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Electricity from renewable energy sources and the internal electricity market

Working Paper of the European Commission

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INTRODUCTION

1. The objective of the present Working Paper

In the first report on Harmonisation requirements for the internal electricity market[1], the Commission concluded that:

"*As already outlined clearly in the White Paper on renewable energies[2], a clear need for common rules in this area can already be identified. The contemporaneous existence of different support schemes appears likely to result in distortions of trade and competition. The role of renewables in the EU will clearly increase in the coming years, given the Kyoto commitments. Thus, potential market distortions will accordingly increase. Whilst the trade and competition distorting effects of different renewable support schemes is rather limited at present, given the limited EU market share of electricity from renewable sources, this negative effect appears likely to significantly increase in the coming years. In this light, it is appropriate to move towards the definition of some common rules in this area as rapidly as practicable*".

However, before doing so, the Report concludes, it is necessary to gather and analyse a further detailed range of information, notably in order to determine the relative merits and disadvantages of the different approaches to renewables support in the different Member States.

The objectives pursued by this Working Paper are to report the findings of the Commission following the investigations undertaken subsequent to the adoption of the above-mentioned report, and to suggest some possible conclusions and options for action as a consequence of these findings. It is envisaged that on the basis of the comments received following the adoption of this report, notably from the Council and Parliament, the Commission will determine which subsequent measures, if any, should then be proposed.

It is important to underline that the Commission has at this stage reached no final conclusions on whether harmonisation measures at the Community level should be proposed, or their detailed content if they were to be proposed. Whilst this working paper does point out a number of possible options that merit careful consideration, a final decision on all these issues will be taken in the light of the reactions to this document.

The annexes to this working paper contain information on the share of Res electricity in the Member States, prices paid for this electricity, support for R&D and details on the scope and contents of the investigations undertaken by the Commission as well as on the consultations of interested parties.

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[1] Commission report to the Council and the European Parliament on Harmonization requirements. Directive 96/92 concerning rules for the internal market in Electricity. COM(1998)167, 16.03.1998

[2] Energy for the future: renewable sources of energy. White paper for a Community strategy and action plan, COM(97)599 final, 26.11.1997

Finally, details on the different support schemes applied in the various Member States will be outlined in a forthcoming Commission Staff Working Paper

2. Renewable sources of energy and EU energy policy

2.1. Promotion of renewable sources of energy is a Community priority

The main priorities of EU energy policy are:

- security of energy supplies,
- competitiveness, and
- environmental protection.

The promotion of renewables, aimed at increasing their share in the fuel mix, notably by ensuring efficient and appropriate support schemes, thus driving down costs, is compatible with all these policy objectives.

The main reasons why renewable energy sources need to be developed are linked to:

the environment: The environmental advantages of renewable energy sources (RES) are undisputed. Renewable energy sources emit no, or reduce drastically, harmful gaseous emissions such as CO2, NOx and SOx. CO2 is considered to be the main contributor to the greenhouse effect and in part causes global climate change. NOx and SOx are gases that cause acid rain, the negative effects of which have been widely documented. RES are either carbon free fuels, or are carbon neutral, like biomass. The Kyoto protocol obliges the European Union Member States, either individually or jointly, to reduce greenhouse gas emissions by 8% of their 1990 levels in the commitment period 2008 to 2012. RES therefore constitute an important element of the package of measures needed if the European Union is to reach the commitment it has made in ratifying the Kyoto protocol. A significant increase in the share of renewables in the EU's primary energy consumption is also an important element of the integration of environment and in particular climate change into EU energy policy as called for by the European Council in Cardiff and Vienna.

Competitiveness of the EU RES-sector: a policy of increasing the share of RES will give an impetus to the European RES-industry. It will make a significant contribution towards reaching the critical mass necessary to finance increasing R&D in this sector in the EU. Exports of machinery and technology will contribute positively to the European Union's trade balance.

security and diversity of supply: RES, being indigenous sources of energy, increase the security of energy supply within the European Union, which is becoming ever more dependent on the import of fossil fuels. They also increase the diversity in the fuel mix.

social and economic cohesion:

- RES have considerable advantages for isolated regions which are not sufficiently or are not at all connected to the grid,

- use of RES-electricity ("RES-E") in small isolated systems can help to avoid or delay expensive extensions to the grid,
- some RES are a labour intensive form of industry and create jobs especially at location sites, in rural areas. This is especially the case for biomass. The Employment guidelines 1999 recommend to Member States to promote the job potential within the area of environmental technologies.

In the light of this, and the Commission's continuing analysis in this sector, future Community support schemes with respect to regional development will be able to become more effective and focused in the coming reference period of 2000-2006.

2.2. Historical development and projected growth in the EU

The only renewable source of energy to have been exploited on a significant scale before 1990 has been hydro, usually large hydro. Since then growth has been significant for all new renewables, between 15-30% per year due to various support measures of governments and the Community. However, the overall contribution to the EU electricity market still remains small, around 3% when excluding large hydro. The specific development in installed capacity in the wind power sector can be seen the annex I.

