THE ROYAL SOCIETY

ROYAL ACADEMY of ENGINEERING

The role of the Renewables Directive in meeting Kyoto targets

Royal Society
document 11/00
ISBN 0 85403 548 6

October 2000

Summary

- There is a strong case for acting to mitigate the threat of climate change associated with the unrestrained increases in emissions of greenhouse gases (GHG), particularly CO_2.

- The Kyoto Protocol (if ratified at the Sixth Conference of the Parties in The Hague in November 2000) commits EU Member States to reducing overall annual GHG emissions by 342 MtC (CO_2 equivalent) averaged over the period 2008 to 2012. This target includes emissions from electricity generation, transport, heating and industrial processes. The energy industries are responsible for 28% of net greenhouse gas emissions and the EC Renewables Directive specifically addresses electricity generation.

- The Directive sets indicative targets for the generation of electricity from renewable sources as a percentage of total generation (22.1% aggregated over Member States). In an increasing energy use scenario, this target is unlikely to meet the EU's Kyoto commitments based on tonnes of CO_2 emitted. **We recommend that indicative targets be based on absolute tonnes of CO_2 emissions rather than a percentage of electricity generation from renewable sources.**

- The Directive recommends that EU Member States should be allowed to experiment with support mechanisms to encourage the adoption of renewable energy sources. However, the advocated policy of waiting for 5 years prior to reviewing support mechanisms with a view to harmonisation will probably result in ever-divergent schemes developing in the intervening period. We believe that the introduction of the correct economic instruments is the single most important factor controlling the sustainable growth of renewable technology. **We therefore recommend that the EC formulates its plans for harmonisation now, so that Member States can work towards them. We suggest that harmonisation should be based on a framework of a carbon tax on all primary fuels across all energy sectors**.

- One of the reasons behind proposing this Directive is to reduce GHG emissions, yet it ignores other sources of energy that could be used to replace fossil fuels with minimal or no emissions of greenhouse gases. **We therefore recommend that large hydroelectric installations should have equal status with other renewables under the terms of the Directive. We also suggest that policies regarding energy from waste and the nuclear power industry be reviewed so that they can play a full and continued role in reducing emissions of GHGs**.

This statement has been prepared by a joint Royal Society and Royal Academy of Engineering working group chaired by Sir Eric Ash FRS FREng and consisting of: Dr Mary Archer (National Energy Foundation); Sir Alan Budd (University of Oxford); Mr Peter Ewins FREng (Meteorological Office); Dr John Hassard (Imperial College, London); Sir John Horlock FRS FREng (Whittle Laboratory, Cambridge University). Secretariat: Dr Rebecca Bowden, Mr Brian Doble, Mr Richard Ploszek, Dr Rachel Quinn and Miss Sarah Wright.

This statement has been endorsed by the Council of the Royal Society and approved for publication by The Royal Academy of Engineering.

1 Greenhouse gas emissions, Kyoto and the EC draft Directive on electricity from renewable sources

The Royal Society and The Royal Academy of Engineering stated in a report issued in June 1999 [1] that "there is a strong case for acting to mitigate the threat of drastic climate change associated with the unrestrained increases in emissions of greenhouse gases (GHG), particularly CO_2". Therefore measures proposed by the European Commission to reduce the emission of GHGs are welcomed.

The necessity of stabilising the concentration of atmospheric GHGs at a level which would prevent the worst affects of global climate change was also acknowledged by the majority of world leaders when they signed the United Nations Framework Convention on Climate Change in 1992. This was followed by the Kyoto Protocol in 1997 which had the objective of committing developed nations to reducing their annual aggregate emissions by 5.2% from 1990 levels by 2008-2012. The European Union (EU) undertook to reduce its annual emissions by 8% (342 MtC CO_2 equivalent) and this target has been redistributed between Member States. Although CO_2 is the least potent greenhouse gas per molecule featured in the "basket of gases" used in the Kyoto Protocol, it is the most common, accounting for 80% of greenhouse gas emissions globally. This has led Member States such as the UK to set a specific target for reducing CO_2 emissions.

