

**NEW & RENEWABLE ENERGY**  
*Prospects for the 21st Century*



# C O N T E N T S

<b>1</b>	Foreword by John Battle MP, Minister for Energy and Industry
<b>3</b>	Summary
<b>5</b>	<b>SECTION 1 – INTRODUCTION</b>
<b>7</b>	What are new and renewable energy sources?
<b>10</b>	World markets for renewables
<b>11</b>	<b>SECTION 2 – WHY SUPPORT RENEWABLES?</b>
<b>19</b>	Summary of issues
<b>21</b>	<b>SECTION 3 – FORM OF SUPPORT</b>
<b>24</b>	Tackling the issues
<b>27</b>	Research and Development Programme
<b>28</b>	Summary of issues
<b>29</b>	Market stimulation measures
<b>30</b>	Market stimulation of renewables in a reformed electricity market
<b>32</b>	Summary of issues
<b>33</b>	<b>SECTION 4 – POLICY OPTIONS FOR THE FUTURE</b>
<b>34</b>	Strategies and targets
<b>35</b>	Possible cost of support measures
<b>36</b>	Key activities for parties involved in any future strategy
<b>38</b>	Summary of issues
<b>39</b>	<b>SECTION 5 – RESPONSES TO CONSULTATION</b>
	<b>Annexes</b>
<b>41</b>	1 New and renewable energy policy review: terms of reference
<b>42</b>	2 Current status of renewables
<b>44</b>	3 Potential future markets
<b>48</b>	4 Historic UK programme
<b>50</b>	5 Introducing renewables: tackling the issues
<b>55</b>	6 Possible mechanisms to support market stimulation
<b>67</b>	7 Support programme to tackle other issues in the energy market
<b>69</b>	Glossary of terms



F O R E W O R D

by John Battle

*Minister for Energy  
and Industry*



# NEW & RENEWABLE ENERGY

*Prospects for the 21st Century*

By their nature fossil fuels will inevitably run out. New and renewable energies will therefore become one of the world's main energy sources in the new millennium. Developing a thriving renewables industry in the UK therefore represents a real opportunity for UK plc. It provides a three term "win-win-win" equation: encouraging the development of new technologies; creating new jobs; and tackling global environmental challenges.

Renewable sources of energy make an important contribution to secure, sustainable and diverse energy supplies and are an essential element of a cost-effective climate change programme.

The Government is working towards a target of renewable energy providing 10 per cent of UK electricity supplies as soon as possible. It hopes to achieve this by 2010. Whilst this is an ambitious target it is not an end in itself. Rather the programme outlined in this

document (and on which we would welcome your views) aims to give new and renewable technologies a push in the right direction. I do not want to see renewables stop at 10 per cent. I want to see a strong, world-beating industry develop in the UK. I also expect renewables not only to generate power, but also to provide heat and transport for our homes, industry and commerce in centuries to come.

Renewables are not only important in generating jobs and developing future industries, they will also play a crucial role in enabling the UK to meet our environmental targets of reducing greenhouse gases by 12.5 per cent by 2008–2012 and our goal of reducing emissions of carbon dioxide by 20 per cent by 2010. As Tony Blair has emphasised, this Government is committed to putting the environment at the heart of our decision making. As the Kenyan proverb says, "The earth was not given to us by our parents, it was loaned to us by our children". We all

have a responsibility to ensure that the way we live today does not adversely affect the inheritance we leave for generations to come.

This Government is therefore committed to encouraging sustainable development; to developing policies and encouraging behaviour which combines economic, social and environmental objectives to ensure a better quality of life for everyone. We must find new patterns of production and consumption that are globally sustainable. Sustainability should not be seen as a barrier or burden to business. Rather it is economic common sense. The drive to sustainability will stimulate invention and innovation and will bring new opportunities for business and growth, both here and in export markets overseas. Nowhere is this more apparent than in the renewables industry.

The skills and the will are already there in the embryonic UK renewables industry. Some 650MW of renewable energy capacity from Non-Fossil Fuel Obligation (NFFO) Orders 1–5, Scottish Renewable Orders (SRO) 1–3 and Northern Ireland Orders (NI-NFFO) 1–2 are currently operational. The fifth Non-Fossil Fuel Obligation which I announced last September represented the biggest and cheapest order to date. A record 261 projects were contracted under the Order with a capacity of 1,177MW of electricity – enough to supply the needs of 1.4 million homes. Furthermore, with the low cost of most of the near-market technologies supported, an average price of 2.71p/kWh for the latest Order was just off the competitive market price.

Currently around 3,500 people are directly employed in the renewables industry in over 700 companies. The majority of companies involved in the renewables industry are small and medium sized enterprises. However large multinational companies based in the UK are also moving into the field. BP/Amoco for example has a growing solar business. National Wind Power, a subsidiary of National Power, already has some 10 projects across the UK

and has further projects in development world-wide. British industry is also involved in the development of new energy technologies for the future. Rolls Royce and Johnson Matthey, amongst others, are involved in the development of fuel cell technology.

Two per cent of the UK's electricity supply already comes from renewables. Renewable projects range from wind farms (such as the community owned Harlock Hill windfarm in Cumbria or the Border Wind semi-offshore facility in Blyth harbour), to energy from waste stations (such as the CHP plant at St James' Hospital in Leeds which uses medical waste to generate electricity) and hydro-electric stations (such as the 4.2MW Elan Valley project in mid-Wales).

As further projects become operational, the proportion of electricity generated from renewable sources should rise to 5 per cent by 2003. However, we cannot stand still. A real drive is needed over the next decade to push renewables into the next millennium. For its part the Government has already allocated £43.5 million over the next three years to investment in the development of new and renewable energy. But Government cannot make this happen on its own. In this document we have set out our analysis of the status and prospects for renewables; we have also looked at the kinds of support mechanisms which might be used. I would welcome your views.

I am determined for energy supplies to become more and more sustainable, and as part of that I want to see the contribution which renewables make to electricity supplies increase way beyond 10 per cent over the course of the 21st Century, and I encourage you to help make this vision a reality.

John Battle MP



Minister for Energy and Industry

# S U M M A R Y

The Government has a Manifesto commitment to “a new and strong drive to develop renewable sources of energy”. It has undertaken a review of the status and prospects of renewables, including an examination of what would be necessary and practicable to achieve 10 per cent of UK electricity requirements from renewables by 2010 and what contribution renewables could make to reducing greenhouse gas emissions. This Consultation Paper reports on the outcome of that review and possible ways forward in implementing the Government’s new drive for renewables.

One very clear outcome of the review is to reaffirm the Government’s commitment to the development of renewables and to ensuring they make an increasing contribution to our energy supplies. The Government intends to work towards the aim of achieving 10 per cent of the UK’s electricity supply from renewables. Renewables are an essential component of any cost-effective climate change strategy. Achieving the 10 per cent target could lead to a reduction of 5 million tonnes in UK carbon emissions, making a valuable contribution to our overall climate change strategy. But the key role of renewables will be in the longer term; over time, we will have to reduce our dependence on fossil fuels and turn increasingly to energy efficiency and non-fossil sources. Although the Government hopes that it will be able to achieve its 10 per cent target by around 2010, its key priority is therefore to ensure that momentum is maintained so that even after 2010 the share of renewables can continue to rise in response to the need to limit greenhouse gas emissions to a sustainable level. This will require a level playing field for renewables in competitive energy markets. As this Paper indicates, the Government has already made a very strong commitment to renewable energy. The Government’s support for renewables means that, by 2003, 5 per cent

of our electricity should be provided by renewables compared to the current figure of 2 per cent. The Non-Fossil Fuel Obligation (NFFO – see box on page 22) has provided over £600 million of support for renewables to date. The Government has introduced the 5th Non-Fossil Fuel Obligation Order (NFFO 5) for England and Wales in 1998 – the largest ever – and the Third Scottish Renewables Order in 1999. Support for renewables under the NFFO arrangements, which has declined recently, will accelerate again in the first decade of the next century and could rise to around £150 million a year. The programme has been successful in its objective of driving down costs – the cost of generating electricity under NFFO contracts has been halved over the past decade and the more mature renewables technologies are now almost competitive.

Similarly, the Government has announced that it is to reverse the downward trend in expenditure on the renewables research and development programme which complements the NFFO arrangements. A new and growing R&D effort is now under way: expenditure will rise from around £10 million in the current financial year to £18 million in the year 2001–2002.

In addition, the Government is pressing ahead with reforms which will both improve the operation of energy markets and enable renewables to compete more effectively. Electricity liberalisation, for instance, is giving consumers the ability to choose their electricity supplier, allowing them to express a preference for sustainable sources and enabling the development of “green” electricity options. Combined with the cost reductions noted above, this has encouraged key players in the market to come forward with schemes which do not require subsidies, giving a basis for the development of a thriving and commercial renewables industry.

The Paper also explains how the Government intends to remove institutional and market barriers to the development of renewable electricity. In particular, in its plans for the separation of the supply and distribution activities in the electricity sector, it will be looking closely at arrangements to ensure that so-called “embedded” generators (i.e. those directly connected to local distribution systems – as is often the case with renewables producers) receive a fair price for their electricity. This will minimise the cost of supporting renewables. It will also be looking at planning arrangements, opportunities for developing energy crops, and other issues which might help the development of renewables.

Taken together, all these measures will give a significant boost to the further development and deployment of renewable forms of energy. However, as the Paper makes clear, the Government will not stop there. We are working towards the target of producing 10 per cent of our electricity from renewables (as compared with around 2 per cent today). Some measures to stimulate the market for renewable energy may be needed to achieve this ambitious target. The support for renewables under the existing NFFO scheme will in any event have to be adapted to the new competitive structures of the electricity industry and this creates the opportunity for considering other forms of market stimulation. Various different options for support under any new scheme are discussed in this Paper, including the question of whether any obligation should be on the supply or distribution business.

Producing 10 per cent of the UK's electricity from renewables appears to be a feasible target. There will however be some additional cost as compared with the cheapest sources of generation available. The level of those costs will depend on the nature of any support measures, particularly the extent to which they support longer term as well as near market technologies, and the success of the other measures mentioned

above. The aim of any programme would, however, be to continue to put downward pressure on the cost of renewables, so as to meet our objectives in a cost-effective manner.

The Government hopes that it will be possible to achieve its target by around the year 2010, but it will wish to gauge the precise level of support needed in the context of its overall climate change programme and the other measures introduced in that context, as well as the rapid market changes currently under way. What is clear is that renewables will be an essential part of our overall response to the climate change challenge, particularly in looking forward to the longer term, post 2010.

The Government is confident that it has set the stage for its new drive to develop renewables. It has committed itself to devoting increased resources to their development. Along with the market reforms it is introducing, and the success of earlier programmes in bringing down costs it believes that many conditions have been satisfied for an increasing contribution from renewables over time, but also for an increasingly successful and commercial renewables industry. These are both essential elements of the Government's approach, and of a cost-effective climate change programme. The Government will continue to work towards these objectives, and will be prepared to consider what further forms of support might be necessary in order to achieve its aim cost-effectively.

This Consultation Paper seeks views on the balance of measures and the precise form of support for renewables in the next stage of their development. It identifies key issues which the Government, industry and other players will need to address. It affirms the Government's commitment to its new drive to develop renewables; identifies the practical steps which might be needed to achieve this objective; and seeks to engage a wider public in the development and realisation of its strategy.





## SECTION 1

# INTRODUCTION

1 The Prime Minister has underlined the Government's determination to put the environment at the heart of its decision making. Climate change is recognised as one of the greatest environmental threats facing the world today. Prudent use of natural resources, including renewable energy sources, is one of the Government's objectives. In its Manifesto, the Government committed itself to "a new and strong drive for new and renewable sources of energy". The Energy White Paper, **Energy Sources for Power Generation**, published in October 1998, confirmed that the Government's central energy policy objective is to ensure secure, diverse and sustainable supplies of energy at competitive prices. Energy from renewable energy sources is clearly an important element in securing both the diversity and sustainability objectives and has the potential to be supplied on an increasing scale at competitive prices.

The UK already has an active programme of support for renewables through a research programme, having spent almost £80 million since 1994, and through the Non-Fossil Fuel Obligation (see page 22 for details), a levy on electricity consumers to support electricity from renewables. Already, Government's support for renewables means that by 2003, 5 per cent of our electricity should be generated from renewables (which would represent more than a doubling of the contribution of renewables to electricity generation in a decade).

2 The Government is committed to ensuring that the contribution from renewables increases over time. It conducted an interdepartmental review in 1998 including considering what would be necessary and practical to achieve 10 per cent of the UK's electricity needs from renewables. The terms of reference for the review are at Annex 1.



## New and Renewable Energy Web Site



The Department of Trade and Industry has developed an exciting new Web site specifically

aimed at the education sector. The site is called "Planet Energy" and visitors can travel around its "Energy Trail", learning about the following new and renewable energy technologies:

*Energy from the Sun*

*Energy from Water*

*Energy from Wind*

*Energy from Wood and Crops*

*Energy from Waste*

Other Renewables: Waves; Tides; Heat from Inside the Earth

The Web site is fully illustrated with renewable energy images, examples of how each technology works and simple animations.

The site is divided into three sections:

- Teachers' information zone. This includes classroom work sheets for Key Stages 3 and 4 with teachers' notes and information on a new and renewable energy CD-ROM.

- Information zone for 7–11 year olds. New and renewable energy is explained in the simplest terms. Students are able to complete a multi-choice quiz and will receive a "renewable energy challenge" certificate. Students are able to print out a certificate with their name, school name and the score they have achieved in the quiz. There are suggested class room activities for this age group, e.g. thinking of how renewable energy can be used at home or at school.
- Information zone for 12–16 year olds. This section has more detailed information about new and renewable energy. Students can also complete a "renewable energy challenge" quiz and print out a certificate.

In addition, Planet Energy has links to other renewable energy Web sites across the world which are designed for the education sector, and to sources of further information.

Visitors to the site are able to complete a short questionnaire to help the Programme gain feedback on the site and to request further information from the New and Renewable Energy Enquiries Bureau.

Plant Energy is located at:

[http://www.dti.gov.uk/renewable/ed\\_pack/](http://www.dti.gov.uk/renewable/ed_pack/)

3 The UK now has one of the most open, fair and competitive energy markets in the world. Any support for renewables therefore needs to work both with the Government's Competitiveness White Paper and with the grain of competitive markets, including consistency with the Government's wider climate change programme, on which a consultation document was published in October 1998. This renewables paper looks at:

- what renewables are;
- the reasons for supporting renewables;
- the forms of possible support for renewables including:
  - removal of barriers to entry into the renewables market;*
  - research and development support;*
  - market stimulation measures in the form of an obligation on the electricity industry to purchase renewable energy.*
- policy options for the future.

4 The sections below develop these questions in more detail, while background to the issues involved is provided in Annexes 1 to 7 of this paper. The consultation paper covers the whole of the UK. To avoid undue complexity, most of the references in this document are related to the situation in England and Wales. It is recognised that different market situations and administrative arrangements apply in both Scotland and Northern Ireland and many of the issues affecting the renewable energy industry, although broadly similar throughout the UK, have slight, but distinct, regional variations. A supporting document **New and Renewable Energy: Prospects in the UK for the 21st Century** published in parallel with this consultation paper, contains more analysis and detail of the technologies, their costs, status and prospective markets.

## What are new and renewable energy sources?

5 First, it may be worth taking a brief look at the term 'new and renewables' and the nature of the sources involved. Renewable sources of energy are those which are continuously and sustainably available in our environment such as wind and solar energy. These sources produce significantly lower levels of environmental pollutants than conventional sources of energy; in particular, they generally emit no greenhouse gases or are neutral over their life-cycle in greenhouse gas terms (for instance, energy crops produce carbon dioxide when they are burnt, but the new crop growth absorbs an equivalent amount of carbon dioxide from the atmosphere, making the process as a whole neutral in carbon terms). Waste for which there is no more economic use such as recycling can also often be used as a fuel and achieve savings in fossil fuel use and reductions in CO<sub>2</sub> emissions. New energy sources include technologies such as fuel cells which convert the energy of a chemical reaction, typically between hydrogen and oxygen (generally from air) directly into low voltage direct current electricity and heat.

### Delabole wind farm

Windelectric's ten-turbine project at Delabole in North Cornwall was the UK's first commercial wind farm. It began operating in 1991.

As well as making an important contribution to sustainable energy supplies and savings on greenhouse gas



*Delabole wind farm*  
Windelectric

emissions, the wind farm provides some local work and helps the rural economy by attracting visitors – over 35,000 in the first year. Delabole's turbines produce ~10.5 GWh/y. DTI's total support to the project is £25,800 which comprised five surveys: two on public opinion, one on radio and TV interference, one on background noise and one on legal and planning issues.

### Thermomax – Solar Water Heating Tubes

Thermomax produces state-of-the-art evacuated tube solar collectors at its factories in Wales and Northern Ireland. They export over 90 per cent of their production, largely to Europe, where they are the largest supplier. More than 2 million of their tubes are now in use at over 60,000 locations world-wide, including the CIA Headquarters in Washington, a meteorological station in Antarctica, an IKEA Store in Italy, and the North Terminal at Gatwick Airport.



*Solar tubes, Gatwick*  
Thermomax

## First UK Community Wind Turbines



*Harlock Hill  
wind farm*  
Bay Wind Energy

The UK's first community-owned wind turbine, which forms part of the Harlock Hill Wind Cluster in Cumbria, was commissioned in 1997. It was bought by the Bay Wind community co-operative. Most of the £620,000 investment was derived from small

investors in the local area. Bay Wind has since bought a second turbine at Harlock Hill, which has a NFFO-3 contract. The DTI contributed to the venture's preparatory work.

## Rural Generation Ltd – Northern Ireland

Brook Hall Estate's 100kWe gasifier is the first to be connected to the National Electricity Grid in the UK. The heat generated is used in buildings and residences and to supplement a straw-based grain drying system. Developed by Rural Generation Limited from the research gasifier at Enniskillen, the installation, which will be run entirely on willow coppice grown at the site, has been using bought-in wood while awaiting the willow harvest. The Estate has now finished the planting of 43 hectares of coppice, with the first 14 hectares ready for harvesting in December 1999. All the coppice is planted on EU set-aside land. The plant is well on its way towards 7,000 hours of proving time demanded by the developers prior to commercial exploitation.

6 The sustainability of renewables means that they will continue to be available even in the longer term future, when fossil fuel sources may be getting scarcer. But adapting to using renewable technologies on an increasing scale may require significant changes in our institutions and attitudes. Most of the technologies are small-scale, modular, and deployed close to the resource itself. If they become a major part of our energy supplies this will have implications for its overall structure – probably involving large numbers of individual power sources, rather than the present limited number of large central installations.

7 Another significant difference is that renewable energy technologies tend to have relatively high capital costs. Fossil fuels represent a very concentrated form of energy. Renewables, by contrast, normally use dispersed sources with low energy concentrations, such as wind. On the other hand, they tend to have low operating costs, because the fuel is normally free or low cost.

8 A further key feature of renewables is that since they depend generally on the natural environment, the range of sources available internationally will vary significantly from country to country. For instance, the UK is relatively well placed as regards wind power potential by comparison with other countries, but its geography is not in general very favourable to more hydro-power. Similarly, different regions of the UK offer different potential renewables contributions.

