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JOINT NATURE CONSERVATION COMMITTEE

ENERGY AND NATURE CONSERVATION

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1. Background

1.1 Energy production and use is currently a high political priority, both in the UK and EU, driven by concerns about climate change mitigation, energy security and fuel poverty.

1.2 In January 2008, the European Commission released its Renewable Energy and Climate Change Package[1]. Amongst other measures, this sets a target of a 20% share of renewable energy within the EU by 2020 and proposes a Renewable Energy Directive.

1.3 In the UK, an Energy White Paper (*Meeting the Energy Challenge*) was published in May 2007[2]. This sets out the Government's international and domestic energy strategy. It was supplemented by a White Paper on nuclear power, published in January 2008. The devolved administrations are developing their own responses to the EU and UK policy framework.

1.4 Impacts on biological and geological diversity arising from the production, distribution and consumption of energy in the UK are potentially significant, and there may be conflicts between climate change mitigation technologies (producing low-carbon energy) and nature conservation targets.

1.5 The general scientific consensus on the need for deep and urgent cuts in carbon emissions (some 80% of global emissions by 2050) and the focus on 'supply side' (rather than demand reduction) issues by government means that the potential for conflict between energy production and nature conservation is likely to intensify in the near future.

1.6 During discussion of the JNCC position statement on biofuels at the September 2007 Committee meeting it was agreed that there was a need for an over-arching JNCC position on energy to inform policy development.

2. Non-climate change impacts of energy production, distribution and use on biodiversity

2.1 Generally speaking, the significantly adverse impacts of energy production and consumption on biodiversity can be classified into four main groups:

[1] http://ec.europa.eu/energy/climate_actions/index_en.htm
[2] http://www.berr.gov.uk/energy/whitepaper/page39534.html

- emissions (to air, land or water);
- land-take;
- impacts of construction;
- direct operational impacts (such as bird strike or displacement of species).

2.2 A review of the potential impacts is attached at Annex 1. It should be noted that this list is not intended to be exhaustive but, instead, aims to illustrate the main nature conservation and landscape issues (other than climate change) associated with energy production. An important point is that the use of energy in the UK may have biodiversity impacts abroad, e.g. in relation to biofuel production and overseas oil and gas exploration.

2.3 Annex 1 also summarises potential technology-specific impacts of energy production on biodiversity. The key message to be drawn from this is that nearly all forms of production can have adverse impacts on biodiversity and that, rather than any form of technology being regarded as 'green' *per se*, each should be considered on its own merits.

2.4 Annex 2 summarises the main impacts of the electricity and gas distribution networks on nature conservation interests. The most notable of these impacts is that of transmission loss which makes a significant contribution to greenhouse gas emissions.

2.5 The implications for nature conservation policy of policies to address energy security and fuel poverty are considered at Annex 3.

3. Potential conflicts between energy production and nature conservation

3.1 The following examples highlight current potential conflicts between energy targets (reducing greenhouse gas emissions, increasing security of supply) and nature conservation.

Severn Barrage

3.2 Following the production of a report by the Sustainable Development Commission on the potential for tidal power in the UK[4], the Department for Business, Enterprise and Regulatory Reform (BERR), the primary regulator for electricity generation in England and Wales, has announced the commissioning of a feasibility study and strategic environmental assessment (SEA) into tidal range technology (barrages or lagoons) in the Severn. While such a project could deliver a significant proportion of the UK's electricity (between 3 and 5%) with only minimal CO_2 emissions, the potential for adverse impacts on nature conservation interests (including Natura 2000 sites) is immense. Natural England, CCW and JNCC are involved in the SEA and environmental working groups being organised by BERR as part of the feasibility study.

[4] http://www.sd-commission.org.uk/publications.php?id=607

Offshore wind

3.3 Recently the Government announced plans for the large-scale expansion of the offshore wind industry. The proposals, which are subject to SEA, may expand the amount of offshore wind in UK waters fourfold (from around 8 GW currently under consideration or built to as much as 33 GW). Much of this capacity may be deployed on shallow sandbanks and other areas with sensitive benthic habitats and species. Significant adverse environmental effects could arise from these large-scale proposals. Given that some of the current Round 2 projects (particularly those in the Wash) are already considered to be potentially unacceptable in terms of nature conservation impacts the challenge of delivering these revised targets is immense. Well-resourced and co-ordinated input into the SEA and Environmental Impact Assessment (EIA) processes by the nature conservation agencies is required.

Transmission systems

3.4 The electricity grid in the UK is not optimised to allow electricity from renewable sources (largely situated in the north and west of the country) to be delivered to areas of high consumption (in the south). A large number of upgrades will be required to meet renewable energy targets. High-voltage overhead lines have a number of impacts on natural heritage, most notably on landscape.

3.5 The UK's increasing reliance on imported liquefied natural gas has required a new 122 mile pipeline between the import terminal at Milford Haven and the national gas network in Gloucestershire. The Felindre to Tirley pipeline[6], which crosses a number of ecologically important areas, including the Brecon Beacons National Park and several SACs and SSSIs, was consented in 2007. The design incorporates a number of novel mitigation measures to minimise impacts on ancient woodland, hedgerows, rivers and wetlands.