Meeting these Kyoto targets will be a challenge for the Member States. Only the UK, Germany and Luxembourg appear to be on track to achieve their reductions. However, these targets are only the first step in reducing emissions. An upper limit of atmospheric carbon dioxide of 550 parts per million by volume (ppm), approximately double the pre-industrial level, has been advocated by the Royal Commission on Environmental Pollution [2]. The European Union has called for stabilisation at less than 550 ppm [3]. It has been estimated that to achieve stabilisation at this level, and to allow developing countries to increase their emissions, will require a developed country like the UK to reduce CO_2 emissions by 60% by 2050 [2]. With these more stringent targets in mind it is important that the EU develops a long-term strategy to reduce CO_2 emissions rather than focusing solely on Kyoto targets.

With respect to reducing greenhouse gas emissions, renewable energy sources have the advantage of either not emitting GHGs (e.g. wind, solar, tidal) or being essentially GHG-neutral (e.g. biomass crops that emit no more CO_2 in the electricity generating process than they have absorbed during their growth). In addition, it is argued they will increase security of supply (through diversification of power sources) and provide an important contribution to sustainable development as reserves of fossil fuels decrease. One of the main sources of GHGs is the burning of oil, coal and gas for energy supply. In the EU, the energy industries are responsible for 28% of net greenhouse gas emissions, the majority of which is in the form of CO_2 [4]. In the UK, power stations were the largest single source of CO_2 emissions accounting for 26% of emissions in 1998; transport accounted for a further 22% [5]. The proposed Directive on the promotion of electricity from renewable energy sources in the internal electricity market (RES-E Directive) aims to supply 22.1% of electricity from renewable energy sources through setting indicative targets for member states [6]. This is part of the wider commitment to meeting 12% of gross inland energy consumption from renewable sources by 2010 [7].

The Working Group supports the RES-E Directive in its ambitions to reduce the emission of greenhouse gases and meet the EU's Kyoto commitments, but believes that the reliance on percentage targets is flawed. The Kyoto Protocol uses 1990 emissions figures, quoting an equivalent mass of CO_2 as a baseline. However the reduction (in tonnes) of CO_2 emitted by generating a percentage of electricity from renewable sources will depend on the total demand for electricity and on the origin of the electricity. For example, a requirement for 10% electricity from renewable sources in a scenario of increasing electricity supply would leave 90% of the increase being supplied from other sources and thus the potential for an increase in emissions to the environment. Similarly, a reduction in the electricity supplied from non-CO_2 emitting sources, such as nuclear power, and its replacement with electricity supplied from renewable sources would result in no net change in emissions. A target set in terms of a maximum mass of CO_2 emitted from electricity generation would seem to be more appropriate. We also question the rationale of the Directive in ignoring other sources of energy that could be used to replace fossil fuels with minimal or no emissions of greenhouse gases. We will address this in more detail below with reference to large hydroelectric schemes (a renewable source excluded from subsidies in the Directive), energy from waste (where the burning of landfill gas can have a role in removing methane, another greenhouse gas) and nuclear power (a non- CO_2-emitting source of electricity generation).

2 Meeting indicative targets for electricity from renewable sources

The proposed target of 22.1% of electricity from renewable energy sources will be achieved by Member

States meeting the indicative targets (in terms of percentage electricity generated from renewable sources) set out in the proposed RES-E Directive. We have already expressed our reservations about the use of targets expressed as percentages. In this section we concentrate on those issues that might influence whether these indicative targets can be met. We focus on the UK as it is the system that we, and those who have provided information to the study [Appendix 1], are most familiar with. We recognise that the UK is only one of the Member States but many of the issues raised below are also applicable in other Member States.

In the UK 2.8% of electricity was generated from renewable sources in 1999 [5]. Of this small percentage, approximately 50% was generated by large-scale hydroelectric plants and almost 34% was generated by using landfill gas as a fuel, or from the incineration of municipal solid waste and sewage sludge (all excluded from the Directive). Onshore wind provided a further 8.9%. The UK's indicative target is to generate 10% of its energy from renewable sources by 2010. However, the majority of people who provided information in relation to this study expressed doubt that the UK would be able to meet its indicative target in this timescale. There is no doubt of the **theoretical** potential of renewables to satisfy the demand for electricity generation in the UK. The offshore wind resource alone could supply more than the UK's entire electricity requirement [8,9]. Other potential sources include tidal, wave and solar energy but none of these is currently being exploited to a significant extent. There are a number of factors that are controlling the growth of the renewable industry in the UK and that will affect its ability to meet the 10% target. For simplicity, we have considered these under the headings of implementation and economics. However, it is clear that many of the implementation issues could be resolved if the correct economic instruments were in place. We consider this conclusion in the context of the decision not to harmonise support schemes as set out in the explanatory memorandum to the RSE-E Directive.