9 It is also important to stress that although it is convenient to talk about 'renewables' as a single category, many different technologies and fuels are involved, all with very different characteristics. Some, such as wave energy are still at the research stage (although three projects have been awarded contracts under SRO-3). Others, such as energy crops, are at the technical demonstration stage.

Technologies such as wind are beginning to be deployed on a significant scale but generally in markets where there is some financial assistance. Hydro-electricity is well established. Other technologies currently have applications only in niche markets, for example photovoltaics, but with further development to reduce their costs, they could be deployed competitively on a large scale.

10 In general, many technologies can be regarded as immature in terms of their market development and few are yet both fully competitive and technologically proven. Furthermore, individual renewable sources or technologies have inherent limits, because they depend largely on a fixed natural resource. One important implication is that if renewables are to expand their contribution to the UK's energy mix significantly, this will require not just the expansion of existing sources and technologies, but also the development and deployment of new technologies.

11 New and renewable energy technologies can be applied in the heat, electricity and transport markets, for example wood-burning stoves and solar water heating panels to produce heat, wind turbines to produce electricity, and fuel cells to power motor vehicles. But in UK conditions, the main emphasis historically has been on electricity generation because many of the technologies are best applied to produce electricity and that is the earliest market likely to be economic on a major scale. This document therefore concentrates mainly on renewables for electricity though other technologies are addressed for UK and particularly overseas markets. Annex 2 gives more information about the status of renewables.

## Intersolar – British Manufacturer of PV Cells

The Intersolar Group manufactures thin film silicon photovoltaic material at its factory in Bridgend, with 75 per cent of its output being exported. This British product is used in a variety of ways: framed as panels for use as Solar Home



*Portable PV panel*  
Intersolar

Systems in the developing world, laminated for use in buildings, designed as modules for professional applications, or cut and integrated into consumer products. The company has announced that it will be tripling its capacity after securing £3.5 million financing from the City.



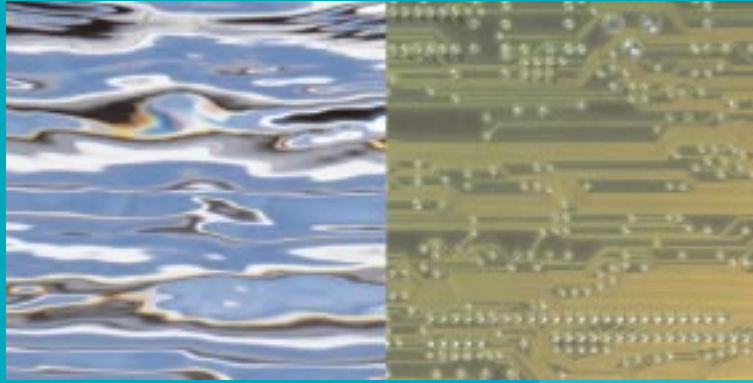
*PV panels in N. Africa*  
Intersolar

## World markets for renewables

**12** Renewable sources of energy are estimated to meet between 15 and 20 per cent of current final world energy consumption – predominantly from hydro-electricity, wood, biomass and geothermal. Renewables currently meet around 6 per cent of European energy demand. In the UK in recent decades they met around 2 per cent of our electricity needs mainly from hydro-electricity, equivalent to 1 per cent of primary energy demand.

**13** Renewables are seen by most institutions producing projections of future energy needs as making an increasing contribution in the medium term and playing a very substantial role in the long term. This reflects the reducing role for fossil fuels as they become scarcer, the need to contain fossil fuel use because of their emissions and the need to reduce their impact on climate change. Estimates based on World Energy Council projections indicate cumulative investment in renewables ranging from £150 billion to £400 billion between 2000 and 2010. Scenario analyses by Shell, which assume pressure towards sustainability, show renewables meeting around 40 per cent of world energy needs by the middle of the next century. The EC estimated the world market for renewables at £31 billion in 1990 and projects that European business in 2010 will be valued at 37 billion ECU, with a further 17 billion ECU from exports into the expanding world markets. The European Commission is proposing doubling the contribution from renewables to 12 per cent of Europe's energy needs with an investment of 165 billion ECU by 2010. Studies of the renewable resource available in the UK suggest that about half the current UK electricity consumption could be available at costs of less than 3p/kWh in the longer term. How much of this resource it will be possible to develop will depend upon future circumstances. Annex 3 gives more information about potential markets for renewables.





## SECTION 2

# why support RENEWABLES?

14 The Government's central energy policy objective is to ensure secure, diverse and sustainable supplies of energy at competitive prices. Renewable energies, produced from sustainable natural sources, clearly contribute to the sustainability element of this objective. Although they currently form only a relatively small part of the UK's electricity generation, as mentioned above, their use is expanding and they have a contribution to make to the future diversity of our energy mix. Since most of the sources are indigenous and naturally available, they also have a potential contribution in terms of security – supplies will not be disrupted by international crises or run out over time. However, since they depend in most cases on natural processes, this security is not always the same as with fossil fuels. For instance, some sources such as wind power are intermittent, while other sources such as hydro may vary in their potential according to the weather – a

dry year often means reduced supplies of hydro-based electricity in countries heavily dependent on this source.

15 Looking at these arguments in more detail, there are a number of distinct energy policy reasons for supporting the development of renewables:

- their potential contribution to diversity and security in energy supply;
- recognition of the environmental benefits of renewables, and in particular the contribution they can make to meeting current and longer term climate change targets for the reduction in emissions of greenhouse gases;
- long term economic viability. Support provided now may help address economic and other barriers which need to be overcome to enable renewables to gain a firm foothold in the market, after which they should be increasingly competitive with a declining need for support.

## ARBRE

The foundation stone has now been laid at the UK's first significant power plant to be fuelled by energy crops. The ARBRE project at Eggborough in North Yorkshire will generate 8MW of electricity for the National Grid from an annual 43,500 dry tonnes of wood, initially from forestry residues and in time from specially grown willow coppice. ARBRE was awarded a contract under the NFFO-3 round and has received support from the European Union, via a THERMIE grant, to address specific technical questions arising from the development of the plant; and, indirectly, from the Ministry of Agriculture, Fisheries and Food (MAFF) through a planting grant regime intended to encourage local farmers to plant energy crops to supply the power station with fuel.



*Short rotation coppice*  
British Biogen

## Weobley School

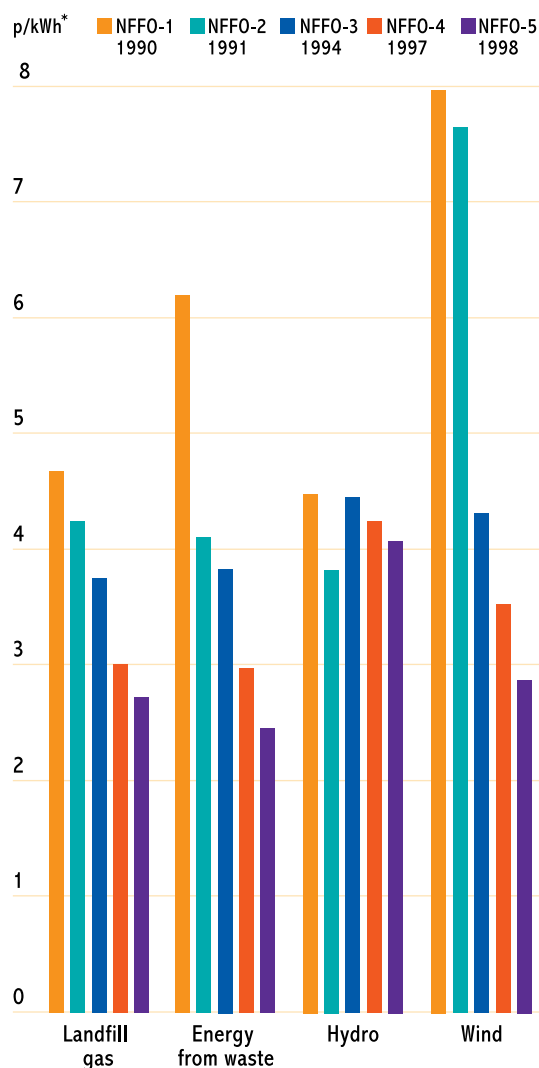
A 350kW wood-fired heating system has been installed at Weobley School in the county of Hereford and Worcester. Supported by the DTI, the European Union, the Ministry of Agriculture, Fisheries and Food, and the Rural Development Commission, the project received a prestigious Environmental Award in recognition of engineering's contribution to protecting the environment and sustainable development. The project demonstrates the practicality of wood chips as a "carbon dioxide neutral" fuel and should help develop the market for wood fuel in the UK.

This suggests that any support may need to be selective in the technologies for which it is used.

In the context of industrial policy there could also be additional gains, including assisting the renewables sector of UK industry become competitive, exporting goods and services and providing new employment.

16 As far as diversity is concerned, as Section 3, and Annexes 3 and 4 indicate, significant amounts of renewable generation are likely to be competitive against new coal or nuclear plant in the next decade or two, provided the momentum of development is maintained.

Figure 1: Showing reduction in electricity generating costs over successive NFFO rounds



NB: NFFO-1 and 2 data adjusted for shorter contract lengths



The cost of generating electricity from renewables under the Non-Fossil Fuel Obligation for England and Wales (NFFO) has almost halved on average since 1990 and the more mature technologies, such as landfill gas, now generate electricity at prices not far above the wholesale market price. See Figure 1 opposite. The average price of the most recent contracts for renewables was 2.71p/kWh compared with the electricity pool selling price of 2.60p/kWh for (the calendar year) 1998. Prices have fallen similarly under successive Scottish Renewables Order (SRO) and Northern Ireland Non-Fossil Fuel Obligation (NI-NFFO) rounds. Renewables are, on present projections, amongst the lowest cost ways of providing alternative options to gas fired generation.

17 But the key current argument for support for renewable energy is the environment. The challenge of climate change in particular is recognised as one of the major environmental threats facing the world today. The UK has accepted a target of reducing emissions of a basket of greenhouse gases by 12.5 per cent below 1990 levels by 2008 – 2012 as its contribution to the European Union target of an 8 per cent reduction. The UK has also set itself a domestic goal of a 20 per cent reduction in carbon dioxide emissions by 2010. On 26 October 1998 the Government published its consultation document **UK Climate Change Programme** to stimulate a national debate on how we might meet our targets. It will follow this up by preparing a draft UK climate change programme for consultation later in 1999 with a view to implementation from 2000 onwards.

## Guide to UK Renewable Energy Companies

This guide, produced for the DTI by James & James, aims to raise the profile of the UK renewables



DTI

industry, generating new business in international markets. It identifies over 700 companies which are active in renewable energy, from small and specialist firms to large multinationals with renewable energy subsidiaries. 6,000 copies of the guide are distributed annually through overseas posts and at appropriate national and international events.

## Renewable Energy Systems Ltd

Renewable Energy Systems Ltd (RES) is one of the largest and most successful wind farm developers in the world having earned an international reputation for its commitment to its own programme of research and development in all aspects of wind farm design, construction and operations. The USA is one key market where RES has established its presence and is successfully carrying out in excess of \$20 million of work involving re-powering of 105MW of existing assets in Tehachapi, California. RES is also firmly established in Portugal where it has almost 100MW of projects under development with the first 10MW due for construction in 1999. Currently the DTI is assisting RES to develop the 52/1000, a 1MW demonstration machine which has been installed on a site in Northern Ireland. The new machine was erected in December 1998 by the engineering firm, Peter Brotherhood and has not been fully commissioned. DTI support for development and construction of the demonstration machine is £590,000 plus an equal amount from the company and a further £1,180,000 from the EC.

## Brogborough

The 10.7MW generation plant at Shanks and McEwan's Brogborough landfill site turns methane, which is a very potent greenhouse gas, into electricity, demonstrating how such generation can benefit the environment both by abating direct emissions and by substituting for fossil-fuelled electricity generation.



*Brogborough landfill site*

DTI

18 Fossil fuel sources are a major contributor to greenhouse gas emissions. Reducing our use of fossil fuels, and replacing them with non-fossil sources, will be a key part of our long-term strategy to reduce greenhouse gas emissions. Indeed, renewable sources of energy are already contributing to the reduction in carbon dioxide emissions which has taken place since 1990. They will also have a key role to play in a new climate change programme to meet the UK's targets. The scope for emission reductions from a growth in renewable energy was one of a number of policy options in the energy sector, including improved energy efficiency and further use of combined heat and power systems, highlighted in the recent climate change consultation paper.

19 More generally, as the Government's climate change document noted, development of low and zero carbon energy sources, such as renewables, is likely to be essential if tighter climate change targets are introduced for the period beyond 2010. In the longer term new and renewable sources of energy will have to provide an increasingly large share of world energy needs as environmental constraints necessitate changes in the pattern of fuel use or as fossil fuel sources decline or increase in price.

20 The climate change consultation paper sets out the Government's intention to produce a balanced programme, with all sectors playing a part. The programme will focus on existing targets, but will also recognise that the Kyoto targets are only the first step in the fight against climate change, and that cuts in emissions may be needed over time. An effective climate change programme will require a range of policy options, so that a balance can be struck between the need for measures which are effective in the long term as well as the short term, and the need to minimise the risk of undue dependence on any one option.

21 Renewables would be part of a portfolio of measures, which could also include:

- **fuel-switching** in power generation between fossil fuels – this has already produced very significant CO<sub>2</sub> savings, though there are inevitably limits to how far this can be taken, without jeopardising other objectives (such as diversity);
- **combined heat and power** – this produces significant CO<sub>2</sub> savings, and is a major plank in the Government's approach, the ultimate potential will in part depend on the availability of suitable opportunities with the right balance of energy demand;
- **energy efficiency** – there is, and will continue to be for the foreseeable future, considerable scope for greater efficiency in the use of energy, and this, too, is central to the Government's approach.

22 Modern society remains dependent on the availability of energy in sufficient quantities to meet its needs, and the above issues, together with security of supply issues in the longer term, highlight the need to secure an increasing contribution to energy supplies from renewables, as well as pursuing the other measures.

## UK's First Fuel Cell CHP System – Woking Park



*Woking Park*  
Woking Borough Council

As part of Woking Borough Council's "green energy" initiative, the UK's first fuel

cell CHP system will be installed in Woking Park, Surrey. The 200kWe phosphoric acid fuel cell system, which should be operational in 2000, will serve both the Council's 'Pool in the Park' swimming pool complex and Woking Leisure Centre. The DTI's New and Renewable Energy Programme is making a contribution to the capital and installation costs of the system as well as supporting a project to monitor the system through planning, development, procurement, financing and installation as well as subsequent operation and maintenance.

## Fuel Cell Bus Demonstration Project

The DTI is to part-fund the demonstration of the first methanol-powered fuel cell bus in the world on

commercial routes. The £3.85 million project, to be led by the bus builder Robert Wright and Sons Ltd., will

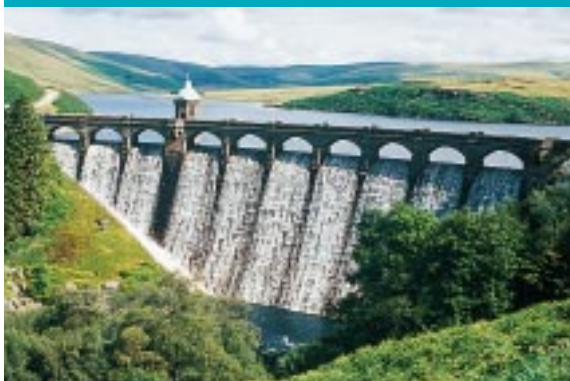


*Fuel Cell Bus* DTI

involve the design, construction and evaluation of a full-size solid polymer fuel cell (SPFC) bus. Other partners in the project include Johnson Matthey (advanced methanol fuel processor) and Alstom Transport SA (electric drive train). The demonstration bus is expected to be undergoing road trials in 2001, with the aim of proving the technology is viable on commercial urban routes.

## Elan Valley

Hyder, in response to NFFO, has successfully developed 5 separate yet interconnected hydropower schemes in the Elan Valley, Mid Wales. The 5 reservoirs and 4 impounding dams that provide the scheme's infrastructure are in an outstandingly beautiful and environmentally sensitive area. The hydropower stations are housed within listed historic monuments, produce 4.2MW of electricity and are linked to the local grid via 20kms of underground cable.



*Elan Valley Hydro Scheme*

DTI

## Tyseley

The 25MW energy-from-waste plant at Tyseley, awarded a contract under the NFFO-3 round, uses well-established technology to turn 350,000 tonnes of Birmingham's waste per year – waste which would otherwise be landfilled – into electricity while at the same time recovering around 16,000 tonnes of ferrous metal for recycling per year.



*The Tyseley plant*

DTI

23 Renewables are becoming increasingly cost-effective and are helping to meet current environmental targets. Annex 3 notes that obtaining 10 per cent of electricity from renewables by 2010 appears to be feasible, at a cost of around 3.5p/kWh. In the long run, there is clear potential for renewables technologies to compete on an equal basis with other forms of generation and to need no subsidy. Annex 3 also shows estimates of the potential resource equivalent of up to half of today's consumption, at generation costs of up to 3p/kWh by the year 2025, though it is of course not possible to say how much of this it will prove practical to exploit. In the short term, however, electricity prices do not reflect full costs, including environmental externalities, and there are a number of issues to address in the development of renewables (set out in Section 3 and Annex 5).

Furthermore, even if the playing field were to be levelled in respect to externalities, there could still be a need to support individual renewable technologies in the market until they have achieved the necessary economies of scale, technological development and investor confidence. There is therefore an argument for Government support for renewables in order to help establish initial market share and demonstrate the viability of renewables sources – after which economies of scale and technological development would take over.

24 Overall, there is a strong case for support for renewables as:

- an option for maintaining a degree of diversity in the electricity system in the longer term;
- the most promising option for the development of a sustainable non-fossil electricity generation system. Although fossil fuels are not currently in short supply, the world can clearly not sustain rising fossil fuel demand indefinitely and renewables will be required on a growing scale in the coming decades;
- an increasingly cost-effective means of reducing CO<sub>2</sub> emissions, if development is supported and maintained.



25 In addition to the economic and climate change arguments, renewables will have to be pursued in the context of a number of Government policy initiatives:

- The Government's White Paper **Energy Sources for Power Generation** published in October 1998 set out the broad objective of energy policy as indicated in paragraph 14 – to ensure secure, diverse and sustainable supplies of energy at competitive prices. It made clear that competitive markets were the key to achieving this objective, but also saw a role for Government in securing the public interest in areas such as the environment and the promotion of renewable energy.
- **Sustainable Development Strategy** – In the light of responses to its consultation document **Opportunities for Change** which was published in February last year, the Government is working on a revision of the UK Sustainable Development Strategy to be published during 1999. Prudent use of natural resources, including renewable resources, is one of the key objectives. The strategy will set out the Government's vision of sustainable development and its approach to achieving the integration of economic, environmental and social objectives to ensure "a better quality of life for everyone, now and for generations to come". The provision of reliable and affordable energy for businesses and individuals underpins everyone's quality of life and the Government considers that renewable sources have an increasingly important role to play in meeting those needs.

