Impacts of Wind Farms on Upland Habitats

The Environmental Cost of Scotland's Renewable Revolution

The John Muir Trust

Executive Summary

The John Muir Trust is one of the United Kingdom's leading guardians of wild land and wildlife. As a prominent membership organization we carry out our charitable role through the ownership of land, the promotion of education and volunteer conservation activities. In order to protect wild land, the Trust campaigns against threats to wild land and for wild places to be valued by society.

The Trust recognizes the unprecedented threat that we all face from the impact of climate change and the essential role that renewable energy, including wind power, has to play in combating it. The Trust is working to ensure that on-shore wind power is appropriately placed and developed with a minimal impact on vulnerable upland habitats. Uplands contain priority habitats identified by the Convention on Biological Diversity and the EU Habitats Directive, specifically biodiverse grasslands and blanket bog (peatland).

These priority habitats support a diverse community of plant and animal life. They also provide an important element in supplying freshwater to river systems. In addition, they have been identified as important stores of carbon stocks. In effect, the peatlands and biodiverse grasslands are the part of a mosaic of habitats which act as the rainforests of the northern latitudes.

Climate change is likely to impact on uplands by:

- Increased erosion and siltation due to intense storm events;
- Drying out of soils due to changes in precipitation patterns;
- Accelerated decomposition of peaty soils further fuelling climate change, and;
- Increased loss of soil through water and wind erosion.

Given the global importance of peatland and biodiverse grasslands (such as upland heathland), both in terms of biodiversity and as stores of carbon stocks, the EU and Member States have an international responsibility for protecting these habitats from the impact of climate change and development.

Unfortunately, a poorly planned, unsuitably located or inadequately operated renewable energy development and infrastructure could damage and destroy habitats, cause wildlife disturbance and fatalities and, if inappropriately placed, decrease the ability of ecosystems to store carbon stocks.

The John Muir Trust has reviewed various Environmental Statements for wind turbine developments in upland areas. The Trust is concerned to note that wind turbine projects require the removal of considerable areas of upland habitat. This is cleared for turbines, construction areas and infrastructure (such as roads, drainage ditches, buildings, distribution lines, etc.).

Review of development proposals and actual sites indicates that the habitat destruction and land take for a 16 to 53 wind turbine installation is 6.57 to 44.16 hectares. However, the modification of natural drainage by the construction of turbine infrastructure could cause impacts over a much wider area of upland habitat. Modification of peatland drainage by the use of ditch systems associated with wind turbine developments is likely to lead to the drying of peatlands, ultimately resulting in erosion of habitats over a wide area. The size of area is comparable to the land take for the agricultural production of biofuels or construction of an industrial facility (power station, factory, etc.), shopping centre, airport, etc. The habitat damage is also similar to the effects of climate change on upland areas.

The Trust is concerned that:

- Habitats are not being successfully restored after construction;
- Restored habitats do not have the same biodiversity value and carbon storage potential, and;
- Clearance of vegetation, compaction of soils, re-profiling of slopes, etc. result in erosion damage and associated siltation within river catchments similar to predicted climate change impacts.

Research by Stirling University indicates that peatlands impacted by construction lose 25 to 50% of the carbon that would normally be taken up each year "and so adds significantly to the potential impacts of climate change". In addition, independently peer reviewed research by the Royal Society for the Protection of Birds is now also indicating that the impacts of wind turbine developments may not be limited to direct impacts from construction and operation. The research proposes a number of potential causes for lower bird numbers at wind turbine sites. These include avoidance by birds causing displacement of populations to other sites and increased adult bird mortality due to collision with turbines. The research concludes that bird "populations that are under stress from wind farm development are likely to be more susceptible to additional pressures from climate change."

Previous research which could help safeguard our uplands has also been selectively misquoted to suggest wind turbine development on peatlands does not result in significant carbon release, this is particularly with regard to the University of Aberdeen and the Macaulay Institute research report concerning: Calculating Carbon Savings From Wind Farms On Scottish Peat Lands - A New Approach. This report recognised that "Wind farms tend to be sited on peat lands which hold large stocks of poorly protected carbon and so have the potential to greatly increase overall carbon losses." The report developed a formula which needs to be applied to each individual site to calculate losses.

Protection of non-statutory upland sites is being weakened due to inconsistencies in EU Policy and the development, by the Scottish Government, of a "fast track" planning system which risks paying little attention to protecting habitats outside international or European statutory sites which have stronger legal safeguards due to treaty obligations. The John Muir Trusts believes that unprotected upland areas are now at risk from damage or destruction, resulting in the loss of ecosystems which maintain our wilderness areas, provide habitat for wildlife and act as natural stores of carbon stocks. The EU should reform its renewable energy policy to provide better environmental protection from the construction of wind turbines. The Scottish Government should act now to implement advice it was given in 2006 by the Strategic Environmental Assessment of the Scotland Rural Development Programme to develop a National Renewable Energy Strategy. This paper sets out the problems posed by industrial scale wind turbine developments, together with recommendations on how to safeguard the upland habitats.