2.1 Implementation issues

Implementation issues which hinder the development of renewables, and therefore the meeting of the Directive's targets, can be both technical and procedural. In addition, the sheer scale of the implementation required puts significant strain on the engineering and manufacturing industry.

2.1.1 Administrative procedures

The RSE-E Directive requires Member States to review their existing legislative and regulatory framework with regard to authorisation procedures applicable to installations generating electricity from renewable energy sources, with a view to streamlining procedures (Article 6). The current position in the UK suggests that planning regulations are a major barrier to new renewable energy generators and anything that can be done to ease this situation is commended. However, a significant number of wind projects are objected to by the Ministry of Defence on the grounds of military and civil air safety, and the interruption of line-of-sight communications links [10]. It is hard to see how any streamlining of the planning procedures could address these.

There is evidence that the information available to planning committees is out of date, in particular in the case of wind farms where noise and visual intrusion are often cited as reasons for denying permission. Technology has progressed and can now mitigate some of these objections, but planning committee members need to be made more aware of the progress. We therefore welcome the EU-funded projects that aim to raise awareness of renewables in local communities, but we were concerned to hear that there has been some question over the future of the ALTENER Programme [11] that funds such projects.

2.1.2 Integration into the grid

Integration into the UK's national grid has been an obstacle for many renewable generators and the Working Group welcomes the objectives of Article 7 of the RES-E Directive of ensuring that distribution operators grant priority access to renewable generators. However, in the UK it must be recognised that the geographical areas which offer the most potential for renewables are remote from suitable grid connection points. Additionally, many are in the North of the country where connection will add to the already significant North-South movement of power. There will also be significant implications for the Scotland/England interconnectors whose capacity is already fully utilised. Whilst granting priority access is to be applauded, it is unclear who will fund the upgrade of the distribution systems that were developed to serve central generators.

It has been made clear by a number of respondents that the distribution systems can cope with at least 10% of renewable generation (including variable sources). There are, however, concerns that the quality of supply may decline in terms of the stability of the frequency and the presence of unwanted harmonics. Central generators currently provide system protection and as renewable generators inevitably replace them, so the burden must be passed on. While we have doubts that the UK will meet its indicative target of 10% renewable generation by 2010, quality of supply and system protection are areas that are unlikely to require action in the near term.

2.1.3 Build Requirement

In order to meet the indicative targets a significant change in the rate of building and commissioning renewable energy installations is required. Under the correct political and economic environment, this build rate may be attainable, but there are significant engineering issues to be addressed. With current technology and available equipment, respondents assumed that most of the UK's indicative target would have to be met by increasing the amount of wind generation. The scale of generation needed (in the order of 39-44 TWh per year by 2010) would require the construction and installation of between 3,000 and 5,000 new wind turbines over the next 10 years (in excess of 1 per day). There are doubts as to whether the resources are available to achieve this build rate in the current economic and political climate.

2.2 Economic considerations

We believe that the introduction of the correct economic instruments is the single most important factor controlling the sustainable growth of renewable technology. Most renewable energies are not inherently competitive with fossil fuel energy (partly due to their high capital cost) and Member States are each evolving their own frameworks of economic instruments to overcome the deficit. We are in accord with the RES-E Directive, that it would be almost impossible to bring about an immediate alignment of these approaches. We support the recommendation that Member States should carefully monitor the impacts of the economic instruments they introduce so that their success can be measured and the suggestion that the EU should observe how they work over the next five years and then embark on the attempt to gain progressive harmonisation. However we are concerned that if no attempt is made at the outset to find some common ground, it is entirely possible that the systems operating in different member states will diverge making comparison and evaluation ever more difficult. Any substantial divergence during this period will also affect the ease with which harmonisation can be achieved. For example, technologies in countries that have benefited from a high level of subsidies in the interim could see dramatic reduction in support under a simple quota scheme. In contrast, countries where technologies have not received adequate support may have failed to develop to the extent where they can take advantage of new harmonised support mechanisms. There is a feeling among our respondents that uncertainty regarding future support schemes has deterred potential investors in UK renewable energy. If the EU is contemplating harmonisation in five years time we would therefore recommend that the preferred method be indicated as early as possible. We outline our preferred economic instrument below.