## PV Rooflights on Ford Engine Plant, Bridgend

The 26 rooflights on the roof of Ford's Bridgend plant in South Wales represent the largest application of solar photovoltaics in the UK. Covering 25,000sq.m., and incorporating BP Solar PV panels, the arrays are capable of generating approximately 100kW of power. The south-facing rooflights are solar panels, the north are clear glazed to allow in natural light. The total cost of the project was £1.4 million, a large proportion of which came from a European grant with £100,000 support from the DTI N&RE Programme.



*PV Rooflights, Bridgend*

DTI

## Rolls-Royce – Philippines

Rolls-Royce Power Ventures has successfully completed development of an on-site Combined Heat and Power (CHP) plant at a distillery in the Philippines owned by LaTondena Distillers Inc., a subsidiary of San Miguel. The plant will use waste biogas from the distillery's water treatment plant to produce steam and 7.5MW of electricity which will be consumed by the distillery.



*The Rolls-Royce CHP plant*  
Rolls-Royce Ventures Ltd.

## BP Solar – World Supplier of Photovoltaic Systems



*Bedford PV powered service station*  
BP

BP Solar is one of the world's largest and most successful solar energy companies, with its Headquarters and Research

Centre in the UK. It employs over 900 people world-wide, with manufacturing plants in Spain, Australia, India, Thailand, Saudi Arabia and California. John Browne, Group Chief Executive of BP, has stated that it plans to increase its sales of PV equipment tenfold to \$1 billion a year within the next ten years.



*BP Solar showcase, Birmingham*  
BP

## Foresight Sclar PV Schools' Project

In July 1998 Mr Battle switched on the first solar photovoltaic system under the Government's Foresight Sclar Programme, at Cardinal Hinsley School in London. The £2.5 million 'Sclar' Programme for PV in the UK, £1 million of which comes from Government, aims to install PV systems in 100 schools and colleges nationwide by the year 2000. As well as the PV system, which can power the school's computers, they also receive teaching materials on photovoltaics and access to a Sclar Web site to compare notes with other schools on the programme.

- **Industrial energy efficiency** – In 1998 the Marshall Task Force considered the use of economic instruments to improve business use of energy and help reduce greenhouse gas emissions. Lord Marshall reported to the Chancellor on 3 November 1998. He considered that a mixed approach would be necessary with a role for economic instruments alongside regulation and voluntary action. He also considered that both an energy tax and emissions trading should be explored further as possible tools to help the UK meet its greenhouse gas reduction targets. Following up Lord Marshall's report, in March 1999 the Government announced its proposals to introduce a climate change levy on business use of energy, from April 2001. The £1.75 billion/yr levy is estimated to produce 1.5MtC/yr greenhouse gas savings by 2010. It will be introduced on a revenue neutral basis, with offsetting cuts in employer National Insurance Contributions. The rate of the levy will be set out in the Finance Bill 2000, and set on the basis of the energy content of the fuel. Additional support of £50 million has been set aside for schemes to promote energy efficiency, to promote low carbon technologies through a 'carbon trust', and to stimulate the take-up of renewables. A consultation paper, issued on budget day 1999, seeks views on the detailed design and administration of the levy, and invites comments on whether specific incentives for renewables could be given through the proposed structure of the levy. Such measures could affect the competitiveness of renewables and the need for support (or the type of support needed).

- **Industrial competitiveness** – The Government has published its White Paper **Our Competitive Future – Building the Knowledge Driven Economy**. The renewables market provides an opportunity for a new and innovative, knowledge-based industry to prosper in that environment.

- **EC White Paper on Renewables** – The European Commission's White Paper on renewables **Energy for the Future: Renewable Sources of Energy** proposes a target of doubling to 12 per cent the contribution of renewables to Europe's energy needs by 2010. The Council of Ministers has adopted a Resolution agreeing that there is need to promote a sustained and substantially increased use of renewable sources of energy throughout the European Union, and urging Member States to implement national strategies for the promotion of renewables.
- **Foresight Programme** – The Government's Foresight Programme identified alternative sustainable energy technologies amongst its key priorities "where further work was absolutely vital and demanding top priority".

## Summary of issues

26 There are strong energy policy arguments for supporting renewable energy as a component of our overall energy system. In particular, renewable energies offer diversity and security as well as sustainability and other environmental benefits. In the short term renewables may need support to help achieve the necessary economies of scale, technological development and investor confidence. In the longer term, non-fossil sources may form an increasingly large proportion of our electricity and energy systems and those of expanding economies, at competitive prices. Furthermore, renewable technologies need to be considered individually as they have different environmental impacts and are at different stages of development.

Views are invited on these issues.

27 The following sections of this paper go on to discuss the possible form of such support, how it should be delivered **and broad policy options for the future.**

## Blyth Harbour – Pioneering Wind Power

Border Wind's nine turbine semi-offshore wind farm, situated on the harbour wall at the port of Blyth, Northumberland was installed in 1992. Hexham-based Border Wind successfully won European Commission THERMIE funding for both this NFFO-2 scheme, and a fully-offshore (max 4MW) wind farm 1km from the coast. This offshore NFFO-4 scheme is due to be constructed in the summer of 1999. In addition the DTI has supported a bird monitoring programme to assess impact on birds.



*Blyth Harbour wind farm* Border Wind Ltd.

## Thetford

The 38.5MW Thetford Power Station – fuelled by 430,000 tonnes of poultry litter per year – is the biggest producer of power from biomass in Europe, generating sufficient electricity into the National Grid to supply the needs of 67,000 homes. Developed by Fibrothetford Limited – a member of the Fibrowatt Group – and drawing on experience from Fibrowatt's pioneering Eye and Glanford poultry litter fired plants, Thetford employed nearly 300 people during construction, will employ 30 people during operation, and demonstrates a technology with significant export potential already being realised with projects currently being developed in continental Europe and the USA.



*Thetford Power Station*  
TWC Engineering







### SECTION 3

# form of SUPPORT

28 The historic UK programme is described in Annex 4. UK policy has been to stimulate the development of new and renewable sources of energy where they have had prospects of being economically competitive and environmentally acceptable, in order to provide secure, diverse and sustainable energy supplies, reduce emissions of pollutants, and bring a competitive UK industry into being for home and export markets. It has involved a two part strategy:

- to stimulate demand for renewables and thereby the industry by providing a guaranteed market (at a premium price subsidised ultimately by the electricity customer) via the Non-Fossil Fuel Obligation (NFFO);

- support for research and development to assess potential, develop new technologies, disseminate information, remove barriers and stimulate an industrial capability. The current programme has spent almost £80 million since 1994 primarily on assisting those technologies with prospects of market penetration over the next 10 years.

29 This programme has been successful in its task of stimulating the renewable energy industry, introducing renewable energy into the UK energy mix and at the same time bringing down costs. The examples illustrated in this section and in Annex 4 show some of the major achievements of the programme. Amongst other things, it has ensured a contribution of up to 2 million tonnes of carbon towards greenhouse gas savings required to meet our international commitments.

## B9 Energy Biomass Limited – Northern Ireland

B9 Energy Biomass Limited won a NI-NFFO-2 contract to supply 200kW of electricity to the Northern Ireland Grid from wood fuel at the Blackwater Valley Museum in County Armagh. The fully automated, continuous feed, downdraft gasifier converts wood chips at high temperature into a combustible gas which is cleaned and cooled and used to fuel a compression ignition engine/generator set. The engine exhaust heat is recovered for hot water which is pumped to the museum's radiators for space heating. The Northern Ireland Department for Economic Development supported the project and the DTI are monitoring the performance of the plant.

## The Non-Fossil Fuel Obligation

The Electricity Act 1989 empowers the Secretary of State to require by Order that Public Electricity Suppliers in England and Wales secure a specified amount of generating capacity from non-fossil fuel and for a levy to be raised on electricity customers to meet additional costs involved. This Non-Fossil Fuel Obligation has been used to stimulate the market and industry to assist renewable energy technologies become competitive in the longer term without further support. Support for renewables amounted to about £130 million in the financial year 1998/99. This compares with the £1,200 million originally used to support nuclear capacity. The obligation is put out to competitive tender putting downward pressure on the costs of subsidy for renewables. Contracts are placed by the Non-Fossil Purchasing Agency on behalf of the Regional Electricity Companies for up to 15 years thus producing a long term stable framework for renewables projects. Analogous arrangements operate in Scotland and Northern Ireland.

## Key achievements of the programme strategy

- the initial R, D and D programme brought industry into renewables. Subsequent market stimulation has led to the creation of an embryo industry of over 700 organisations.
- major companies such as BP and Shell have declared long term strategies for renewable energy businesses and Eastern Electricity has set itself a target of utilising 10 per cent of its power from renewable energy sources by 2010;
- 650MW of electricity plant has been commissioned from NFFO contracts;
- the first few new generating projects outside NFFO are coming on stream and companies specialising in renewables trading and investment are beginning to be formed ('Green Trading');
- almost all of NFFO-1 and 2 projects whose NFFO contracts expired at the end of 1998 are expected to continue to generate under purely commercial contracts;
- private sector investment has been running at around £200–300 million per year in the renewables sector;
- the costs of generating electricity under NFFO contracts have been halved (NFFO-5 contracts were at an average of 2.71p/kWh compared with the average Pool Selling Price of 2.60p/kWh in 1998).

30 In short, the NFFO programme has a number of major achievements to its credit and can be considered a considerable success. Furthermore, the programme is essentially long term in nature – projects with contracts under the programme can take up to 6 years to build and will be under contract until as late as 2018 and probably generate beyond that date. The table below shows potential above-market costs of the NFFO programme:

Financial Year	Potential Above Market Cost of NFFO & SRO under Existing Policy (£million)
1998/99	130 <sup>1</sup>
1999/00	80
2000/01	110
2001/02	130
2002/03	145
2003/04	150
2004/05	150
2005/06	150
2006/07	150
2007/08	150
2008/09	150
2009/10	150
2010/11	130
2011/12	110
2012/13	80

1 Expenditure for NFFO-1&2 ended on 31 December 1998.

31 Why then is it necessary to reconsider support for this successful programme? An important factor is that the structure of energy markets is changing, as discussed in paragraphs 50 and 51. For the future, change in market structure also gives the opportunity to think about other options for support against the background of these structural changes and policy and market developments. In particular, following Lord Marshall's recommendations the Government is to introduce a climate change levy to encourage energy efficiency in business. The Government proposes to introduce the levy in 2001 and to consult beforehand on the technical details. There will be no overall

## Garrad Hassan

Garrad Hassan is one of the world's leading wind energy consultants and counts amongst its clients all the major manufacturers, wind farm developers and most of the banks with interest in this sector. The company has acted as Bank's Engineer for the world's five largest wind farm projects in Canada, the USA and Italy. These projects represent a combined investment of £500 million. The development of sophisticated tools for prediction of the behaviour of wind turbines and wind farms has been a theme of Garrad Hassan's work and these tools are now widely used throughout the industry. The DTI's programme has supported various projects with this company to evaluate wind resource, develop wind turbine technology in partnership with potential component suppliers and carry out market research on world-wide market and niche markets in the UK.

## Aerpac in Scotland



*Aerpac Factory*  
Aerpac UK

Aerpac designs and manufactures glass-epoxy rotor blades from 15m to 70m in diameter, for turbines of 50kW to

2MW. It has established a 4000m<sup>2</sup> production facility at Glenrothes, Fife, Scotland. Aerpac UK currently employs 70 full-time local employees; this is set to double within 2 years. This plant will supply customers serving the Scottish, Irish and English markets. It also acts as buffer capacity for the Almelo plant in the Netherlands. Aerpac UK is also involved in R&D activities.



*Aerpac Factory*  
Aerpac UK

## Resource Studies

In the course of the decade, the renewable energy resources of the country have been consistently mapped out through a series of



DTI

studies undertaken jointly between Government, the Regional Electricity Companies (RECs) and local planning authorities. Published studies show which renewables occur where and highlight the practical issues affecting the development of those resources.

## Guide to Finance for the UK Renewable Energy Industry

This guide, with the short title 'Going International', was produced for the DTI by Delphi International Ltd and Impax Capital Corporation Ltd. It aims to help UK renewable energy companies understand the issues involved in international finance and to explain the sources of finance and support, together with a number of case studies.



*Going International*

DTI

## Energy Power Resources Limited (EPRL)

Energy Power Resources Limited (EPRL) secured £101 million – one of the largest amounts raised to date by a renewable energy developer – through a mix of equity investment, loan facilities and project finance, in order to develop new projects fuelled by straw, agricultural and municipal wastes. Two projects, one straw fired and one poultry litter, are already under construction.

increase in the burden of tax on business as revenues will be recycled in full; the domestic sector will not be affected. The consultation will consider whether or not it would be possible to exempt renewables from the levy but there are a number of technical difficulties in doing so. The Government has nonetheless made it clear that there will be an extra £50 million for schemes aimed at promoting energy efficiency and support for renewables. Decisions about future support for renewables will need to take account of the inter-reactions with the climate change levy.

## Tackling the issues

**32** We need to see what more may need to be done to help ensure that renewables contribute to sustainable energy supplies. This is discussed below and in more detail in Annexes 5 and 6.

### *Planning and development control processes*

**33** Like any other energy source, renewable energy sources have environmental impacts which need to be taken into account. When local authorities assess applications for planning permission they have to take account of both the immediate impact of renewable energy projects on the local environment and their wider contribution to reducing emissions of greenhouse gases. The generally small scale of renewable energy projects and constraints on where they can be sited to take advantage of natural resources means that achieving this balance can present particular challenges. Indeed, it will rarely be the case that any individual project will be big enough to be essential in energy terms. Yet, overall, renewable energy sources have a significant contribution to make to achieving global environmental objectives.

34 Concerns have sometimes been expressed that the current NFFO scheme does not address e.g. environmental aspects sufficiently effectively. Future support mechanisms or obligations will need to deliver good quality schemes. Against the background of our targets for renewables, DTI and DETR are reviewing with the territorial departments whether the planning system is achieving the correct balance and what practical steps might be taken to ensure that the planning system enables renewable energy provision to contribute to the UK's sustainable energy needs while continuing to protect the countryside. Larger renewable plants, for example those dealing with energy from waste, can face different planning issues. The Government hopes shortly to publish a Planning Policy Guidance note on waste (PPG10) which will address the issues faced by EfW plants and landfill gas projects. There is also a need for better public familiarity with renewables. Local people's involvement and participation in renewables proposals will be increasingly important.

### *Embedded generation*

35 A second set of issues also arise from the generally **distributed** nature of renewables generation, but is more economic in character. Renewable forms of generation are very frequently 'embedded' – that is, they connect to the local electricity distribution system rather than to the main national transmission grid. It is important that the price generators receive for their electricity reflects this special situation. There are clearly some advantages in having electricity close to the point of consumption, including lower transmission costs and associated losses. There may also be disadvantages, and the sources may be less easy to control within an integrated system. Whatever the balance, it is important that the prices for embedded generation reflect the overall economics properly, so that renewables can compete on a level playing field.

## Green Electricity

The advent of green electricity supplies – made possible for individual consumers by the opening up of the domestic electricity market – allows customers the option of choosing an electricity supply supporting renewable energy generation, with suppliers such as the Renewable Energy Company offering a direct match between supply and generation and suppliers such as Eastern and Northern Ireland Electricity offering customers the opportunity to invest in a fund which will support sustainable energy development. Some suppliers of green electricity are offering their product at premium prices, others are seeking to supply at the same price as conventional electricity supplies.

## Energy Saving Trust – Renewable Energy Accreditation Scheme

The Energy Saving Trust (EST) are preparing to launch a new Renewable Energy Accreditation Scheme (REAS), with the aim of giving consumers confidence in the green electricity supplies now being offered. The scheme will ensure that suppliers' green claims are supported by independent auditing and that consumers know the mix of generation used to meet the tariffs they are choosing.

## The Wind Fund plc

The Wind Fund allows investors both large and small to take a stake in the development of renewable energy projects. Launched in 1995 by Triodos Bank and with two successful share issues to date, the company has invested in both small hydro and wind generation. The Wind Fund believe that an investment of 1,000 shares – £1,300 – would finance sufficient renewable generating capacity to meet the average household's electricity needs.

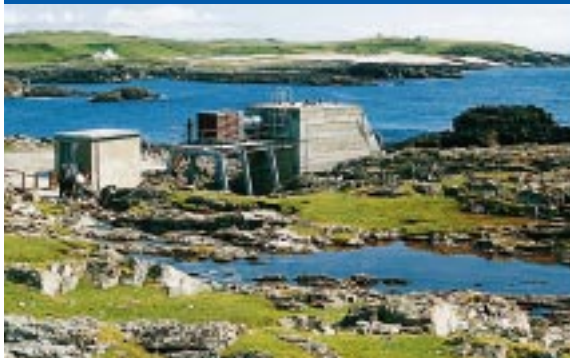


## Wave – Islay

Both the Government and the wave energy industry have learnt much from the innovative 75kW wave facility built on the coast of Islay. Although now at the end of its working life, the new generation wave energy devices now under development draw heavily on the experience gained.

The device has demonstrated the effectiveness of the oscillating water column concept and the operation of the Wells turbine which rotates in one direction irrespective of the driving air flow direction. Larger versions of this turbine (1MW) were installed in the world's first near-shore prototype, the Osprey.

The original device received £1.5 million support from the DTI through five separate stages which covered initial design, civil construction, design and installation of the mechanical electrical plant, plant operation and optimisation and finally decommissioning.



*Islay Wave Device*

DTI

36 In particular, it has been suggested by a number of commentators that distribution companies may not face proper incentives in this area – their income under their tariff controls may depend on the size of their distribution asset base (the wires they own). Where there is a choice between extending that asset base and accepting electricity from an embedded generator, they may prefer the distribution option to the generation option because of the distortions in the incentives they face. Removing these distortions should both promote more effective competition and create a level playing field for renewables.

37 The government is currently considering new legislation on the regulatory framework for the energy industries (gas and electricity) as part of its review of utility regulation. It will ensure that the regulator and the distribution companies have clear responsibilities to ensure fair competition in generation and distribution prices consistent with the use of the distribution system.

### *Availability of information*

38 Other, less tangible, obstacles to the development of renewables may have existed in the former monopoly dominated markets. For instance, **information** was not always available to consumers about renewable energy options – or in the monopoly market, they may simply have lacked the **opportunity** to express their preference for such “green” alternatives. Even when these alternatives are available, there is also the issue of trust, and the need to ensure that so-called “green” options are genuinely environmentally less damaging.

39 Several companies operate green electricity or investment tariffs and the Energy Saving Trust is about to launch an accreditation scheme for such schemes. Improving information flows, providing genuine consumer choice and information, are further examples of pro-market measures which should help stimulate demand for renewables. These issues are discussed in Annex 5.



### *Innovative technologies*

40 The Government's White Paper **Our Competitive Future – Building the Knowledge Driven Economy** sets out a strategy to reverse a century of relative decline and raise the sustainable level of growth in the UK. Innovation and new technology will be central to this objective; the development of sustainable technologies for the future, such as renewables, will be a key feature of a forward-looking economy.