The development of electricity generated from renewable energy sources in the various Member States can be seen in annex II.

The importance of Res-electricity will increase significantly over the coming years. The International Energy Agency (IEA) has, for example, in its World Energy Outlook for 1998, projected that the increase in RES-E will be far greater than in conventionally generated electricity in the Member States of the European Union.

This is confirmed by indications received by the Commission from the Member States. The following countries[3] have indicated targets for the share of renewables generated electricity (excluding large hydro, unless otherwise indicated): Austria (3% in 2005), United Kingdom (10% in 2010, incl. large hydro), Denmark (20% by 2005, 79 % by 2030), Finland (100 MW wind by 2005, 25% increase in bioenergy by 2005), Greece (255-355 MW by 2003), Ireland (19.7% in 2010, incl. large hydro), Portugal (837 MW by 2006), Spain (1200 MW by 2000).

2.3. The White Paper

In the White Paper on renewable sources of energy[4] it is stated that renewable energy sources still make an unacceptably modest contribution to the Community's energy balance as compared to the available technical potential. In 1995 the contribution of RES to the Union's overall gross inland energy consumption was somewhat less than

[3] In replies to a Commission questionnaire addressed to all Member States in 1998.

[4] Energy for the future: renewable sources of energy. White paper for a Community strategy and action plan, COM(97)599 final, 26.11.1997

6%. The White Paper sets the ambitious target of a doubling of the share of RES to 12% by 2010. This percentage is all the more ambitious since the major part of the current 6% RES-share stems from large hydro for which the development perspectives are very limited. The Member States have agreed that there is a need to promote a sustained and substantially increased use of RES throughout the Community and have welcomed the White Paper as a basis for the development of actions at Community level complementary to actions at national level[5]. This commitment is all the more vital in view of the commitments of the EC and the Member States to reduce greenhouse gas emission under the Kyoto protocol.

3. The electricity single market Directive

Directive 96/92/EC[6] concerning common rules for the internal market in electricity provides only one explicit mechanism for the favourable treatment of electricity from renewable energy sources, Article 8(3)[7]:

"A Member State may require the system operator, when dispatching generating installations, to give priority to generating installations using renewable energy sources or waste or producing combined heat and power".

This provides an exception from the basic rule, established in Article 8(2), that in normal circumstances the dispatching of generating installations and the use of interconnectors shall be determined on the basis of criteria (which)... *"take into account the economic precedence of electricity from available generating installations...".*

This mechanism is, in fact, one followed by most Member States prior to liberalisation: the transmission system operator purchases renewable energy sourced electricity at prices higher than "traditionally" generated electricity, and passes this additional cost on to its captive customers, spreading the additional cost over the total captive consumer base.

However, following liberalisation, it may become increasingly difficult to continue to base the support of renewables on this mechanism. As a significant number of consumers have the choice from whom to purchase electricity, they may opt not to purchase it from the vertically integrated System Operator. If so, the System Operator is only able to pass the cost of the dispatching priority obligation for renewables to a smaller client base. This in turn will require the System Operator to increase prices, as the price uplift resulting from the renewable dispatching priority is passed through to fewer customers. This in turn may cause further eligible clients to purchase elsewhere, resulting in a vicious circle.

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[5] Council Resolution of 8 June 1998, OJ C 198, 24-6-1998

[6] OJ L27, 30 January 1997, p. 20

[7] A similar provision, Article 11 (3), provides for the same in the distribution and the following analysis is also valid for this Article.

As a consequence, under a liberalised system, Member States will be under pressure to abandon such a mechanism for one whereby all electricity consumers, irrespective of their eligibility status, contribute equally towards the additional cost of supporting renewables. In the EU this has taken place via a financial support mechanism, financed by all domestic electricity consumers. Article 8(3) is not applicable to such schemes, as it is clearly limited to dispatching priority without any further financial supporting instrument.

Thus the Directive does not explicitly approve the support schemes presently in operation in the EU.

Since the Directive does not justify a derogation from the application of the current State aid rules of the Treaty, these rules are applicable to financial support mechanisms Member States have set up to support RES electricity. If the assessment leads to the result that such support systems do involve State aid, such aid may be justified in accordance with the principles laid down in the Community guidelines on State aid for environmental protection[8]. Point 2.3. of these guidelines specifically mentions promotion of renewable energies. These guidelines will be reviewed in the course of 1999.

[8] OJ C 72/03 of 10 March 1994.

I. CURRENT SUPPORT SCHEMES FOR RES IN THE EUROPEAN UNION

1. The need for support for RES

Renewable sources of energy will need support in the short and medium term to develop and to fulfil the Kyoto commitments. The reasons for the need of support are basically linked to the following two elements:

Cost The biggest disadvantage of RES-E at the moment is the fact that under the current framework conditions, characterised by the non-internalisation of external costs of energy production, costs tend to be significantly higher than those of conventional sources of energy.