2.2.1 The UK perspective

There is widespread concern that the framework of economic instruments in the UK will prevent the renewables industry from developing at the rate necessary to reach the indicative targets by 2010. Our understanding of the UK system is summarised briefly here, and further details can be found in Appendix 2. Under the new Renewables Obligation (incorporated in the Utilities Act 2000) and associated Renewables (Scotland) Obligation, electricity suppliers will have to supply a proportion of their electricity from renewable sources or purchase the equivalent number of 'green certificates' from others who have supplied power from renewable sources. However, suppliers who are unable (or do not wish) to provide the required proportion of electricity from renewables can 'buyout' their obligation (essentially pay a fine). The level of this buyout price is critical, as it will set the maximum market price for renewables. Indications are that it will be set at 3 pence per kilowatt hour (p/kWh); too low to encourage the more expensive technologies (such as offshore wind) that will almost certainly be necessary to meet the UK's 10% target. In contrast, the non-fossil fuel obligation (NFFO) previously employed in the UK, operated a banded pricing scheme to reflect the different costs of the various technologies. In addition, it provided contracts of up to 15 years, a factor that offered a level of security to potential investors. The situation for the renewable industry in the UK is further complicated by the New Electricity Trading Arrangements [see Appendix 2] that would appear to discourage renewable energy schemes as a consequence of their variability of supply and thus their inability to guarantee to supply a contracted amount of electricity within the specified period.

2.2.2 The case for a carbon tax

In the light of the potential threat of global climate change, the primary aim of any economic measures should be the reduction of greenhouse gas emissions. The most direct economic approach therefore is to introduce a cost for such emission, namely a tax on the quantity of carbon emitted – an upstream carbon tax on primary fuels. We are disappointed that the UK's new Climate Change Levy (CCL) will be based on energy consumption rather than the carbon content of fuel used. While most renewable sources are now exempt from the CCL, electricity generated from large hydroelectric installations and nuclear power plants is taxed at the same level as coal. We accept that it is not a realistic option to impose a comprehensive carbon tax in a single step; the complex fiscal adjustment that would be needed would take time – and large quantities of political will. But if targeted as the *eventual* solution, it could help to reconcile some of the issues outlined above. It can provide a basic framework that provides clarity and the basis for

comparison between different member states and offers the prospect of eventual harmonisation of policies. We recommend that the Directive should assess the case for advocating a carbon tax framework. We are aware of concerns that a carbon tax might have an impact on economic competitiveness and possibly lead to 'carbon leakage' (the increased production of goods elsewhere with possible overall increases in emissions [1]). However we feel that there are ways to overcome this [1]. We are also aware that a carbon tax would improve the economic viability of large hydroelectric schemes, energy from waste and nuclear energy. Some of the complex and potentially controversial issues surrounding these power sources are addressed in the next section.

2.2.3 Funding for Research and Development
Sufficient levels of funding of research and development are crucial in ensuring sustained growth of renewable technology, with the correct balance depending on the technology in question. Wind turbines, for example, no longer require core research funding but do require investment in development to reduce manufacturing, production and installation costs. We repeat our previous recommendation [1] that investment in this area be increased. The revenue from any carbon tax could provide an appropriate source of revenue to fund this increase. Finally, we must stress the importance of co-ordination between programmes promoting research and development of renewable technologies and those responsible for developing policy in this area. The interaction between research funded under the ALTENER programme and the development of the RES-E Directive would appear to be a good example of such co-ordination.

3 Other non-emitting sources

We have already questioned the rationale behind a Directive that aims to reduce greenhouse gas emissions yet ignores some sources of power that could have a major role in achieving this aim. Given the possibility that at least one Member State, namely the UK, will fail to meet its targets for the generation of electricity from renewable sources by 2010, we examine other sources of energy that could be used to replace fossil fuels with minimal or no emissions of greenhouse gases. These power sources are either partially excluded (large hydroelectric schemes) or completely excluded (energy from waste and nuclear power) from the Directive.

3.1 Large Hydroelectric schemes (>10MW)
There is no question that hydroelectricity is a renewable energy source and indeed the Directive concedes that electricity generated from this source can be included in any certification scheme. However, large schemes will not be eligible for any future subsidies. There appears to be little justification for an arbitrary cut-off point of 10MW. There are often valid environmental and social concerns relating to the flooding of large areas that accompanies the creation of many large hydroelectric dams. We are also aware of recent research that reveals that substantial amounts of carbon dioxide and methane are being released from reservoirs as vegetation decomposes [12]. This problem is more significant in tropical regions and can be reduced by clearing areas prior to flooding. However it would be unfortunate if the exclusion from subsidies meant that the installation of hydroelectric plants on existing reservoirs or the refurbishment of established large hydroelectric sites were not economically viable, with an associated impact on emissions. We therefore recommend that the decision to exclude large hydroelectric installations from subsidies should be re-examined.