Energy and nature conservation: possible 'win-wins'

3.6 The examples described above highlight two main issues. Firstly, that the actual impacts of any particular form of generation or energy use can vary dramatically depending on scale, location or proximity to sensitive receptors. The second point is that nearly all forms of production will have at least some adverse environmental impact.

3.7 One way of assessing these impacts is through well-resourced Strategic Environmental Assessment (SEA) and, at a project level, Environmental Impact Assessment (EIA) and, where relevant, 'appropriate assessment' under Article 6 of the Habitats Directive. In this context, high-quality guidance can assist in conflict resolution. For example, SNH's strategic location guidance

[6] http://www.nationalgrid.com/uk/Gas/Pipelines/milfordhaven/fs5/

for windfarms[7] has successfully sought to guide developers away from particularly sensitive locations.

3.8 There is a concern that nature conservation interests may need to be compromised in order to meet renewable energy targets. It is, however, important to note that renewable energy targets need not necessarily be prejudiced by natural heritage issues. For example, in Scotland a 50% renewable energy target set by the Scottish Government is likely to be met.

3.9 The greatest environmental and nature conservation benefits may be delivered by focussing on demand-side issues of energy consumption rather than supply side issues of production. In this context energy efficiency (see Annex 4) is particularly important. Micro-renewables (see Annex 1) and, particularly, locally embedded combined heat and power technology (CHP), if correctly sited with due regard for landscape and biodiversity issues, are also capable of delivering reductions in greenhouse gas emissions without adversely affecting biodiversity interests (although visual impacts will be extremely pertinent here).

4. Developing a JNCC position statement on energy and nature conservation

4.1 It is intended to prepare a draft JNCC position statement on energy policy and biodiversity for discussion by the Joint Committee in June. This would build on existing/developing JNCC and country agency positions[8].

4.2 Provisional headline points for the position statement include the following:

i. policies on energy production and consumption have a critical role to play in reducing emissions of greenhouse gases and thus mitigating climate change;

ii. full lifecycle assessments of the carbon emissions of energy schemes are required to ensure that greenhouse gas reductions are optimised;

iii. low-carbon technologies are not necessarily benign in terms of their environmental impact. Policies on energy production and consumption should not compromise the UK's ability to meet domestic, EU and global commitments on nature conservation;

iv. the impacts of some aspects of UK energy policy on biodiversity beyond the UK are significant and must be taken into account in assessing the sustainability of proposals;

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[7] www.snh.org.uk/strategy/renewable/sr-WP.asp

[8] For example SNH policy statement: 06/02 *Energy and the Natural Heritage* (http://www.snh.org.uk/pdfs/polstat/EnergyPolStat.pdf); JNCC position statement on transport biofuels and biodiversity (http://www.jncc.gov.uk/pdf/2007_positionstatement_Biofuel_nov07.pdf); JNCC response to the Energy Review (http://www.jncc.gov.uk/default.aspx?page=4209); developing Natural England positions on various aspects of energy policy (http://www.naturalengland.org.uk/about/board/feb08/NEBPU0904-PolicyDevelopmentPriorities.pdf); CCW's revised position statement on *Energy and Natural Heritage*.

v. high priority should be given to reducing demand for energy by providing incentives for efficient resource use and penalising wasteful activities (in line with the principles of sustainable consumption and production);

vi. the use of micro-generation and small-scale embedded CHP should be promoted (e.g. through market frameworks);

vii. robust and well-resourced use of SEA and EIA is essential.

Annex 1. Non-climate change impacts of energy production in the UK

1. General impacts

Although it is the climate change impact of energy production that attracts the most attention there are other significant adverse impacts of energy production and consumption on nature conservation. Generally speaking these can be classified into four main groups:

- emissions (to air, land or water);
- land-take;
- impacts of construction; and
- direct operational impacts (such as bird strike or displacement of species).

1.1 Emissions

i. In addition to carbon dioxide, emissions may include nitrous oxides (NOx), sulphur dioxide (SO_2), radioactivity, and solids, such as ash or soot.

ii. NOx and SO_2 from the combustion of fossil fuels (either to directly produce heat or in the production of electricity) contribute to acidification of the environment. Although SO_2 emissions from large power plants have reduced considerably in recent years (primarily due to decreased use of coal and the use of desulphurisation processes) emissions of NOx from the energy industries have increased since 1999[9]. Critical load thresholds of SO_2 and NOx, above which acid deposition causes significant harm to the environment, have been calculated. In 2002, these critical load thresholds were exceeded in 55% of sensitive habitat areas[10]. Increases in acidity associated with these emissions lower the resistance of plants to disease (particularly in trees), alters the structure of ecological communities, and can kill sensitive aquatic species. Additionally, deposition of nitrogen can lead to eutrophication of sensitive habitats such as heather moorland, where changes from heathland to grassland can occur. Emissions are the key impact likely to arise across national boundaries, affecting biodiversity overseas.

iii. Radioactivity can impact upon the abundance, distribution, life history and mutation rates of plants and animals. Whilst, barring accidents, radiation from operational activities at nuclear power stations is contained within facilities to environmentally acceptable levels, the storage, discharge or transport of wastes from generation or processing can lead to radiation entering the environment.

iv. Cooling water can impact on local biological communities if it is significantly different in temperature from the waters to which it is discharged. Outlet areas are known to often support potentially harmful invasive species.