Recommendations

European Parliament

Given the similar scale and potential environmental impacts renewable energy projects can have on peatlands and biodiverse grasslands, it is recommended that the Directive *on the promotion of the use of energy from renewable sources* COM(2008) 19 be amended now or by future legislation to ensure that:

a. the provisions of the "sustainability regime" enacted by Articles 15, 16 and 17 are extended from the growing of biofuels and bioliquids to also cover the construction and operation of renewable energy generation and distribution projects;

b. a similar provision for calculating the green house gas impact of biofuels (Article 17) is also developed for renewable energy generation and distribution projects, possibly based upon the University of Aberdeen and Macaulay Institute report;

c. as the use of the term “pristine” can be used to undermine the biodiversity and carbon storage value of upland ecosystems, the term should be changed to “valued”;

d. an EU strategy is developed to ensure renewable energy policy and development projects are linked to and do not undermine environmental protection of biodiversity, habitats, species and stores of carbon stocks, and;

e. Article 6 of Directive 2001/77/EC, together with the proposed Article 12 of COM(2008)19 are amended by future legislation to ensure they are in keeping with the Gothenburg Agenda and EU Directives and Communications with regard to environmental protection and the safeguarding of biodiversity, habitats, species and stores of carbon stocks.

Scottish Government

f. That the recommendation of the Scottish Government’ s Rural Development Strategic Environmental Assessment is enacted and that a National Renewables Energy Strategy for Scotland is produced which guides developers away from environmentally sensitive sites;

g. That the Scottish Government ensures that it meets its obligations under the Habitats Directive, particularly Article 10 and;

h. That the Scottish Government should base future rural development and renewables policy decisions on “sustainable development”, as defined by the Brundtland Report as *" development that meets the needs of the present without compromising the ability of future generations to meet their own needs."*

Introduction

The John Muir Trust is one of the United Kingdom's leading guardians of wild land and wildlife. As a prominent membership organization we carry out our charitable role through the ownership of land, the promotion of education and volunteer conservation activities.

Established in 1983 the Trust owns and manages estates in Scotland in Knoydart, Assynt, Lochaber, Perthshire and on the Isle of Skye. The iconic peaks of Ben Nevis, Schiehallion and many of the southern Cuillins of Skye are protected by the Trust. In addition to our owned properties, we work in partnership with many other communities in the management of estates across Scotland.

Sustainable future or scar on landscape?

Because of our experience, interests and responsibilities in the management of upland areas, the Trust is well placed to comment upon the potential threats to these sensitive ecosystems.

The Trust recognizes the unprecedented threat that we all face from the impact of climate change and the essential role that renewable energy, including wind power, has to play in combating it. The Trust is working to ensure that on-shore wind power is developed with a minimal impact on vulnerable upland habitats.

Climate Change and Upland Ecosystems

UK uplands are defined as the land surface lying above the upper reaches of enclosed farmland. The uplands are composed mainly of dwarf shrub heaths, grasslands and peat bogs. The UK Climate Impacts Programme (UKCIP), which advises the UK Government, has provided scenarios as to the potential impacts of climate change[1]. Based upon this information, the Scottish Environmental Protection Agency (SEPA), a UK Government statutory agency, has determined that climate change may lead to the following impacts which may damage the ecosystems of Scottish uplands:

- Increased erosion and siltation with consequences for fish spawning;
- Drying out of soils combined with higher intensity storm events causing landslides, with potential disruption to transport;
- Accelerated decomposition of peaty soils, resulting in increased emissions of carbon dioxide and methane, further fuelling climate change, and;
- Increased loss of soil through water and wind erosion.

For the complete list of predicted impacts and implications, please refer to the SEPA website[2]. The Trust considers that similar impacts could be expected across EU upland and mountainous ecosystems as climate change progresses.

Uplands contain priority habitats identified by the Convention on Biological Diversity[3] and the EU Habitats Directive. These priority habitats are:

EU Habitats Directive Annex 1: Priority Habitats

- (4010) Northern Atlantic wet heaths with *Erica tetralix*
- (4030) European dry heaths
- (4060) Alpine and Boreal heaths
- (7130) Blanket bog

The associated UK Biodiversity Action Plan (BAP) also identifies Blanket Bog and Upland Heathland as habitats at threat and in need of protection. These habitats are similar, or identical to those identified under Article 15 of the proposed Directive *on the promotion of the use of energy from renewable sources* COM(2008) 19 final.

These priority habitats support a diverse community of plant and animal life. They also provide an important element in supplying freshwater to river systems. In addition, they have been identified as important stores of carbon stocks.

Given the global importance of peatland and grasslands (such as upland heathland), both in terms of biodiversity and as stores of carbon stocks, the EU and Member States have an international responsibility for protecting these habitats from the impact of climate change and development.