3.2 Generating electricity from waste
The issues of waste and of the incineration of waste are complex. We recognise that waste is not strictly a renewable energy source and that concerns about the emission of pollutants such as dioxins and sulphur dioxide have led to the adoption of a Common Position on the proposed Directive on the Incineration of Waste. However, if waste or landfill gas is to be incinerated then we would wish to see the correct economic incentives put in place to ensure that this is undertaken in a way that would minimise net greenhouse gas emissions. Concern has been expressed in the UK that the subsidy provided to waste-to-electricity schemes by the UK's NFFO mechanism has encouraged electricity-only generation schemes even where combined heat-and-power (CHP) or heat-only schemes would have been of greater benefit in terms of reducing CO_2 emissions. It is therefore possible that simply including energy from waste in the RES-E Directive may not be the best way to achieve this. In this case we would like to see Member States encouraged to introduce other mechanisms to ensure that this source of energy is utilised in the most efficient way possible.

We are aware of two pieces of European legislation (existing and proposed) that have a bearing on the issue of energy from waste. The Landfill Directive, which came into force in 1999, aims to reduce the amount of methane emitted from existing landfill sites and may well result in an increase in the incineration of landfill gas. In addition, the proposed Directive on the Incineration of Waste (mentioned above) states that as far as is practicable the heat generated during incineration should be recovered, through CHP for example. We again raise the question of whether the correct economic instruments are in place to ensure this.

Given the complexity of issues surrounding the methods of dealing with waste, we also recommend that this area is subject to a rigorous life cycle analysis.

3.3 Nuclear power

In 1999, nuclear power accounted for over 34% of the total electricity consumed in the EU [13]. Projections based on the energy policies being pursued by the Member States suggest that this figure will fall to 9% by 2025 [14]. To prevent an associated rise in CO_2 emissions, this capacity must be replaced by other non-emitting sources or electricity demand must be reduced. In the UK, at least, electricity demand is still rising [5]. We recognise the important issues of the long-term management of nuclear waste has to be addressed [1]. However, if the main priority of the EU and member states is to reduce emissions of greenhouse gases then the nuclear option should be kept open until it can be demonstrated that the renewables industry has developed to the extent that it can replace this carbon-free source of power. As outlined above, concerns relating to the financial viability of nuclear power would be addressed by a carbon tax. It is clear that if nuclear power is to play a long-term role in reducing greenhouse gas emissions, the decision to build new nuclear power plants in Member States such as the UK must be taken in the very near future.

4 Carbon sequestration and energy conservation measures.

The RES-E Directive is part of a wider commitment to generating 12% of the EU's gross inland energy consumption from renewable sources by 2010 [7]. However it is clear that this measure alone will not be sufficient to achieve the reduction in emissions necessary to meet either the targets set out in the Kyoto Protocol or the more stringent long-term reductions that have been advocated by the EU [3] and the Royal Commission [2]. We therefore welcome the two European initiatives announced in 2000 that aim to reduce consumption of fossil fuels through improving energy conservation and efficiency. The recent Energy Efficiency Action Plan proposed by the European Commission includes measures to integrate the energy efficiency dimension into other Community policies and to promote the use of CHP. In addition, the SAVE II Programme will provide funding for activities that stimulate energy efficiency measures and encourage investments in energy conservation. Carbon sequestration can also play a role in stabilising atmospheric concentrations of CO_2. It can be achieved both by increasing the rate of removal of CO_2 from the atmosphere (e.g. through afforestation) and capturing CO_2 from power stations and injecting it into long term reservoirs (e.g. underground aquifers or the deep ocean). We have discussed the potential of both these approaches in our previous report and highlighted the need for further research and development to establish the feasibility, cost and safety of this mechanism of reducing atmospheric CO_2 [1]. We are aware that the European Commission has previously funded work on the underground storage of CO_2 under the Joule II programme [15] and we would encourage the funding of further research into the methods and limits of carbon sequestration.

