

Wind energy: the debate

“Wind energy harnesses the kinetic energy of moving air.”¹ The primary relevant application of this technology involves the production of electricity “from large wind turbines located on land (onshore) or in sea- or freshwater (offshore)”¹. According to the IPCC “Onshore wind energy technologies are already being manufactured and deployed on a large scale”, but “offshore wind technologies have greater potential for continued technical advancement”¹.

Wind generated energy in the UK

The first functioning, experimental wind turbine for the generation of electricity was built by Professor James Blyth in Glasgow in 1887². The technology Blyth pioneered was developed over the next century with trials taking place in various countries including the USA and Denmark. The UK’s first commercial windfarm was built in Delabole, Cornwall and opened in 1991³. The UK’s first offshore windfarm opened in 2001 in Blythe harbour⁴. The UK is now the world leader in offshore wind power generation, with 3.6 GW capacity installed, which at the end of 2012 represented over 3% of total UK energy generation capacity⁵. A further 1.4 GW of capacity is currently under construction and a great deal more has either passed, or is awaiting planning permission⁵.

The UK Climate Change Act, passed in 2008, requires a reduction in greenhouse gas emissions of 80% below 1990 levels by 2050⁶ and wind power, which is the largest contributor to UK renewable energy generation (unless the contributions of all forms of bioenergy are amalgamated)⁷, is considered to be very important if we are to meet this target. DECC predicts that by 2020 UK offshore wind farms could potentially supply enough energy for 5.3-7.9 million households⁴.

The controversy

The construction and operation of wind turbines for the generation of power can be highly controversial locally and politically. There is often considerable local opposition to the construction of onshore wind farms and there are various potential environmental and nuisance impacts associated with both onshore and offshore wind farms, which makes the issue politically complex. Nevertheless, the UK is legally bound by the 2009 EU Renewable Energy Directive to produce 15% of its energy through renewable means by 2020⁸. This factsheet is intended to present various perspectives on the issue, focusing largely on environmental concerns.

The issue	What the Government says	What the industry says	What the campaigners say	What the scientists say
<p>How much of our energy needs can wind farms realistically supply?</p>	<p>The UK is legally committed to meeting 15% of its energy demand from renewable sources by 2020 under the 2009 Renewable Energy Directive⁸. The UK government recognises the need to “radically increase its use of renewable energy” to combat climate change and secure a stable future energy supply⁹. In the UK Action Plan to meet the 2020 targets, it is estimated that on- and offshore windfarms will generate more energy than any other renewable source in 2020⁹. However, government policy on wind power is not very coherent and often complicated by political in-fighting.</p>	<p>“Future success depends on a stable policy framework.”¹⁰</p> <p>The industry body RenewableUK argues that on- and offshore wind farms can deliver an increasing percentage of UK energy capacity if policymakers help to build an environment where investment in the sector is promoted. However, a survey of industry confidence does show there is increasing concern over the reliability of this framework¹⁰.</p>	<p>A report published by the Adam Smith Institute presents evidence based on measurements at 22 points in the UK that power generation is below 20% of potential output for 20 weeks in a year and argues that this means wind power would not be a viable means for the generation of a large proportion of the UK’s energy requirements as the inherent variability in generation would require back-up from a large number of traditional power-plants to ensure a continuous supply¹¹.</p>	<p>Pryor and Barthelmie (2010) have reviewed models and evidence regarding the impact of future climate change on potential wind energy production and conclude that “the current state-of-the-art suggests no detectable change in the wind resource or other external conditions that could jeopardize the continued exploitation of wind energy in northern Europe, though further research is needed to provide greater confidence in these projections.”¹²</p> <p>“Wind electricity is both variable and, to some degree, unpredictable, but experience and detailed studies from many regions have shown that the integration of wind energy generally poses no insurmountable technical barriers.”¹¹</p>
<p>Local objections and visual impacts</p>	<p>The government has been keen to make the point that the need for renewable energy does not automatically override local environmental protections and the concerns of local communities. Although local communities do not get a veto over planned windfarm developments, since 17 December 2013 legislation has been in place to ensure that they are consulted early in the planning process so their views are</p>	<p>“Opinion polls consistently show high levels of support for onshore wind in the UK, with higher support in rural areas.”³</p> <p>RenewableUK promotes engagement with local communities during planning and development and promotes the industry-led Community Benefits Protocol which provides clear commitments on community benefit</p>	<p>Wherever onshore windfarm developments are planned there tends to be local objection. Wind turbines are generally built in rural areas (due to the large amount of space required for their construction) and campaigners argue they have a negative impact on ‘unspoilt’ rural landscapes. Local residents often set up very vocal campaigns and petition politicians to oppose developments.</p>	

