Department
of Energy &
Climate Change

Source A

UK Renewable Energy Roadmap Update 2013

November 2013

Ministerial Foreword

The last year has been one of the most successful years ever for Britain's renewable energy drive, with big leaps forward in actual deployment, in newly announced projects and in long term policy completion. This Update brings together the story of this rapid progress and sets out our shared high ambitions to go further than many thought possible just a few years ago. As we see record levels of investment and large numbers of new green jobs being created already, we are determined to do more to maximise the green growth potential of Britain's renewable energy drive.

The Government's commitment to cost effective renewable energy as part of a diverse, low-carbon and secure energy mix, is as strong as ever. Alongside gas and low-carbon transport fuels, nuclear power and carbon capture and storage, renewable energy provides energy security, helps us meet our decarbonisation objectives and brings green growth to all parts of the UK. (1)

Since the publication of the last Update in 2012, the UK has made very good progress towards our challenging 2020 renewables target, to deliver 15% of our energy demand from renewable sources. We are fully committed to achieving this target and have seen a significant amount of deployment to date, particularly in the renewable electricity sector. This was demonstrated in 2012 when more than 4% of the UK's energy came from renewable sources – above our interim target. We will continue to monitor our progress towards the target, ensuring that we have measures in place to reach our goal.

We are continuing to make excellent progress in the deployment of renewable electricity across the UK. In Quarter 2 of 2013, renewables accounted for a record 15.5% of all electricity generated. This represents a significant increase in generation since the publication of the last Update. Overall capacity has grown by 38% over the period July 2012 to June 2013 and now stands at 19.5 GW. This, alongside a healthy set of deployment pipelines, demonstrates the progress that is being made to decarbonise our economy and secure our future electricity supply. Actual deployments, will of course, ultimately depend on the sector's ability to drive down costs. We are clear that costs must continue to come down if we are to see the continued deployment of renewables.

Between January 2010 and September this year, DECC recorded announcements worth £31 billion of private sector investment in renewable electricity generation. This investment has the potential to support over 35,000 jobs and we are seeing new capacity coming forward all the time. The Pen y Cymoedd onshore wind project in Wales and the building of the world's largest advanced gasification plant on Teesside are good examples of this. It is great to see the renewable energy sector in the UK showcasing itself as a key driver of green growth. We are determined to ensure that UK-based supply chains are able to make the most of this opportunity. That is why we have launched the Offshore Wind Industrial Strategy. This will provide a long term framework to promote innovation, investment and economic growth.

capacity at all stages of development (under construction, awaiting construction and applications being considered) coming through. There has been significant growth in the offshore wind pipeline with total capacity increasing from 10.6 GW to 15.1 GW at the end of June 2013. This has been driven by developments in Scottish Territorial Waters and in the UK's Round 3 zone formally entering the planning consent regime. A number of significant offshore wind projects, with an estimated capacity of around 5 GW have entered the planning system since the end of June 2013.

The Renewables Obligation (RO) and Feed in Tariffs (FITs) scheme continue to play a crucial role in supporting the accelerated deployment of commercial and small scale renewable electricity capacity in the UK. The Government has made significant progress with Electricity Market Reform (EMR) and a number of important milestones have been reached since the last Update including the publication of draft CfD strike prices for renewable technologies.

The Renewable Heat Incentive (RHI) has continued to help stimulate growth in the deployment of renewable heat, with around 16.4 TWh of energy generated from all renewable heat sources in 2012, an increase of 7% on the previous year. Biomass, energy from waste Combined Heat and Power (CHP) and heat pumps remain key renewable heat technologies.

We are building new markets for renewable heat in the UK and seeking a step change in consumer and industry behaviour. Decarbonisation of the heat sector has always been seen as a longer term task, and we expect deployment of renewable heat to increase more steadily during the second part of the decade. Government is taking a number of actions to encourage this growth including the enhancement of the existing RHI support available to certain non-domestic projects and introducing a domestic renewable heat incentive, both currently planned for implementation in spring 2014.

There has been an increase in liquid biofuels with consumption rising by 7%, from 368 million litres in Quarter 2 of 2012 to 394 million litres in the same period in 2013.

The Government's latest projections of energy consumption in 2020 have been revised downwards. The amount of renewable energy (for heat, transport and electricity) estimated to be required to meet the 15% target has also been revised downwards slightly from last year's range of 223-230 TWh to 216-225 TWh.

There has been good progress in unlocking cross cutting and technology specific barriers to deployment. Some of the key activities since the publication of the last Update include:

- The UK is currently the world's biggest offshore wind market with more capacity deployed than any other country. In August 2013, the sector saw the launch of the joint industry and Government Offshore Wind Industrial Strategy, which provides a long-term framework to promote innovation, investment and growth in the UK-based supply chain. Government will continue to work in partnership with industry over the coming months to implement the strategy and provide the tools necessary to support large scale investment, raise awareness of the commercial opportunities, and deliver the innovation and competition needed to bring down costs for consumers. As set out in the draft Delivery Plan for EMR, Government modelling indicates deployment of up to 16 GW by 2020, with much higher levels of deployment in the 2020s as costs fall.

A2

SOURCE B

Environmental
Change Institute
UNIVERSITY OF OXFORD

wind power and the UK wind resource

Executive Summary

Overview

The importance of wind power to the United Kingdom's renewable electricity supply is predicted to increase in the coming years. Together with this greater reliance on wind power there is a greater need for understanding the characteristics of the UK's wind resource.

This report presents information on the characteristics of the UK wind resource, and some of the impacts that wind power will have on the UK electricity network.

The UK wind resource

Extensive wind speed records were used to identify patterns of wind power availability. These records show that:

- Wind power availability is greater during winter than at other times of the year, and is on average stronger during the day than overnight
- Wind power delivers around two and a half times as much electricity during periods of high electricity demand as during low demand periods;
- The recorded capacity factor for onshore wind turbines in the UK is around 27% - this is higher than that recorded in Denmark or Germany, and emphasises the need to use UK data in wind power assessments.

Extreme lows or highs in wind speed are a natural feature of the UK wind climate; however a diversified wind power system would be less affected as it is rare that these extreme events affect large areas of the country at the same time. This report found that:

- Low wind speed conditions affecting 90% or more of the UK would occur in around one hour every five years during winter;
- The chance of wind turbines shutting down due to high wind speed conditions is very rare – high winds affecting 40% or more of the UK would occur in around one hour every 10 years.