5 Conclusions

There is a strong case for acting to mitigate the threat of climate change associated with the unrestrained increases in emissions of greenhouse gases (GHG), particularly CO_2. We therefore support the RES-E Directive in its ambitions to reduce the emission of greenhouse gases and meet the EU's Kyoto commitments. However we believe that indicative targets based on a percentage of electricity generated from renewable sources rather than absolute tonnes of CO_2 emissions is flawed and could prevent the Kyoto targets being met.

We have identified a number of issues that may prevent the UK's ability to meet its indicative target and we do not think that they are unique to the UK. We believe that the introduction of the correct economic instruments is the single most important factor controlling the sustainable growth of renewable technology. We are concerned that the advocated policy of waiting for 5 years prior to reviewing support mechanisms with a view to harmonisation will result in ever-divergent schemes developing in the intervening period. We therefore recommend that the EC formulates its plans for harmonisation now, so that Member States can work towards them. We suggest that this harmonisation should be based on a framework of a carbon tax on all primary hydrocarbon fuels across all energy sectors.

We have highlighted the possibility that at least one Member State, namely the UK, will fail to meet its indicative targets by 2010. We have examined the other sources of energy that could be used to replace fossil fuels with minimal or no emissions of greenhouse gases. We recommend that large hydroelectric installations should have equal status with other renewables under the terms of the Directive. We also suggest that policies regarding energy from waste and the nuclear power industry be reviewed so that they can play a full and continued role in reducing emissions of GHGs.

6 References and Notes

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2. Royal Commission on Environmental Pollution (2000) *Energy – the changing climate*. Twenty-second report, Cm 4749, 292pp.

3. *Community Strategy on Climate Change*: Council Conclusions. March 1998.

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5. Department of Trade and Industry (2000). *Digest of United Kingdom Energy Statistics*. 306pp.

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8. Matthies, H.G., Garrad, A.D., Scherweit, M., Nath, C., Wastling, M.A., Siebers, T., Schellin, T., Quarton, D.C. (1995). *Study of Offshore Wind Energy in the EC*, JOULE I (JOUR 0072), Verlag Naturliche Enegie, Brekendorf, Germany.

9. However we should note that this would require a building programme on a massive scale. This is addressed in more detail in section 2.1.3.

10. House of Lords Select Committee Report on European Communities (1999). *Part 5: Views of Witnesses and Opinions of the Committee.* Twelfth Report.

11. The ALTENER programme is a non-technological EU programme aimed at promoting the use of renewable energy sources. Its aims include: supporting pilot actions on infrastructures that will increase investor confidence, stimulating the take-up of renewable energy technologies and improving their competitiveness; improving information dissemination and co-ordination at the international, EU, national, regional and local level, thereby increasing investor confidence and market penetration; supporting targeted actions designed to speed up investment in renewable energy technologies and to increase operational capacity for energy production from renewable energy sources; implementation of the EU renewable energy strategy.

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Appendix 1 - Press release & list of respondents

Press release

The following press release was issued on 14 August 2000:

Renewables - the energy issue for the new millennium?

The Royal Society (RS) and Royal Academy of Engineering (RAEng) today announced that they are undertaking a study to examine the role which renewable energy policy could play in helping Europe realise its Kyoto Summit commitment to reduce greenhouse gas emissions.

The RS/RAEng Working Group3 has been established, under the chairmanship of Sir Eric Ash FRS FREng, to assess the European Commission's (EC) recent draft Directive (adopted in May 2000) on the promotion of electricity from renewable sources. This Directive commits the EU to achieving a target of 22.1% of electricity generated from renewable sources by 2010.

Of major concern is the current predicted decline of the nuclear power industry that will increase reliance on fossil fuels for electricity generation, leading to a growth in greenhouse gas emissions. This could only be prevented by increased use of renewable energy sources, together with significant gains in energy efficiency and a reduction in energy demand. The Kyoto Protocol committed the European Union (EU) to reduce its greenhouse gas emissions by 8% and the UK has agreed to a 12.5% cut by 2008-12.

The DTI is currently seeking views on the EC's draft Directive that will help shape the UK Government's negotiations at EU level, and the Working Group is making an interim response this week. The Working Group will also produce a more detailed statement in the Autumn.

The working group will seek to address the following questions:

- What is the potential contribution from renewable energy sources for electricity generation in the UK?
- Should the UK and EU target for renewables be increased in the light of current policy on nuclear power generation?
- Is the EC's definition of renewables broad enough (i.e. are there circumstances under which energy from municipal waste should be considered as a renewable energy source)?
- Are the appropriate economic instruments (e.g. the climate change levy) in place to enable the indicative targets to be met?
- Is the growth of the renewables industry sustainable given the current economic instruments and levels of funding of R&D into renewables technology?