	taken into account. The government has also proposed that communities should receive an enhanced community benefit package when an onshore wind farm is accepted nearby ¹³ .	provision ¹⁴ . In early November 2014 a new scheme was also announced to allow communities to invest in local onshore wind projects, sharing benefits further ¹⁵ .		
Is wind turbine noise a problem?		RenewableUK has criticised media reports that living near wind farms can have a detrimental effect on hearing in a recent press release, arguing that research actually demonstrates that the levels of low frequency sound communities near wind farms are exposed to doesn't pose any health risk ¹⁶ .	Local communities often oppose windfarm developments, citing evidence that wind turbines can be noisy and have negative impacts on health and sleep. Campaigners often argue turbines can be as noisy as a busy road and the vibrations can cause health problems such as headaches, however, the science behind these claims is contested.	<p>“Wind farms are a new source of environmental noise. The impact of wind turbine noise on health and well-being has not yet been well-established and remains under debate. Long-term effects, especially, are not known, because of the short time wind turbines have been operating and the relatively few people who have so far been exposed to wind turbine noise.”¹⁷</p> <p>Some studies have supported claims that sleep disturbance is more common amongst those living close (within 1.4km) to industrial wind turbines¹⁸</p>
What is the impact of windfarms on wildlife?	Government recognises that renewable energy developments can have negative as well as positive impacts on wildlife and landscapes. As such, Natural England has developed an approach to assess where wind farms might be sustainably and successfully integrated into the landscape with minimal negative impacts on the natural environment ¹⁹ . These concerns should also be considered as part of the planning process once a development is proposed.	<p>“Wind energy is one of the cleanest, most environmentally friendly energy sources... it emits no greenhouse gasses, and therefore reduces the threat posed by climate change – the single largest threat to biodiversity.”²⁰</p> <p>“At the local level, wind energy can also have positive effects on biodiversity, and offers an opportunity to practice ecological restoration.”²⁰</p> <p>“Potential site-specific impacts on birds or bats can be avoided and minimised by careful planning and siting, or else mitigated or compensated. In fact, wind farm developers are required to undertake Environmental Impact Assessments to gauge all potential significant environmental effects and</p>	<p>BirdLife International recognises the importance of renewable energy in combating climate change, but argues that there is a need to balance risks and benefits and minimise adverse environmental effects²¹. Many NGOs take the position that local disruptions to wildlife “are dwarfed by the global ecological fall-out of climate change.”²²</p> <p>Wind farms have been shown to have detrimental effects on bats and marine mammals, but birds are considered to be the group at greatest risk²³.</p> <p>The main potentially damaging effects on birds are:</p> <ul style="list-style-type: none"> • Direct collision with turbines or associated infrastructure • Disturbance/displacement 	<p>There is a definite impact on wildlife, particularly with avian collisions. It has been proven that some species adapt their movements to avoid wind farms (e.g. common eiders in Denmark²⁴), but this represents a disruption which could also be potentially damaging. However, the need to reduce GHG emissions is widely scientifically recognised, and renewable energy generation, such as wind power, should be an important component in meeting our energy needs, whilst complying with emissions targets.</p>