The Problem

There is no doubt that climate change threatens the environment and our society which depends upon this environment. The John Muir Trust recognizes that well planned, suitably placed and competently operated renewable energy installations, such as wind turbine developments, together with their associated infrastructure, should form part of a "mix" of energy sources used to reduce emissions and combat climate change.

However, a poorly planned, unsuitably located or inadequately operated renewable energy development and infrastructure could damage and destroy habitats, cause wildlife disturbance and wildlife fatalities and, if inappropriately placed, decrease the ability of ecosystems to store carbon stocks.

The John Muir Trust has reviewed various Environmental Statements for wind turbine developments in upland areas. The Trust is concerned to note that the construction of each wind turbine at a facility typically requires the removal or damage of 1200 m² of habitat for crane/ heavy plant hard standings and concrete foundations. Considerable areas of upland habitat are also cleared for infrastructure such as roads, drainage ditches, buildings, distribution lines, etc. For example, a small installation of only 16 wind turbines could result in the disturbance and destruction of upland habitats over an area of 65,700 m². Other sites are substantially larger, for example the South Lewis, Muaitheabhal development is planned to have 53 wind

turbines, resulting in a land take from existing habitats of 441,600 m². For a full description see Annex 1. It should be noted that whilst the North Lewis proposal was rejected in 2008, no decision has been made on the Muaitheabhal development, South Lewis.

The habitat destruction and land take for a 16 to 53 wind turbine installation is 6.57 to 44.16 hectares. It should be noted that the modification of natural drainage by the construction of roads, ditches, etc. could represent an impact on upland habitat over a much larger area. Modification of peatland drainage by the use of ditch systems associated with wind turbine developments is likely to lead to drying of peatlands, ultimately resulting in erosion of habitats over a wide area[4]. The size of area is comparable to the land take for the agricultural production of biofuels or other industrial facility. The habitat damage is also similar to the effects of climate change on upland areas.


Damage to natural drainage system by ditch

The Trust notes that many developments recommend the use of restoration works. However, based on evidence beginning to appear, the Trust is concerned that:

- Habitats are not being successfully restored;
- Restored habitats do not have the same biodiversity value and carbon storage potential, and;
- Clearance of vegetation, compaction of soils, re-profiling of slopes, etc. result in erosion damage and associated siltation within river catchments similar to predicted climate change impacts.

Annex 2 provides photographs taken by the Trust, which demonstrate the environmental impact of wind turbine developments on upland areas. A recent case before the European Court, demonstrated that the European renewable industry may not be adequately applying the use of environmental assessment to ensure environmental affects are minimized[5].

Recent research in the uplands of Scotland gives rise for concern with regard to locating renewable energy projects in sensitive areas. Impacts from climate change may now be worsened by the construction of wind turbines in upland areas.


Erosion damage and poor protection on site

Research indicates that there have been increases in the concentration of

dissolved organic carbon and sediment released from areas where the ground has been extensively disturbed by the construction of wind turbines and their associated infrastructure. This research indicates that in areas of peat soils, where there has been wind turbine construction, the ability of peat soils to take up carbon is being reduced. Figures indicate 25 to 50 % of the carbon that would normally be taken up each year is instead lost, "and so adds significantly to the potential impacts of climate change" (Grieve and Gilvear, 2008).

Importantly, the increase in sediment and organic matter eroded from the turbine sites causes discolouration of river water, leading to reducing light penetration and siltation of gravels which support spawning fish, such as salmon and trout (Grieve and Gilver, 2008). The research indicates these impacts are continuing after construction. This is likely to be as a result of how the sites were initially planned, where they have been located and the "ineffective provision" of sediment trapping during operation[6].

Independently peer reviewed research is now also indicating that the impacts of wind turbine developments may not be limited to direct impacts from construction and operation. Recent scientific research by the Royal Society for the Protection of Birds (RSPB) indicates that wind turbine sites are having a cumulative negative impact on some peatland birds.

Golden Plover over an unspoilt upland

The impacts on birds appear to be caused by three issues.

1. The locations for wind turbine developments closely correspond to habitats normally highly suitable for peatland birds such as Golden Plover.
2. Birds appear to avoid otherwise suitable upland habitats if wind turbines are present.
3. The "breeding density [of birds] appears to be lower than predicted"[7] at sites containing wind turbines.

The research proposes a number of potential causes for lower bird numbers at wind turbine sites. These include avoidance by birds causing displacement of populations to other sites and increased adult bird mortality due to collision with turbines.

It is thought that birds, such as Golden Plover are particularly at risk of collision with turbines when they travel to and from their breeding and feeding areas (Pearce-Higgins, et al, 2008). Such impacts can endanger the survival of species into the future. Once again, turbines in upland areas are exacerbating

the very impacts of climate change rather than preventing it.

In this case, as with climate change, the construction and operation of turbines is preventing habitats from supporting natural populations of birdlife. The research concludes that bird "populations that are under stress from wind farm development are likely to be more susceptible to additional pressures from climate change." (Pearce-Higgins, et al, 2008).