The Working Group would welcome succinct responses to the above questions from interested parties by 31 August 2000. Further information can be obtained from Sarah Wright (sarah.wright@royalsoc.ac.uk) or Rachel Quinn (rachel.quinn@royalsoc.ac.uk), The Royal Society, London SW1Y 5AG, Tel: 020 7451 2590.

List of respondents

We are very grateful to those organisations and individuals who responded to our request for information in support of our study. Those who agreed to be identified are listed below. We should stress that this statement reflects our views only and that they did not comment on the final statement or earlier drafts.

Mr Paul Allen. Centre for Alternative Technology.

Mr B Arthur. Institute of Electrical Engineers.

Mr J Baxter. Powergen plc.

Prof B Brinkworth FREng. Formerly Professor of Energy Studies, Cardiff University.

Mr B Cheetham. Environment Trust Associates.

Prof R Clift FREng. University of Surrey.

Mrs D Dorkin. Energy from Waste Association.

Dr D Elliot. Dept Design & Innovation, Open University.

Dr G England FREng. Formerly Chairman CEGB.

Dr N Eyre. Energy Saving Trust.

Prof I Fells CBE FREng FRSE. Fells Associates.

Mr S Gillibrand CBE FREng. AMEC.

Mr D FitzHerbert. Landfill Gas Association.

Mr N Goodall. British Wind Energy Association.

Mr D Green. Combined Heat and Power Association.

Prof J Harrison FREng. Dept of Fuel and Energy, University of Leeds.

Mr O Harwood. Country Landowners Association.

Dr D Infield. CREST, Loughborough University.

Dr S Ion FREng. British Nuclear Fuels plc.

Mr Peter Jones. BIFFA Waste Services Ltd.

Dr M Kennedy CBE FREng. PB Power Ltd.

Dr S McLanaghan. Environmental Services Association.

Mr M Liston FREng. The Jersey Electricity Company Limited.

Ms I Michel. ABS Consulting.

Mr D Milborrow. Energy consultant.

Dr L Mitchell FREng. BNFL Magnox Generation.

Mr N Morley. Renewable Energy Office for Cornwall.

Mr J Munnery. Clarke Energy Ltd.

Mr T Panesor. Institute of Physics.

Mr A Papageorgi. The National Grid Company plc.

Dr D Pike. Green Land Reclamation Limited.

Mr D Porter. Association of Electricity Producers.

Dr P Randerson. Salix Project, Cardiff University.

Mr K Vowles. ScottishPower.

Shell International Limited.

Mr C Sloan. Heat Pump Association.

Prof J Swithenbank FREng Chemical Engineering and Fuel Technology, University of Sheffield

Mr F Treble. Photovoltaic consultant.

Prof A Williams CBE FREng. Dept of Fuel and Energy, University of Leeds.

Appendix 2 - The UK System

New Electricity Trading Arrangements (NETA)

NETA, expected to come into force 30 January 2001, deals with how electricity is supplied to the distribution system (the National Grid), and how demand is balanced with supply. In order to supply electricity into the Grid, generators must sign and become party to the Balancing and Settlement Code (BSC). The trading arrangements consist of three separate "markets".

- Forwards and futures markets (including short-term power exchanges), which evolve in response to the requirements of participants, that will allow contracts for electricity to be struck over timescales ranging from several years ahead to on-the-day markets;
- A Balancing Mechanism in which National Grid Company, as System Operator, accepts offers of and bids for electricity to enable it to balance the system; and
- A Settlement Process for charging participants whose contracted positions do not match their metered volumes of electricity, for the settlement of accepted Balancing Mechanism offers and bids, and for recovering the System Operator's costs of balancing the system.

The financial penalties of a generator not being able to supply its contracted amount is heavy, and in addition, oversupply is bought by the grid at a significantly reduced price. This places a significant burden on variable renewable sources' competitiveness within the trading arrangements. Renewable generators are given the option of not signing the BSC under NETA and selling their electricity directly to one of the supply companies acting as a consolidator.