[9] Pages 28-9, *The environment in your pocket 2005,* Defra / National Statistics
[10] ibid, page 27

v. Non-radioactive solid waste, such as pulverised fuel ash, requires land for its disposal and can impact further upon biodiversity by polluting watercourses if improperly disposed of.

1.2 Land-take

i. Whilst the total footprint of power stations and other energy production facilities in the UK is relatively small, for instance compared to housing, the footprint of the energy transmission system is very significant (see Annex 2). In some cases development can impact upon sensitive habitats. For example, the footprints of a number of proposed terrestrial windfarms (which when taking into account maintenance roads and turbine bases and foundations can be extremely large) are likely to affect sensitive sites in national parks and Natura 2000 locations. Of particular concern is the potential loss of peatland areas, particularly arising from windfarm development, most notably in the Scottish uplands. Peatlands constitute an important carbon sink but the net carbon balance of windfarm development in these areas is not well understood.

ii. The provision of compensatory land by power companies can mitigate these impacts. For example, a number of generation licence holders have developed ponds and wetlands to compensate for habitat lost in construction.

iii. The extraction of coal from open-cast mining in the UK (and abroad) can give rise to significant land-take. Coal-fired generation remains a significant part of the UK's energy mix, with proposals being made for new plants.

1.3 Construction impacts

i. Construction activities can impact on land beyond the footprint of the development being built. Movement of construction plant and materials and the use of adjoining land for storage can impact upon biodiversity. Habitats may take many years to recover from the use of temporary construction roads and dust from construction activities. In the marine environment noise from construction can impact upon marine life. Piling noise is considered likely to create a significant avoidance reaction in fish and marine mammals at tens of kilometres from construction activity and closer to the source could result in serious injury or even death.

1.4 Operational impacts

i. In addition to emissions, operational effects such as noise, lighting and maintenance traffic can give rise to further impacts on biodiversity. These factors can lead to disturbance or displacement of wildlife. Offshore windfarm development and operation has been recorded as leading to the displacement of birds such as diver and sea-duck at distances of up to 4 km[11].

[11] http://uk.nystedhavmoellepark.dk/upload/pdf/BSR_2004.pdf; http://www.hornsrev.dk/Engelsk/default_ie.htm; http://www.npower-renewables.com/northhoyle/environment.asp

ii. Extraction of cooling water, particularly from freshwater sources, can adversely impact upon aquatic ecosystems and requires careful management. Fish-take and injury to marine mammals (particularly seals) can occur from the extraction of seawater for the cooling of coastal generation projects.

iii. Visual impacts, particularly of large-scale thermal plants and windfarms, together with associated infrastructure such as sub-stations and power lines, are also significant environmental issues.

2. Technology-specific impacts

2.1 Oil and gas exploration and production

i. Generally speaking the high standard of environmental management of oil and gas exploration production in the UK means that adverse impacts on nature conservation are minimised.

ii. Regulation and environmental assessment of activities such as drilling and the installation of sub-sea and above-water facilities generally ensures that potential impacts on sensitive receptors from the disposal of drill cuttings, pollution caused by the escape of hydrocarbons, and the direct impact of development upon sensitive habitats are avoided. Appropriate assessments under the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 now take place routinely to ensure that habitats such as biogenic reef formed by *Sabellaria spinulosa* and submerged sandbanks potentially qualifying for designation as SACs under the Habitats Directive are taken into account when planning new development.

iii. More specific impacts on biodiversity include the effects of sub-sea noise (most notably that arising from seismic survey) on marine mammals.

iv. Oil and gas pipelines, terminals and refineries are large-scale developments, the placement of which in coastal landscapes and habitats threatened by sea-level rise can be problematic.

v. Transportation of hydrocarbons from offshore facilities to shore can result to discharges to the environment and although many are extremely small-scale their cumulative impact on the health of marine ecosystems cannot be disregarded. Large-scale, catastrophic releases of oil from accidents involving shipping are thankfully rare due to enforcement of high standards of seaworthiness of vessels in UK waters.

vi. The generally high standard of environmental regulation in respect of North Sea oil and gas production has been contributed to greatly by the use of Strategic Environmental Assessment, a process which has been commissioned by central government in respect of most relevant areas of the UK's territorial waters and Exclusive Economic Zone.