This cost disadvantage will decrease over time. Prices of the production of electricity from RES have reduced considerably in the last ten years, because of advances in technology and the bigger scale on which electricity from RES is produced, as can be seen from the table below:

Development of cost of production of Renewable Electricity per kWh (in €)

Technology Area	1980	1985	1990	1995	2000 (forecast)
Wind	0.22 ⇔ 0.57	0.11 ⇔ 0.28	0.067 ⇔ 0.17	0.030 ⇔ 0.077	0.025 ⇔0.065
Biomass					
a)Gasification				a) n.a.	a) 0.077
b) Co-firing				b) 0.061	b) n.a.
c) Steam cycle	c) 0.12	c) 0.10	c) 0.10	c) 0.083	c) 0.074
Small Hydro	0.02 ⇔ 0.17	0.02 ⇔ 0.15	0.019 ⇔ 0.13	0.019 ⇔ 0.12	0.019 ⇔ 0.1

Source : ATLAS, Compendium of Technology Modules , Energy Technology information base 1980-2010, European Network of Energy Agencies

This decrease in costs has had, of course, an impact on prices. In the United Kingdom, for instance, the average price paid by electricity companies for power was 2.53 pence per kWh in 1997, the average bid for wind (> 0.768 MW) was 3.53 pence per kWh, compared to 10 p/kWh in 1990. For complete figures on the price development in the UK see Annex III.

As a consequence of the above, it appears correct to conclude that in order to develop positively in the future, renewable generated electricity will require two essential elements: a price support mechanism that enables renewables producers to enter the market and make a reasonable profit, and a stable regulatory environment such that investors can enter the market without concern that the price support mechanism will be modified in a manner likely to make their investment unprofitable.

Infrastructure In terms of infrastructure, renewables generators have a number of important challenges that need to be addressed:

- planning: many projects are held up and finally do not materialise because of lengthy planning procedures. Since RES-E is mostly generated on a decentralised basis the necessary installations often have to be located closer to communities than conventional plants. Simplified and accelerated planning procedures, preferably at the local and regional level that could minimise local environmental disturbances and hence opposition, would facilitate a continued expansion of RES-E.

- grid connection issues: the connection of renewables generation to the grid, due notably to their decentralised nature and, compared to traditional generating facilities, their low unit output, presents a number of challenges and opportunities to transmission and distribution system operators. Notably, for the above reasons, connection to the transmission grid can be expensive, particularly where new lines have to be laid. However, on the other hand, due to their decentralised nature, renewables generators can often feed in electricity at distribution or local level, minimising transmission costs. These elements, together with the need to ensure that connection charges are levied on a cost-reflective basis, and that the benefits of new connections to others are taken into consideration, are not always, according to information available to the Commission, fully taken into account by transmission and distribution system operators.

Research and technological development Research and development has been essential in the identification of new applications and in the development and demonstration of technologies based on RES. It has also provided important contributions to the reduction in generating costs and in solving technical issues related to infrastructure and grid connections. Continued research and technological support in the pre-commercial phase will be required if RES is to develop to its full potential.

2. The different schemes in the Member States and at the Community level

All Member States support RES in one or more ways, via Research and Development, tax reductions/exemptions, guaranteed prices, investment subsidies and the like. The Commission itself has been supporting for over a decade research and development in the field of renewable energies in the scope of the Framework Programme for Research and Development, in particular in the Non-Nuclear Energy Programme. This programme includes the support to the development and use of renewable energies through research and demonstration activities, with the objectives of providing better and more reliable technologies, delivered at lower costs to the users. Under the Fifth Framework Programme[9] this programme will continue to contribute actively in

[9] Decision No 182/1999/EC of the European Parliament and the Council of 22 December 1998 concerning the Fifth Framework Programme of the European Community for research, technological development and demonstration activities (1998-2002), OJ L 26, 1 February 1999, p. 1

providing the technical solutions to the two bottlenecks identified in this working paper.

The magnitude of the support varies largely between Member States, given the national situations, both policy priority wise and as far as the presence of natural resources is concerned. A detailed description of the main support schemes will be provided for each Member State in a forthcoming Commission Staff Working Paper.

In summary, however, the main forms of support are:

- Support from the government and the Commission is given to almost all forms of RES via subsidies for research and development. The average budget for financial support to R&D in renewable energy sources from the Fourth Framework Programme amounted to 87.5 million ECUs (1995 – 1998).
  (See annex IV for details concerning budget expenditure for the individual Member States and for the OECD)

- Subsidies for **capital investment** or loans to investments are given in some countries. Relatively higher levels of subsidy are given to promote the technological development of the as yet less economical technologies, such as rooftop PV systems. Technologies closer to the market, such as wind, does also in many cases profit from subsidies, albeit at relatively lower levels.