The current pressure on upland ecosystems should not be seen in isolation. In the 1980's campaign work was undertaken to safeguard these habitats from commercial forestry. This led to the closure of tax loopholes in 1989 which had encouraged forestry on peatland[8]. Similarly, in the 1990's the Peatlands Campaign Consortium, formed from conservation NGOs promoted the protection of peatlands from exploitation for garden peat. This resulted in a change in government mineral extraction policies. Both campaigns resulted in recognition for the need to protect peatland areas.

Unfortunately, these hard won environmental gains now appear to have been lost due to the weakening of EU policy and legislation- specifically due to Article 6 of Directive 2001/77/EC[9], together with the proposed Article 12 of COM(2008)19, which reduce safeguards under other policy and legislative areas. The Trust has noted that protection of upland ecosystems, derived from the Habitats Directive may have been undermined and there is not now an appropriate level of protection from wind turbine developments, particularly to areas outside of international or European conservation sites if there is a failure to apply Articles 6 and 12 of the Habitats Directive. Evidence for this is provided by proposed reform to the Scottish planning system "to fast track" renewables projects.

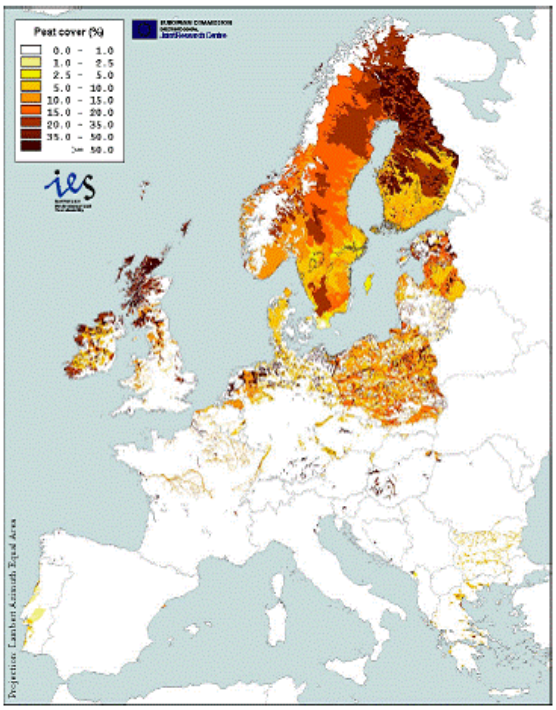
In addition EU policy, derived from the Gothenburg Agenda, does not appear to be properly applied to renewable energy projects. For example, the Braes of Doune wind turbine development, built adjacent/ within the River Teith Special Area of Conservation, has been shown to have identical impacts on upland ecosystems as climate change would have[10]. Having visited several similar upland facilities, the Trust fears that these impacts may be widespread across the upland ecosystems of Scotland where wind turbine installations and infrastructure have been sited.

Erosion and siltation problems on site

The uncoordinated development of multiple wind turbine sites is demonstrated in Scotland. Without an overall national strategy there are currently 43 operational sites with 709 turbines[11]. "More than 80 plans are currently lodged for new wind farms in Scotland, which could lead to more than 1,600 extra turbines being built across the country. About 50 more wind farms

already have permission but are yet to be built, bringing about 700 more turbines[12]."

The soils of Scotland represent approximately 55% of the UK terrestrial carbon store and are thought to be at particular risk from climate change[13]. The UK contains approximately 10.9% of the EU peat and peat topped soils[14]. This represents a carbon reserve of 3 billion tonnes[15]. The importance of Scotland's peatland resource to Europe is emphasised by the map of relative cover of peat and peat topped soils, below.



Relative cover (%) of peat and peat topped soils in the European Soil Database[16]

Given the uncoordinated cumulative scale of wind turbine developments in Scotland, as an example of European uplands, the John Muir Trusts believes that these areas are now at risk from damage or destruction resulting in the loss of ecosystems which maintain our wilderness areas, provide habitat for wildlife and act as natural stores of carbon stocks. In addition, the continued loss of peatlands in the Tropics emphasises the need to protect peat carbon stocks elsewhere in the World. As a result, it could be said that the value of Scotland's peatlands, and the ecosystems these support, is increasing daily.

Given that much of these ecosystems are outside of statutorily protected Natura 2000 sites, the Trust contends that there is a failure to protect these important ecosystems and the species these support, particularly in relation to Articles under the Habitats Directive[17] and Birds Directive[18]. Within the UK this appears to be an ongoing problem which has not been addressed for wind turbine projects. A case in the European Court in 2005, demonstrated a failure to protect priority habitats under the Habitats Directive (92/43/EEC)[19]. In addition, the number of operational and proposed wind turbine projects may also be undermining the ability of species to migrate between Natura 2000 sites (Article 10, 92/43/EEC). The example of the Lake District National Park, Cumbria (Annex 3), demonstrates how areas of conservation value can be isolated from their hinterland by a ring of wind turbine developments.