2.2 Oil and gas combustion, including electricity generation

i. Oil and gas consumption takes place to produce electricity, in industry as part of manufacturing and other processes and, domestically and commercially, to provide heating.

ii. CO_2 emissions from the combustion of natural gas are relatively low compared to the use of oil or coal. Indeed, the reduction of CO_2 emissions in the UK by 21% from 1990 levels is very largely due to the wide-scale adoption of gas as a replacement for coal-fired electricity generation over that period.

iii. The combustion of hydrocarbons also gives rise to emissions of other atmospheric pollutants. Gas is less ‘dirty’ than oil in this respect and a large element of recent national reductions in the level of emissions producing acidification (NO_X and SO_2) is attributable to the switch to gas. As noted above, extraction of cooling water at oil- and gas-fired power stations, and its return to rivers and estuaries, can adversely impact upon aquatic ecosystems and requires careful management.

iv. The increasing reliance of the UK on imported hydrocarbons, in particular natural gas, is likely to give rise to other impacts, both at home and abroad. Environmental protection in countries where these fuels are produced and imported from may be lower than in the European Union. Additionally, import infrastructure (e.g. pipelines, terminals and LPG tanker handling facilities) will themselves give rise to adverse impacts on biodiversity.

2.3 Coal mining and combustion

i. The burning of coal (primarily for electricity generation but also domestically and elsewhere) is a particularly heavy CO_2-producing activity, making a disproportionate contribution to climate change for the energy it provides. Additionally, it contributes significantly to levels of atmospheric nitrates and sulphur dioxide (although in respect of the latter this can be significantly mitigated by existing technical solutions). As discussed above, acidification caused by these emissions can impact upon sensitive environments, both at home and abroad.

ii. The so-called ‘clean coal’ technologies may offer some solutions to emissions issues although many of these technologies are not yet well proven and, in some instances, their economic viability is questionable. Additionally, as discussed in 2.13 below, carbon capture projects may themselves give rise to adverse environmental impacts. Waste products from clean coal production, some of them toxic, will require safe disposal to minimise environmental impacts.

iii. Open cast extraction of coal can have large-scale, long-term impacts on landscapes and habitats. Although remediation and restoration projects can help to mitigate the impact of these projects most extraction will result in significant habitat loss. The overseas extraction of coal may be less well-regulated than in the UK.

iv. Spoil heaps, pulverised fuel ash storage facilities and water contamination arising from deep-mined coal can also impact upon the natural environment.

v. As discussed above, extraction of cooling water, particularly from freshwater sources, can adversely impact upon aquatic ecosystems and requires careful management.

2.4 Nuclear generation of electricity

i. Many of the concerns relating to the sustainability or otherwise of nuclear power focus upon the long-term economics of the development, operation and decommissioning of nuclear power plants and of the storage of nuclear waste. These issues are outside the scope of this paper, which focuses on the known impacts of energy production and consumption on nature conservation interests. However JNCC and others (including the Sustainable Development Commission) have previously advised that the economic consideration of nuclear generation should be based on robust, whole-life cost and benefit analysis (including the costs of long-term storage) and should take into account appropriate valuations to ensure that all environmental factors are taken into account over the long- and short-term.

ii. There is little evidence that the routine, well-regulated operation of nuclear generation gives rise to significant adverse impacts on biodiversity. Most documented adverse impacts of radioactive isotopes in the environment have arisen from poor regulation and/or accidental release[12]. In the UK whilst electricity generation from nuclear sources increased by 50% between 1985 and 2003, radioactive emissions to air and water fell by 76% and 82% respectively[13].

iii. However, adverse impacts on biodiversity could occur in respect of two aspects of nuclear power: extraction of uranium ore and long-term storage and security of nuclear waste.

iv. Environmental standards relating to the extraction of uranium ore are not consistent, even in countries with a relatively good environmental record. It is likely that over the next 25-30 years uranium ore supplies in countries such as Australia and Canada will become depleted and the UK may need to rely upon supplies from countries with a poor record of environmental protection.

v. In respect of waste storage, the long-term risks to the environment from untested storage technologies are significant, particularly given the extremely long periods of time (tens of thousands of years) during which adverse impacts on biodiversity might occur. There are global uncertainties relating to the treatment and storage of existing nuclear waste (most of which is currently stored in temporary facilities pending the development of suitable technologies). Expanding nuclear capacity would therefore create further

[12] Moller, A.P and Mousseau, T.A. (2006). Biological consequences of Chernobyl: 20 years on. *Trends in Ecology and Evolution* **21(4)**, 200-207
[13] *The environment in your pocket 2005,* Defra / National Statistics

radioactive wastes when technical solutions for treatment and storage may be many years from useful and low-risk deployment. Impacts on biodiversity from deficient long-term storage might extend from localised effects to more significant and wider-range impacts, particularly if contamination of groundwater occurs. Even relatively low levels of radioactivity can have significantly adverse effects on biological receptors [14].

2.5 Large-scale hydro-electric generation

i. Large-scale hydro-electricity provides around 1.5% of the United Kingdom's electricity and around 32% of the UK's renewable energy production. [15]

ii. While only one large-scale scheme has been built in recent years the potential for such projects to impact upon nature conservation interest is significant. Construction of projects can give rise to large amounts of carbon dioxide, particularly where concrete is used for construction. Although they can produce large quantities of reliable zero-carbon electricity, the impacts of the construction of dams and races in the form of land-take and changes to river flows is generally regarded as an adverse impact. While impacts can be mitigated by 'ladders' and 'lifts' hydro projects can impact adversely on salmon and other migratory fish. Additional aquatic habitat can be provided by the creation of new lakes, but such positive impacts (which may only arise after many years) may not outweigh the negative impacts of large-scale hydro-electricity on the environment. As is the case with many of the technologies discussed in this paper, appraisal of project-specific impacts is vital.

iii. In many cases improvements in technology can increase the productivity of existing and, in many cases, aging hydro-electric infrastructure. The use of such technologies should be promoted for the benefits they provide, allowing more electricity to be produced without additional environmental impacts.

