site was also to be contained within cells. At that time, observations were made of other sites where peat slides had occurred and sites of similar gradient to Straboy were seen in Roscommon (windfarm near Arigna) in which significant peat failure had occurred both in natural peat from upstream excavation and in freely deposited peat on slopes over 2 degrees.

Regardless of the efficacy of measured shear strength of peat using vane tests, the changed characteristics of excavated peat suggest that the best approach to analysis is through comparison with experience on other sites.

In short, the proposed peat repository is very likely to carry a high risk of failure, both from the drainage control as well as from potential peat sliding. Its design, location and environmental impact have not been appropriately assessed.

Excavation at turbine sites

The steep slopes associated with the ridge along which the twenty-five wind turbines are located suggest that there are likely to be significant problems in excavating and stabilizing the peat around the foundations. There are two well-known issues – enhanced runoff and drainage from the newly created sites (as well as during construction) and stabilizing of the peat at the margins of the completed foundations. From the data presented, it appears that all

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but four (T10-T13) sites will ultimately drain southwards towards the Stracashel River catchment past a number of houses on the 'upper road'. While the excavations and foundations will increase the 'flashiness' of the runoff, and in spite of suspended sediment control, there is likely to be a deterioration (ie an increase) in the colloidal content of the runoff as it reaches potential receptors along the natural drainage path. Rarely do any of the conventional controls (such as 'silt busters') work on these finer sediments which are typical of peat. More complex filtration-type controls are required but which also engender greater cost and maintenance, if original 'natural' water quality is required.

More important is the management of the peat at the margins of the foundations – inevitably, these margins represent a zone of weakness both in terms of water ingress and structural stability in the peat. If there already exist planes of weakness, particularly at the weathered zone at the junction of the peat and the bedrock, there is potential for peat movement/sliding. Such risks are particularly high when the slopes along the ridge are steep (ie >2 degrees). There are many examples of failures in this context (such as the well known Derrybrien in Galway). Massaging the peat into merging with the slope, as suggested in the EIS, will not work as the peat will remain disturbed. The change in hydraulic gradient (arising from the excavation) will gradually induce subsidence and fissuring in the peat which will increase the ingress of water and the potential for slip failure. The evidence for numerous slips in the peat on these slopes as mentioned in the EIS, supports the probability for inducing similar failure as construction proceeds. Each and every foundation needs careful analysis and the development of realistic mitigation measures.

Less critical but important to the potential receptors (eg houses) downgradient is the potential drainage along the access roads. It is not clear precisely how these roads are to be built but conventionally, locally excavated rock aggregate is used, which, when laid, itself, provides a very good drainage pathway for some of these runoff waters from the turbine locations and from the adjacent blanket bog to accumulate and converge towards the local natural stream system. The environmental impact of this enhanced drainage needs to be assessed, especially because of the gradients involved, including the effects on the bog.

The same hydrological analysis should have been done for the four 'borrow pits', as these will create significant runoff, given the high rainfall in the area. Moreover, the impact on the groundwater does not seem to have been addressed at all. The area is designated a Poor aquifer but productive in local zones, which in this type of igneous and metamorphic geology suggests discrete fracture flow. Where these fractures receive infiltrating rainfall, they can result in flow over quite long distances (sometimes emerging in flushes and local springs). How these borrow pits (and indeed the turbine excavations) affect this regime is unknown and has not been evaluated.

In a similar context, the four turbine sites at the top of the ridge (T10-T13) have potential drainage to the north, ie towards the Derkmore catchment which is in a different geology (marble) characterized by karstic features. While the turbine sites do not appear to be on the marble itself, the north side of the ridge does drain towards that catchment. Acid peat waters draining into a limestone/marble area gives rise to very characteristic vegetation and any

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disruption to the natural drainage of the catchment has to be assessed for potential impact on the associated ecology. While the drainage amounts may be small (as reported in the EIS), the effects of change can be large.

Summary

The construction of 25 wind turbines and ancillary infrastructure on a blanket bog covered ridge with relatively steep slopes is a difficult undertaking requiring careful assessment of the hydrological and associated impacts. Very little appears to have been completed. The consequences of disrupting natural drainage and the risks of peat slides represent significant risks to receptors (ie houses) on the south side of the overall site. The changes in water quality and in the flows in the natural streams have not been assessed and are likely to be significant, especially in this area of high rainfall. The siting of the peat repository and its design is totally inadequate.

The deficiencies in the environmental impact assessment for this project strongly justify a refusal of planning permission.

Paul Johnston

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