41 As mentioned previously, many of the renewables technologies and the supplying industry are **immature and underdeveloped** compared with conventional options and hence costs tend to be high. There is often a reluctance to invest in what are sometimes seen as risky projects demanding a risk premium. Also some of the technologies which could make a major contribution to future energy supplies have yet to be demonstrated and suitable institutional frameworks are not yet in place. One example of this is offshore wind where the development and consent-obtaining processes are being explored. Another example is energy crops grown especially as a fuel where the farming industry is unwilling to fund the initial planting of crops unassisted when financial assistance is generally available for alternative activities. The Ministry of Agriculture and the territorial departments are considering what future support might be needed to launch this source. The Forestry Commission has made available planting grants for energy crops for demonstration projects currently being developed. Many technologies such as photovoltaics and fuel cells need further R&D to reduce costs and bring them to the point where they can begin to be deployed on a significant scale.

## Research and Development programme

42 Many of the issues referred to above, both the institutional and technological ones, will need to be removed if renewables are to develop. The Government plans to extend its support programme to help remove barriers to further uptake of renewables by further stimulating research, development and demonstration, disseminating information and facilitating industrial activities in UK and export markets.

43 The Engineering and Physical Sciences Research Council (EPSRC) has launched an expanded £3.5 million/year programme on renewables. A consultation exercise was undertaken by the EPSRC and priorities consistent with the strategy outlined in this document have been adopted with a view to the longer term prospects for renewables. The Department of Trade and Industry intends to increase expenditure on research and development, and plans to provide a growing budget for its support programme as follows:

Year	Budget (£million)
1998/1999	9.6 <sup>1</sup>
1999/2000	11.5
2000/2001	14.0
2001/2002	18.0

1 Estimated outturn.

The Department expects to share costs appropriately with industry within the European state aid provisions and for contributions to be sought from European sources, most notably the Fifth Framework Programme. The support programme proposals are summarised in Annex 7.

## Near Term (by 2000)

Technologies closest to being competitive in UK or with immediate export potential

### UK and Export Market

Wastes and some biomass residues,  
Landfill gas, Onshore wind, Hydro,  
Passive solar.

### Primarily Export Market

Photovoltaics (stand alone),  
Biomass residues, Active solar

## Medium Term (by 2010)

Additional technologies which could contribute by 2010 and would be needed to meet a 10 per cent UK target, or with export potential:

### UK and Export Market

Some biomass residues, Offshore wind,  
Energy crops

### Primarily Export Market

Photovoltaics, Fuel cells

## Longer Term (after 2010)

Technologies with longer term potential if pursued via R, D&D programme:

### UK and Export Market

Fuel cells, Photovoltaics (building integrated), Wave, Photoconversion

### Primarily Export Market

Solar thermal electricity

## Very Long Term (after 2025)

Technologies unlikely to be worth pursuing extensively at this time except at the fundamental research level where this would be perceived as necessary:

### UK and Export Market

Tidal barrage, Hydrogen, Geothermal hot dry rock, Ocean thermal currents

44 The Government also plans to introduce a volume-based R&D tax credit in the year 2000 for SMEs spending more than £50,000 p.a. on R&D. It will increase the existing 100 per cent tax credit to 150 per cent so that at the smaller companies' rate the cost of R&D would be reduced by 30 per cent. It will also be extended to companies not yet in taxable profit.

### *Technology priorities for Research and Development*

45 Within any programme, priorities will have to be set for the development of technologies in terms of their likely cost effectiveness in home and export markets, the contribution they can make to reducing greenhouse gas emissions on differing timescales, and the scale and timing of any contribution. A classification of technologies on this basis (derived from the analysis in Annex 3 and the supporting report) is given opposite.

46 It is proposed that DTI will prioritise its budget primarily towards the technologies as relevant to the short, medium and longer term periods in the classification table, taking account of other UK and European sources of funding. The technologies for the short and medium term would also need consideration for market stimulation.

## Summary of issues

47 Renewables would be helped significantly by tackling the issues discussed in paragraphs 32 to 41, and in Annex 5. The Government is reviewing how the planning system can contribute to the development of renewable energy. There is a potential market for 'green electricity', that needs to be encouraged, including addressing any obstacles there may be to consumer acceptance of 'green electricity'. It is also important that renewable electricity should pay a fair price for its use of the distribution system. There also remains a necessity for an

ongoing Government research and development support programme, based on the technology priorities indicated in paragraphs 45 and 46 and Annex 7.

Views are invited on these issues.

## Market stimulation measures

**48** Paragraphs 32 to 41 discussed a range of measures particularly relating to the development of renewables. It must, however, be recognised that it is likely that for the reasons discussed above (particularly the need to encourage long term technologies and the environmental benefits of renewables) some more positive form of market stimulation would then fall to be considered.

Options include:

- **Economic instruments: taxes or emissions trading permits.** The Chancellor announced in the budget the intention to introduce energy taxes on electricity supplied to businesses, with consultation on whether the structure of the tax could be amended to assist renewables. He also referred to a pilot emissions trading scheme in discussion with industry. However, unless directed at specific renewables technologies, such support would not be selective and might not bring forward the newer, and initially more expensive, technologies needed for the longer term.
- **A scheme to stimulate a market for renewable sourced electricity.** This could take the form of a simple obligation to ensure that a specified proportion of electricity from renewables was sold or it could be targeted on specific technologies, particularly new ones. It could include related technologies such as combined heat and power from non-fossil sources and might or might not involve public expenditure.
- **Direct grants,** including any available European Structural Funds and support from the EC's Fifth Framework Programme, and directed to new (including demonstration) projects could also be used to stimulate the market.

## Impax Capital

Impax Capital is a financial advisory firm specialising in green and environmental utilities. Founded in 1994 and regulated by the Securities and Futures Authority, it is authorised to provide financial advisory, asset management and strategic consulting services to its UK and overseas clients.

Impax Capital's clients range from project developers and technology providers, to government agencies, private and institutional investors. Impax Capital has arranged the project financing for Europe's largest chicken-litter fuelled power station and for the world's largest straw-fired power station. To date, Impax Capital has raised over £200 million in debt and equity and is mandated to raise a further £650,000 for its clients, making it the leading financial institution in Europe with an exclusive focus on environmental utilities. Impax Capital drew on the advice of the DTI's Finance Guide.



49 These possible approaches could be complementary to one another. This paper does not look in detail at wider fiscal options which raise different and more general policy questions. Emphasis in this section is on how an obligation mechanism might best be used to stimulate the market for electricity from renewable sources, and in particular on how a future scheme might work in the reformed electricity market.

## Market stimulation of renewables in a reformed electricity market

### *The market is changing*

50 The UK electricity market is in transition, as a result of the introduction of domestic supply competition, utility regulation reform, reform of the electricity pool (England and Wales only), electricity wholesale trading arrangements and industry restructuring. The Government recognises that these changes will have a significant effect on all players in the market, including renewables generators.

51 The key features of the reformed market are:

- **A fully competitive supply market.** Once the process of introducing competition in electricity is complete later this year, no suppliers will have a monopoly in the supply market or long term tied consumers. All suppliers will be put on an equal basis for regulatory purposes. This will make it difficult to specify a specific sub-group of suppliers which could take on obligations relating to the promotion of generation from renewables – at present only Public Electricity Suppliers have this obligation. Furthermore, in a competitive market individual suppliers may not have sufficient security to be able to sustain an obligation placed on them to purchase specified quantities of renewable electricity over a prolonged period because they will be unable to guarantee a minimum customer base in a competitive market environment. It would also be vital for any obligation to preserve a level playing field between different companies: any mechanism must work with the competitive supply market and avoid introducing market distortions.

- **Separation of supply and distribution business** is to be introduced in the electricity market following the consultation on the Government's Green Paper *A Fair Deal for Consumers*. This will mean that for regulatory purposes the separate businesses of electricity supply (buying and selling electricity) and electricity distribution (transporting electricity to consumers) will have to be distinguished. Detailed proposals will be announced later this year. The development is likely to leave supply businesses as ones whose key commercial objective is to manage their risks. Distribution on the other hand will remain, like transmission, a closely regulated monopoly activity, with the clear aim that distribution businesses should be ringfenced from in the competitive electricity market.

- **New wholesale electricity trading arrangements** will be introduced in England and Wales to replace the present electricity pool (the wholesale market for electricity). They are likely to reward plant with a flexible and predictable output. Inflexible and unpredictable plant are likely to fare relatively less well. Any obligation would need to take account of the additional risks this brings to certain types of renewable generation, especially wind. It is also important that the new market is transparent and undistorted, and essential that the new arrangements take proper account of the special characteristics of less conventional forms of generation such as renewables and CHP. The Government has asked that this aspect should be given particular attention in the detailed elaboration of the new arrangements. These issues are addressed further in Annex 6.

52 Consideration would need to be given to where, in the new electricity industry, any obligation could be placed. There are only two realistic options which are briefly discussed below and in more detail in Annex 6:

- One option, to place the obligation on the **distribution** companies, is attractive at first sight. Where there are public interests that the market is unlikely to satisfy fully, these could be assigned to the natural monopoly (the distributors), as they provide an opportunity to pass on the above-

market costs without having any impact on the competitive supply market. However this option could raise problems of principle since the purpose of the proposed separation of businesses is to ensure that distribution businesses do not get involved in the competitive electricity market. However, suitable mechanisms could be devised to mitigate these difficulties.

- an alternative, therefore, is that any obligation could be based on **supply** companies. Given that they would be operating in a competitive market, mechanisms would have to be found for ensuring a level playing field. Annex 6 discusses some of the possibilities.

**53** In principle, alternative approaches could be considered, for instance an obligation on generators or on customers. However, these options are unattractive for the reasons discussed in Annex 6.

### *Nature of obligation*

**54** A further question is the nature of any obligation. Should it be in terms of capacity or of electricity supply? Should it be a generic obligation (i.e. simply to include a proportion of renewables in the supply mix) or should it have some way of focusing on particular technologies? How should an obligation be funded? Historically, additional costs of renewables have been met by electricity customers via a levy in their bills. Is a levy mechanism desirable?

**55** The analysis in Section 2 suggests that the longer term aims of support for renewables might be better met by a more targeted scheme which encouraged the development of new renewables with potential for the longer term; on the other hand, there are clear dangers in trying to pick winners and arguably more efficiencies will be gained by choosing the lowest cost way of meeting an obligation – again the arguments are spelt out in more detail in Annex 6.

### *Transitional arrangements*

**56** The Government is committed to ensuring the integrity of the existing NFFO contracts. This is being considered as part of the review of electricity trading arrangements.

**57** It will be important to maintain investor confidence in NFFO contracts already in place. These represent over 2.5GW of capacity much of which is expected to seek project finance and go forward to commissioning over the coming 5 years. At present in England and Wales it is the host Public Electricity Suppliers (the Regional Electricity Companies) together with the Non-Fossil Purchasing Agency that have contracted with generators in non-pooled NFFO contracts. Were the ex-PES supply businesses to become parties to these contracts they would lose some commercial flexibility in the competitive supply market. They might also, depending on any future “reference price” (see paragraph 58 below) incur additional costs. Further consideration will need to be given to whether, and if so how, these contracts can be embraced by any new arrangements.

**58** There is a more technical question related to the appropriate “reference price” for contracts under the old NFFO arrangements (and potentially any new scheme). For England and Wales an estimate of the wholesale price of electricity (the pool price) has been used as the “reference price” to estimate the additional costs of renewables above that of alternative supplies of electricity from fossil fuels. In Scotland, to reflect the different structure of the industry there, the reference price is currently set at the marginal cost of production at Longannet Power Station. That reference price will need to be considered in the light of any changes to the reference price in England and Wales. The electricity pool will be replaced primarily by bilateral contracts and so some other method of establishing a “market” price for

calculation of subsidy under the current NFFO arrangements will be needed. Implications of alternatives for a reference price are referred to in paragraph 67 and explained in Annex 6.

### *Legislative issues*

**59** As mentioned in paragraph 51 the Government has already announced its commitment to new legislation – a key aspect of which will be to license supply and distribution separately. This will provide the opportunity to address the barriers implicit in connecting embedded generators to the distribution system addressed in this Section and Annex 5. The new legislation would also provide the opportunity for a broad new enabling power for a market stimulation mechanism. The detailed workings of the mechanism could then be set through secondary legislation, thus offering greater flexibility. Such legislation would contain a transition mechanism to ensure that changes in the legislation did not create problems for any existing or new NFFO contracts. Further details of the proposed legislation can be found in Annex 6.

## Summary of issues

**60** As described in paragraphs 50 and 51, and Annex 6, the mechanisms for supporting renewables would need to change given electricity market developments, particularly the introduction of a competitive supply market, the separation of distribution and supply activities and the review of electricity trading arrangements. The nature of any new renewable energy obligation would need to be carefully designed to ensure that it stimulated timely investment in new renewable electricity generating capacity at minimum cost to the electricity consumer. This could be achieved by placing obligations to purchase renewable electricity either on suppliers or distributors. The obligation could be technologically neutral or include a mechanism to bring forward specific, longer term technologies. Under either

approach it would be important to ensure that the cost of renewable electricity was minimised. The need for any new levy arrangements would depend on the nature of any new obligation arrangements put in place.

Views are invited on the foregoing and on the possible mechanisms outlined in Annex 6.





## SECTION 4

# policy options for THE FUTURE

61 The previous sections have discussed why renewables should be supported, and what forms of support could be given. This section looks in more detail at broad policy options for the future.

62 A variety of possible aims for future UK policy could be considered, including:

- assisting the UK to meet national and international targets for the reduction of emissions including greenhouse gases;
- helping to provide diverse, secure, sustainable and competitive energy supplies;
- stimulating the development of new technologies necessary to provide the basis for, and continuing growth of, the contribution from renewables into the longer term future;
- assisting a UK renewables industry to become competitive for home and export markets;
- assisting to provide employment in a rapidly expanding sector.



The cost (but also potentially the pay off) of implementing a strategy would rise with the number of aims to be met by it. In principle a policy could be limited to contributing to the first two aims in the short and medium term via a limited obligation, perhaps on a simple electricity generated basis, though with some activity to address other issues. However, if an option is required which could provide for a growing contribution into the longer term (though at a higher cost), then further activities would need to be added; new technologies would need to be brought forward initially by research, development and demonstration. On the basis of past experience, this would then need to be followed by market stimulation, perhaps based on specified capacities of the targeted technologies. This option would give an enhanced opportunity for UK industry to develop, serving UK and export markets.

## Strategies and targets

63 More detailed strategies can be derived to serve the possible aims above and targets developed against those strategies. The UK has greenhouse gas reduction targets for the period 2008–2012 which could point to the operation of a renewables strategy over a similar period. But the more important contribution from renewables would probably come after that date, when new and tighter international targets can be expected. A strategy should therefore also need to have regard to the longer term. Another key consideration would be the levels of industrial investment required to achieve significant deployment of renewables. This will only be forthcoming if industry has confidence in a stable and long term commitment to a policy. This again suggests that a commitment over a minimum of a decade would be required for a strategy to succeed. Intermediate targets against which progress could be measured would also be advantageous.

64 A combination of market stimulation, via a developed form of obligation, in association with a package of measures to remove barriers and develop future technologies is likely to be needed. If successful that could open the path to growing longer term deployment of renewables on a competitive basis.

**65 A possible strategy would be to assist the creation of long term options for a continuously growing contribution from renewables with a competitive industry to supply UK and world markets, perhaps using a developed form of obligation in the electricity market. UK milestones of 5 per cent electricity from renewables by 2003 and 10 per cent by 2010 could be the benchmarks for progress.**

This would be likely to involve measures selected from the following:

- bringing the nearly mature and new technologies to the point of economic competitiveness over the next decade so that they can then be deployed in the liberalised market;
- continuing stimulation of the electricity market, via a developed form of obligation;
- promoting new and initially more expensive technologies (for example offshore wind and energy crops) since the resource for some of the more mature resources may have been largely utilised. This would also provide capability for continuing longer term growth in the contribution from renewables;
- a continuing DTI support programme and action by all parties to tackle issues relating to the development of renewables;

- development of longer term technologies such as fuel cells, photovoltaics and wave which are unlikely to contribute significantly in UK markets by 2010, but could be major contributors in the longer term if successful and would be required if a continuing growth in renewables were needed;
- development of industrial competitiveness and exports;
- demonstration of technologies in the important but not historically-treated heat and transport markets.

## Possible cost of support measures

66 No attempt has been made at a detailed costing of such a strategy – given the context outlined above, the cost could clearly vary considerably according to what other measures were in place, how the policy was implemented, and its detailed objectives. There is also no single figure for the cost of renewable technologies. There is a range of figures, varying for the particular renewable source, its location, the stage of its development, and the timescale chosen. Annex 3 contains some indicative estimates which are drawn from the accompanying report to this consultation paper, **New and Renewable Energy: Prospects in the UK for the 21st Century**.

67 There is an additional, specific problem in costing the possible routes for market stimulation via an obligation, arising from the structure of the present arrangements. These are based on the cost of a cross-subsidy which is in turn based on the pool price. The pool price (the price at which generators bid and which is used to determine the plant which operates) does not necessarily represent the value of electricity produced by an embedded generator in England and Wales. This could be higher, as explained in Annex 6. The Pool price may therefore not be the appropriate reference point for embedded generation such as renewables. There is therefore reason to believe that the current size of the NFFO levy is not necessarily an appropriate measure for the true cost of support for renewables.

68 It is also difficult to calculate the likely outcome in the absence of any support, or if only the measures to remove institutional barriers discussed in Section 3 are taken forward. The cost of individual renewables is site specific, and it is therefore difficult using traditional economic models, to judge how far they would succeed commercially in the absence of further support, especially given the changes in the market structure already underway and the level playing field measures proposed above. Without further support for renewables (i.e. subsequent to the NFFO arrangements already in train), it is therefore not clear how far the penetration of renewables would go beyond the 5 per cent of electricity production expected for 2003.

69 One of the purposes of the review was to determine what would be necessary and practicable to achieve a target of 10 per cent of UK electricity, to be produced from renewables by 2010. The Government believes that it is feasible to work towards a 10 per cent target and has set this as its aim. It hopes that it will be possible to achieve this target cost-effectively by around 2010. However, it follows from the above that no precise costing can be given at this stage. The cost of meeting this target would in practice depend on the precise mechanisms chosen, including the forms of market stimulation, the particular objectives of the programme, what other market reforms had taken place etc. Decisions will reflect the relationship between costs and benefits. Costs and benefits of measures designed to combat climate change will be considered in the context of the Climate Change White Paper which DETR plan to publish in the Summer.

70 Support for renewables through the NFFO has been running at well over £100 million per year (though it has recently fallen as the contracts under early NFFO rounds no longer attract support). A more ambitious programme to raise renewables penetration by a greater percentage could involve proportionately greater costs – if passed on to consumers, this could add 1–2 per cent or more to electricity prices. Other measures to reduce greenhouse gas emissions also have economic costs. A new levy arrangement might not in practice be necessary if the additional costs could be imposed equitably either on all distributors or on all suppliers as the case may be. However, the economic costs involved are not affected by whether there is a levy. Any additional costs arising from an obligation would be borne ultimately by the electricity customer whether or not a levy was involved. The bottom line is that the cost is real, and the justification for such expenditure would need to be analysed carefully.