Wind power in electricity networks

Wind power developments need to be integrated in the wider electricity network – this will have impacts on the network, including that:

- The development of wind power will result in a reduced need for conventional capacity – with wind power supplying 10% of UK electricity, around 3GW of conventional plant could be retired;
- A small increase in the cost of electricity is likely to result from wind power development – this would be equal to around 2.5% of the average domestic cost of electricity with 10% wind power, and
- The cost of balancing wind power variability is expected to reduce with improvements in wind power forecasting techniques.

SOURCE C

Energy and Climate Change Committee

Written evidence submitted by the Grantham Research Institute on Climate Change and the Environment, London School of Economics

1. *What do cost benefit analyses tell us about onshore and offshore wind compared with other measures to cut carbon?*

1.1 Onshore wind has the lowest cost of all forms of low-carbon electricity generation. It is also competitive (or will soon be competitive) with fossil fuel-based power, once the economic costs of carbon are fully factored in. Offshore wind, in contrast is still a relatively expensive technology.

1.2 However, the visual impact of onshore wind is a non-trivial local issue and should be built into cost calculations. First, onshore wind developments should not be allowed in areas of outstanding natural value. Second, people value natural landscapes and are willing to pay to preserve them. Studies indicate that willingness to pay could range from 0.3 to 4p/kWh. This would add between 3 and 60% to the current levelised cost of onshore wind (which is 6.6 to 9.3p/kWh). Such local environmental constraints can make more expensive renewable technologies—such as offshore wind or solar photovoltaics—potentially attractive. One can think of their extra cost as the premium society is willing to pay to avoid the local environmental cost of onshore wind.

1.3 There is a distributional aspect to wind developments in that those bearing the local environmental cost (local communities) are different from the beneficiaries of a project (electricity consumers and producers). In addition to concern about costs and benefits, there are therefore questions of adequate benefit sharing with (or financial compensation for) local communities.

2. *What do the latest assessments tell us about the costs of generating electricity from wind power compared to other methods of generating electricity?*

2.1 The UK is bound, under the Climate Change Act (2008) and the subsequent carbon budgets, to cut its annual greenhouse gas emissions by half by 2025, compared with 1990. This requires a power sector that is virtually carbon-free by the mid to late 2020s. With this in mind, the issue of wind energy deployment becomes a choice between this and other low-carbon energy sources, not between wind energy and fossil fuels. C1 C2

2.2 It has been argued that efficient combined cycle gas turbine (CCGT) power plants may be a cheaper way of meeting our 2020 targets. However, the further decarbonisation required in the 20s cannot be achieved by relying heavily on unabated gas power stations. Prioritising penetration of CCGT plants rather than wind energy risks higher costs in the long run as undesirable technologies are locked in that would then have to be scrapped prematurely.

3. *How much support does wind power receive compared with other forms of renewable energy?*

3.1 Renewable energy subsidies can help overcome the market failure related to introducing relatively immature technologies to the market. These market failures mean that new low-carbon technologies will not develop at all or quickly enough if the market forces alone are relied on, for instance because of the so-called "valley of death" between the *push* of publicly-funded research and the *pull* of commercial development. Renewable energy subsidies complement (and, where the carbon price is too low, partly replace) policies to put a price on carbon. Carbon must be priced to reflect the environmental cost of climate change and remove the implicit subsidy fossil fuels enjoy for their greenhouse gas pollution.

3.2 Renewables subsidies should be gradually reduced and removed as technologies mature and overcome the market failures. For onshore (but not offshore) wind we can expect this process to be relatively quick. For example, some estimated that onshore wind could be economically competitive with older conventional sources of energy in five–10 years (see eg Bloomberg NEF, 2011). It is important that the phasing-out of subsidies is done in a predictable way, with the criteria and timetable for decisions being clear and transparent. Ad-hoc and sudden changes in subsidy levels creates policy risks which act as a disincentive to private investors and increase energy costs.

3.3 It is worth noting that fossil fuels also benefit from a range of direct and indirect subsidies. Subsidies for fossil fuels are mostly direct consumption subsidies through the lower rate of VAT on domestic electricity (although this may also benefit non-fossil-fuel electricity) and other tax rebates. The OECD (2011) estimates that subsidies for coal, gas and petrol in the UK were in the order of £3.6 billion in 2010. Furthermore, fossil fuels benefit from direct exploration and production subsidies, such as the £65 million support for the development of fields west of the Shetlands announced by the Chancellor in the last Budget (HM Treasury, 2012).

4. *Is it possible to estimate how much consumers pay towards supporting wind power in the UK? (ie separating out from other renewables)*

4.1 The impact of renewables is embedded in the cost of the Renewables Obligation, the main subsidy mechanism for renewable energy. Using official estimates of future electricity consumption and generation capacity (DECC, 2011; CCC, 2011; ENSG, 2012), and assuming an average Renewable Obligation Certificate (ROC) price of £45 per MWh, it is possible to obtain an indicative value for the contribution of wind technologies to the overall bill. This would be about 0.18p/kWh in 2011 and 0.37p/kWh in 2020 for onshore wind, and about 0.29p/kWh in 2011 and 1.47p/kWh for offshore wind. Assuming the average household consumption of electricity will remain unchanged at 3,400kWh per year,[1] this would imply an additional annual cost of £6 in 2010 and £13 in 2020 for onshore wind, and roughly £10 in 2010 up to £50 in 2020 for offshore wind.

5. *What lessons can be learned from other countries?*

5.1 Experience from Germany and Denmark, which have wind capacities respectively of 27,000 MW and 3,700 MW), confirms that the involvement of local communities is crucial when developing new installations. Unlike the UK, where the majority of onshore wind projects are developed and owned by commercial companies, the majority of projects in Germany and Denmark (up to 80% in Denmark) are characterised by a "community ownership" model, where local communities pool resources to finance the purchasing, installation and maintenance of projects, and individuals are entitled to a share of the annual revenue which is proportional to their investment (CCC, 2011).