2.6 Terrestrial renewables: commercial wind and solar

i. The significant contribution that large-scale terrestrial renewable generation projects can make to emissions reductions, and the undoubted environmental benefits of these projects, means that the statutory nature conservation agencies in the UK are generally supportive of such technologies. However, projects have the capacity to cause environmental damage if they are not developed in a way that minimises their impact on the natural heritage. Such impacts might include, in respect of terrestrial windfarms:

- bird strike;
- barrier effects;
- displacement (of birds and other species);
- land-take in areas of sensitive or rare habitat;
- fragmentation of rare or sensitive habitat;

[14] Moller, A.P and Mousseau, T.A. (2006). Biological consequences of Chernobyl: 20 years on. *Trends in Ecology and Evolution* **21(4)**, 200-207

[15] *The environment in your pocket 2005,* Defra / National Statistics

- visual impacts;
- landscape change; and
- impacts on hydrology and freshwater.

ii. It is likely, particularly in areas of high wind resource, that a landscape's or local environment's ability to absorb further windfarm development will reach limits, particularly as incremental development will give rise to cumulative impacts. Further research is required in this area in order to ensure that renewable energy does not itself become an unsustainable industry.

iii. Whilst commercial-scale solar radiation has, to date, been confined in the UK to installation on existing structures, similar considerations to those discussed above will be required should large-scale deployment ever become a commercial likelihood.

2.7 Marine renewables: offshore wind

i. Part of the rationale behind developing offshore windfarms (which are more expensive to construct than their terrestrial counterparts) is that, in addition to more consistent wind resource, environmental constraints on development are likely to be fewer. While generally speaking this may be the case both the SEA and EIA processes associated with the Round 2 windfarms in the UK have identified environmental sensitivities and, as with terrestrial wind, such developments should not be regarded as sustainable *per se*. Possible impacts on nature conservation interests include:

- construction noise impacts on marine mammals and fish;
- displacement of seabirds, most notably diver and sea-duck;
- bird mortality arising from collision for certain species such as sandwich tern and whooper swan;
- potential impacts of cabling on Special Areas of Conservation;
- risk of adverse interaction with features of high nature conservation interest such as sandbanks and biogenic reef, both features protected under the Habitats Directive;
- visual impacts.

ii. Notwithstanding these concerns our understanding of the environmental impacts of offshore wind have grown immensely in recent years and it should be possible for sites to be identified where the carbon-free benefits of this form of renewable development can be delivered without adverse impacts on biodiversity.

iii. Recently the Government announced plans for the large-scale expansion of the offshore wind industry. Much of this capacity may be located on shallow sandbanks utilised by feeding birds. Significant adverse environmental effects could arise from these large-scale proposals

2.8 Marine renewables: wave and tidal devices

i. Just as marine wind projects can give rise to significant environmental impacts the same is true for wave and tidal devices, although these have yet to reach commercial deployment with only a few 'demonstrator' devices currently in operation.

ii. SNH's policy statement on energy[16] suggests that these technologies may, subject to the provisos raised in the organisation's marine renewables policy[17], be one of the most environmentally benign methods of generating electricity. The key issue here is that potential impacts are not well understood, an issue which can be problematic in the context of the precautionary approach adopted in Article 6 of the Habitats Directive relating to the appropriate assessment of projects. The demonstration of an absence of significant effect is more difficult in the marine environment than on land.

iii. The location of the most productive wave and tide resources in the north and west of the UK, away from large population centres and high-capacity grid connections and transmission lines means that significant upgrading and extension of the grid is likely to be required, particularly in western Scotland.

2.9 Biomass

i. Woody biomass can provide a low-carbon energy resource, particularly for heating. Many of the concerns relating to such technologies relate to land cover and forestry management issues. Potential impacts could include those affecting soil, water, biodiversity and landscape. To date very few schemes have progressed, as technology remains at a prototype level. However, 'co-firing' of woody biomass occurs at many coal-fired plants, forming up to 10% of the fuel burnt at some installations. Biomass is likely to be a particularly prominent technology in Scotland and Wales where the Forestry Commission is actively exploring a number of schemes.

2.10 Biofuels

i. Although fuels such as wood and charcoal have been used both domestically and industrially as a source of energy for many generations the large-scale use of crops to produce fuel (biofuels rather than biomass) is a recent innovation. Although, because their growth involves the absorption of as much atmospheric carbon dioxide as their combustion emits, they are perceived as being 'carbon-neutral' and, therefore, 'green' the use of biofuels has the potential to give rise to significant harm to biodiversity and the wider environment. Potential adverse impacts include habitat loss, intensification of agricultural practices and loss of natural carbon sinks.