Quantifying the Problem

The John Muir Trust recognises that in order to successfully extend the "sustainability regime" to mitigate the impacts of renewable energy projects upon peatlands and biodiverse grasslands, a system to calculate the greenhouse gas impact of renewables developments, similar to Article 17 of

COM(2008)19 will need to be put in place.

In June 2008 the University of Aberdeen and the Macaulay Institute provided a research report concerning: Calculating Carbon Savings From Wind Farms On Scottish Peat Lands - A New Approach. This report recognised that "Wind farms tend to be sited on peat lands which hold large stocks of poorly protected carbon and so have the potential to greatly increase overall carbon losses. Scotland contains the majority of peat soils in the UK (defined here as soils with a surface organic horizon greater than 50cm in depth) and the estimated stock of carbon held in Scottish soils is approximately 2800 MtC or 11000 MtC02 equivalent. Scotland has a responsibility to ensure the stability of this carbon where possible and ensure that developments do not cause a significant loss of this reservoir." It then went on to develop a methodology for calculating the impact of wind turbine developments on the soil carbon stocks held in peats. This provides a transparent and easy to follow method for estimating the impacts of wind farms on the carbon dynamics of peat lands.[20]

Although there will be a need to develop this methodology further for grasslands and the need to take into account impacts on biodiversity, the Trust considers that this methodology is a starting point for extending the ethos of Article 17 to renewables projects. It should be noted that the report is a methodology, not the definitive answer as to how much carbon is released, although it has been selectively misquoted by the renewables industry[21].

The Solution

European Legislation

The Trust is concerned that whilst the Lisbon Strategy is being applied to the development of industrial scale wind turbine facilities, the Gothenburg Agenda may not be. This is with particular respect to upland areas outside or adjacent to Natura 2000 sites with little statutory protection. The Trust commends the EU for recognizing this problem with regard to biofuels, but is concerned that the development of wind turbines in upland areas may not meet the sustainability criteria of the Gothenberg Agenda or the level of protection intended by the Habitats and Birds Directives and other related instruments, notably the *Biodiversity Action Plan for the Conservation of Natural Resources /COM/2001/0162* final**.** As a result the Trust questions if EU renewable energy policy is actually consistent with other policies and objectives of the Union.

The Trust contends that the consultation on the implication of biofuels, together with the inclusion of the **sustainability regime** in *Directive on the promotion of the use of energy from renewable sources* COM(2008) 19, Articles 15, 16 and 17, has already made the case for protecting upland habitats such as peatlands and grassland (e.g. Annex 1 habitats under the Habitats Directive) from unsustainable renewable energy sources. Therefore, the Trust proposes that the sustainability regime is extended to protect these habitats from all forms of renewable energy development, including industrial scale wind turbine installations and their associated infrastructure.

Although the Trust welcomes the sustainability regime in the *Directive on the promotion of the use of energy from renewable sources* COM(2008) 19, we question the use of the term "pristine" peatland. In the world today, we fear that it is difficult to find any habitat which has not been influenced by human activity. The Trust has experience of developers using the term "pristine" to undermine the value of upland ecosystems and to justify development. Research does provide evidence that peatlands are in a complex process of eroding and renewing[22]. If this ecosystem is maintained, then the ability of peatlands to retain carbon is also maintained. Building wind turbines on such sites may, therefore destroy this ecosystem and turn a peatland from a store of carbon to an exporter into the environment- undermining efforts to control climate change. Rather than destroying degraded peatlands, they should be restored to improve EU carbon sequestration. The John Muir Trust would recommend the replacement of pristine with "valued". *A valued peatland or biodiverse grassland should be a habitat which provides an ecosystem that supports a diverse range of plant and animal life, safeguards stored carbon stocks and provides a landscape and sense of wilderness prized and enjoyed by local human communities and visitors.*

The Trust would contend that a strategy is required across the EU which links environmental protection with renewables policy to ensure wisely sited, constructed and operated renewable energy installations that do not cause impacts similar to climate change. Due to the piecemeal nature of Environmental Assessments, applied on a site by site basis, a strategic approach is required in order to avoid cumulative impacts.

The Trust considers that Article 6 of Directive 2001/77/EC[23], together with the proposed Article 12 of COM(2008)19 Final actually remove planning and environmental protection controls and effectively undermine efforts to implement truly sustainable renewables projects which should not only seek to reduce greenhouse gas emissions, but protect the ecosystems they are placed within. The Trust suggests that both these articles are amended by future legislation to ensure they are in keeping with the Gothenburg Agenda and EU Directives and Communications with regard to environmental protection and the safeguarding of biodiversity, habitats, species and stores of carbon stocks.