6. *What methods could be used to make onshore wind more acceptable to communities that host them?*

6.1 A study by Bowyer at al. (2009) investigating UK, Danish and German experiences confirms that to create an effective planning system that respects concerns about nature conservation whilst securing rapid onshore wind development, a number of requirements must be met. These include: early engagement of stakeholders, clarity over nature conservation concerns and high quality environmental impact assessments. It is advisable that such elements are taken into account in the context of the UK planning framework.

6.2 In turn, wind investors will want to see wind developments to be regulated by sound policy-making. As outlined by Bassi et al. (2012) key measures should include: a clear price on carbon; a planning system that (i) reduces the costs for developers, (ii) factors in local environmental concerns and prevents developments in important environmental areas and (iii) ensures appropriate compensation in areas where local impacts are acceptable; and flanking measures eg better interconnectivity of grids, are required to ensure that the electricity system can cope with intermittent resources.

June 2012

Source D

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Why Onshore Wind?

Why don't we focus on offshore and hydro projects rather than onshore wind farms?

The UK Renewable Energy Road Map sets out the Government's strategy for meeting our low-carbon aspirations. Click here for more information.

The road map shows there is significant potential for generating more of our electricity from offshore and hydro projects. However, this can only be achieved if the costs are reduced and new technology can be made commercially viable.

Onshore wind is one of the most cost-effective and proven renewable energy technologies. This means that onshore wind must be an essential part of our strategy for achieving our 2020 renewable energy targets. D1

If you would like to see a detailed comparison of the generation costs and deployment potential of renewable electricity technologies in the UK then this report has all the details:

Subsidies - How much do you pay towards subsidies for renewable energy?

Figures released by Ofgem in 2013 show that supporting the growth of wind energy costs you just 3.2p a day. This equates to 22.4p a week or £11.68 a year. You can read more about this story here

Ofgem also produces a regular factsheet that explains how the costs on your energy bills come about. Click here for more information.

The main reason you have seen your energy bills going up in recent months is the increasing price of fossil fuels that we import from abroad. Investing in onshore wind means that we can reduce our reliance on foreign imports increasing the security of our energy supply.

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Source (E)

Renewable and Low Carbon Energy Generation in North Somerset: Wind Turbines Draft Supplementary Planning Document

Draft Wind Turbine SPD

Background

1.1 Onshore wind farms are the most established large-scale source of renewable energy in the UK. Onshore wind farms will continue to play an important role in meeting renewable energy targets.

Renewable energy policy

1.2 The EU Renewable Energy Directive suggests that if the UK is to meet its renewable energy target of 15% from renewable sources by 2020, all local authorities need to engage in identifying and approving appropriate renewable energy development.

1.3 The Government is committed to increasing the proportion of energy we use from renewable sources. Development of renewable energy resources on a commercial scale is a crucial element in meeting the Government's commitments on reducing emissions and combating climate change. The Climate Change Act sets the UKs legally binding targets to reduce carbon dioxide emissions by 80% by 2050 (34% by 2020), from a 1990 baseline. The Government expects each local authority to contribute to meeting the targets and reducing overall demand for energy.

1.4 The UK Renewable Energy Roadmap (update 2013) states that: *'onshore wind, as one of the most cost effective and proven renewable energy technologies, has an important part to play in a responsible and balanced UK energy policy.'* Government recognises that some people have concerns about onshore wind developments, and it remains committed to ensuring that projects are built in the right places, with the support of local communities and that they deliver real local economic benefits. E1

1.5 The secretary of State for Communities and Local Government (Mr Eric Pickles) released a written ministerial statement: Local Planning and Onshore Wind in June 2013. This included the intention for compulsory pre-consultation with communities, which is now required for all applications of two or more turbines and those over fifteen metres in height. The statement was also clear of the requirement that protecting the local environment is considered alongside the broader issue of protecting the global environment.

1.6 The Department for Communities and Local Government (DCLG) published 'Planning practice guidance for renewable and low carbon energy' in July 2013. This provides advice on the planning issues associated with the development of renewable and low carbon energy and supports policy set out in the National Planning Policy Framework (NPPF). This guidance can be a material consideration in planning decisions and should generally be followed unless there are clear reasons not to. The guidance states that: *'planning has an important role in the delivery of new renewable and low carbon energy infrastructure in locations where the local environmental impact is acceptable.'* The guidance also states that *'Renewable energy developments should be acceptable for their proposed location.'* Specific detail on planning considerations relating to wind turbines is provided in paragraphs 29 to 44. Reference to this guidance will be made within the appropriate sections of this document.

1.7 The NPPF sets out guidance to support the development of renewable and low carbon energy, by stating that local planning authorities should recognise the responsibility on all communities to contribute to energy generation from these sources. Paragraph 97 of the NPPF states that local authorities should:

- have a positive strategy to promote energy from renewable and low carbon sources;
- design policies to maximise renewable and low carbon energy development while ensuring that adverse impacts are addressed satisfactorily, including cumulative landscape and visual impacts;
- consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure the development of such sources;
- support community-led initiatives for renewable and low carbon energy, including developments outside such areas being taken forward through neighbourhood planning;
- and identify opportunities where development can draw its energy supply from decentralised supply systems and for co-locating potential heat customers and suppliers.

1.8 North Somerset Council is committed to reducing carbon emissions and supporting renewable and low carbon forms of energy generation. The council is responsible for determining applications for onshore renewable energy schemes up to 50MW generation capacity. The Planning Inspectorate will determine applications for installations with a generation capacity greater than the 50MW threshold.

1.9 This Supplementary Planning Document (SPD) covering wind turbines is part of our planning policy guidance on renewable and low carbon energy generation. It is both for developers proposing an installation, and North Somerset Council in determining applications received relating to wind turbines. Once adopted, this SPD will have statutory weight and be a material consideration in the determination of planning applications.

1.10 This SPD provides more detailed guidance to support North Somerset Core Strategy policies : CS1: Addressing climate change and carbon reduction and CS2: Delivering sustainable design and construction. The overall aim of this is to provide guidance to facilitate renewable and low carbon energy development, while ensuring that adverse impacts are addressed satisfactorily. We have set out our intentions for policy objectives for individual applications in the draft Sites and Policies DPD: Policy DM2: Renewable and Low Carbon Energy Generation.