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[16] SNH policy statement: 06/02 - *Energy and the Natural Heritage* http://www.snh.org.uk/pdfs/polstat/EnergyPolStat.pdf

[17] www.snh.gov.uk/strategy/renewable/sr-MP.asp

ii. The assertion of 'environmental friendliness' remains largely unproven and many of the real drivers for the increase in biofuel production relate to the economic potential of these crops for European farmers and fuel security issues. Biofuels are not all alike, with different feedstocks for bioethanol and biodiesel. The feedstocks likely to produce ethanol in the UK are wheat, maize and rye (sugar beet is seen as uncompetitive). For biodiesel, rapeseed is the prime feedstock in the EU. However, imported raw or refined products (primarily palm oil) are likely to be the main source for this industry.

iii. The growing demand for fuel feedstocks will bring direct competition with the food industry and will have implications for European agriculture and farm practices particularly in respect of growing cereals which can be used for bioethanol production. Further study is required to assess what impact on biodiversity the expansion of the market for these crops will have. Additionally, there is a large potential for UK consumption of these products to have significant overseas biodiversity impacts, thereby undermining the 'green' credentials of this energy source. Tropical deforestation (itself a source of carbon emissions) to provide biofuel crops is already occurring in many countries (most notably in Brazil in respect of soya-based biodiesel and in south-east Asia for palm oil). The EU is likely to need to import fuels or feedstocks to meet demand for biofuel products.

iv. JNCC have produced a policy statement[18] on transport fuel and biodiversity, recommending a possible approach to UK and European biofuels policy.

2.11 Waste to energy

i. Much of the waste incinerated in UK waste to energy plants is not from renewable sources, with plastics derived from hydrocarbons being a significant element of these fuels. Such generation therefore cannot, where mixed wastes are utilised, be regarded as renewable *per se*. However, the use of such technologies is likely to have benefits for nature conservation in that demand for landfill disposal would be reduced (although there are some suggestions that emissions may have an adverse effect on human health). Additionally, a large element of the carbon output of waste products occurs regardless of the manner in which they are disposed. Waste products which biodegrade can form methane, a greenhouse gas far more damaging than carbon dioxide.

ii. The largest increase in renewable energy in recent years has been from landfill gas, increasing from 1185 GWh in 1998 to 4004 GWh in 2004[19]. While this is a welcome use of what would otherwise be a wasted resource, the amount of waste the UK currently sends to landfill is not sustainable.

iii. Waste to energy projects should not be promoted at the expense of waste reduction, recycling and other sustainable consumption and production initiatives.

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[18] http://www.jncc.gov.uk/pdf/2007_positionstatement_Biofuel_nov07.pdf

[19] *The environment in your pocket 2005*, Defra / National Statistics

2.12 Combined Heat and Power (CHP) and district heating

i. Combined Heat and Power plants (CHP) utilise the combustion technologies discussed above (most notably gas-fired electricity generation) and contribute to greenhouse gas and other atmospheric pollution. Nevertheless, they represent an extremely efficient use of non-renewable resources as they utilise a large proportion of the 60% of the energy used to generate electricity which is lost as waste heat.

ii. Additionally the use of local ‘embedded’ CHP can contribute towards the reduction of CO_2 emissions by cutting down on transmission loss, thereby adding to fuel efficiency.

iii. District heating programmes (which through tri-generation can add to efficiencies by providing chilled water for air conditioning during summer months when heated water is not required) are an efficient method of sharing the efficiencies derived from CHP more widely. As well as providing nature conservation and wider environmental benefits these schemes could also usefully address fuel poverty issues by providing reliable, cheap heat to disadvantaged areas. Because there are substantial building costs associated with retro-fitting pipe networks these technologies may be better suited to large-scale new building projects (e.g. the Olympic developments in East London).

2.13 Microgeneration: small-scale solar, wind and hydro

i. Microgeneration is generally defined as being small-scale electricity generation technologies suitable for domestic or small business use, including photovoltaic cells, small wind-turbines, small hydro plants (e.g. installed in weirs or old mill races) and fuel cell technologies. Small-scale CHP, known as ‘micro CHP’ is also frequently included within the definition of microgeneration. Although the electricity produced is primarily intended for local consumption, excesses can be exported to the national grid.

ii. Microgeneration units are usually installed in or on existing structures and electricity is consumed locally (thereby avoiding transmission inefficiencies). Such units therefore have the potential to contribute to the reduction of emissions and have negligible impacts on biodiversity although their inability to achieve the economies of scale obtained by larger projects means that they may not achieve optimum generating efficiencies.

iii. This ‘decentralised’ approach to generation lacks the backing of large businesses and the established utility companies and for that reason has, traditionally, struggled to make its voice heard.

iv. Microgeneration can also contribute towards security of supply (by moving away from reliance on a vulnerable and, at times, over-stretched, grid) and fuel poverty (by empowering local communities and putting energy decisions in their hands).