- In a number of countries (notably Germany, Spain and, at present, Denmark) RES-E is supported via **guaranteed prices**, coupled with a purchase obligation by the utilities. However, the levels of the guaranteed prices vary considerably from country to country, with, on average, regulation in Germany, Denmark, Spain and Italy offering the highest prices to RES-E producers (for details on prices see Annex III).

  The normal form of feed in tariff is a fixed price that all renewable generators receive for the electricity generated, combined with an obligation on the system operator to purchase all such electricity offered to it. This, for example, is the system in Germany, the Stromeinspeisungsgesetz. The fixed tariff may be modified from period to period by the appropriate regulatory authority to reflect, for example, falling prices due to technological progress. However, this may be resisted by existing Res-electricity generators. The tariff may also be supplemented with subsidies from the State, as e.g. in Denmark where a subsidy per kWh delivered to the grid is paid to independent producers.

  However, one key issue is the fact that under certain fixed-price feed-in schemes, the price is set as a percentage of the electricity price actually sold by the utility to final – usually industrial – customers. RES-E producers receive a fixed proportion of this final price, or "avoided cost". In this manner, the actual price received by RES-E producers does not, necessarily, refer to any "market price" for RES-E, nor necessarily take account of falling RES-E production costs due to technological improvements.

- In the United Kingdom and the Republic of Ireland a **tendering system** operates. Under this approach, the Member State decides on the desired level of RES, according to the source mix (wind, biomass, solar, waste, etc.) that public policy dictates. It then places a series of tenders for the supply of the electricity, which would thereafter be supplied on a contract basis. The electricity is then sold by the authority responsible for organising the tender at market prices, financing the difference between sale and purchase price through a non-discriminatory levy on all domestic electricity consumption. This system permits a number of variables: the Member State may decide the level of RES, the mix between different RES sources, their growth rate over time, and the level of long-term security offered to producers over time.

- Support can also be given in the form of voluntary **green pricing** schemes which have made an appearance in 1996 in The Netherlands and Sweden and are now in place or considered in other Member States as well. In green pricing schemes, consumers can voluntarily opt to pay a premium for renewable electricity. The consumers pay part of the full extra costs that the generation of RES-E entails. The schemes vary considerably, the smallest commitment is asked in a United States (Colorado) scheme, where consumers, who so choose, round up their bills to the nearest dollar. Furthermore, consumers can volunteer to donate into renewables plans, or they can opt to take all their electricity from renewable sources; this typically amounts to a price increase of around 20% per kWh.

- Introduction of renewable specific **standards/consent procedures** and regulation in building codes and design guidelines are implemented in some Member States with the objective of reducing or streamlining administrative planning barriers. The obligatory designation by local authorities of eligible zones for RES-development, for example, (as in Denmark) also facilitates renewables growth.

- Some Member States also support renewable electricity via the tax system. They take the form of (i) exemptions from or refunds of energy taxes where they exist (as for example in Finland where the electricity tax is reimbursed, in Denmark where the CO_2-tax, which is also levied on RES electricity is reimbursed, and in Sweden where an environmental bonus is given to wind power producers), (ii) lower VAT rates on some RES-systems, like solar energy equipment in Portugal, (iii) tax exemptions for investments in small scale RES-E and (iv) via the introduction of SO_2 and NOx taxes as in Denmark and Sweden which especially favours the development of wind and hydro power. The Commission proposal for the taxation of energy products (COM (97) 30) also provides for tax reductions or exemptions for energy from renewable energy sources.

3. Overview of price and renewables market penetration

Annexes I – III provide information on the development of RES electricity and the prices paid to independent producers. The annexes indicate that[10]

[10] All price figures have been transformed into Euro.

- The largest increase in production of all forms of res-electricity, excluding large hydro, measured in percentage of the electricity consumption has taken place in Denmark (from 2.4% in 1990 to 6.3% in 1996), the Netherlands (from 1.4% in 1990 to 3.5% in 1997), Spain (from 2.6% in 1994 to 4.0% in 1996) and Sweden (from 4.1% in 1994 to 5.3% in 1996), while it has remained rather stable in the other Member States (e.g. Germany where it increased slightly from 2.2% in 1994 to 2.4% in 1997, Belgium stable at 0.9%).
- Concerning the capacity development, figures on installed wind power capacity show the largest increases in Denmark, where the capacity increased from 343 MW in 1990 to 1111 MW in 1997, Germany, where it increased from 48 MW in 1990 to 1966 MW in 1997, Spain where it increased from 7 MW in 1990 to 455 MW in 1997. In the Netherlands, it increased from 57 MW to 330 MW and in United Kingdom from 10 MW to 322 MW in the same period.
- That potential new investors in res generating plants receive the highest remuneration per kWh delivered to the grid in Germany (€ 0.086), Italy (€ 0.083), Denmark (€ 0.079, including subsidy from the State) and Spain (€ 0.068).
- That the remuneration has been stable since 1990 in Germany and Denmark which have fixed prices, while it has decreased by 50% in United Kingdom in the same period from € 0.099 to € 0.049.