1.11 The current Government scheme for subsidising the installation of renewable generation facilities of up to 5MW output is the Feed-in-Tariff (FiT). For larger schemes, the Renewables Obligation (RO) is in place. The RO places a mandatory requirement on licensed UK electricity suppliers to submit a

HM Government

SOURCE (G)

Industrial Strategy: government and industry in partnership

Offshore Wind Industrial Strategy
Business and Government Action

August 2013

Offshore wind UK: an industrial opportunity

Offshore wind is an ideal technology for the UK where our shallow seas and strong winds make it an important national asset. Since the first UK offshore wind farm was built over a decade ago, offshore wind has evolved to become a large-scale commercial renewable technology with an important role to play in the Government's long term plan for a balanced low carbon electricity generation portfolio to help meet our 2050 carbon targets and enhance security of supply. Together with long-term price stability and a huge development pipeline, this has helped make the UK one of the most attractive locations in the world to invest in the offshore wind market.[1] G1

The UK has an unparalleled opportunity to develop offshore wind in the decades to come. The offshore wind sector has the potential to become one of strategic economic importance to the UK, supporting a thriving UK supply chain and exporting expertise and technology all over the world. In 2020/21, under a strong growth scenario, the sector could deliver in the order of £7bn Gross Value Added (GVA) to the UK economy (excluding exports) and support over 30,000 full time equivalent UK jobs.[2] Longer term, the outlook is for further strong growth in the sector. Independent analysis forecasts 28GW of installed offshore wind capacity across the EU by 2020 and 55GW across the EU by 2030.[3] By 2030, it has been estimated that offshore wind could increase net exports by £7-18bn.[4] G2

The Government is committed to providing unprecedented levels of price support to low carbon generation, through the Renewables Obligation and then through Contracts for Difference (CfDs). For offshore wind to benefit fully from Government and consumer support, it is vital that this results in investment in the UK supply chain and delivers economic growth and long term jobs in the UK. Increased supply chain capacity will in turn help to reduce the costs to consumers through greater competition in the market.

1 Ernst & Young (May 2013), *Renewable Energy Country Attractiveness Indices* http://www.ey.com/Publication/vwLUAssets/Renewable_energy_country_attractiveness_indices_-_Issue_37/$FILE/RECAI-May-2013.pdf

2 BVG Associates estimate. This is based on a scenario of 16GW installed by end 2020, with 50% UK content in capital expenditure and 85% content in operational expenditure. Derived from The Crown Estate (June 2012), *Offshore wind cost reduction pathways, Technology work stream*, Renewable Advisory Board (2010), *Value breakdown for the offshore wind sector* and Cebr Report (June 2012), *Macroeconomics benefits of investment in offshore wind*

3 Bloomberg New Energy Finance

4 Cebr Report (June 2012), *Macroeconomics benefits of investment in offshore wind*

Foreword from Government

The UK has done more than any other country to support the development of a sustainable and ambitious offshore wind industry but we recognise we have to work hard to keep that position and to reap the rewards. We are now putting in place the framework needed to maintain this position through Electricity Market Reform, which will offer industry guaranteed price support lasting into the 2030s and help provide the certainty needed to underpin long term investment.

We recognise the importance of getting this right. The strategy brings together government and industry to work in partnership to develop the UK's offshore wind industry and provide the tools necessary to support large scale investment in the UK supply chain, raise awareness of the commercial opportunities in the UK and overseas and deliver the innovation and competition needed to bring down costs for consumers.

As part of our new industrial policy, we want to see UK-based businesses grow to create a centre of engineering excellence that delivers cost reduction for UK projects and exports to overseas markets. To achieve the vision set out in this strategy, we need to grow our manufacturing base to be world-leading in more areas of offshore wind supply and to achieve levels of UK content in our offshore wind farms which are similar to those achieved by our North Sea oil and gas industry where more than 70% of capital expenditure is through UK-based suppliers.

To support this, the Manufacturing Advisory Service will deliver the GROW: Offshore Wind service, with £20m funding from the Regional Growth Fund, to enable manufacturers to take advantage of the rapidly growing offshore wind market. We are creating the Offshore Wind Investment Organisation to significantly increase the levels of inward investment to the UK in the offshore wind supply chain. And we are supporting the new Offshore Renewable Energy Catapult to drive innovation, with £46m of funding for a 5 year business plan, enabling innovative companies to commercialise their products which will bring down costs for consumers.

SOURCE H

Environmental Impact Assessment for Wind farms

Ruth Stevenson, BSc, MSc, PhD

The UK Government has set out Energy, Climate Change and Planning Policy that supports renewable energy in the attempt to curb CO_2 emissions. These policies were explored in a previous paper on 'Planning for Renewables' (Module 3). As a result of these UK wide policies, Local Authorities are required to set regional renewable energy targets. Wind power is viewed by many Authorities to be one of the prime technologies for meeting these targets. However, in order to implement wind energy projects, planning permission is required, either from the Local Authority or from the Government through the Secretary of State for Business, Enterprise and Regulatory Reform (<50MW by Local Authority and > 50MW by Government). For the majority of windfarm schemes, planning permission will require the presentation of an Environmental Impact Statement (EIS), which identifies the environmental, social and economic impacts of the development. This is used as a decision tool when determining whether planning permission should be granted.

This paper will review the environmental Impact Assessment process, indicating how this fits in to the planning process but equally how it can be used as design guide for windfarm planning. The paper will address the following questions:

1. What is an Environmental Impact Statement (EIS)?
2. When is it required?
3. What is the process of an Environmental Impact Assessment (EIA)?
4. What are the environmental, social and economic issues associated with windfarm developments? How do you assess them and mitigate for them?
5. How does the regulatory body decide whether to grant permission?
6. How does the regulatory body enforce any mitigation requirements following construction?

What is an Environmental Statement?

This is the document containing the EIA that accompanies the Planning Application. It has certain statutory requirements in terms of its contents. If a full EIA is not required (see below) the environmental information can be presented in a shorter document without these requirements. The idea is that enough information is provided so that readers can verify the Statement's conclusions and to identify the source of the information provided. A Non Technical Summary (NTS) is one of the requirements of the EIS.

What is an Environmental Impact Assessment?