A Strategy for Scotland

In May 2006 HASKONING UK LTD undertook a Strategic Environmental Assessment (SEA), on behalf of the Scottish Government, of the Scotland Rural Development Programme, 2007 – 2013[24]. The SEA indicated that renewables related developments, such as construction of wind turbines, would have "*potentially negative impacts*". The SEA suggested that "*these developments* (among others*) could result in a range of environmental impacts including the potential loss of land supporting biodiversity interests and priority and/or protected habitats and/or species, impacts on soil quality and quantity, impacts on the water environment and impacts on air quality and the release of greenhouse gases into the atmosphere.*

However all options offer potential environmental benefits and mitigation measures to minimise or negate these impacts while still allowing the actions to proceed were identified." The construction of wind farms in rural Scotland has significant impacts on the landscape although views are divided about whether these impacts are negative or positive. However, as they alter the traditional landscape of rural Scotland the impacts on landscape in this assessment are considered to be negative. Wind farms can result in alterations to the water environment as a result of increased runoff from access roads to the generally remote sites and the morphological impacts of river crossings. The loss of valuable habitat such are moorland and woodland if wind farms are not sited carefully can have significant impacts on habitat and species diversity although the generation of power from wind farms can result in reduced greenhouse gas emissions."

The SEA indicated that: *The [Scottish Government's] target for increased energy production from renewable sources will impact on Rural Scotland as many of these facilities are located in rural environments, such as the top of hills and mountains where there are increased winds.* The SEA identified to the Scottish Government that upland areas may potentially be at risk. It is therefore surprising that little action appears to have been taken by the Executive on the issue of protecting sensitive habitats and landscapes from renewables projects.

The SEA then went on to state that: "*Mitigation measures suggested include the development of a National Renewables Strategy for Scotland which would identify those areas where wind farms, hydropower schemes, biofuel plants (and associated biomass cropping sites), and marine and coastal renewable schemes should be permitted.* This necessary work has not been undertaken by the Scottish Government. It is required because, in the words of the SEA, *schemes are commonly located in rural Scotland where there is a sufficient volume and velocity of wind…for maximal energy production. However, these remote locations result in a greater potential for these plants to require significant supporting infrastructure such as roads to allow access to the sites, and power lines to get the power generated from the site to the National Grid. At present, the approach with relation the development of renewable energies is industry lead and therefore impacts on stakeholders and the environment is considered in a relatively piecemeal way. A more proactive suite of siting guidelines and a national strategy could deliver a more planned and sustainable approach. The introduction of a national strategy would identify sites where wind farms…should be permitted and identify where, due a numerous reasons including remoteness from the National Grid and environmental sensitivities of specific areas these activities should not be permitted.*

It should be noted that rather than a past initiative, this recommendation is made on a currently operating programme. The Trust therefore recommends that the Scottish Government implement this recommendation as soon as possible to ensure that the roll-out of the Scotland Rural Development Programme is in line with the SEA for that programme. It is worth noting that in this context the SEA

indicated that: *Renewable sources which could be produced within Rural Scotland and which therefore could be influenced by the SRDP* [Scottish Rural Development Programme] *include wind power, hydropower, biomass and biofuels.* The Trust would contend that the delay in providing a National Renewables Strategy for Scotland is resulting in environmental damage due to the use of inappropriate upland locations. The Trust is also concerned that the Scottish Governments focus on statutory sites and "sustainable economic growth" rather than true "sustainable development" is placing at risk biodiversity and landscape which may be vulnerable outside of protected sites. The Trust is concerned that planning applications in Scotland are not being considered with regard to Article 10 of the Habitats Directive.

Recommendations

European Parliament

Given the similar scale and potential environmental impacts renewable energy projects can have on peatlands and biodiverse grasslands, it is recommended that the Directive *on the promotion of the use of energy from renewable sources* COM(2008) 19 be amended now or by future legislation to ensure that:

g. the provisions of the "sustainability regime" enacted by Articles 15, 16 and 17 are extended from the growing of biofuels and bioliquids to also cover the construction and operation of renewable energy generation and distribution projects;

h. a similar provision for calculating the green house gas impact of biofuels (Article 17) is also developed for renewable energy generation and distribution projects, possibly based upon the University of Aberdeen and Macaulay Institute report;

i. as the use of the term "pristine" can be used to undermine the biodiversity and carbon storage value of upland ecosystems, the term should be changed to "valued";

j. an EU strategy is developed to ensure renewable energy policy and development projects are linked to and do not undermine environmental protection of biodiversity, habitats, species and stores of carbon stocks, and;

k. Article 6 of Directive 2001/77/EC, together with the proposed Article 12 of COM(2008)19 are amended by future legislation to ensure they are in keeping with the Gothenburg Agenda and EU Directives and Communications with regard to environmental protection and the safeguarding of biodiversity, habitats, species and stores of carbon stocks.

Scottish Government

l. That the recommendation of the Scottish Government' s Rural Development Strategic Environmental Assessment is enacted and that a National Renewables Energy Strategy for Scotland is produced which guides developers away from environmentally sensitive sites;

g. That the Scottish Government ensures that it meets its obligations under the Habitats Directive, particularly Article 10 and;

h. That the Scottish Government should base future rural development and renewables policy decisions on "sustainable development", as defined by the Brundtland Report as *" development that meets the needs of the present without compromising the ability of future generations to meet their own needs."*

Annex 1: Components of a Wind Turbine Development

What does an industrial scale wind turbine development look like? At first sight it would appear that there is very little land "take" or disturbance around a modest development of 16 turbines or a larger development of 53 turbines.