4. Preliminary examination of direct support schemes

4.1. Introduction

As part of its preparations for this Working Paper the Commission has examined the advantages and disadvantages of direct support schemes presently existing in the EU, or future possible alternatives.

In undertaking thus analysis, the Commission has considered four main issues:

1. **The compatibility of the schemes with the basic Community rules on the internal market and state aid.**

   As the market share for renewables generated electricity increases, the Treaty rules on the freedom of movement of goods and state aid are likely to come increasingly into play. In particular, schemes that limit support to renewable generation only at domestic level, and do not apply to imported electricity generated under equal conditions will, in due course, conflict with the internal market and state aid rules of the Treaty. Thus, all national support mechanisms will over time need to incorporate the possibility for imported renewables generated electricity to have access to domestic support schemes on a non-discriminatory basis. It is important to determine the extent to which the different schemes comply with this requirement.

2. **The ability of the schemes to provide a stable regulatory environment.** In developing markets such as the one under consideration, which depends for its survival and growth on financial support, regulatory certainty is important. Two issues are relevant here; (i) does the support scheme itself provide a stable support

mechanism to generators ?, and (ii) do doubts as to its legality under the EU rules in the medium term threaten to undermine, or at least attenuate, any benefits identified under (i) above ?

3. **The efficiency of the schemes,** in static terms (i.e. ability to ensure that electricity is generated and sold at minimum cost) and, in dynamic terms (i.e. ability to foster innovation, thus, again, driving down cost), and their effectiveness (i.e. ability to increase Res-generation levels).

4. **Political or administrative consequences of the schemes** which may have effects on their effectiveness as support mechanisms.

Whilst this analysis is a preliminary one, and will be further elaborated in the light of comments received following publication of this paper, the following summarises the Commission's initial findings in these respects:

4.2. Fixed feed-in tariffs

4.2.1. Compatibility with EU Treaty rules

Fixed feed-in tariff schemes do not permit trade at present, and do not permit competition between Res-generators. Furthermore, it is difficult to determine how, in their present form, they could incorporate the possibility of trade, at least whilst they fail to ensure equivalent price reductions to competition/quota based systems, and other quota/competition systems exist in neighbouring Member States. Where for example, a given country maintains a relatively high priced fixed feed-in tariff, but its neighbours practice lower-priced competitive mechanisms, generators in the latter countries will increasingly be attracted to export their capacity to the higher priced neighbour. This could for example happen in a situation where Germany continued to pay high fixed feed-in prices while the Netherlands introduced a competition-based system where the total payment would be lower than the German price. Dutch RES producers may therefore gain by selling the electricity to a German utility which has an unlimited obligation to purchase the electricity fed in.

4.2.2. Secure regulatory environment

Feed-in tariffs provide a high level of short-term regulatory security to potential investors, as they are guaranteed a fixed return on investment. This is an important advantage, and one that has been translated into the creation of generation capacity.

However, two important issues remain to be addressed in this respect. First, the security only exists so long as prices are not modified, or modified frequently, by the regulatory authority responsible for setting the tariff. As costs reduce due to technological development, the feed-in tariff must logically be reduced. As any reduction is decided at government level, this inevitably provides uncertainty.
Second, for the reasons mentioned above, there are important questions as to the legality of such schemes under the EU state aid and internal market rules in the medium term. The resultant uncertainty may, over time, limit investor confidence.

4.2.3. Efficiency and effectiveness

As mentioned above, in terms of their **effectiveness** in increasing levels of Res-generation, the fixed feed-in tariff scheme has been highly effective. The highest levels of Res-generation increase have taken place in recent years in countries in which such a mechanism operates.

However, in terms of **static efficiency**, significant shortcomings of such schemes have been identified.

Indeed, the major disadvantage of fixed feed-in tariffs identified during the Commission's analysis relates to the static efficiency of such schemes. As can be seen from the pricing information in Annex III, fixed feed-in tariff schemes have failed to produce price reductions for Res-electricity. Two important factors contributing to this have been identified.

- First, fixed-price schemes are not able to react flexibility and quickly to possible price reductions resulting from efficiency gains, as any price reduction decision must be taken by the appropriate regulatory authority.

- Second, as mentioned above, the feed-in tariff should be reviewed to avoid excessive profits for new producers when technological development implies lower production costs. However, whether the tariff is fixed in absolute terms or as a percentage of the market price for electricity from "traditional" sources, it may only be changed through regulatory intervention. This may prove to be unpopular and thus politically difficult to carry out as existing producers have strong economic interest in ensuring continued high pricing levels payments.