## Key activities for parties involved in any future strategy

71 To achieve success, further programmes will need involvement and activity by many parties. Key aspects include:

### For industry:

- a willingness amongst equipment suppliers, large and small developers, utilities consultants and financiers to pull together, and make the necessary investments and share in the risks;
- take public opinion with them on issues of environmental acceptability of significant numbers of locally sited power plants.

### For central and local Government including Northern Ireland Office (NIO), Scottish Office (SO) and Welsh Office (WO):

- prime responsibility for establishing a legislative and regulatory framework for the energy market, including the provision of any incentives arising from the introduction of the Climate Change Levy, whether through the Levy structure or by giving tax relief or credits; and for providing guidance to the regulator on the Government's environmental policy (DTI and C&E);
- prime responsibility for setting the regulatory framework for the energy utilities, and industrial and science support budgets in line with Foresight recommendations on priorities and opportunities for UK industry and sustainable development (DTI and SO);
- considering future planning and development control issues and particularly how to maintain a balance between overall environmental benefits in national terms and local environmental impacts in light of experience gained with NFFO projects. (DETR, SO, WO, NIO, Local Planning Authorities);
- considering future support mechanisms or obligations which will need to deliver good quality proposals;

- considering the need for regional approaches or targets bearing in mind any special duties of the new National Assemblies in Northern Ireland and Wales and the Scottish Parliament to promote sustainable development (NIO, WO, SO,). It would need to take into account existing systems and environmental considerations;
- monitoring to ensure appropriate emission standards are maintained (Environment Agency NIO, SO and WO);
- helping the construction industry to become confident about renewables, improving cost-effectiveness, and updating building regulations as required to take account of renewable energy sources (DETR, DTI, NIO, SO, WO);
- maintaining an appropriate national waste strategy (DETR, C&E, NIO, SO, WO);
- producing a national energy crops strategy (MAFF, NIO, SO, WO);.

#### For the Regulator:

- ensuring that within the policy and regulation framework renewables and embedded generators generally are given a full opportunity to compete and that necessary codes and guidelines are established and do not disadvantage them;
- ensuring that renewables are given full consideration within the economic, environmental and social framework proposed for regulation of the energy utilities.

#### For the energy companies:

- developing their own commercial strategies consistent with an overall need for sustainable development and playing a full role in the development of renewables;
- ensuring that necessary codes and guidelines exist to interconnect renewables to their systems with equitable distribution of costs (Electricity distribution companies).

#### For non-Governmental organisations such as the Energy Saving Trust:

- establishing a "green electricity" accreditation scheme in order to give the public confidence that electricity marketed as being produced from renewables is in fact so;
- helping to inform the public on the nature and characteristics of renewables.

#### For members of the public:

- acceptance that the development of new lower environmental impact technologies will require a marginal increase in costs in the short term;
- acceptance that deployment of these renewable energy technologies will require many small and locally sited power stations with some unavoidable local environmental impact but with wider environmental benefits in reducing emissions, and contributing to the development of sustainable local electricity supplies;
- supporting "green electricity".

## Summary of issues

### 72 Policy options include:

- continuing support for renewables can help achieve future UK policy aims. An appropriate and robust strategy would be necessary to ensure a continuously growing contribution from renewables. There is, however, uncertainty about the costs of supporting renewables, and the extent to which they would develop without specific support;
- a variety of detailed aims could be considered. The overall objectives should be to ensure that the momentum of renewables development is continued, confidence in the industry is maintained, and development of renewables continues to meet our longer term objectives;
- the cost of an obligation mechanism designed to reach a 10 per cent target is uncertain, as noted above, but it could be mitigated by ensuring renewable generators pay a fair price for connection to the local electricity distribution system. A more reasonable estimate of the cost of any such mechanism could be made once the various other pieces of the jigsaw (electricity market reform; the outcome of the consultation on the Government's proposals for a climate change levy; removal of barriers etc.) are in place and the costs are better understood and reflected in prices;
- as noted above, the overall climate change programme will be designed as a balanced overall package. The place of renewables needs to be considered carefully within this wider context to ensure a coherent overall approach. Renewables have an important role to play as a longer term measure. The achievement of diversity and sustainability argue in favour of keeping up the momentum of a successful renewables programme;
- regional approaches or targets to ensure the progress of sustainable projects.

Views are invited on the foregoing, including on the balance between different elements of a renewables programme, and in sum, to determine the right level of support against the background of rapid market developments.





## SECTION 5

# responses to CONSULTATION

**73** Your views are invited on the analysis set out in this document and the issues listed in Sections 2–4 covering the rationale for supporting renewables, the form of that support and future policy options.

**74** Responses to this consultation document should be sent to one of the addresses opposite by 28 May 1999. DTI plans to publish at least a summary of comments received (though excluding those of any contributor who objects to their comments being published).

**75** Please also note that following devolution, the Northern Ireland and Welsh Assemblies, and the Scottish Parliament will also have responsibilities for many of the policies which relate to encouragement of renewable energy. These include the environment, climate change, planning, the countryside and natural heritage. Comments

received from respondents in Northern Ireland, Scotland and Wales will therefore be copied to the NIO, SO and WO respectively.

*By post to:*

Mr Neil Hornsby  
Room 1115, Energy Technologies Directorate  
Department of Trade and Industry  
1 Victoria Street, London SW1H 0ET

*By e-mail to:*

neil.hornsby@hend.dti.gov.uk

This consultation paper is also available on the Internet at the DTI web site:  
<http://www.dti.gov.uk>



# A N N E X 1 NEW & RENEWABLE ENERGY POLICY REVIEW

## Terms of reference

1 To review **new and renewable energy policy**, including consideration of what would be necessary and practicable to achieve 10 per cent of UK's electricity needs from renewables by the year 2010.

2 To consider the potential contribution which new and renewable energy technologies can make to meeting future **greenhouse gas reduction commitments**.

3 To prepare **costed options** for consideration by Ministers.

4 To review the current status of all the **new and renewable energy technologies** described in Energy Paper 62 and to assess their potential to contribute towards meeting our future energy needs and environmental objectives.

5 To review the status of the **UK New and Renewable Technology Industry** including its prospects in both the **home and export markets**<sup>1</sup> and its potential contribution to meeting industrial and employment goals.

6 To consider the role of the **Non-Fossil Fuel Obligation (NFFO)** including possible refinements to it and the need for any additional market enablement mechanism(s).

7 To consider the need for **research, development, demonstration and dissemination (R,D,D&D)** including the DTI New and Renewable Energy Programme and Technology Foresight.

8 To consider the **barriers** to the deployment of new and renewable energy and the measures which may be necessary to overcome them.

9 To **provide appropriate links** with the Clean Coal and CHP<sup>2</sup> Reviews and to take account of the potential for reductions in future energy demands as a result of the adoption of energy efficient measures.

10 To **provide appropriate links** with the Comprehensive Spending, Climate Change and regulation Reviews.

1 Markets to include electricity (both grid and non-grid connected), heat and transport

2 This review is being carried out by DETR

# A N N E X 2 CURRENT STATUS OF RENEWABLES

1 World-wide, traditional renewable sources of energy are estimated to meet between 15 and 20 per cent of final energy demand – predominantly from hydro-electricity, wood, biomass and geothermal. In the UK in recent decades they met around two per cent of the country's electricity needs mainly from hydro-electricity, equivalent to one per cent of primary energy demand. 'New' renewables are just being brought to the market.

2 The technologies, markets and supply industries are at widely different stages of development. Some, such as traditional hydro-electricity, are well established. Solar water heating is spreading rapidly in countries with high insolation levels. Other technologies, such as wind with around 9GW installed world-wide, are being deployed commercially but are not yet fully competitive. Others such as energy crops are at the demonstration stage, and still others require substantial R&D before they could be demonstrated and deployed. Photovoltaics is finding competitive commercial application in niche markets and has enormous long term potential but needs substantial R&D and market development if it is to become competitive on a widespread basis. A substantial part of the early, large scale-market for photovoltaics is likely to be in developing countries away from already established energy supply infrastructure.

3 Renewable energy technologies tend to have high capital costs since they use dispersed low energy-density sources such as wind and low operating costs because fuel is free or low cost such as waste. Studies by the International Energy Agency have shown that promotion programmes over the last decade, including R&D, demonstration and market stimulation, have typically reduced the capital cost of renewable energy technologies by about half. A further 50 per cent reduction is projected for the next decade although there are expected to be substantial variations around this average. Costs are therefore expected to continue to fall faster than those for conventional technologies. It is not however possible to predict when individual new renewables technologies will be competitive with conventional technologies in particular given the uncertainty of future fuel prices.

4 New and renewable energy sources utilise a very wide range of technologies, fuels and locations contributing to diversity and security of supplies. Most technologies are small-scale, modular and must be applied close to the resource. Some are deployed in rural and others in urban areas. In England and Wales, planning procedures are generally governed by the Town and Country Planning Acts (similar legislation applies in Northern Ireland and Scotland), and associated guidance rather than the Electricity Act. Section 36 of the Electricity Act only applies generally to generating stations above 50MW in size in England, Wales and Scotland.

## Environmental characteristics

5 Many renewables technologies produce no environmental emissions. Those which do, generally produce substantially less emissions than conventional sources of energy. Others such as energy crops recycle carbon, by taking up as much carbon during growth as they give out in combustion, thus with no net addition to CO<sub>2</sub> in the atmosphere. Renewables can therefore contribute substantially to reducing pollution and in particular to reducing greenhouse gas emissions. For example producing 10 per cent of UK electricity from renewables could reduce CO<sub>2</sub> emissions by between 3.5–5.4 MtC. above that from existing programmes and could contribute to the Government's domestic goal of a 20 per cent reduction in CO<sub>2</sub> emissions by 2010. No energy source is however free of environmental impact and renewables need careful attention to mitigate local impact such as visual intrusion, transport movements, noise, other emissions and recycling of equipment at the end of its operational life.

6 Commercial decision making often does not take full account of environmental costs which are not fully reflected in prices. If they were to do so then the balance would shift towards renewables. There is however considerable uncertainty about the magnitude of these environmental externalities and it may be difficult to incorporate them directly into economic appraisals in the near term.

## Employment issues

7 The UK renewables industry is estimated to employ around 3,500 staff directly. It is believed that the manufacture and operation of renewables plant is more labour intensive than for conventional energy sources. In an expanding world market there is also the opportunity for the UK to develop its own industry. These two factors could lead to job creation in the UK. On the basis of preliminary studies for the European Commission, combining a 10 per cent aim with an exports drive might result in 10,000 – 45,000 additional net jobs in the renewables sector in the UK. However there is little well-founded analysis in this area and therefore estimates must be treated with caution. There is also little information on the extent to which investment in renewables would displace investment in other fields which could also have an impact on employment.

8 Renewables tend to be dispersed, some in rural areas, and there is therefore a tendency for employment to follow that pattern. For example if energy crops find large scale application then that could increase rural employment.



# A N N E X 3 POTENTIAL FUTURE MARKETS

## World

1 Renewables are seen as making an increasing contribution in the medium term and playing a very substantial role in the long term by most institutions producing projections of future energy needs. There is however wide variation between scenarios representing historic policy circumstances with modest growth in renewables and those seeking 'sustainability' with rapid growth in renewables. The EC estimated the world market for renewables at £31 billion in 1990. The EC White Paper on renewables estimated that the internal business in 2010 will be valued at 37 billion ECU, with a further 17 billion ECU from exports in the expanding world markets. Estimates based on World Energy Council projections indicate cumulative investment in renewables ranging from £150 to £400 billion between 2000 and 2010. Shell scenarios which assume pressure towards sustainability show renewables meeting 40 per cent of world energy needs by the middle of the next century. But on any of these scenarios there is a new and rapidly growing market which UK industry has the opportunity to service.

2 The current emphasis on sustainability and CO<sub>2</sub> emission reductions has led most countries to institute policies and programmes to assist renewables to become competitive on a widespread basis and to promote their deployment. International institutions also are seeking to promote renewables. The World Bank, Global Environmental Facility and International Finance Corporation have launched a series of aid schemes. These include the Solar Initiative, the Solar Development Corporation and the Market Technology Initiative, all with the aim of promoting uptake of renewables in developing countries to assist their economic development whilst limiting emissions.

## Europe

3 The European Commission's White Paper on Renewables proposes a target of doubling the contribution of renewables from 6 to 12 per cent of Europe's total primary energy needs by 2010. The Council of Ministers has adopted a Resolution agreeing that there is need to promote a sustained and substantially increased use of renewable sources of energy throughout the European Union, and urging Member States to pursue national strategies for the promotion of renewables with a view to bringing about a substantial increase guided by the White Paper's indicative target of 12 per cent.

4 The capital investment needed to achieve this was estimated by the Commission to be 165 billion ECU. The White Paper proposes a series of subsidiary targets for individual energy sources including 40GW of wind, 105GW of hydro-electricity, 3GW of photovoltaics and 135Mtoe of biomass. The White Paper sets out an Action Plan with 37 different action lines.

These include a number of proposals for directives and communications from the Commission as well as a variety of actions that Member States are expected to implement. Topics covered include:

- fair access for renewables to the electricity market;
- taxation of energy products;
- start-up subsidies for production plants, small and medium sized enterprises, and job creation;
- development/harmonisation of 'green' funds;
- increasing market share of liquid biofuels in transport;
- amendment of the SAVE directive to take account of passive and active solar and to extend its scope to building materials with low energy content;
- renewables to be among the main priorities in allocating regional development funds;
- promotion of biomass in the Common Agricultural Policy and rural development policy;
- renewables to feature in work with third countries under the Lomé Convention, and EC support schemes such as PHARE, TACIS and SYNERGY;
- support through ALTENER II and Fifth Framework Research and Technology Development Programme;
- relaxation of competition and state aid rules to favour renewables.

5 The White Paper also proposes a 'campaign for take off' which comprises four key actions:

- installation of 1 million photovoltaic systems, half in building roofs/facades within EU, the other 500,000 as exports for rural electrification (estimated cost 3000 MECU);
- installation of 10GW of wind farms (10,000 MECU);
- 10GW biomass CHP plants (5000 MECU);
- integration of renewables in 100 communities so that they are 100 per cent supplied by renewables (2500 MECU).

6 The Commission has since prepared a draft proposal for a Fair Access Directive which covers measures for harmonisation of market support measures, national targets including achieving at least 5 per cent of electricity from renewables by 2005 and not less than a 3 percentage points increase from the current contribution, codes for connection arrangements for generators to distribution systems, and removal of planning barriers.

## UK

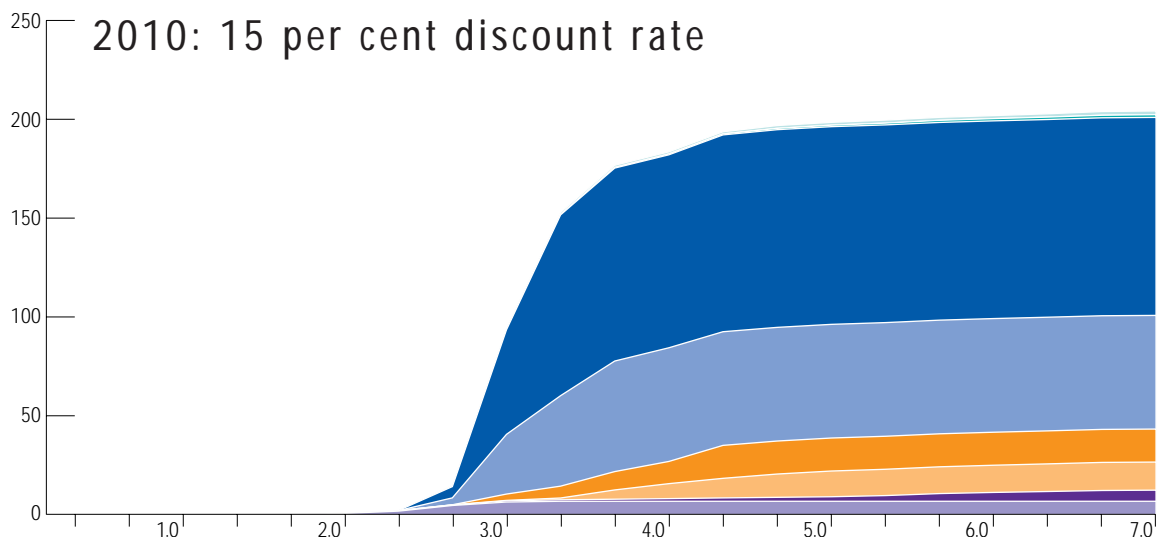
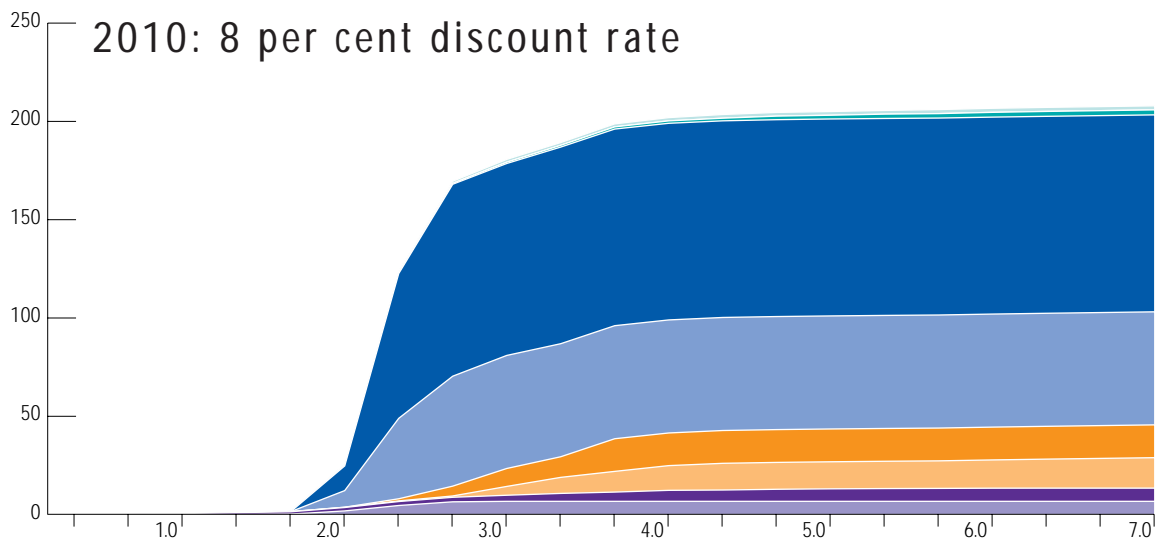
7 An updated study estimating the potential contribution of renewables in the UK electricity market has been undertaken for the Review. It suggests an available resource from renewables of up to about half of current UK electricity consumption at prices below 3p/kWh in the longer term assuming a development programme can be successfully carried out. A typical cost resource curve is illustrated in Figure 2. This estimates the cumulative resource available from which electricity could be generated at the price indicated. It is shown at two interest rates and at two years in the future (2010 and 2025). Renewables are assumed to continue to develop between 2010 and 2015 and hence become cheaper. How much of this resource might prove economic or possible in planning terms will depend on future circumstances, including the price of electricity more generally.