Wind turbine road showing 5 meter wide area of disturbance and habitat damage

In order for a wind power development to function and provide power to a transmission grid, a number of components are required additional to the actual wind turbines. The following provides an overview of the various elements of a wind turbine site:

1. Turbines. A turbine consists of a tower, rotor (three blades, hub and nose cone) and nacelle (generator, gear and framework). A typical development in Scotland could use turbines each with a hub height of 67 meters and a rotor diameter of 80 meters giving the total height of 107 meters. However larger turbines are available. Each turbine is mounted on a concrete foundation, four to five metres in diameter (20 m^2). The depth of these is approximately 1 metre, but this can vary due to the location and substrata to be built on. As a result, literature quotes figures of between 750 to 1500 tonnes for the amount of concrete used on each foundation.

2. Transformer. Associated with each turbine is a transformer, normally with a height of 2-3 metres, width 2-3 metres and length of 3-4 metres. Transformers are usually sited on the hard-standing(see below).

3. Work area/ hard standing. Associated with each wind turbine is a work area or hard-standing used for the assembly and placing of the turbine. This area is constructed to take the weight of a mobile crane, turbine components and associated materials plant and equipment. Typically, it consists of two areas, one of 800 m² and another of 400 m² adjacent to the turbine foundation (1200 m² in total per turbine).

4. Temporary Construction Compound. In addition to the hard standings, each wind turbine site will require a temporary compound/ hard standing for the storage of plant and equipment, materials, staff facilities, etc. For a 16 wind turbine site, this can be 50 metres by 60 metres (3000 m²). This can however vary, for example the larger South Lewis, Muaitheabhal development is planned to have 9 compounds (8 will be 50m x 100m, with the main compound being 50m x 150m), 47,500 m² in total.

5. Control Building. Monitoring, telemetry and storage building for site, normally 45m by 60m (2700 m²).

6. A cabling trench from the turbines to the control building and supply network. A 16 wind turbine site could have a 12 km trench (12,000 m²). For the larger South Lewis, Muaitheabhal development it is planned to have a 41 km trench for 53 wind turbines (41000 m²).

7. Meteorological mast. Similar height to turbine , but with smaller foundation.

8. Borrow pits. Used to provide aggregate to the site. Any number or size are possible. For the example of a 16 wind turbine site, typically two borrow pits could be used (40 x 40 m² and 40 x 80m²), 4800 m². This can however vary, for example the South Lewis, Muaitheabhal development is planned to have 17. This could be approximately 40800 m² in total.

9. Drainage ditches. Associated with the hard-standings, buildings/ infrastructure and roadways will be a network of drainage ditches between 0.5 and 1 metre in width and depth. The length of the ditch system varies with sites, but typically could be 4km (i.e. covering an area of 4000 m²) for a small 16 turbine site and 41km (41,000 m²) for a larger 53 wind turbine site,

It is interesting to note that environmental assessments often quote the “land take” for a site as the area taken up by roads and the base of wind turbines and other structures, but not the total area to be reinstated. However, if we wish to understand the amount of land where habitats are removed and an ecosystem damaged or destroyed then the total area of land disturbed should be considered (i.e. include the area to be reinstated following use as work area, hard standing, temporary construction compound, etc.). So a 16 turbine facility would result in a land disturbance of 45700 m² (not including roadways), whilst a 53 wind turbine site could result in a 236600 m² land take. The impact following construction is therefore dependent on the success of reinstatement in returning the sites biodiversity to predevelopment levels.

Depending on the remoteness of the area, roadways could be approximately 4km for a 16 wind turbine site, at 5 metres wide (20000 m²). So that gives a total area of 65,700 m² (6.57 hectares) for a small site. Whilst for a larger 53 wind turbine site, such as Muaitheabhal, 41 km of road will be required (205000 m²). This gives a total land take for a large site of 53 wind turbines as 441,600 m² (44.16 hectares). As we can see, the land "take" and disturbance for even a modest development is comparable with other industrial facilities, urban housing developments, airport terminal commercial business estates, shopping centre, port facility or land use change for agriculture. In short, wind turbine developments are civil engineering projects with similar impacts to other types of civil engineering projects and should therefore be considered in exactly the same way.