AN EIA is a predictive tool, where the likely significant effects of a development, both positive and negative are objectively analysed. This information is used to determine whether the development should go ahead or not. As the Department for Communities and Local Government (2006) state:

"It is a means of drawing together, in a systematic way, an assessment of a project's likely significant environmental effects. This helps to ensure that the importance of the predicted effects, and the scope for reducing them, are properly understood by the public and the relevant competent authority before it makes its decision."

I think there are also some important additions to this definition of an EIA. The 'environment' in this case actually covers, not only natural resources, but also environmental quality and impact on communities, be they environmental, social or economic. The EIA process should enable all of these factors to be given due weight when an application is being determined.

An EIA is not only a tool for decision makers, it is also a tool for the designers and developers of a scheme to ensure that they derive maximum benefits from a development (in terms of energy output

Source J

Delivering community benefits from wind energy development:

A Toolkit

A report for the Renewables Advisory Board

July 2009 edition

1 Introduction

"The routine provision of meaningful benefits to communities hosting wind power projects is likely to be a significant factor in sustaining public support and delivering significant rates of wind power development."

Community Benefits from Wind Power: Policy Makers Summary
Report to Renewables Advisory Board and DTI, Centre for Sustainable Energy & Garrad Hassan, 2005

Wind energy developments can produce significant benefits – financial, environmental and social. They also produce impacts, most obviously on the local landscape.

Questions have been raised as to whether the communities which host these impacts are participating sufficiently in the benefits of developments. Compared with many other forms of development (like new housing, shopping, or commercial buildings), the benefits of wind energy developments tend to be much less concentrated in the area around the development. For example, the benefits of reduced carbon emissions are global and the contribution of wind energy to improving the security of energy supplies is nationwide.

There are also concerns over whether there is a sense in some local communities that wind developments are 'done to them' by outside forces which may be fuelling antipathy towards proposed wind farm developments.[1]

There are no simple answers to these questions. A study published in 2005 for the Renewables Advisory Board[2] concluded that more significant benefits were routinely accruing to communities hosting wind farms in those EU countries which have enjoyed much higher rates of deployment than the UK (specifically Spain, Germany and Denmark). It also revealed that these benefits were the result of country-specific policies relating to local taxation, local and regional procurement and/or opportunities for local ownership. However, these policies were not obviously or immediately transferable to the UK.

A significant further increase in wind power capacity in the UK can be expected as a result of the ambitious target for renewable energy contained within the EU Renewables Directive.

The 2005 study concluded: *"This overseas evidence points to a need to make meaningful community benefits more routine and systematic in UK wind power projects if future rates of deployment are to grow."*[3]

What this Toolkit is for

This Toolkit is designed to help to make meaningful community benefits more routine and systematic in UK wind energy projects. It sits alongside activities to support improved public engagement in the wind farm planning process (see 'The protocol for public engagement with proposed wind energy developments in England: a report for

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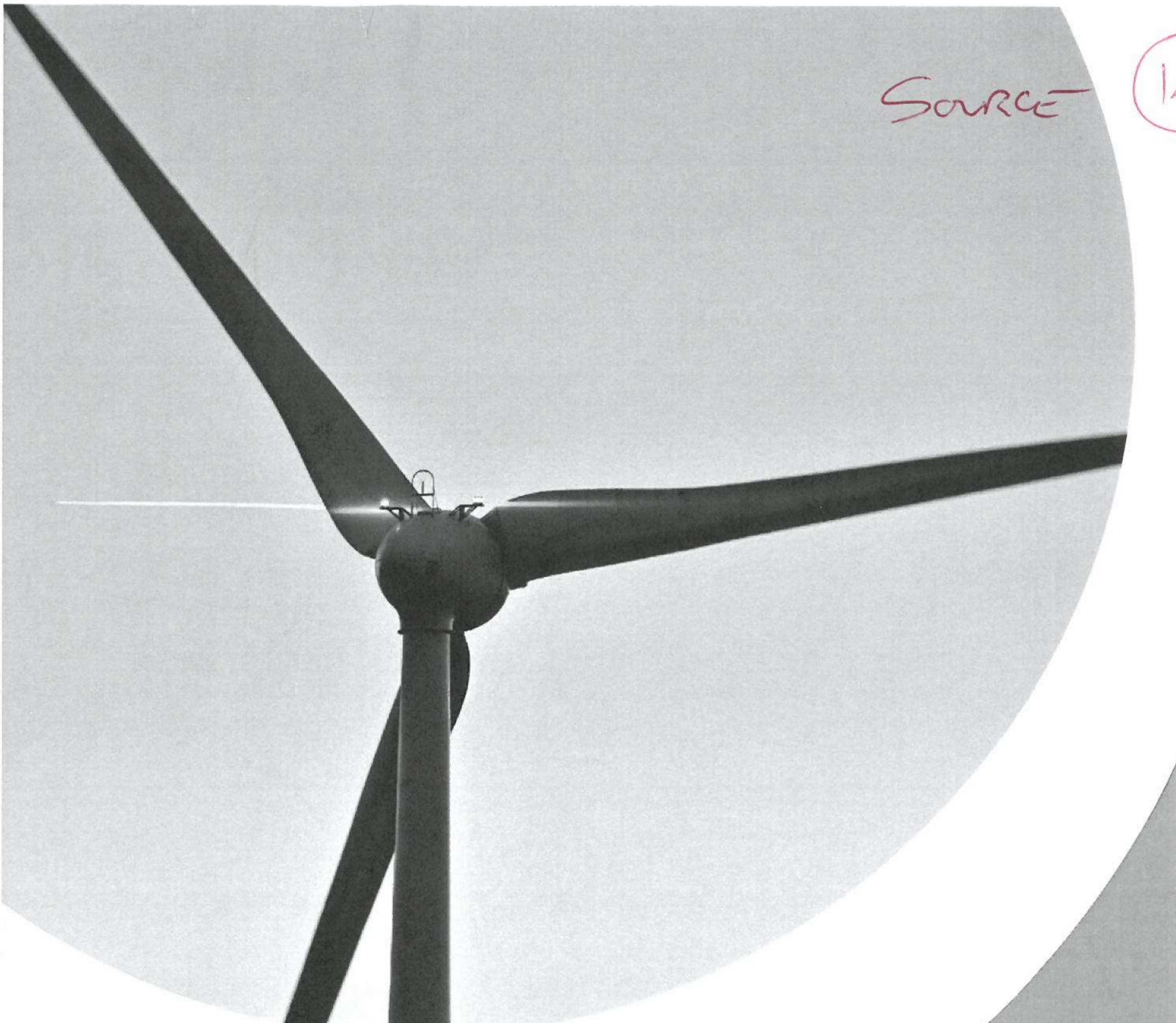
1 This concern is not, however, supported by opinion polling evidence which routinely exposes higher levels of support for wind energy amongst people living near wind energy projects

2 The Renewables Advisory Board (RAB) is a Non-Departmental Public Body whose remit is to advise the Secretary of State for DECC on renewable energy. Its members are individuals appointed through an OCPA-regulated process.