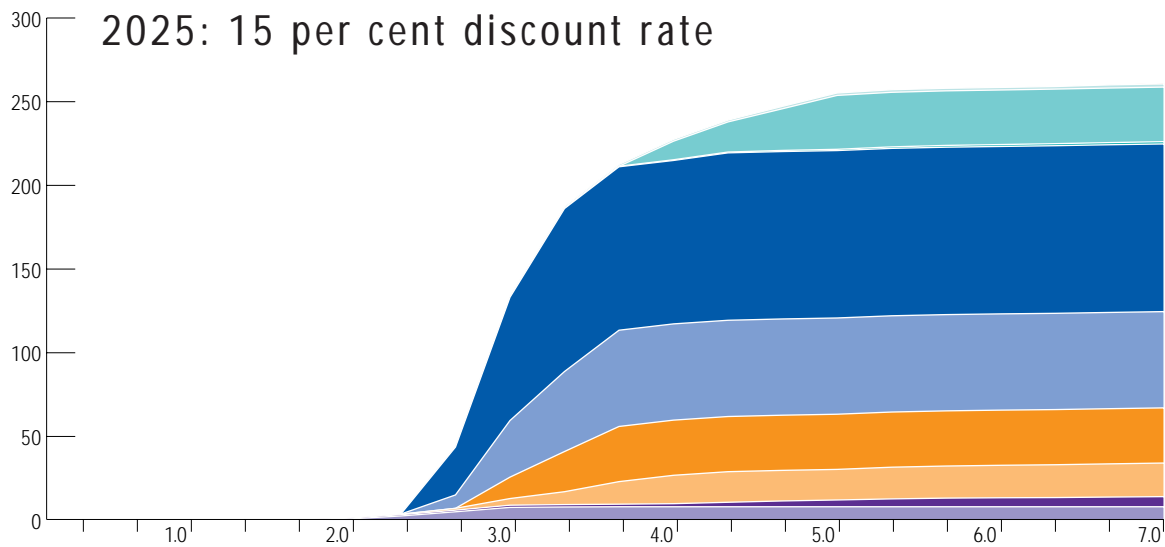
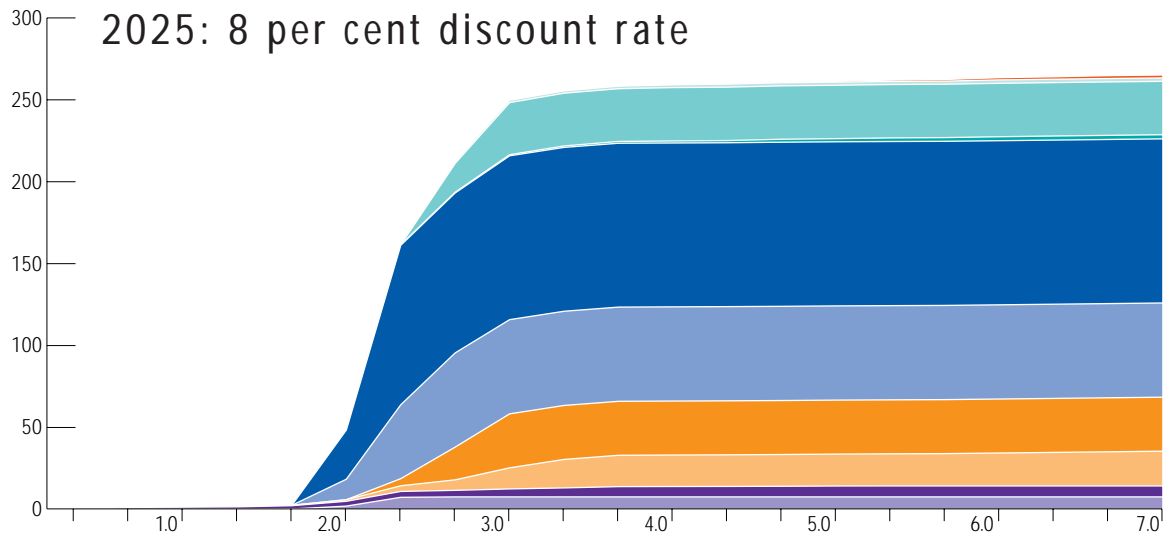
8 Scenario studies suggest that obtaining 10 per cent of electricity from renewables by 2010 appears to be feasible (Renewables provided 2 per cent of the UK's electricity supplies in 1997). On the basis of the cost curves at Figure 2, a 10 per cent contribution could be achieved at a cost of around 3.5p/kWh. That would be at additional cost compared with the cheapest alternative of more gas-fired generation. It would require of the order of 3–4 GW (Declared Net Capacity) of new plant in addition to that already contracted.

9 The scenario studies show which technologies might contribute in the periods up to 2010 and 2025. Wastes (municipal, industrial and agricultural), wind (onshore and offshore), and energy crops could make the dominant contributions with modest contribution coming from the remaining landfill gas and hydro resources. Other technologies such as photovoltaics have the potential to make major contributions to world energy needs in the longer term if their development continues and energy companies announce their intention of moving into this market on a significant scale.

Figure 2: Resource-cost curves for renewables

Amount of electricity (in TWh) available to be generated annually at the prices indicated (p/kWh)  
(Total UK electricity sales in 1997, from all forms of generation, were 301TWh)





■ Solar
 ■ Offshore wind
 ■ Agri & forestry wastes
 ■ Tidal stream
 ■ Onshore wind
 ■ Municipal solid wastes
 ■ Wave
 ■ Energy crops
 ■ Landfill gas
 ■ Small scale hydro

NB: The lack of commercial or demonstration (i) tidal stream or (ii) wave schemes means that the cost and performance of these forms of power generation has had to be estimated (i) theoretically or (ii) using a costing model.

10 Some technologies including waste-fired combined heat and power, solar and biomass could also contribute to the heat market in the periods to 2010 and 2025, and fuel cells could contribute to both the transport and electricity/heat markets in the longer term.

11 Those technologies which may be needed for the UK market also offer opportunities for export. Other technologies such as solar for which the UK market is expected to be limited over the next decade (because the technologies are some way from being competitive in UK conditions yet) may nevertheless provide rapidly expanding export opportunities.

# A N N E X 4 HISTORIC UK PROGRAMME

## Strategy

1 Historically UK policy has been to stimulate the development of new and renewable sources of energy where they have had prospects of being economically competitive and environmentally acceptable, in order to provide secure, diverse and sustainable energy supplies, reduce emissions of pollutants, to bring a competitive UK industry into being for home and export markets and to work towards achieving 1,500MW of new electricity generating capacity from new and renewables by 2000.

It has involved a two part strategy:

- stimulating the market and renewables industry by providing a guaranteed market and premium price for renewables sourced electricity, subsidised by the electricity customer, utilising the Non-Fossil Fuel Obligation;
- a complementary support programme in collaboration with industry and the European Commission R,D&D programmes (Joule and Thermie). This has helped to assess the resource, develop the near market and medium term technologies, remove institutional barriers, disseminate information, and stimulate an industrial capability (the support budget for the last phase of the programme declined from £26 million/year in 1992/93 to £11 million/year 1997/98).

2 To date five Non-Fossil Fuel Obligation Orders have been made in England and Wales, two equivalent Orders in Northern Ireland and three in Scotland. The fifth and largest England and Wales Order was laid in September 1998 for 1,177MW (Declared Net Capacity) and the third Scottish Order was laid in February 1999 for 150MW (DNC). These Orders form the first step in the Government's fulfilling its Manifesto commitment on renewables. Together the Orders made to date total to 3.5GW (DNC) of power purchase contracts for new capacity and should contribute to around 5 per cent of UK electricity needs being met from renewables by 2003.

## Achievements

3 Key achievements of the strategy so far have been:

- the initial R,D&D brought industry into renewables. This was followed by market stimulation creating an embryo industry of approaching 700 institutions offering goods and services. Major companies such as BP and Shell have declared long term strategies for renewable energy businesses and Eastern Electricity has set itself a target of utilising 10 per cent of its power from renewable energy sources by 2010;
- 650MW of electricity plant has been commissioned from the 1,250MW of contracts in the early NFFO Orders (Capacity from the later and larger orders, notably NFFOs 4 and 5 will come on stream over the next 5 years). Only a proportion of projects will go forward due mainly to failure to get planning permission or finance. A failure rate is allowed for in setting the size of the Order so that the planned capacity can result;



- the first few new generating projects outside NFFO are coming on stream and companies specialising in renewables trading and investment are beginning to be formed ('Green trading'). The vast majority of NFFO 1 and 2 projects whose NFFO contracts expired at the end of 1998 are expected to continue to generate under purely commercial contracts, thus completing the technology development cycle through R,D&D, market stimulation in a protected market, through to commercial operation;
- private sector investment has been running at around £200–300 million per year in the renewables sector;
- the cost of generating electricity under NFFO contracts has been halved on average to the point where the more mature technologies now generate electricity at around the same cost as the average wholesale price for electricity from conventional plants but not yet at prices competitive with new gas-fired generation (NFFO-5 contracts were at an average of 2.71p/kWh compared with the average Pool Selling Price of 2.60p/kWh in the calendar year 1998);
- exports have risen from an estimated £15 million/year to around £80–100 million/year over the last few years;
- renewables will make the planned 1.4–2.0MtC contribution to the UK's current climate change programme, though delivering this about two – three years later than originally envisaged;
- most local authorities have or are putting in place policies on renewables in their development plans in line with planning guidance but views have been expressed that these policies have yet to be fully and consistently implemented in the planning system.

## Comparison with other countries

4 Most industrialised countries have had their own promotion programmes for renewables. This includes a variety of market stimulation schemes such as the German 'feed law' where renewables generators are entitled to connect their projects to the distribution system and receive a payment in the range of 65 to 90 per cent of the retail price for electricity, and the proposed Dutch obligation on customers where the electricity, depending on the technology, would be traded using 'green certificates'. Grants and tax relief on investment have also been used historically on a significant scale to boost demand, in particular for wind in Denmark and photovoltaics in Germany and Japan.

Most countries have also had R&D programmes. The UK ranked 10th amongst International Energy Agency countries for its absolute level of expenditure on renewables R&D in 1996 but 19th out of 24 in relation to its Gross Domestic Product.

# A N N E X 5 INTRODUCING RENEWABLES: TACKLING THE ISSUES

1 Key issues relating to the framework set by Government include how to deal with many small projects in the planning and development control process, connecting those that generate electricity to the distribution system, and ensuring that they receive equitable treatment within the newly liberalised markets. While much has been achieved through the existing programme, a number of issues remain.

## *Planning and development control*

2 There are clear and well understood legislative and administrative procedures for planning consents and development control for the bulk of energy plants which were historically mainly large and centralised. Renewable energy plants are however small, numerous and necessarily sited where the resource occurs, often in locations where there has been no previous expectation of plants and no experience in the planning and development control system. This has been rectified in part by issuing planning guidance, the formation of policies by local authorities in response to that guidance and the experience gained from stimulation by NFFO.

3 However there has been a trend for some planning consent applications particularly for onshore wind farms to become more controversial and in some parts of the UK a higher failure rate is becoming evident though there has been no change in Government policy or guidance. Against that background the Government is reviewing the contribution which the planning system has to make to delivering its target for renewable energy.

This review includes:

- looking at the pattern of planning decisions to see what lessons might be learned;
- considering the role of regional planning guidance and development plans in developing a strategic approach to renewable energy provision;
- increasing understanding of the importance of renewable energy resources, building on DETR's recent guidance on "Planning for Sustainable Development: Towards Better Practice", e.g. through further advice to local planning authorities.

The Government is also looking at whether renewables should be highlighted in local authorities' own sustainable development strategies (Local Agenda 21s) and what more might be done to promote public understanding and acceptance of the role and characteristics of renewables.

4 Widespread adoption of renewable sources of energy will not be possible unless the public is prepared to accept projects in their locality.

### *Connecting embedded generators to the electricity system*

5 Traditional electricity systems have been based on a small number of very large power stations connected to the high voltage transmission system. If expectations for renewables, combined heat and power and smaller-scale conventional generation plant are realised then many thousands of power plants supplying perhaps 15–20 per cent of customers' electricity needs could be connected to the electricity distribution system over the next decade or so. In the longer term if technologies such as photovoltaics and fuel cells were successfully developed this would open the prospect of hundreds of thousands or even many millions of generators being connected to the distribution system.

6 These potential developments raise a number of fundamental issues about the management and operation of the electricity system, which go beyond the scope of this consultation paper; they would mean fundamental changes in the way the system operates. As far as **this** consultation paper is concerned the key issue is to ensure that the system should allow fair access for embedded generation, so that the benefits (and any disadvantages) are properly reflected in the pricing and other arrangements, and embedded plant including renewables can compete fairly.

7 At present, it is possible that in some respects the playing field is not level – existing systems have grown up largely on the basis of central generation, and may not be well adapted to a possible future situation in which local generation is also a prominent feature. New connection, metering, design and reinforcement, protection and operation procedures would be likely to be required for the distribution system. Some work is already underway in the UK e.g. a new connection code for small domestic photovoltaic installations is being prepared by the industry.

Parts of the network in rural Scotland are particularly weak given the distances involved and the sparsity of the population. This (together with the quality of the landscape resource), may limit the scope for promoting renewable energy in the more remote parts of Scotland. The proposed EC Fair Access Directive arising from the White Paper on Renewables is expecting to address this issue. The electricity companies and particularly the distribution companies, together with the Regulator, would need to put in place appropriate practices, codes and guidelines to ensure that embedded generators understood the requirements and were not disadvantaged.

8 Also existing arrangements may not recognise the economic value of embedded generation – other things being equal, electricity closer to the point of consumption is more valuable than electricity further away. Pricing systems may not at present be sophisticated enough to give full recognition to the benefits (and disadvantages) involved. Furthermore, local distribution companies may not have the proper incentives to recognise this value and accommodate embedded generation. Generation can in some circumstances effectively be a substitute for distribution – for instance, a local distribution company may have a choice between on the one hand new investment in distribution wires to strengthen its system in order to import more electricity and on the other encouraging new investment in generation locally in order to reduce the need to import electricity from outside. In the former case, the extra distribution capacity becomes part of the distribution company's asset base, and it can expect to earn a rate of return on that capacity within its price cap. In the latter case, the generation capacity is owned by a third party, and does not form part of the distribution company's asset base. There is therefore a risk that the company could prefer the distribution approach to the embedded generation approach even in circumstances where overall system costs would be lower on the second basis.

9 It is not clear how significant these potential distortions are, and whether they are major problems for the development of embedded generation such as renewables and CHP. The benefits of embedded generation may be quite sensitive to their precise location within the distribution network. However, it is important that there should be no unnecessary barriers to the development of such forms of embedded generation.

10 The proposed new legislation will establish distribution as a separately licensable activity for the first time in primary legislation. This provides an opportunity to assess the way that distribution is regulated in the light of potential barriers to embedded generation. In particular, in the future, distribution should not be seen solely as the business of constructing distribution wires. Business should be required to maintain efficient and economic distribution systems in such a way as would give them incentives to maintain the lowest cost system, by whatever combination of distribution and generation capacity was most effective and which provided a satisfactory level of security. The appropriate rights and obligations would be placed on distribution licence holders through the new legislation (see Annex 6), and in more detail in the licence conditions. There may also be a need for technical codes and guidelines to ensure that there is a clear framework for the connection of embedded generation plants to the distribution system.

11 Taken together, these measures should help to remove barriers to the introduction of renewables, and other embedded generation. They might effectively increase its value (by ensuring more accurate price signals) and so make investment in renewables more attractive. By making the market value of renewables and other embedded generation more transparent, more accurate price signals would also make it easier to identify the additional costs associated with electricity generation.

### *Developing renewables in the liberalised electricity markets*

12 The open markets will both offer new opportunities and present difficulties in the development of renewables:

- there will be many more opportunities for both generators and traders to come into the market and sell to other utilities and direct to customers in a range of markets and at a range of market prices. There are already a number of 'green trading or investment schemes' being offered with more under preparation aimed specifically at renewables. Some propose prices competitive with the market and some seek a premium reflecting a perceived 'green value'. Such schemes may play a particularly significant role in the transition of projects from the historic financially assisted NFFO market to longer term operation in the purely commercial market;
- establishing market prices in the range of new market sectors will be difficult particularly for new players. Most of the new electricity generation plant will be embedded in the distribution network and there is limited knowledge of the value of electricity and costs of connection at this point;
- new and particularly small operators may be disadvantaged in entering the market in competition with established players. Of particular difficulty will be ensuring a sufficiently long term customer base for new projects to be financed;
- customers may be unaware of the opportunities available or be reluctant to purchase in an unfamiliar and unaccredited market. The Energy Saving Trust is proposing to market, with DTI assistance, an accreditation scheme intended to provide reassurance to customers that claims that electricity sold as being from renewables or investments made in renewables by accredited companies are genuine.

## Other issues

**13** There are also several other issues relevant to the widespread uptake of renewables. Key ones are:

- **Technological immaturity and high costs** – The different renewables technologies are at varied stages of development and in some cases need to mature via R&D, demonstration, commercialisation and larger scale manufacture and deployment;
- **Immature industry** – The renewables supply industry is immature world wide. In the UK an embryo industry has been stimulated by the historic programme but it does not yet have the resources to undertake unaided the necessary technology or market developments in the UK or for export. Much of the industry is composed of SMEs or separate cost centres within larger companies.
- **Introduction of new technologies** – some technologies which are likely to be required and have prospects of becoming competitive in the UK are at an early stage of development and face particular difficulties over and above those faced by renewables in general. Particular examples of these include:
  - offshore wind** – the technology has yet to be demonstrated in the UK. An industry is only just beginning to be formed and technical and bidding procedures for early projects are only just being formulated. Legislative and administrative procedures for consents, licences and environmental appraisal which might apply were established for other purposes and are ill understood and extremely complex for application to offshore wind. A consultation document has already been issued on technical and bidding procedures for early projects and work is underway on an approach to consents, licensing and environmental appraisal;
  - energy crops** – the commercial growing of the crops and/or the conversion step via combustion, gasification or pyrolysis processes have yet to be demonstrated. The first significant scale power station is under construction now – to be fired predominantly by forestry residues in the early years though planting of short rotation

coppice is also underway with the assistance of planting grants via Forest Enterprise.

Projections of the longer term costs for this technology suggest that it could become competitive. However at present competing agricultural activities receive financial support and it is unrealistic to expect the farming industry to switch to an untested crop for which there is no equivalent financial support. It may therefore be necessary to extend equivalent financial support temporarily to energy crops to pump prime the industry if it is to progress;

**photovoltaics** – photovoltaics is finding commercial application in unsupported markets for stand-alone applications where electricity supplies from remote distribution systems would be more expensive and in financially assisted demonstrations. It is currently far too expensive for more general application though it has huge potential for further cost reduction and could potentially be a major contributor to energy needs more generally in the longer term future. However the large investments necessary to continue to develop the technology and take it to large scale production may only be made if market stimulation on a growing scale is undertaken.

- **Difficulty of addressing heat markets** – there has been very limited activity historically in the UK on applying renewables in markets for heat. It is intrinsically more difficult to devise an approach to promoting renewables into the heat market since the supply routes and industries are more disparate and therefore more difficult to access. Also since natural gas is the predominant fuel in urban areas and is highly competitive in price it provides a harder price target for renewables to achieve.
- **Raising awareness** – Awareness of the potential, characteristics and status of renewables is still comparatively low outside specialists in the energy field. This lack of information and understanding hampers decision making at all levels from policy, investment, planning and individual customer decisions.