Furthermore, with respect to **dynamic efficiency** important question-marks exist with respect to fixed feed-in tariff schemes. As the system is not one based on direct competition, either amongst Res-generators, or between Res-generators and "traditional" electricity producers, the incentive for innovation must, by definition, be less pronounced than under a scheme that is based on competition.

4.2.4. Political/administrative issues

Once a significant level of renewables generated electricity develops, and the consequent price uplift to overall electricity tariffs becomes appreciable, the need to demonstrate "value-for-money" and the avoidance of monopoly profits becomes increasingly vital if continued public support for large levels of Res-electricity is to be maintained. This reason, for example, has recently led the Danish Government to announce its intention to move away from a fixed tariff system towards one based on competition. In this respect, therefore, the long-term maintenance of a feed-in tariff system may be difficult.

In administrative terms, however, it should be noted that a fixed feed-in tariff is a system that requires little regulation or "bureaucracy".

4.2.5. Concluding remarks

From the above it is generally accepted that the move from a fixed tariff approach towards one based on trade and competition is at some stage inevitable; notably when renewable generated electricity makes up a significant proportion of total national electricity consumption. Once, however, competition is introduced, prices will fall, leaving certain generators that entered the market on the basis of higher, guaranteed, prices, stranded. In many cases, this may need to be resolved through expensive stranded cost mechanisms.

Thus, on the basis of an examination of the schemes presently in operation in the EU, and in the light of experience gained in the implementation of the Electricity Directive 96/92, it might be argued that whilst a fixed feed in tariff might be considered an appropriate mechanism to ensure low-level market take-off, it may suffer from a number of important disadvantages in the medium term. Indeed, once a minimal critical mass of RES-generated electricity is produced, such schemes may even be counter-productive to their underlying objective of increasing RES-generation levels, as they might fail to produce "value for money" through price cuts and efficiency gains, on the basis of which support for increasing levels of RES electricity depends in the coming years.

4.3. Quota (Competition-based) systems

4.3.1. Compatibility with the EU Treaty rules

In principle such schemes do not present major difficulties in this respect, as, by definition, they envisage competition between Res-generators.

4.3.2. Secure Regulatory environment

It is correct that, in general, fixed price schemes do provide a higher degree of security than quota/competition-based schemes. Indeed, in many respects this security of fixed-price schemes, together with their relatively high prices, are main factors for their success in producing rapid levels of renewables generation growth in countries using such systems.

However, it is possible to introduce competition-based schemes which provide, by design, a very considerable level of security.

For example, it should be noted that a tendering-based scheme provides a level of security for successful tenderers that is higher than for fixed price feed-in schemes. Once a tenderer has been successful, the company in question then receives a fixed purchase price for the electricity supplied for the duration of the supply contract –

similar, in fact, to Power Purchase Agreements in the "traditional" electricity sector. The duration of this fixed price depends on the terms and conditions of the tender, and can be set by the regulatory authority in the light of the market related necessity to guarantee long term price security to attract relevant levels of supply. Once the tender is closed, the contractual situation guarantees that the tenderer in question receives the agreed and fixed remuneration for the electricity produced for the full term of the contract period.

4.3.3. Efficiency and effectiveness

With respect to **static and dynamic efficiency**, as can be seen in annex 3, quota/competition-based schemes have been the most effective in the EU in driving down prices for renewable generated electricity and, according to economic theory, as a result of the competition, stimulating innovation.

However, with respect to their **effectiveness** in terms of increasing Res-generation levels, they have been less effective than fixed-price schemes. The Commission has examined the reasons behind this trend.

One major difficulty faced by the NFFO (the UK tendering system) has been the fact that numerous successful tenders have in fact not installed the contracted capacity. For example, of the 1251 MW given out in contracts under the first three NFFO orders (1990, 1991 and 1994), an amount of only 443 MW had been commissioned as at 30/9/1997[11]. The reason for this was the inability for successful tenderers to acquire the requisite planning permission to construct the renewable generating facility sufficiently quickly. This, however, is not an argument as to why competition-based systems, and in particular a tendering-based system, are unable to develop renewables growth levels envisaged or required. The only issue involved in the NFFO system as a growth constraint has been the issue of planning. Such issues related to planning can be addressed by Member States if they are sufficiently determined to do so: for example, the Danish System of identifying, in advance, areas where permission to build renewables generating capacity is granted. This issue is independent of the issue of the type of support scheme and will facilitate, or limit, the growth of renewables in an equal manner irrespective of the nature of the support scheme.

Another issue with respect to the long-term efficiency of such schemes relates to the concern that the fixing of an Res-quota, the basis of such schemes, which results in the creation of an artificial and separate market from the overall electricity market, may have significant draw-backs. By isolating the RES-market from the overall market, this may reduce competitive pressures on the RES segment overall, thus limiting the movement towards RES-electricity becoming fully competitive with electricity from "traditional" sources. This argument merits careful consideration, as a number of examples exist of the enduring nature of support schemes for products that are artificially isolated from competitive pressure.