		meet all requirements of EU legislation before construction can start.” ²⁰	<ul style="list-style-type: none"> • Barriers to movement and disturbance to prey species • Habitat loss <p>As such, guidelines for site selection and impact assessment (avoiding protected areas, and other locations of significance etc.) and all development projects should be supported by detailed research and monitoring²¹.</p>	
What is the impact of offshore wind farms on the marine environment?	<p>“Potential offshore wind environmental impacts are considered on a project by project basis as part of the planning process through the requirement for developers to undertake Environmental Impact Assessments (EIAs) and Habitats Regulations Assessments (HRAs) where appropriate.”²⁵</p> <p>“We recognise that better evidence about the extent of the environmental impacts of offshore wind farms, especially on sensitive receptors such as mobile species, is of prime importance and DECC continues to fund research to fill these strategic evidence gaps.”²⁵</p>	<p>On the large scale, the industry argues that “Wind power has a long-term positive impact on biodiversity by reducing climate change emissions, the major threat to biodiversity”²⁶.</p> <p>The European Wind Energy Association (EWEA) argue that “More locally, provided that offshore wind development is well planned, the local marine environment can benefit from the existence of wind farms in multiple ways”. For example, they cite trawling restrictions, and the positive impacts that artificial reefs can have for certain species²⁶.</p>	<p>In general, environmental campaigners recognise the need for expansion of renewable energy. In a collaborative report with the Marine Institute, Friends of the Earth note it is clear that “the marine environment is already being damaged by the increasingly apparent impacts of climate change”²⁷.</p> <p>They go on to argue “It is a truth that to prevent extremely negative impacts on marine biodiversity – and society – it will be necessary to intrude into the marine environment by building large amounts of Marine Renewable Energy (MRE). Done well – in consultation with marine ecologists and conservation groups, within the spirit and letter of the Habitats Directive – MRE could hold overall benefits for the marine environment”²⁷.</p>	<p>Fox et al. emphasise the need to improve our models regarding seabird avoidance responses, particularly as many of our assessments of turbine impact on habitat availability and quality utilise bird densities as a proxy measure²⁸.</p> <p>Petersen and Malm argue that current evidence suggests disturbance caused by noise, vibrations and electromagnetic disturbances are of minor importance to the marine environment. Rather, the “reef effect (i.e. addition of a hard substratum) is believed to cause the largest impact on the marine environment”²⁹. The reef effect has impacts at different scales, from micro impacts on benthic invertebrates to macro impacts caused by larger changes in the level of the sea floor. Specific impacts will of course depend on local context, and their perception will depend on the indices used in any given assessment.</p> <p>In a generalised assessment Bergström et al. argue that potential impacts during the construction phase must be carefully considered in marine spatial planning. The potential impacts during</p>

				variable and can be either negative or positive depending on biological conditions and management regimes ³⁰ .
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¹ IPCC (2011) Renewable Energy Sources and Climate Change Mitigation: Special Report of the IPCC. Prepared by Working Group III of the IPCC [O. Edenhofer, R. Pichs-Madruga, Y. Sokona, K. Seyboth, P. Matschoss, S. Kadner, T. Zwicker, P. Eickemeier, G. Hansen, S. Schlömer, C. von Stechow (eds)]. Cambridge: Cambridge University Press. Available at: srren.ipcc-wg3.de/report [accessed October 2014]

² Price, T.J. (2009) 'Blyth, James (1839-1906)' Oxford Dictionary of National Biography, Oxford University Press. Available at: www.oxforddnb.com/view/article/100957 [accessed October 2014]

³ RenewableUK (2014) 'Onshore wind' [online] www.renewableuk.com/en/renewable-energy/wind-energy/onshore-wind/ [accessed October 2014]

⁴ RenewableUK(2014) 'Offshore wind' [online] www.renewableuk.com/en/renewable-energy/wind-energy/offshore-wind/index.cfm [accessed October 2014]

⁵ Department of Energy & Climate Change (2014) Offshore wind – key facts. Available online: www.gov.uk/government/publications/offshore-wind-key-facts

⁶ Climate Change Act 2008, Chapter 27, London: HMSO. Available at: www.legislation.gov.uk/ukpga/2008/27/contents [accessed October 2014]

⁷ DECC (2014) Digest of United Kingdom Energy Statistics 2014, London: The Stationary Office

⁸ Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC [2009] OJ L140/16

⁹ HM Government (2010) National renewable Energy Action Plan for the United Kingdom. Available at: ec.europa.eu/energy/renewables/action_plan_en.htm [accessed November 2014]

¹⁰ RenewableUK (2013) Wind Energy in the UK: State of the Industry report 2013. Available at: www.renewableuk.com/en/publications/reports.cfm/state-of-the-industry-report-2012-13 [accessed October 2014]