## Measures which could be considered for any future strategy

14 Any proposed strategy may need to encompass action to tackle each of the issues in parallel. It would be short-sighted for example to rely on technology development without tackling planning issues or the availability of finance.

15 Each technology could progress through the stages of assessment, R&D, demonstration, market entry, full-scale industrialisation and finally open competition. A strategy might therefore have to encompass this process with technologies being at different stages of development at any one time. An exit strategy would be needed to encourage the industry to become competitive without subsidy. Green trading for electricity could be a significant element of an exit strategy.

### *UK market*

16 Action on each of the following could be undertaken by the industry and Government to stimulate the development and deployment of new and renewable energy technologies in the UK:

- resource, technology and environmental assessment;
- research and development;
- demonstration;
- market stimulation and industrialisation;
- removal of legal and administrative barriers;
- marketing, information dissemination and education;
- appropriate consideration of planning and development control issues.

17 Particular emphasis might have to be given to the following, if the UK were to have an indigenous industry and not merely a market to be exploited by others:

- industry responding to the opportunities;
- development of both components and plant;
- demonstrations of UK equipment;
- development of turnkey plants by UK suppliers.

### *Export market*

18 There is a rapidly expanding world market which provides opportunities for UK industry. International competition is fierce and if there is to be a UK industry then it would of necessity have to compete in world markets and not just be restricted to the UK. Other countries are ahead of UK industry at present in tackling export markets in some technologies with a range of joint Government/industry actions. If the UK is to succeed in world markets then it would be necessary for industry to:

- develop exporting skills within companies many of which are small and have no experience;
- develop strong trade associations with the capability to organise export activities;
- link the new industry to the established export network in government, embassies and business;
- provide market assessments in this new and little understood area;
- develop 'turnkey groups' capable of providing the full range of consultancy, project development, equipment, and finance;
- establish demonstrations in target markets;
- reinforce links to the international institutions such as the World Bank, Global Environmental Facility, Asian Development Bank, European Bank for Reconstruction and Development, etc., all of which have policies and funds to promote the deployment of renewables.

# ANNEX 6 POSSIBLE MECHANISMS TO SUPPORT MARKET STIMULATION

1 Encouraging markets for new and renewable energy sources could be approached in a number of ways:

- **Energy taxes and emissions trading.** The Marshall Task Force considered the potential for using economic instruments to meet environmental goals. For example, energy or carbon taxes could have the effect of stimulating the market for renewables. The Government has considered the recommendations of Lord Marshall and has recently issued a consultation paper for a Climate Change Levy. The levy will not be applied to renewable energy supplied for heating purposes, but is proposed to be applied to all electricity supplied, including that from renewable energy sources. The consultation paper also seeks views on the provision of a further incentive for renewables through the structure of the levy. However, over the medium term, some additional measures may be required to bring forward newer and, initially, more expensive technologies.
- **A scheme to stimulate a market for renewable sourced electricity** could be instituted. This could take the form of a simple obligation to ensure that a specified proportion of electricity from renewables was sold or it could be suitably targeted to focus as necessary on specific technologies and in particular new ones. This approach would provide an in-built exit strategy to commercial operation without subsidy as the technologies matured. It could include related technologies such as combined heat and power from non-fossil sources.
- **Direct grants** for new projects could also be used to build new capacity. This would not necessarily stimulate the market nor provide an exit strategy which might be available using the foregoing approaches.

2 These possible approaches could be complementary to one another. Some would be appropriate for heat, electricity and transport markets. Others are best suited to a single market such as the electricity market. The focus in this annex is on how an obligation mechanism might best be used to stimulate the market for electricity from renewable sources. It does not however consider any fiscal incentives which would help to achieve that goal, emerging from the responses to the consultation exercise on the Government's proposals for a climate change levy.

3 Any market stimulation mechanism should be market based to encourage the deployment of new renewables capacity and aim to provide:

- sufficient confidence to enable projects to be financed. (Generally this has meant ensuring income stream to a project over a sufficiently long period by for example a power purchase contract);
- competition to minimise costs and provide transparency of costs;
- flexibility to respond to technological development and complementary environmental and agricultural policies;
- minimal impact on existing arrangements and speedy introduction of new arrangements;
- equitable treatment between players in the electricity market;
- an exit strategy to introduce technologies to the commercial market as and when the opportunity arises.

## Market stimulation of renewables in a reformed electricity market

### *The market is changing*

4 The UK electricity market is in transition. Change comes from the introduction of domestic supply competition, utility regulation reform, reform of the Electricity Pool, and industry restructuring.

5 The key features of the reformed market relevant to encouraging the growth of generation from renewables using some form of obligation are:

- A fully competitive supply market. The removal of the separate category of first tier suppliers (Public Electricity Supply Licensees) will result in all suppliers being put on an equal basis for regulatory purposes. No supplier will have a monopoly in the supply market to provide a long term tied consumer base. This would make it difficult to specify a sub-group of suppliers which could take on obligations relating to the promotion of electricity generation from renewables. No individual supplier will have sufficient security to be able to sustain an obligation placed on them to purchase specified quantities of renewable electricity over a prolonged period because they will be unable to guarantee a minimum customer base in a competitive market environment. Thus, any mechanism would need to work with the market and avoid introducing market distortions. Any obligation on suppliers would also need to ensure that new entry was not inhibited;
- Separation of supply and distribution is likely to leave supply businesses as ones whose key commercial objective is to manage their risks. Any scheme to support renewables which had the effect of reducing their commercial flexibility could work to increase their costs. This would be undesirable and would need to be avoided in the design of any scheme. Distribution will remain, like transmission, a closely regulated monopoly activity. Any scheme requiring distribution businesses to become involved in the procuring of renewable electricity generating capacity would have to be

carefully designed and structured to ensure that any regulatory and presentational difficulties against the background of utility reform could be satisfactorily dealt with;

- The new trading arrangements to be introduced to replace the Pool in England and Wales are likely to reward plant with a flexible and predictable output. However, inflexible and unpredictable plant are likely to fare relatively less well. Any obligation would need to recognise the additional risks this brings to certain types of renewable generation, especially wind.

### *On whom should an obligation be placed?*

6 There are five groups in the electricity market on whom an obligation could be placed – generators, transmission companies, distribution companies, supply companies, and consumers.

7 The Government believes that it would not be appropriate to place an obligation relating to renewables on generation companies because, whilst it could result in the creation of new renewables capacity, it would not help directly to create a market among consumers for electricity from renewable sources.

8 The transmission company is not an appropriate body to hold obligations relating to the development of a market in renewables-sourced electricity, although there would be clear advantages resulting from placing such an obligation on such a monopoly service provider. In practice regulatory reform is moving towards the further separation of functions. Institutionalising the involvement of a monopoly in the competitive electricity market could cause future regulatory difficulties as the Regulator increasingly seeks to separate monopoly activities from competitive ones.

9 There could be advantages in placing obligations on the distribution companies.

These include:

- they would be regulated monopolies. Consequently they would be able to enter directly into the long term commitments necessary for the development of new renewables capacity;
- there are few of them – administration would be simple and relatively cheap;
- they would be price-regulated and are likely to remain so. This would allow the above-market costs of renewables generation to be incorporated into their charges or recovered through an easily administered levy;
- they could be distanced from the supply market by the electricity generated being sold through a wholesaler, possibly a successor to the NFPA;
- they are more likely to be able to offer attractive transitional arrangements for existing NFFO and SRO contracts and any contracts entered into before the revised arrangements are in place. In particular, they would not act as suppliers but could be responsible for a wholesale function that could make electricity generated under NFFO contracts available to suppliers wishing to develop a market for 'green' electricity now and so potentially reduce the support required for NFFO arrangements already in place.

Against this regulatory reform is moving towards the further separation of distribution and supply. Obliging distribution companies to remain in supply would clearly go against this trend, so it could be necessary to design arrangements which provided a market for the electricity through organisations other than the distribution companies themselves. Suitable arms length governance arrangements over the marketing of such electricity would then be needed if future regulatory difficulties were to be avoided as the Regulator increasingly seeks to separate monopoly activities from competitive ones.

10 The suppliers are also obvious candidates to carry any obligation as they have a market for their electricity. The advantages of placing a renewables obligation on supply companies are:

- existing supply companies already have a market for electricity;
- supply companies are well placed closest to customers to foster a market niche for renewable electricity for example by special marketing schemes for 'green electricity', but might be inhibited from doing so while the levy exists;
- they have an interest in driving down the cost of renewables generation through their licence condition to purchase economically;
- selling renewable electricity is complementary to their core business.

11 There are, however, problems which would need to be overcome:

- it would be necessary to keep track of a possibly increasing number of supply companies in a dynamic market. However, supply is a licensed activity which should ease the task of tracking suppliers;
- obligations placed on individual suppliers could make it difficult for individual new entrant suppliers to fulfil their obligation. This could come about because existing suppliers could be in a position where they hold all existing rights to renewables. This could result in a barrier to entry, even if those rights were tradable. One way to overcome this problem would be to aggregate the obligation;
- supply companies in a competitive environment could not individually provide long term commitments that are required for the construction of new renewables capacity. Again, some form of aggregation could help overcome this problem;
- producing transitional arrangements so that power from existing NFFO contracts becomes available to the nascent green market would be far from straightforward.

Without solutions to these sorts of problems, supply companies could be distress buyers – having to buy electricity at prices higher than for which they could sell.

12 An obligation could also be placed directly on consumers. This would have the advantage of directly creating a market in renewable-sourced electricity. However, most consumers of electricity obtain their supply through a licensed supplier and could not directly influence the sources of their electricity supply. They would have to rely on their supplier to do this on their behalf. The large number of consumers would also make such a scheme difficult and expensive to administer. The Government believes that there would be no advantage in placing an obligation on consumers which could not more easily be achieved by placing the obligation on suppliers.

13 The Government's view is that supply companies and distribution companies are likely to prove the only feasible choices to hold obligations relating to electricity from renewable sources.

#### *How should an obligation be administered?*

14 An obligation could be placed directly on suppliers or it could be aggregated. This could be achieved by the existence of a body which could take on the role of a wholesaler. The 'wholesaler' could be a statutory body or one created by the industry. The share of a total obligation carried by individual supplier could be on an agreed basis, for example in proportion to the market share of the suppliers or a market might be established to trade the obligation directly, perhaps through a system of 'green certificates'. In this case the competition aspects would need to be examined carefully to ensure that a fully competitive market in tradable certificates could be established and properly regulated.

#### *Which suppliers should hold the obligation?*

15 An obligation to support renewables could be placed, as now, on only some supply companies or on all suppliers. Placing the obligation on only some supply companies would have the advantage that the administration of the obligation scheme would be simplified, only financially strong companies could be selected, and small or new entrant suppliers could be excused the burden of the obligation. However, placing the obligation on only some supply companies would impose significant costs on that group and so would create a substantial distortion to competition. Consequently a mechanism would be required to recompense those suppliers holding the obligation for the additional costs they had incurred as a result of being obliged to purchase from renewable sources.

16 Alternatively, the obligation could be placed on all supply companies. If an obligation-based scheme is operated in such a way that it placed an equal burden on each supplier then no distortion to competition should result. However, such a scheme could create barriers to new entrants to the market as explained above. A mechanism to overcome this problem would be required.

#### *How can market distortions be avoided?*

17 Currently a levy, paid by suppliers and passed on to customers through their bills, is used to fund the additional cost of generation from renewable sources (the difference between a reference price, intended to represent the costs of alternative electricity that would be purchased, and the premium price paid in NFFO contracts). This method is appropriate where only some of the companies in a sector are obliged to purchase renewable electricity. A levy enables this cost to be spread fairly evenly over the whole industry.

However, there would be a market distortion arising from the loss of commercial flexibility of those on whom the obligation is placed. Alternatively the additional cost of generation from renewables could be met from general taxation. However, the effect of raising support funds from general taxation would be to spread the cost of generating electricity from renewables across all taxpayers. However the Government believes that the additional cost of generation from renewable sources, whilst kept to a minimum, should be met directly or indirectly by electricity consumers. This would ensure that the costs of addressing environmental problems caused by electricity are met by those who create the demand.

18 It is not clear whether it would be possible to devise a scheme based on placing an obligation on only some suppliers without there being any distortion to competition. The reasons for this are that electricity from renewable sources may be worth a different amount in the market to electricity from other sources and that value may vary geographically, and the cost of purchasing from renewable sources could vary in different locations and according to the technology used in generation. Disparities such as these could make it difficult to devise a scheme which compensated individual suppliers accurately for the additional costs they had incurred. There could be further disadvantages. In a competitive market it is not possible to be certain that individual suppliers will be able to fulfil obligations entered into over the long term. In addition, the fact that suppliers were compensated for their costs could reduce their incentive to minimise those costs.

19 A levy may not be necessary if an obligation were to be placed on all of one class of licensee in a sector in a way in which the loss of commercial flexibility and additional costs bore equally on each company in proportion to their market size or value because there would be no market distortion to address. If no levy were required, any additional costs to individual suppliers of purchasing electricity from renewable sources could still be passed through to customers through their bills because other companies would have similar costs.

### *How should the obligation be funded?*

20 There will be a cost associated with supporting market stimulation for renewables. As described above, this cost could be recovered through a levy or it could be passed on to customers by distributors or suppliers in their prices as a normal part of their business costs.

21 If the stimulation mechanism were to be funded by a levy then there would need to be a way of calculating the cost to be charged to the levy. Currently this is done by use of a reference price, but an alternative method might be to auction the power generated and so find its open market value.

22 Under the current NFFO mechanism the above market cost to a supplier in England and Wales of fulfilling its obligation has been considered to be the difference between the contract price and a reference price (currently Pool price), and this additional cost is funded through the levy. If a future mechanism were to work in a similar way, however, an alternative reference price would need to be found since the Pool price will cease to exist with the introduction of new electricity trading arrangements which will replace the Pool. Possible new reference prices are being considered as part of the work on new trading arrangements which is being undertaken by DTI and OFFER.



23 Ideally, the reference price should accurately reflect the price at which a supplier could have bought electricity from alternative sources if it were not obliged to purchase from renewables generators. In England and Wales using the pool price historically has had the disadvantage that it represented a bidding price by generators and determined the plant selected to generate but the price charged for electricity had been largely determined by separate bilateral contracts. Using the pool price as reference probably over-estimates the additional costs of renewables compared with the alternatives. Any new reference price should reflect the relevant market price for the alternative electricity which would have to be purchased at the point of connection to the distribution system. Although any levy system would need to be designed such that it provided incentives consistent with downward pressure on the cost of generation, the reference price would not directly affect any extra costs that might be attached to renewables. The reference price would clearly determine the extent of those costs to be met from any levy and might have a substantial impact on the charge to that levy.

24 A number of options for a new reference price are possible:

- the Director General Electricity Supply (DGES) advised the Secretary of State that using the previous year's average electricity purchase price by the Regional Electricity Companies might be appropriate;
- a market price drawn from one of the new markets proposed under the new trading arrangements could be considered but there is considerable uncertainty about what that would be at present;
- a market price derived from actual contracts for the purchase of electricity from embedded generators and published on an annual basis.

25 The impact of different reference prices on the estimated peak above market cost for the additional generation which would be needed to provide 10 per cent of our electricity from renewables is shown in the table below.

Future Options for Reference Price	Estimate of Reference Price (p/kWh)	Estimated Peak Above Market Cost (£million/year)*
DGES advice – last year's average purchase price	3.5	35
Current market price from embedded generation contracts	3.0	175
Pool Selling Price (an average of 2.60p/kWh for 1998 but expected to fall by at least 10 per cent in the medium term)	2.0 to 2.4	340 to 455

\* The estimated peak annual charge to a levy makes assumptions about the mix of technologies supported, the premium prices paid and the performance of projects which go forward to construction, as well as the reference price.

26 It is hard to be certain how these different prices would compare in the future. However, some general observations are possible:

- at a time of falling prices for fossil generation, average purchase costs might be higher than other measures if they included higher-priced historic contracts;
- both average purchase costs and embedded contract terms might be higher than a measure of spot prices since they would include a premium for the avoidance of the volatility to be expected from spot prices;
- embedded contract terms might be higher than average purchase costs and spot prices if, as expected there was a positive value on embedded generation.

In addition to the points above, there are wider uncertainties over the general path of future generation costs and prices over the next decade. If fossil fuel prices remain around current levels, it is expected that prices for fossil generation will fall from recent levels, and this can be expected to affect the reference price for renewables, however it is measured.

27 The Government believes that the price paid for embedded generation would probably be the best representation of the cost of alternative sources of generation for most renewables.

### *Auction approach*

28 One problem with a reference price approach is that it can only represent an average; it is not possible to reflect the different values which may be placed on generation from different plant in different places. This may lead to distortions to competition.

29 An alternative approach could be to establish the additional cost of renewable generation by using an auction. One way of doing this would be for the relevant renewables contracts to be held by a wholesaler who would regularly auction the rights to the output from those contracts. Suppliers would bid in the amount of subsidy they would require in order to buy the electricity at the unit price stated in the contract. In some cases these bids would be negative – the supplier believing that the output is worth more than the contract price (perhaps because of the benefits of embedded generation, perhaps because that supplier can sell ‘green electricity’ at a premium). The above market cost would simply be the total value of the subsidies required by the winning bidders.

30 This auction approach has the advantage that it removes the need for an artificial reference price, it makes the system more transparent and it introduces competitive bidding (which in turn should drive down costs) – all this while retaining the possibility of long term contracts between the renewables generators and a wholesaler body. If it proves possible to design arrangements incorporating the type of auction described above, this would be an attractive approach to the question of a reference price.

### *New schemes – some options*

31 Against the background of the above considerations the following ideas are outlined as examples of obligation-based schemes. They could individually or in combination represent possible schemes which could operate within the reformed market.

*If the obligation is placed on **all** suppliers*

Option A: A supply obligation on supply companies delivered through a wholesale organisation

32 A wholesale organisation could be created, perhaps under the collective ownership of all supply companies. Such an organisation could be put in place as result of a standard licence condition introduced into all supply licences or through powers taken in primary legislation. The renewables obligation (to purchase specified quantities of renewable electricity from specified new renewable sources for a specified period) would be placed on the wholesale organisation. The organisation would be responsible for establishing the required renewables capacity and for selling it into the market – possibly auctioning it competitively as outlined above. The cost of the wholesale organisation would include the cost of administration and the above market costs of renewables generation. These costs could be recovered either through a levy or through a further standard licence condition or obligation on supply companies to underwrite the wholesale organisation. A formula could be specified as to how supplier contributions were to be calculated, possibly in the articles of the wholesale organisation, to take account of changes in the market share over the period of the obligation.

33 The advantages of this idea are that it builds on the experience of the existing NFFO scheme, competitive bidding could bring down prices, it could remove the need for a separate levy and the wholesale organisation could offer the long term contracts that renewables generators need to procure finance. The disadvantage of maintaining a levy could be that it removes the incentive on suppliers to drive costs down, although this problem would be partly solved by introducing competitive auctions and involving the supply companies closely in the governance of the wholesaler. However, a conflict of interest between

suppliers as bidders to and proprietors of the wholesale organisation might need to be avoided. The detailed arrangements would need to deal with suppliers entering and leaving the market both in terms of the share of the power they would take and the share of the above market costs they would meet in the absence of a levy. The impact on the commercial flexibility of suppliers and the additional costs to which they might be exposed depends on the detailed arrangements put in place.