3 *Community Benefits from Wind Power: A study of UK practice & comparison with leading European countries*. Report to the Renewables Advisory Board & the DTI by the Centre for Sustainable Energy and Garrad Hassan, 2004. Available at www.cse.org.uk/pdf/pub1049.pdf

Source (K)



HOW 2 GUIDE for

Wind Energy

Roadmap Development and Implementation

INTERNATIONAL LOW-CARBON ENERGY TECHNOLOGY PLATFORM

Barrier	Details	Action options
Large shares of wind energy may bring need for power market modification	• The output of a WPP portfolio may ramp up steeply • Wind power output is predictable with less accuracy than conventional power on a day-to-day basis • Electricity market may be dominated by vertically integrated utilities (VIU) • Electricity trade may be tied up months, seasons, or years ahead • Most electricity may be traded bilaterally and confidentially over the counter (OTC) • Imbalance prices paid by WPP owners may not reflect actual cost to system	• Encourage holistic planning of wind and other variable generation for minimal correlation of outputs to reduce aggregated variability • Encourage market reform for development of exchanges and futures markets, including proper design of intraday and balancing markets • Introduce shorter trading time horizons; set "gate closure" as close as possible to delivery time • Consider unbundling vertically integrated utilities (generation, transmission and system functions) or other regulatory measures to enhance competition • Encourage wider market collaboration in balancing markets or merging balancing areas • Encourage power exchanges wherein participants have the opportunity to trade openly (as well as OTC) • Reflect real cost to the system through imbalance pricing and enable wind power producers to aggregate their offers to reduce imbalance • Encourage uptake of latest forecasting techniques
Large shares of wind energy have consequences for generation portfolio planning	• Wind energy (alone) provides a lesser contribution to system adequacy than conventional plants • In the short term, the replacement of existing power plants (conventional baseload) with wind power may increase the overall operational cost of the power supply system	• Plan for and encourage wide geographic distribution of WPPs • Consider use of market mechanisms to compensate for lost revenue with payments to plants offering flexible capacity • Consider market reform to reward flexibility from different sources in order to encourage fast power plants, demand-side management and response, interconnection and storage

Financial and economic barriers

The analysis now moves on to financial and economic barriers. Two distinct types of investor are of interest to policy makers when seeking to encourage investment in a wind energy market: those providing commercial investment, and public investors. To attract investors to wind energy projects within a country or region, policy makers should seek to reduce the risks and improve returns on investing through the adoption of various support mechanisms.

It is worth noting that investment in new generation – whether wind or any other energy technology – needs to be co-optimised with the concomitant investment required in the transmission service of that asset. If the transmission cost is too great, alternative options may be appropriate.

Electricity market and system barriers

The third category of barriers covers the design of the electricity market and system. This category includes barriers to the efficient management of electricity generated by WPPs, as outlined in Table 6. This set of barriers and the action options to address them are closely intertwined. An effort has been made here to distinguish among them, but the best approach to this classification process may vary considerably from case to case.

Table 6: Barriers and action options for electricity market and system considerations

Barrier	*Details*	*Action options*
Wind electricity generated is prevented from getting to the market (curtailed)	• (Excessive) curtailment may result from insufficient space in the market (even if public-private agreement [PPA] is in place) • Combined ownership of generation and transmission may hinder access to transmission capacity • (Excessive) curtailment may result from grid bottlenecks/ congestion	• Revisit "must run" classification of conventional power plants and consider according "must run"/priority dispatch status to WPPs • Separate ownership of generation and transmission assets • Use nodal or locational pricing to signal congested areas and transmission bottlenecks • Encourage trade to wheel surplus wind energy across borders • Optimise re-dispatch procedures and reduce opportunities for gaming by capping congestion management prices • Consider flexibility and efficiency improvements in the energy system – at higher penetration levels in particular, incentivise demand-side management and energy storage to provide ancillary services
Wind energy may result in increased system operation challenges above a certain threshold (e.g. 10%-20%)*	• System operators (TSOs and DSOs) may not have adopted international best practice, which itself may act as a barrier to change • Wind power may have impact on local or regional grid voltage and power quality • Variability of wind power may have a negative impact on system-wide balancing and frequency • WPPs may exacerbate (low voltage) fault conditions by disconnecting**	• Advocate system operators' adoption of state-of-the-art practice, and a comprehensive suite of plans and measures to progressively deal with increasing levels of wind energy penetration, including wind forecasts and on-line monitoring in dispatch and operations • Improve policy maker understanding of the issues to better manage operators' concerns • Revise grid code to include voltage control and active power control by wind energy plants • Encourage enhanced control and communication technologies, such as storm control function, to reduce output ramp rate • Have system operators deploy power electronics for voltage control near large WPPs if this is more cost-effective than the WPP providing the service • Actively involve distribution grid managers in managing power flows

* The identification of this share is complex and subtle. Many factors will have a bearing here, including the size of the power system, the make-up of the generation portfolio and correlation of load and wind profiles, among others.

** Although in most cases this should no longer be an issue, it is common industry practice to include so-called "fault-ride-through" capability in modern wind turbines.