2.14 Carbon capture and storage (CCS)

i. Carbon capture and storage (CCS) technology may itself create adverse environmental impacts. Although commentators have suggested that the main risk is associated with the accidental escape of captured CO_2 from artificial reservoirs (either as part of catastrophic failure or slow leakage) it is likely that the most significant impact on biodiversity may arise from the construction of new infrastructure to transport waste CO_2 from sites where it is produced to storage locations. Where former oil infrastructure is not available this is likely to require the installation of new pipelines which can affect both the terrestrial and (if storage is to take place at sea in depleted gas and oil fields) the marine environments.

ii. Leakage of sub-sea CO_2 storage, as well as failing to reduce climate change impacts, could contribute towards marine acidification, a process which appears to be accelerating as levels of CO_2 in the atmosphere increase[20] with potentially adverse impacts on biodiversity. However, CCS may be an extremely useful interim technology, allowing extremely low emissions from existing technologies.

[20] *Ocean acidification due to increasing atmospheric carbon dioxide*. The Royal Society. http://www.royalsoc.ac.uk/displaypagedoc.asp?id=13539

Annex 2. Impacts of energy transmission and transportation

In addition to the production and consumption of energy in the UK adverse impacts on nature conservation interests can arise from the transportation or transmission of energy across the country. The potential impacts of transporting oil and gas ashore from marine production platforms are considered in Annex 1.

1. Electricity transmission

i. A number of potential impacts on nature conservation interests arise from the operation and maintenance of the National Grid. Additional impacts may arise in the marine environment from connections to offshore windfarms and other marine energy generation facilities.

ii. The location of the most productive wind, wave and tide resources in the north and west of the UK, away from large population centres and high-capacity grid connections and transmission lines means that significant upgrading and extension of the grid is likely to be required, particularly in Scotland.

iii. The transmission losses occurring within the national grid (around 10%) represent a significant contribution to greenhouse gas and other emissions. Where electricity from renewable sources is lost in the transmission process this can give rise to natural heritage impacts because it affects the scale and/or number of projects required to deliver given levels of demand.

iv. Overhead cables require land (for masts and pylons) and can impact upon large areas beneath cables to which access must be kept free of tall vegetation for maintenance and safety purposes. However, the ‘undergrounding’ of high-voltage cables, as has occurred for example in national parks, can itself give rise to significant impacts, in addition to being very expensive. Cable burial can disturb habitat in a corridor up to 20 metres either side of the cable and effective restoration of that habitat may not always be successful.

v. High-voltage overhead cables can have a significant visual impact. Although this impact can be avoided by burial in sensitive areas such as national parks this can itself, as discussed above, have impacts upon habitats.

vi. It is generally considered that bird strike and/or the risk of electrocution to birds from power lines in the UK is low compared to other countries, possibly because the incidence of large species, which are more prone to collision, is itself lower[21]. Deflectors and visual deterrents on power lines can be used to mitigate impacts as can full consideration of sensitive locations during the planning process (e.g. by requiring ‘undergrounding’ in these areas). Although bird strike on transmission cables is not generally perceived to be a widespread impact it should be noted that expansion or reinforcement of the network could increase risks in this respect.

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[21] *United Kingdom and its Overseas Territories and Crown Dependencies*, CMS Report, 2005

vii Laying cables at sea (either as interconnectors to other countries for the import/export of electricity or to get electricity generated offshore to the national grid) may give rise to a large number of impacts, ranging from damage to sensitive habitats such as eelgrass beds, biogenic reef and mussel beds to disturbance of marine mammals caused by noise from cable-laying vessels and potential impacts on fish movement and behaviour caused by electromagnetic fields. Further guidance on potential environmental impacts and possible mitigation has recently been drafted by central government in consultation with the nature conservation agencies[22].

viii Because of the potential for adverse biodiversity impacts from the electricity distribution network greater support for microgeneration technologies from government could deliver nature conservation benefits. As discussed in Annex 1, not only are the potential nature conservation impacts of microgeneration minimal but additional benefits (most notably the reduction of emissions by reason of bypassing transmission inefficiencies) can contribute significantly to sustainable development targets.

2. Gas supply network

i. The existing gas supply network gives rise to minimal impacts on biodiversity in its day-to-day operation. However, further expansion of the network could create impacts through sterilisation of land required for pipelines.

ii. As the UK becomes increasingly reliant on imports of gas it is likely that the installation of additional infrastructure will be required, most notably gas pipelines, terminals and port facilities for the handling of liquefied natural gas carried by tankers. The provision of such infrastructure could have a negative impact upon the marine environment and its biodiversity although, at least within the UK Exclusive Economic Zone, these effects can be minimised and mitigated through the environmental impact assessment process.

[22] http://www.berr.gov.uk/files/file43527.pdf

Annex 3. Non-climate change drivers for energy policy

1. Energy security and nature conservation

i. Nature conservation and security of supply interests may in many cases be aligned. In particular, the reliance of UK energy consumers on overseas production of oil and gas may increase the overall ecological footprint of the UK because environmental protection in many overseas jurisdictions (particularly in the former Soviet republics, the Middle East and south-east Asia) is more limited than in Europe and therefore impacts on biodiversity can be far greater.

ii. Additionally, increased imports of energy are likely to require increased construction of infrastructure, particularly in the coastal environment. New port facilities to handle LPG, the construction of sub-sea gas pipelines, and the laying of electrical inter-connectors all have the capacity to impact adversely upon sensitive habitats.

iii. The use of local embedded generation (in particular, fuel-efficient CHP) and microgeneration could both increase security of supply and avoid grid-related impacts on nature conservation interests.

iv. One way to reduce dependency on fuel imports is for society to generally use less fuel. The adoption of energy efficiency initiatives (see Annex 4) could contribute significantly to security of supply whilst reducing impacts on biodiversity.