However, it does appear that, if properly established, these type of quota-based competitive support schemes may well be able to overcome this possible difficulty. In

[11] Source: Renewable Energy Bulletin No 7, Department of Trade & Industry, 25 November 1997.

order for them to do so it is necessary ensure that effective competition exists between RES-generators. This requires that the quota is set at a level which is (a) low enough to ensure that existing RES-E producers face competition from potential new entrants, and (b) high enough to ensure that there is vigorous competition between different producers. Accordingly, to determine quotas accurately, regulators need detailed information about costs and generation capacities of the various types of renewable technologies (which may not be easy to obtain) if the quota is set an appropriate level. If this occurs, competition-based schemes ensure that, through competition between different suppliers, prices will, where economically possible, continue to fall. In the event that prices fall close to those for "traditional" generated electricity, support schemes can be phased out, eliminating the "quota" element.

Furthermore, the competition-based system schemes outlined above (i.e. those presently in existence or preparation in the EU), are not an exhaustive list. Other schemes, that specifically avoid the explicit or implicit political determination of a "renewables quota" might be envisaged, see below point 4.4.

4.3.4. Political/administrative issues

It is correct that, in general, competition-based systems do require more regulatory and administrative arrangements than a fixed feed-in tariff. However, if quota/competition-based support schemes are implemented appropriately, the regulatory issues can be substantially limited.

4.3.5. Concluding remarks

It is clear therefore, that whist such schemes do present a number of important issues that need to be addressed, they do present a number of advantages for the long-term support of Res-generators in the context of the internal market.

It should be noted, in this context, that the tendering based-system presently in operation in the United Kingdom and the Republic of Ireland is not the only possible approach to the introduction of a quota/competition based scheme. An alternative approach, that is expected to be introduced shortly in the Netherlands and Denmark, is based on **green certificates**. Under this system, such certificates are issued to producers of renewable electricity and are issued according to the amount of electricity (kWh) produced (autogenerator) or sold into the grid (commercial generators). The RES electricity that is generated competes with other electricity for sales, and receives, therefore the "market price" for the electricity sold. In order to finance the additional cost of producing RES electricity, and to ensure that the desired RES electricity is generated, a purchasing obligation or quota is placed on all consumers to purchase green certificates according to a fixed percentage of their total electricity consumption. Each consumer is therefore obliged to purchase green certificates representing x% of its total electricity consumption. In this manner, physical flows do not necessarily match actual purchases. Renewable producers receive the "normal" market price for electricity, and, in addition, they receive a payment for their green certificates, which will necessarily be a function of the difference between the price of "normal" electricity and the cost of producing

renewable sourced electricity. In this manner, a secondary market develops, inevitably via a trading mechanism, and usually via a commodity exchange, whereby RES producers compete with one-another for the sale of the green certificates, and thus the RES electricity.

An alternative measure consists of putting the obligation to ensure that RES electricity accounts for a minimum share of the overall electricity consumption on the electricity suppliers, which would be obliged to ensure that x% of the electricity that they supply is generated from renewable sources. The suppliers would then have the choice to generate the RES electricity themselves or buy it in the form of certificates from producers with surplus production. In this manner extra costs from producing RES electricity is shared between all suppliers and consequently by the consumers as these extra costs will be passed on. Thus, the final result would be the same as described above where the purchasing obligation is on the consumers. Italy envisages the introduction of such a scheme.

It should be noted that one advantage of such an approach over tendering schemes is that it results in a constant competitive pressure being exerted on generators, which can only result in improved dynamic efficiency.

4.4. Fixed Premium Schemes

4.4.1. Introduction

During its preparation for this Working Paper, the Commission has also examined possible alternative support mechanisms, not yet introduced or envisaged in the EU. One such approach might be a mechanism that introduces a certain level of competition/internal market rules in the context of a fixed premium approach.

The objectives of such an approach would be to overcome as much as possible the disadvantages of a fixed-price approach, whilst nonetheless harnessing its benefits. In addition, it would seek to introduce competition/internal market discipline into the market, without fixing specific "renewables quotas"

Whilst it is too early to point to the particular details of such an approach, it might contain some or all of the following elements:

- Rather than a fixed-price, a fixed premium might be set, to be paid to all Res-generators, on the basis of kWh of electricity sold into the grid. Producers might receive no priority dispatch, so they would be required to compete with "traditional" electricity generators for market share. This latter competition, if effective, might over time indirectly drive down the overall electricity price and thus the price for Res-generated electricity.

- The actual premium level might be set to take account of a number of elements, including, possibly, internalisation costs, "infant industry" premiums, and mechanisms to reduce the premiums in line with reducing costs resulting from innovation.