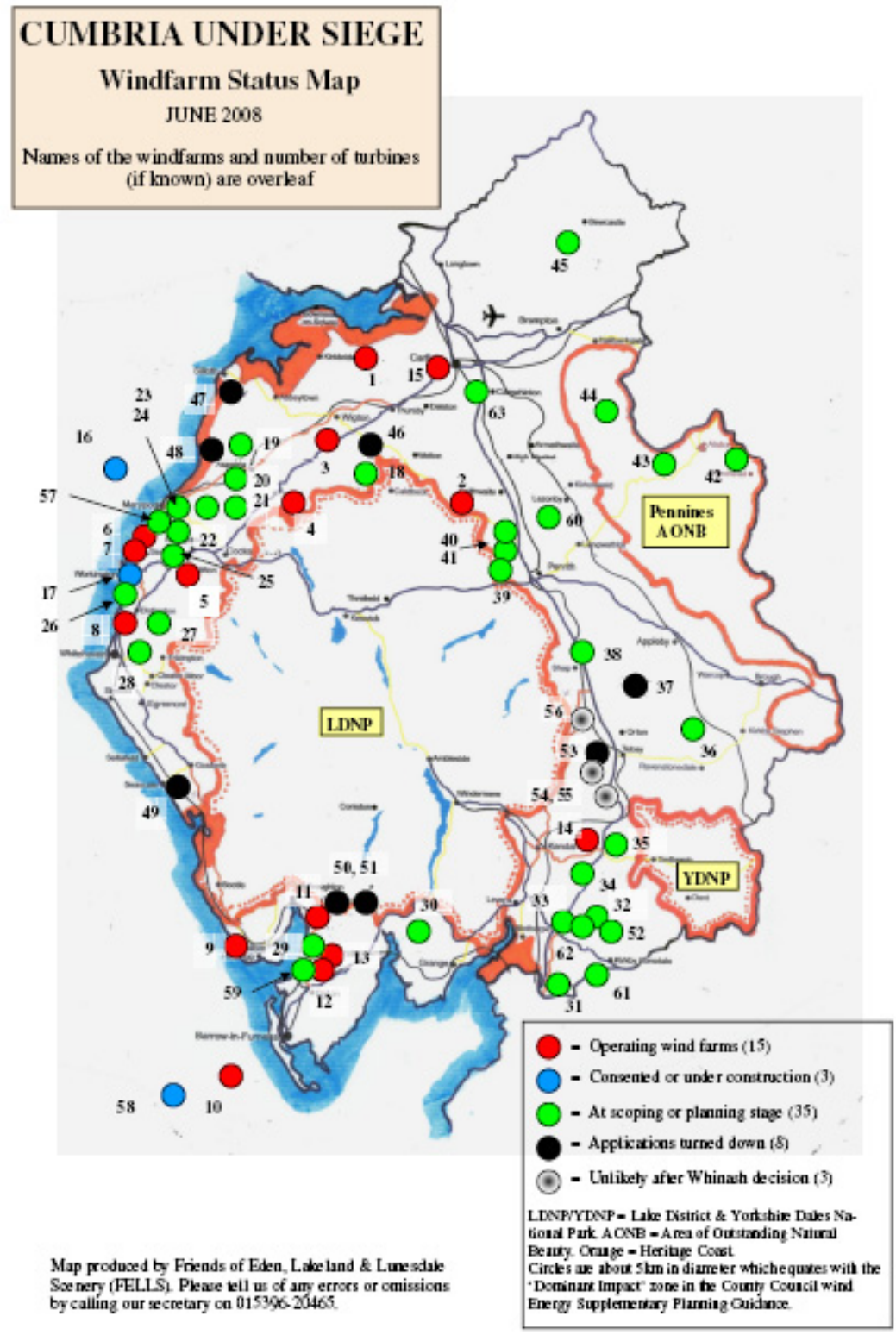
In addition, upland ecosystems are dependent on the natural drainage system of an area and how this affects water-tables, particularly with respect to peatland, stream and wetland systems. The development of a network of drains running across an area of 6.57 to 44.16 hectares has the potential to alter the drainage regime not only of the construction site but a much larger area surrounding the site.

It therefore follows that the final impact of construction is very dependent on the success, or otherwise of reinstatement in returning the sites biodiversity to predevelopment levels. This is also supported by minimising the impact to the drainage system which supplies water and nutrients to the associated ecosystems and governs the erosion and/or sedimentation regime on the site and surrounding areas. With the land take issue in mind we can examine associated impacts and other potential environmental problems associated with industrial scale wind turbine developments, allowing the assessment of satisfactory or unwisely proposed developments.

Annex 2: Environmental Impacts of Wind Turbine Developments

- see attached PDF document.

Annex 3


CUMBRIA UNDER SIEGE
Windfarm Status Map
JUNE 2008
Names of the windfarms and number of turbines (if known) are overleaf
Pennines AONB
LDNP
YDNP
- Operating wind farms (15)
- Consented or under construction (3)
- At scoping or planning stage (35)
- Applications turned down (8)
- Unlikely after Whinash decision (3)
LDNP/YDNP = Lake District & Yorkshire Dales National Park. AONB = Area of Outstanding Natural Beauty. Orange = Heritage Coast.
Circles are about 5km in diameter which equates with the 'Dominant Impact' zone in the County Council wind Energy Supplementary Planning Guidance.
Map produced by Friends of Eden, Lakeland & Lunesdale Scenery (FELLS). Please tell us of any errors or omissions by calling our secretary on 015396-20465.

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