2. Fuel poverty and nature conservation

i. If environmental (including biodiversity) costs are to be explicitly accounted for within fuel costs then it is likely that unit costs of those fuels would increase substantially. The burden of these increases may fall upon consumers with low disposable incomes, particularly those already living with fuel poverty. Mechanisms may therefore be required to ensure that the full environmental costs of fuel production and consumption are equitably shared.

Annex 4. Energy efficiency

Energy efficiency constitutes a potential 'win-win' for biodiversity and energy policies.

1. Domestic electricity demand

i. It is now widely recognised that standby facilities on domestic appliances utilise large quantities of electricity while sitting idle. Studies in the United States have calculated that standby power may account for 5% of total residential electricity consumption in America (some 64 million megawatt hours each year). In France this figure is even higher, at 7%, while some estimates put the proportion of consumption due to standby power as high as 13%[23]. Attempts to reduce such consumption by requiring all standby processes to be performed with consumption of one watt or less are commercially viable and if applied across the OECD developed nations would reduce overall CO_2 emissions by nearly 0.5%[24]. Such an approach, which continues to allow consumers to benefit from the convenience of standby facilities, has been adopted in the US where it is now illegal to sell television, stereo and other electronic products that consume more than specified levels of electricity during standby mode. Similar Executive Order 13211 restricts US government bodies from purchasing electronic goods with standby power devices consuming more than 1 watt.

ii. The energy efficiency of houses in England and Wales is measured by a Standard Assessment Procedure (SAP) rating. The average SAP rating has risen dramatically from around 12 in 1970 to 45 in 2000[25] but still lags a long way behind the level of 120 which indicates an extremely efficient house or even the 100 level required under current regulations. Because new-build only accounts for a very small (approximately 1%) of the housing stock large gains in energy efficiency could be achieved by improving the energy performance of existing houses as well as enforcing regulations relating to new build. This could be achieved by a variety of methods although direct subsidies may be required as the capital costs of works is unlikely to be reflected in the sale costs of refurbished properties.

iii. Both these approaches could deliver substantial energy efficiency benefits that would have little, if any, impact upon biodiversity – unlike supply side solutions to the 'energy gap' which are likely to impact adversely upon nature conservation interests.

2. Transport fuels

i. Emissions from the transport sector account for some 43 million tonnes of carbon a year - over 28% of the UK's total CO_2 emissions (and 35% of all energy use). This is predicted to grow by another 8% between 2000 and 2010[26].

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[23] The Economist Technology Quarterly, March 2006
[24] ibid, page 32
[25] *Energy Consumption in the UK*, 2002
[26] *Our Energy Challenge*, 2006, DTI, page 27

ii. Average emissions from cars fell from 192 grams of CO_2 per kilometre in 1995 to 172 grams/km in 2004 but this rate of improvement has recently slowed, largely due to increased purchases of larger-engined cars, and particularly four-wheel drives. Although fuel efficiency has improved by 10% since 1997 there is still much scope for improvement. Further encouragement towards the use of public transport would also assist in reducing the impacts of transport fuel use.

iii. Between 1990 and 2003 emissions from the use of aviation fuel bunkered in the UK increased by almost 90%[27]. Emissions from high-altitude aviation are thought to have a greenhouse effect over and above that of carbon dioxide emissions alone. Additionally, increased demand for flights has further impacts on nature conservation interests, particularly those arising from airport infrastructure development such as runway expansion. A number of approaches to reducing aircraft emissions are currently under consideration, including increasing the scope of emissions trading schemes to include CO_2 from aviation and the introduction of taxation on aviation fuel. This latter approach would be consistent with sustainable development approaches requiring the full environmental costs of flying to be reflected in ticket pricing. However, given the problems associated with implementing a uniform global aviation fuel tax, it may be that restricting airport expansion could be an alternative, although less effective, restriction on further increases in aviation-related emissions.

iv. In the context of the large greenhouse gas emission cuts required to avoid 'dangerous' climate change the projected rapid growth in aviation-related greenhouse gas emissions could be seen as anomalous. Indeed, modelling carried out by the Tyndall Centre for Climate Change Research[28] has suggested that, at an annual growth rate of only half of that experienced by UK aviation in recent years the UK's aviation sector would by 2050 consume the entire UK carbon budget required to deliver the 450 ppm CO_2 stabilisation level thought by many to be necessary to avoid 'dangerous' climate change.

[27] *Sustainable development indicators in your pocket*, 2005. Defra / National Statistics

[28] Bows *et al.* (2006), *Contraction and convergence: UK carbon emissions and the implications for UK air traffic*, Tyndall Centre Technical Report No. 40