¹¹ Aris, C. (2014) Wind Power Reassessed: A review of the UK wind resource for electricity generation. The Adam Smith Institute. Available at: www.adamsmith.org/research/reports/wind-power-reassessed-a-review-of-the-uk-wind-resource-for-electricity-generation/ [accessed November 2014]

¹² Pryor, S.C. and Barthelmie, R.J. (2010) 'Climate Change impacts on wind energy: A review', Renewable and Sustainable Energy Reviews, 14(1): 430-437

¹³ Smith, L. (2014) 'Planning for onshore wind farms'. Commons Library Standard Note, SN/SC/4370. Available at: www.parliament.uk/business/publications/research/briefing-papers/SN04370/planning-for-onshore-wind-farms [accessed November 2014]

¹⁴ RenewableUK (2013) Onshore Wind: Our Community Commitment. Available at: www.renewableuk.com/en/utilities/document-summary.cfm?docid=3E03FD17-1D22-4945-9D8F9A019D949C7A [accessed November 2014]

¹⁵ RenewableUK (2014) Local communities to be offered a stake in new renewable energy

projects [Press release] 3 November 2014. Available at: www.renewableuk.com/en/news/press-releases.cfm/2014-11-03-local-communities-to-be-offered-a-stake-in-new-renewable-energy-projects [accessed November 2014]

¹⁶ RenewableUK (2014) RenewableUK slams false media reports claiming wind farms affect hearing [Press release] 1 October 2014. Available at: www.renewableuk.com/en/news/press-releases.cfm/2014-10-01-renewableuk-slams-false-media-reports-claiming-wind-farms-affect-hearing [accessed October 2014]

¹⁷ Pederson, A. (2011) 'Health aspects associated with wind turbine noise – Results from three field studies.' Noise Control Engineering Journal, 59(1): 47-53

¹⁸ Nissenbaum, M.A., Aramini, J.J. and Hanning, C.D. (2012) 'Effects of industrial wind turbine noise on sleep and health' Noise & Health, 14(60): 237-243

¹⁹ Natural England (2010) Making space for renewable energy: assessing on-shore wind energy development. Available at: www.naturalengland.org.uk/publications [accessed November 2014]

²⁰ EWEA (2014) 'Wind energy and the environment' [online] www.ewea.org/policy-issues/environment/ [accessed October 2014].

²¹ BirdLife International (2005) Position Statement on Wind Farms and Birds. Available at: www.rspb.org.uk/Images/birdlifewindfarmposition_tcm9-241919.pdf [accessed October 2014]

²² Szarka, J. (2004) 'Wind power, discourse coalitions and climate change: breaking the stalemate?', European Environment, 14: 317-330

²³ Lowndes, N. (2014) 'The impact of windfarms on birds', Environmental Scientist, 23(1): 24-28

²⁴ Larsen, J.K. and Guillemette, M. (2007) 'Effects of wind turbines on flight behaviour of wintering common eiders: implications for habitat use and collision risk' Journal of Applied Ecology, 44(3): 516-522

²⁵ Department of Energy & Climate Change (2013) Offshore wind: part of the UK's energy mix. Available online: www.gov.uk/offshore-wind-part-of-the-uks-energy-mix

²⁶ European Wind Energy association Briefing, 'Positive environmental impacts of wind farms' [online] www.ewea.org/fileadmin/files/members-area/information-services/offshore/research-notes/120801_Positive_environmental_impacts.pdf [accessed November 2014]

²⁷ Marine Institute and Friends of the Earth (2013) Marine Renewables, Biodiversity and Fisheries. Available at: http://www.foe.co.uk/sites/default/files/downloads/marine_renewables_biodiver.pdf [accessed November 2014]

²⁸ Fox, A.D., Desholm, M., Kahlert, J., Christensen, T.K. and Petersen, I.K. (2006) 'Information needs to support environmental impact assessment of the effects of European marine offshore wind farms on birds' Ibis, 148(s1): 129-144

²⁹ Petersen, J.K. and Malm, T. (2006) 'Offshore windmill farms: threats to or possibilities for the marine environment'. AMBIO: A Journal of the Human Environment, 35(2): 75-80

³⁰ Bergström, L., Kautsky, L., Malm, T., Rosenberg, R., Wahlberg, M., Capetillo,