Table 4: Barriers and action options for planning considerations

Barrier	Details	Action options
Competition with other activities (existing or planned, onshore or offshore)	• Statutory restrictions apply to site; site has other economic/ landscape value • Offshore WPPs restrict other marine uses • Land may have historic value	• Reform national planning rules • Assign government to broker planning permissions • Establish national-level body to resolve disputes • Encourage creation of spatial development plans
Proximity of WPP to buildings	• Operational plants create sporadic noise • WPP has a perceived negative visual impact – landscape or shadow flicker	• Require Environmental Impact Assessments (EIA) • Fund public engagement exercises • Appoint government to resolve disputes • Establish standards for noise levels and ensure enforcement
(3) **Concerns that wind turbine operation may interfere with communication systems**	• Defence radar potentially affected by WPP operation and project blocked by military • Civil aviation, telecoms or meteorological radar potential affected by WPP operation	• Assign military authorities to map areas of constraint and encourage early consultation • Establish policies for minimum distance standards for civil aviation, meteorological facilities and WPPs; investment to upgrade radars where critical* (4)
(1) **Imbalance between environmental protection and development**	• Cumulative impacts of multiple WPPs not considered • Ecology in the vicinity of the WPP disturbed/damaged during development and operation • Environmental regulation or lack of baseline environmental data may place excessively onerous requirements on developers	• Conduct Strategic Environmental Assessment (SEA) on regional/national basis • Develop national research projects to address general concerns • Assign national body to resolving disputes • Maintain balance between pragmatism and environmental considerations (2)
Planning process may be overly burdensome	• Involvement of multiple and conflicting government bodies makes licensing process overly complex and lengthy • Institutions lack capacity to manage applications • Wind project developers lack competence in preparing planning application	• Rationalise and align policies at every level of government. Co-ordinate between authorities and make sure all authorities have adequate information for processing applications • Modify planning system to manage conflicts between developers and local population • Establish one-stop shop to streamline planning processes • Educate and train developers in application process

* Ideally, developers and aviation authorities (civil and military) should consult early in the planning process. If all necessary data on the wind energy project and radar system are disclosed, it should ordinarily be possible to determine jointly the ideal wind installation layout and any necessary mitigation measure that may need to be applied to the WPP and to the communication system.

Box 3: Typical wind energy business case (continued)

Factors affecting the business case for wind energy projects

The business case for a WPP depends on the financial appraisal of the development. As part of this, the investor seeks to determine the risk profile of a wind energy project, considering issues such as wind resource assessment, technology selection, planning and permitting, the construction process and timetable, lifetime cash-flows, and operation and maintenance plans. The investor needs to be sure that the project developer is able to secure rights to land and grid access, has clear permitting requirements, and can manage stakeholders. Until such issues and others are addressed, it is unlikely that any financial commitment on the part of an investor will be forthcoming.

The process of reviewing all these issues is referred to as the "due diligence evaluation" of a project.

It is crucial that the policy maker understands the full extent to which his/her actions can support the wind energy business case. Probably the greatest policy impact on the cash flow of a project will result from a regulated FIT or other financial or fiscal incentive. But an enabling environment is also of the utmost importance. Clarity and brevity of planning processes, and adequate transmission infrastructure, are two of the most important facilitators; they are discussed in detail in Table 4 and Table 9 of this *Wind H2G*.

Development barriers

Barriers encountered in the development phase of WPPs mainly concern issues faced by developers, including both technical and social acceptance factors. Policy makers can act in concert with the range of appropriate stakeholders to diminish these. Barriers range in scale from site-specific to regional and national. Barriers likely to be encountered are set out in Table 5.

Table 5: Barriers and action options for development aspect

Barrier	Details	Action options
Inaccurate or inaccessible mesoscale data on the strength and distribution of wind resources	• Absence of public data on energy content of wind resource limits attractiveness to developers • Absence of data on resource quality; i.e. climatic conditions limit attractiveness to investors and developers	• Develop or procure publicly available national wind atlas, including long-term mean wind speeds and direction data and time-series data if possible • Establish national platform for anonymous data-sharing to improve access to and accuracy of wind data • Make accessible all existing meteorological and wind resource assessment data
Obstacles to WPP siting (additional to those under "Planning" in Table 4)	• Data on land or seabed topography and geology are inaccurate or unavailable • Desirable sites are inaccessible to construction and maintenance teams • Opposition of local population affected by the new wind power installations	• Undertake geological and topographical survey in priority areas; ensure public access to existing data • Develop new access infrastructure if appropriate • Implement communications strategy targeting local population and media with factual information about the positive impact of wind energy on jobs, the economy and the environment*

* Among others, the following publications can be useful for building solid arguments in support of new wind power installations and communicating the benefits of wind energy to society: Devine-Wright, 2005; EWEA, 2013, 2012 and 2009b; IRENA, 2012; and Wind IA, 2013b.

Barrier	Details	Action options
Connection to grid is constrained	• Transmission and/or distribution grid owner may not wish (or lack capacity) to connect • Offshore connection costs may be prohibitive • Connection fee may be inappropriate • Local opposition prevents construction of new grid connection • Point of connection may be disputed among developers or with transmission owner • Long distance between potential site and grid node can be a barrier due to cost or existing rights of way	• Regulate monopoly control to allow access for Independent Power Producers (IPP) • Educate local population on benefits of wind power (GHG reduction, green jobs) • Consider underground power lines • Regulate system operators to ensure rates reflect costs • Distinguish connection costs from grid reinforcement costs and assign appropriately • Engage with local stakeholders to manage trade-off between new grid infrastructure and benefits of wind power
Operational aspects	• Wind turbines present health and safety challenges (e.g. ice throw) • Assignment of decommissioning costs • Repowering demands grid upgrade • Shortage of qualified personnel for the operations and maintenance (O&M)	• Ensure interface with planning process to avoid conflicts and provide contact point for local residents • Ensure wind energy policy addresses end-of-life issues (decisions regarding recycling or decommissioning equipment versus repowering) • Ensure that O&M training programmes exist at national or regional level that are consistent with the desired level of wind energy deployment