Utilities Act 2000 (Renewables Obligation)

Under the new Renewables Obligation and associated Renewables (Scotland) Obligation electricity suppliers must supply a proportion of their electricity from renewable sources. By 2010 this obligation will be 10% and is expected to remain at this level until 2025. To fulfil this obligation, suppliers must either physically supply the power from renewables generating stations or purchase 'green certificates' (either directly or indirectly) from others who have supplied such power. Any additional cost of supplying electricity from renewable sources must be met by the suppliers and may be passed onto their customers. However, under the terms of the Utilities Act, suppliers can 'buyout' part or their entire renewables obligation. This buyout payment is expected to be set at 3p/kWh (the current price for electricity is approximately 2.3p/kWh). The buyout option has been introduced to limit the cost to the consumer by setting a price cap on renewables. This price cap has been estimated at 5.3p/kWh (i.e. the current cost of electricity plus the expected level of the buyout). It is intended that the revenue from the buyout payments will be used to encourage suppliers to meet their obligation rather than continuing to buyout. This may be achieved by transferring the revenue from non-compliant suppliers to compliant suppliers although the method is yet to be decided.

Climate Change Levy (CCL)

The Climate Change Levy is effectively an environmental tax on the use of energy. From April 2001, business and public sector users will be required to pay a levy in pence per kilowatt hours (p/kWh) of energy used with different tariffs for different fuels (Table 1). Domestic users are excluded. Electricity is dealt with as a whole because it was deemed too difficult to discriminate between electricity supplied from different primary fuels. Energy derived from renewable sources and "good quality" CHP are exempted from the levy, but because one of the aims is to stimulate new renewable sources, large hydroelectric (>10MW) is not exempted. In contrast, the RES-E directive accepts that large hydroelectric can be included in any tradable certificate scheme. The exemption will be available only to supplies of electricity sold under contracts that are clearly identified as such. Suppliers will be able to offer contracts containing renewable source declarations up to the limit of their contracted purchase from generators using eligible renewable sources, provided they agree to abide by the conditions governing the scheme. Energy intensive businesses will be eligible to an 80% reduction in the CCL rates providing they agree to certain energy efficiency measures.

Commodity supplied	Levy Rate (p/kWh)
Electricity	0.43
Gas (supplied by a gas utility)	0.15
Gaseous hydrocarbon supplied in a liquid state (e.g. Petroleum gas	0.07
Any other taxable commodity eg coal	0.15

Table 1 Climate Change Levy

The levy is expected to raise around £1 billion in 2000/01. It is intended that the CCL will be "revenue neutral" with the majority being fed back to business in the form of a 0.3% point cut in employer's National Insurance reductions and £150 million providing support for energy efficiency measures, promotion of renewable energy projects and low carbon technologies.

Further Information:

The Royal Society
The Royal Society is an independent academy promoting the natural and applied sciences. Founded in 1660, the Society has three roles, as the UK academy of science, as a learned Society, and as a funding agency. It responds to individual demand with selection by merit, not by field. The Society's objectives are to:

- recognise excellence in science
- support leading-edge scientific research and its applications
- stimulate international interaction
- further the role of science, engineering and technology in society
- promote education and the public's understanding of science
- provide independent authoritative advice on matters relating to science, engineering and technology encourage research into the history of science

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The Royal Academy of Engineering
The objectives of The Royal Academy of Engineering are to pursue, encourage and maintain excellence in the whole field of engineering in order to promote the advancement of the science, art and practice of engineering for the benefit of the public.

The Academy comprises the United Kingdom's most eminent engineers of all disciplines. It is able to take advantage of their wealth of knowledge and experience which, with the interdisciplinary character of the membership, provides a unique resource with which to meet the objectives.

Its activities include an extensive education programme, research chairs and fellowships, visiting professorships, industrial secondments and international travel grants. It provides expert advice on engineering matters to government and other bodies and administers the UK's premier annual prize for innovation in engineering, The Royal Academy of Engineering MacRobert Award. Election to the Academy is by invitation only. Up to sixty Fellows may be elected annually, together with Honorary Fellows and Foreign Members who have made exceptional contributions to engineering. All are elected by their peers for personal achievement of exceptional merit and distinction. Fellows are distinguished by the title "Fellow of the Royal Academy of Engineering" and use the designatory letters "FREng".

The Academy was founded in 1976 as The Fellowship of Engineering on the initiative of HRH The Duke of Edinburgh and a group of distinguished engineers. It was granted its Royal Charter in 1983 and, with the consent of HM The Queen, adopted the present title in 1992.

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