Option B: A capacity obligation on supply companies delivered through tradable certificates

34 An obligation could be placed on each licensed supplier to procure from renewable sources a specified quantity of renewables capacity. The quantity would be specified by the Government and would increase gradually towards the policy target. In addition, renewable generators would be supplied with tradable certificates, free of charge, equivalent to the proposed capacity of their plant. Suppliers would be required to fulfil their obligation to procure renewables capacity through the purchase of tradable certificates. Renewables generators would be able to sell their output into the market in competition with other generators at open market prices. In a competitive market the value of the certificates would tend towards the above market cost of producing renewable electricity.

35 The advantage of this scheme is that it could create a distinct market for renewables capacity. The disadvantages are that this scheme would not secure a market for renewables electricity – just capacity. It would be difficult to encourage particular technologies above others. A trading exchange might be required for tradable certificates with the associated transaction costs. Policing would be needed to enforce the holding of certificates. In addition, there are the usual competition problems present in markets which apply equally here.

Option C: A supply obligation on suppliers delivered through tradable certificates

36 An obligation could be placed on suppliers in terms of a specific percentage of the electricity that they supply which had to be bought from renewable generation. The percentage figure could progress gradually towards the policy target. Suppliers could fulfil the obligation in two ways. They could buy renewable-generated electricity themselves. If they had bought an amount in excess of their obligation they could trade it, perhaps in the form of certificates. Suppliers could then meet their obligation by buying renewable electricity directly or by holding certificates, or a combination of the two.

37 This system has the advantage that companies could have a choice – they could choose to:

- (i) buy the correct proportion of renewable electricity;
- (ii) buy less than the correct proportion (and then make up their obligation by paying other suppliers); or
- (iii) buy more than the correct proportion (and then sell on the excess for money).

Disadvantages might be that the market in certificates might not be very liquid and it could be prone to competition problems.

Option D: A supply obligation placed on some suppliers

38 An obligation could be placed on a selected number of suppliers to procure a specified quantity of electricity, possibly from certain types of renewable sources. To fulfil the obligation the chosen suppliers would need to contract with appropriate renewable generators. The additional cost of generation from renewable sources could be reimbursed to the suppliers from the proceeds of a levy placed on all suppliers. Such a scheme could operate along broadly similar lines to the current NFFO arrangements.

39 The advantage of such a scheme is that it is simple. The disadvantages are that it is not clear whether the obligation could be entered into over a long period in a competitive market, and that a levy scheme may not be able to address all of the market distortions introduced by such a scheme.

*If the obligation were placed on the distributor*

Option E: A capacity obligation placed on all distributors

40 An obligation could be placed on each licensed distributor to procure from renewable sources a specified quantity of renewables capacity. The quantity would be specified by the Government and increase periodically to maintain progress towards the policy target. The distributors would discharge their obligation by contracting collectively with generators through a central organisation, possibly a successor to the NFFO. Generators would compete for contracts to supply electricity to the central agency. The contracts would be for a sufficient period of time over which they would be able to attract project finance and service the cost from the revenues generated. The central agency would, acting as a wholesaler, sell the electricity generated to licensed suppliers in a competition intended to maximise its re-sale value. The costs of the wholesale operation, i.e. re-sale price less purchase price, would be shared between the distribution companies in fixed proportions and passed on by them to their customers and ultimately to the consumer.

41 The advantages of this approach are that it builds on the experience of the existing NFFO arrangements, could offer transitional arrangements for existing NFFO contracts and could offer the lowest cost solution without an adverse impact on the commercial flexibility of suppliers in the competitive supply market. The main disadvantage is that distributors could be perceived as engaged in a competitive supply business unless their relationship to the wholesaler organisation were carefully defined.

### *Other issues related to a new form of obligation*

**42** Consultation has taken place before each round of NFFO so far. Issues were raised which are pertinent to consideration of new legislation and the detail of a new mechanism. The key issues raised are listed below:

- providing a consistent approach over the full period of any strategy either with regular NFFO-type orders at agreed intervals or having a continuously open bidding system;
- whether further NFFO orders under existing legislation would be necessary bearing in mind the time required to implement new legislation;
- having a fixed tariff system rather than competitive bidding. Competition is central to the proposed new trading arrangements and has been important in reducing costs of generation under NFFO so far;
- reflecting the time of day and season in the NFFO contract prices since the value of the electricity varies;
- whether the historic form of 'will secure' test was sufficiently effective in filtering out proposals which were unlikely to be able to proceed. Whether this should be addressed in another way in any new mechanism;
- whether other renewables technologies should be included such as photovoltaics or other clean technologies if the system were broadened beyond renewables.

#### Legislative options

**43** The following paragraphs discuss how the various potential support mechanisms might be implemented through legislation.

#### Removing barriers through 'market-friendly' measures

**44** The Government has already announced its commitment to licence supply and distribution separately. This will allow the monopoly distribution business to be operated – and regulated – separately from the competitive supply businesses.

**45** In establishing this new regulatory framework, the opportunity should be taken to address barriers through placing obligations on the new distribution companies (in legislation or in licence conditions). This might work as follows:

- distribution companies could be obliged to facilitate competition in the supply and generation of electricity; if necessary this obligation could specify that – in particular – embedded forms of generation should not be discriminated against;
- distribution companies could be required to publish certain information about costs and constraints within their network in order to give better signals about relatively more attractive sites for embedded generation;
- it might be appropriate to put an explicit obligation on distribution companies – when planning their networks – to consider embedded generation as a possible alternative to reinforcing their system and decide between the two on an objective and non-discriminatory basis; an alternative might be for the regulator to bear this potential distortion in mind when setting the distribution price control.

#### New market stimulation mechanism

**46** The mechanisms outlined in Section 3 represent some of the possible ways to support the introduction of renewables. The electricity market is changing rapidly and any renewables strategy will need to evolve in the light of experience and market developments. Setting a detailed blueprint for a stimulation mechanism in primary legislation (as with the current NFFO) would risk this mechanism becoming quickly outdated – with no easy prospect for adaptation. Instead it would be more appropriate for primary legislation to provide for a flexible solution that is open to adaptation as the market develops and to reflect technical advances.

47 The Government therefore intends to take a broad enabling power that would allow the Secretary of State to introduce a market stimulation scheme for renewables through secondary legislation. This would allow the mechanism to be updated as the market develops. Sections 32 and 33 of the Electricity Act are to be executively devolved to Scottish Ministers following devolution on 1 July 1999. It is expected that any new arrangements would also be executively devolved. A broad enabling power would need to be used carefully to avoid undue regulatory uncertainty – it may be necessary to add safeguards, for example a formal consultation process that must be undertaken before secondary legislation could be changed.

#### Transitional provisions for existing NFFO and SRO contracts

48 The Government has already announced its intention to legislate to provide for separate licences for the supply and distribution of electricity and to end the distinction between PESs and second tier suppliers. In order to avoid creating problems for the existing unexpired NFFO and SRO contracts, and for any further NFFO and SRO contracts entered into during the period before the necessary legislation is passed, the Government intends to create a transition mechanism for such contracts. The exact details of this transition would depend on the nature of any new market support mechanism chosen.

## Technological priorities for market stimulation

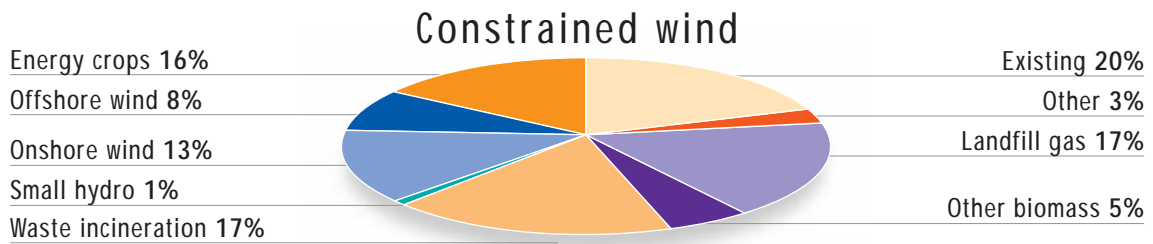
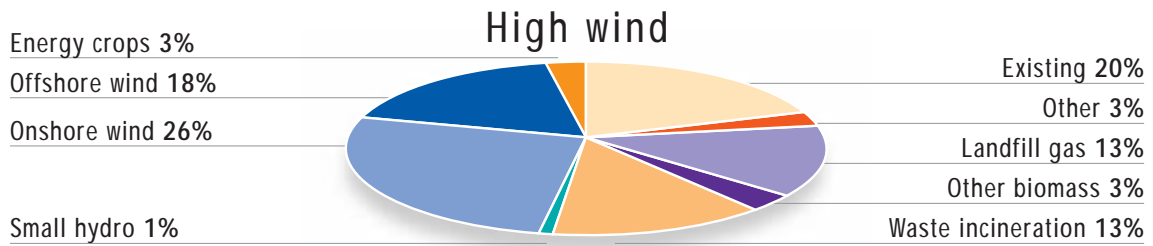
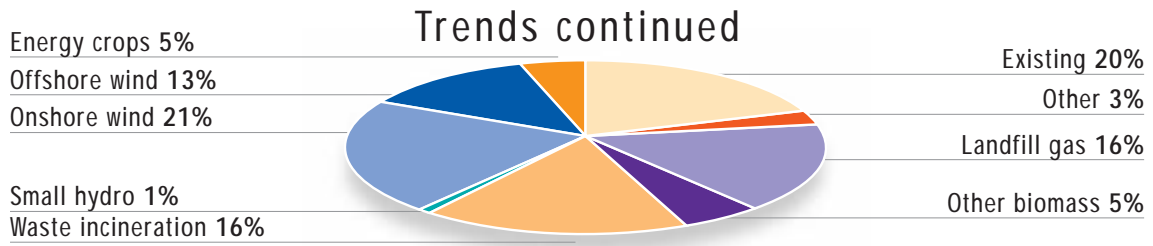
49 It will be necessary to consider which technologies could, with advantage, be promoted by measures to stimulate the market. Given that the different new and renewables technologies and their potential markets are at very different stages of development it would be helpful to consider them in terms of the possible timescale of their development and application in home and export markets. This would also assist prioritisation in any future programme. A simplified classification is presented in paragraph 45 of the main text above.

50 Technologies which would be considered as prime candidates to receive market stimulation in the UK are those most likely to be able to contribute significantly in the near or medium term, up to 2010.

51 Further development of the scenarios referred to in Annex 3, applying judgement to reasonable build-rates, market factors and planning considerations has been undertaken and can provide alternative views of the proportion of these technologies which might make up any particular target in the electricity sector. For example the major contributing technologies are illustrated in Figure 3, for alternative extents of the deployment of wind.



Figure 3: Scenario sensitivity cases: possible technology contributions in 2010 under three scenarios, reflecting alternative extent of the deployment of wind.



# A N N E X 7 SUPPORT PROGRAMME TO TACKLE OTHER ISSUES IN THE ENERGY MARKET

## Budget for support programme

1 A key part of any strategy would be measures to tackle issues concerning further uptake of renewables, stimulate research, development and demonstration, disseminate information, and facilitate industrial activities in UK and export markets. The Department of Trade and Industry intends to provide a growing budget for its share of this activity as follows:

Year	Budget (£million)
1998/1999	10.6 <sup>1</sup>
1999/2000	11.5
2000/2001	14.0
2001/2002	18.0

<sup>1</sup> Estimated outturn.

2 The Department expects to share cost activities appropriately with industry within the European state aid provisions and for contributions to be sought from European sources most notably the Fifth Framework Programme.

## Key issues to be tackled by support programme

3 Annex 5 outlined some of the key issues concerning the deployment of renewables and the measures that would need to be considered for a future strategy. The support programme will address those issues. Some will relate to the development and cost reduction for new technologies where decisions are required in relation to the status of individual technologies and their likelihood of making a significant contribution. Others relate to institutional and administrative barriers to market entry.

## Technological priorities for support programme

4 Technologies which should be considered as prime candidates to receive assistance under the support programme are those that could contribute significantly to UK or export markets in the near and medium term up to 2010, and those with prospects for the longer term up to 2025 that require R,D&D in Figure 2, main section.

5 Support would not normally be considered for the very long term or inappropriate technologies. Assessment of inadequately understood technologies will be considered periodically which could lead to reclassification and further support. A technology falling into this group could be tidal stream.

6 In addition there are underpinning technologies such as gasification and control relevant to several technologies which it would be advantageous to pursue.

7 Demonstration programmes could be considered where necessary. It might be particularly appropriate as a means of promoting technologies in the heat and transport markets where market stimulation via some form of obligation would be inappropriate. A capital contribution of up to 25 per cent could be considered accompanied by independent monitoring of the project and an associated promotion and replication campaign.

## Non-technological priorities for the support programme

8 The programme would also expect to pursue the removal of non technical barriers and assist UK industry to access export markets in conjunction with existing export services.

Key areas for early attention would be:

- embedded generation including:
  - facilitating the electricity industry in producing appropriate codes and guides for the connection of embedded generation;
  - obtaining and disseminating an understanding of the role and value of embedded generation in the trading markets;
- facilitating the development of trading and 'green' markets for renewables including introducing an accreditation scheme for renewable energy trading and investment schemes;
- raising awareness and hence reducing uncertainty on the characteristics of renewables so that consumers and players in the market are correctly informed when making decisions by information dissemination, marketing and education;
- increasing understanding of the potential and role of renewables in the liberalised energy markets;
- facilitating the embryo industry to expand into export markets.

## Fundamental Research and Development

9 The Government has announced its intention to increase expenditure on fundamental research and development. As part of that effort the Engineering and Physical Sciences Research Council has proposed an expanded £3.5 million/year programme on renewables. A consultation exercise has just been completed by EPSRC and priorities consistent with the strategy outlined in this document will be adopted with a view to the longer term prospects for renewables.

## Programme management arrangements

10 The Department will put in place a set of programme management arrangements developed from its historic arrangements. The Department will take executive responsibility for strategy and budgets. It will appoint one or more programme management agencies by competitive tender. These agencies will issue calls for tender periodically in specified areas and appraise, contract and manage the projects, and report on and evaluate the results.

11 This executive machinery will be advised by an overall renewable energy advisory committee and such individual programme committees as are necessary. The advisory committees will comprise independent members drawn from industry, academia, commerce and local authorities as necessary to provide the expertise and breadth of vision necessary.

## Programme evaluation

12 The programme will be subject to evaluation by the DTI's internal evaluation process with reviews at not less than three year intervals. It will also be subject to review by the advisory committees annually and at the end of each phase of the programme with reports published. Other review processes may be instituted as necessary.

# GLOSSARY OF TERMS

## Renewable Energy

Renewable energy is the term used to cover those continuous energy flows that occur naturally and repeatedly in the environment.

## Non-Fossil Fuel Obligation (NFFO)

The Non-Fossil Fuel Obligation requires Public Electricity Suppliers in England and Wales to secure specified amounts of generating capacity from non-fossil fuel sources. It has been used to create an initial market and encourage the renewable energy industry to become competitive in the longer term without further support. The obligation is imposed by Orders made under The Electricity Act 1989.

## *Fossil Fuel Levy*

The Fossil Fuel Levy is paid by electricity customers to meet additional costs involved in supporting NFFO contracts. These additional costs comprise the difference between the NFFO contract price (i.e. the price paid, in pence per kilo-watt hour to those developers who have successfully been awarded a NFFO contract for all electricity generated by their renewable energy project) and the reference price. The levy rate is set by OFFER, applied to leivable electricity, and is currently 0.7 per cent which raises about £85 million p.a.

## *Reference Price*

The price used to calculate the above-market cost of NFFO contracts and thus the contribution required from the Fossil Fuel Levy. The reference price currently used for England and Wales (separate reference price is used in Scotland) is the pool selling price (for non-pooled contracts) which for last year averaged 2.60p/kWh.

## *Pool Selling Price*

The Pool purchase price plus a payment covering the costs of maintaining the stability of the Grid.

## *Pool Purchase Price*

The sum of the price paid for the most expensive electricity generator required to meet forecast demand in a given half-hour (known as System Marginal Price) and a capacity payment designed to incentivise generators to maintain a surplus of plant availability over demand. (As electricity cannot be easily stored, demand has to be met by simultaneous production and consumption; supply and demand is balanced by calling on line generating plant as required on a half-hourly basis, the cheapest being called first.)

## Biofuels

Biofuels are any solid, liquid or gaseous fuels produced from organic matter, either directly from plants or indirectly from industrial, commercial, domestic or agricultural waste.

## *Landfill Gas*

Methane-rich gas produced by anaerobic digestion of waste in landfill sites and combusted to provide energy.

## *Energy from Waste*

The combustion of domestic, industrial or commercial wastes.

## *Municipal Solid Waste*

Waste products collected from households (which may be used as fuel for power and heat generation).

*Industrial and Commercial Waste*

Materials collected from industrial and commercial premises (which may be burnt for power and heat generation).

*Biomass*

Biomass fuels are biofuels produced solely from organic matter and include energy crops and forestry and agricultural residues.

*Energy Crops*

Plants grown specially for use as a fuel: for example, willow coppice or miscanthus.

*Forestry and Agricultural Residues*

By-products of forestry and agricultural operations burnt for energy, such as straw, chicken litter and felling residues. Also covers wet waste such as manure used in anaerobic digestion.

*Energy From Water*

Using the movement of water to produce power is one of the oldest energy technologies. Today, power is extracted from water in three main ways: through tidal, wave and hydro-power devices.

*Hydro Power*

In hydro power schemes, the turbines that drive the electricity generators are directly powered by water either from a reservoir or the “run of the river”.

*Tidal Energy*

Tides are generated by the gravitational pull of the moon and sun, and tidal power stations operate by capturing the water of tidal rise and then passing it through turbines to generate electricity.

*Wave Energy*

Waves are created by the passage of the winds over the surface of the sea and energy is present in their height and movement. Wave power devices are designed to absorb this energy and convert it into electricity.

*Fuel Cells*

Fuel cells convert the chemical energy of the reaction between a fuel and an oxidant directly into electricity.

*Solar Energy*

Solar radiation is the ultimate source of energy for the majority of renewable energy sources. The term “solar energy”, however, is usually taken to refer only to those energy sources that derive directly from the sun’s light and heat.

*Passive Solar Design*

Uses the form and fabric of a building to capture solar radiation and so reduce the building’s energy needs for artificial light.

*Active Solar Heating*

Employs collectors to capture and store the sun’s heat primarily for space and water heating.

*Photovoltaics*

Involves the direct conversion of light energy from the sun into electricity by means of specially prepared semi-conductors.

*Wind*

Power can be extracted from the wind by the use of a wind turbine. As air flows over the turbine blades, it creates a turning force on the rotor assembly which can then be used either to drive pumps, for example, or more conveniently to generate electricity.

Wind farms are currently predominantly located onshore, but can potentially be developed in offshore locations. The technology for offshore deployment is similar to that for onshore.



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