Table 8. Barriers and action options for finance and economic considerations

Barrier	Details	Action options
High upfront costs prevent wind energy development	z Technology risk considered too high by investors z Lack of infrastructure may make WPPs financially unviable z Lack of previous investment experience in target country makes commitments too risky	z Tackle structural market distortions by removing subsidies for fossil fuels z Invoke government support for wind power in the form of tax incentives, credit guarantees or access to affordable finance z Ensure national government prioritises investment in energy infrastructure z Establish or mandate public bank to support investment in wind energy projects where private investors regard the risks as too high, e.g. by underwriting risk
Investor uncertainty	z Instability in the policy and/or regulatory framework z Absence of reliable spot market price makes identifying representative electricity price difficult z Lack of or too few PPA counterparties prevents contracting at a reasonable price z The Levelised Cost of Energy (LCOE) of wind may be uncompetitive relative to other sources of power	z Establish stable government support mechanism to address LCOE issues (e.g. FIT, production tax credit, mandatory purchase price, quota obligation system or tradable certificate) z Implement national policy to support liberalised energy market z Incite national government or its bodies to buy power purchase agreements s directly z Require utilities or large energy users to buy power purchase agreements s from suppliers z Reform energy market to remove direct and indirect subsidies for conventional sources of electricity z Address wind resource uncertainty with national wind atlas or measurement database z Address technology uncertainties (O&M costs) by R&D and requirement for the producers to report to a failure statistic database
Lack of nance for WPP developments	z Project promoter or developer unable to provide equity into the project z Lack of bond finance for projects z Investment banks may be unwilling to offer project finance z Shortage of tax investors z Utility financing of project scarce (reluctance to finance on balance sheet)	z Establish or mandate public bank to support investment in wind energy projects, e.g. underwriting risk z Institute government intervention to reduce cost of loans through grant funding, credit guarantees, tax incentives z Urge government to support development of domestic or regional bond market in low-carbon goods z Build utilities' confidence via long-term policy certainty

SOURCE (L)

Last update: May 2014

Title of the measure:	UK23_Smart metering and Billing

General description

The UK Government's vision is for every home in Great Britain to have a smart electricity and gas meter with In-Home Displays (IHD). Ensuring householders have direct access to information about their energy use within their homes will enable consumers to manage that use and reduce their carbon emissions. The smart energy meters and IHD will provide consumers with near real-time information on energy consumption. Bills will be accurate and switching between suppliers will be smoother and faster. It is expected that new products and services will be supported in a more competitive, efficient energy supply and energy management services market.

The Department of Energy and Climate Change (DECC) is leading the roll-out (links below) with support from the industry regulator, Ofgem. Ofgem E-Serve led the policy design phase of the central programme on behalf of DECC, however, since April 2011, DECC has been directly responsible for managing the implementation of the programme. DECC estimates that over the next 20 years the installation of smart meters will provide £6.7 billion net benefits to the UK: the programme will cost £12.1 billion and provide £18.6 billion in benefits.

The rollout will involve visiting 30 million homes and replacing 53 million domestic gas and electricity meters. DECC has established the Smart Meter Implementation Programme to set the policy framework, revise the regulatory framework including updating consumer protections, and ensure the necessary cross-industry arrangements are in place.

Installation will take place over two implementation phases:

The Foundation Stage – this began in 2011 and Government is working with the industry and consumer groups and other stakeholders to ensure that all the necessary groundwork is completed for mass rollout. The foundation stage will let industry:

- build and test systems;
- learn what works best for consumers; and
- learn how to help people get the best from their meters.

The Mass Rollout – the mass roll-out will start in late 2015 and end by the end of 2020. British Gas has already started to install smart meters, with one million having been installed across the UK.

The transfer of data to and from domestic smart meters will be managed centrally by a new Great Britain-wide function covering both electricity and gas sectors. This central Data and Communications Company (DCC) will be independent of suppliers and distributors. It will provide two way communications to smart meters, to which smart meter service users (suppliers, network companies and other authorized third parties) will be given access to data for specified purposes. In September 2013, Capita was officially granted the Data and Communications Company (DCC) licence, worth an estimated £175 million over 12 years. It has signed contracts with CGI (formerly Logica), Telefonica, and Arqiva to deliver different elements of the programme.

Impact evaluation (methods and results)

Methods

Every two years an assessment is made on progress over the previous target period. The energy savings from in home displays/Smart meters are calculated according to supplementary Green Book policy appraisal guidelines available at http://www.hm-treasury.gov.uk/data_greenbook_index.htm

Results

The DECC Updated energy and emissions projections 2013 (published in Sep 2013) provide estimates of the impact of Real time displays/Smart meters:

Ex-post evaluation	1995	**2010**	**2016**	**2020**
CO_2 (kt)				
Energy (TWh)				
Ex-ante evaluation	1995	**2010**	**2016**	**2020**
CO_2 (Kt CO_2e/year)		0	855	1822
Energy (PJ)*		0	11.6	24.6

* Energy figures converted from carbon by using same energy/carbon ratio as in progress report on UK NEEAP 2007 (published in July 2011) for home displays/ Smart meters in the household sector.

The NEEAP 2014 only contains estimates for the non-domestic smart meter roll-out which are 6.1 PJ for 2016 and 15.8 PJ for 2020.

Measure Impact Level		
☐ **low**	☐ **medium**	☒ **high**

Definition of the qualitative impact level

- The categories (low, medium, high) are linked to the aggregate electricity or energy consumption of the respective sector (households, transport, industry or tertiary), and not to a particular end-use, because the aggregation of the impacts is easier.
- The following limits (in each case in % of the overall final energy or electricity consumption of the sector; in case of fuel substitution and CHP: of primary energy consumption) are defined for the three impact levels:
- **low impact: <0.1%**
- **medium impact: 0.1-<0.5%**
- **high impact: ≥0.5%)**

Interaction of measures

Better metering and billing should support the ECO measures; see UK33_Energy Company Obligation (ECO).

Historical data

It was announced in the 2007 Energy White Paper that the UK Government intends to roll forward a package of measures which will change the way in which energy use is metered and billed. The UK government proposed that from May 2008 and, where technically feasible, every household having an electricity meter replaced and every newly built domestic property would be given a real-time electricity display, free of charge. The display must show real-time information about electricity consumption and cost and meet a minimum performance requirement of 95% accuracy in the normal range of energy use by a household.

An energy demand research project, co-funded by Government and industry, involved several thousand households receiving smart meters or feedback devices, displaying real-time energy use. The project, managed on the Government's behalf by Ofgem (energy regulator), involved trials of different ways of improving billing and metering. The trials provided information on reductions in energy use that consumers make in response to different forms of feedback about their energy use and test consumer response to time of use tariffs that encourage energy use to be switched away from peak periods. The project ran for two years, with regular interim reports on emerging findings and informed the further development of policy on smart meters and associated feedback devices.