- The premium might be paid to Res-electricity purchasers, which would then select the most efficient, or cheapest, generator, thereby encouraging competition amongst renewable generators.

- The premium may be financed from a non discriminatory levy on all electricity consumers.

- A different premium might be set for different types of renewables generation to reflect their different costs.

Whilst the Commission's analysis of such possible schemes is at an early stage, the possible advantages/disadvantages of such a mechanism may include the following:

4.4.2. Compatibility with the EU Treaty rules

Insofar as such a mechanism could ensure that the premium is set at a level that would introduce effective competition, trade with and between other systems appears feasible.

4.4.3. Secure regulatory environment

Again, if a premium can be set in a manner such that active competition develops, and that the prices for Res-generated electricity do reflect falling costs due to innovation, such a system would present a secure legal environment. However, the fact that the premium would need to be regularly reduced to reflect falling costs might, at least potentially, undermine the resultant certainty.

4.4.4. Efficiency and effectiveness

Within a system of competition-related premiums, such systems might well resolve some of the disadvantages of fixed feed-in tariffs outlined above. In particular, by introducing an element of competition, the **static and dynamic efficiency** limitations of a fixed feed-in tariff may be reduced. In particular, the permanent competitive pressure on Res-generators competing for market share may provide a constant incentive for manufactures to increase efficiency and to innovate, similar to that resulting from green certificate schemes and tendering mechanisms which launch regular tenders. However, it should be underlined that the ability of such a mechanism to have this effect rests on the capacity to ensure that the premium accurately reflects the cost of generating Res-electricity at any given moment.

With respect to **effectiveness** in terms of increasing renewables generation, however, much will depend on (i) the level at which any price premium would be set, and (ii) whether some form of predictability can be given regarding its future amendment.

4.4.5. Political/administrative issues.

The principal possible difficulty with respect to such schemes would relate to the fixing of the level of the premium, and its revision.

4.4.6. Concluding remarks

A present, no such scheme has been introduced or is in preparation in any Member State. The Commission will continue to analyse this model, particularly in terms of how methods to ensure that a premium could be set and permitted to evolve at an appropriate level might be developed.

4.5. Conclusion

This analysis is a preliminary one. It will be further developed following the adoption of this Working Paper, and in particular in the light of comments received by the Commission on the above

II. RENEWABLES AND INTERNAL MARKET: FUNDAMENTAL OPTIONS

In the light of the above, it appears that a number of possible objectives need to be taken into consideration in deciding how best to address the objectives of the Community and the Member States in this area:

- The establishment of regulatory framework that is (i) rational and efficiency enhancing (and thus cost reducing and innovation promoting), (ii) long-term (i.e. not subject to frequent regulatory change), and (iii) effective in producing significant growth in renewable sourced electricity.

- A gradual and progressive movement towards any such regulatory framework to ensure that progress made to date in increasing renewables levels is not jeopardised and that key environmental objectives are met.

- A significant push, across the Community, by all Member States to increase renewables penetration in all EU markets, thus increasing economies of scale particularly in manufacturing costs, and thus driving down costs.

- A number of measures to facilitate access of RES-E to the internal electricity market. Such measures, which should be taken by all Member States, should, for example, aim at ensuring that planning, administrative and grid connection rules reduce to the minimum constraints in these areas on the growth of renewable sourced electricity in the EU.

It is clear that, at present, the disparate support schemes across the EU will need to evolve in order to fully address these issues.

In the light of this, and taking into account experience gained regarding the liberalisation of the electricity market in general, there are significant arguments in favour of the progressive creation of a EU market for renewable generated electricity. Any such action or proposal must be viewed within the context of the EU's most basic objectives in this area: the significant and continual growth of RES generated electricity within a framework that captures all the benefits of this energy source.

The creation of such a single market in many other areas, notably transport, telecommunications, electricity and gas, clearly demonstrates the advantages of the single market process in terms of increasing efficiency, improving technological innovation, and lowering price. Aside from the legal requirements flowing directly from the Treaty in this respect, there are a number of reasons why the progressive development of such a market might be viewed as important. These have been addressed in some detail above.

In order to reach this objective of a better functioning of the single market, there are two basic options presently available to the Community that need to be addressed :

Option 1: Gradual achievement of an internal market through continued application of the EU Treaty rules

Under this option, each Member State would continue to freely choose the support system that it views as most appropriate in the light of its particular circumstances; subject, however, to the continued application of the EU Treaty rules, notably those with respect to state aid. The arguments in favour of such an option include the following:

- the physical conditions relevant to the development of renewable generated electricity differ significantly across the EU. It might be considered appropriate to limit the pro-active development of a single market in this area to ensure that each Member State takes the measures most appropriate to its particular situation.

- As mentioned above, one argument in favour of a fixed-price feed-in tariff system, is its possible appropriateness to ensure the rapid take-off of renewables generation from very low levels, which is the existing situation for most EU Member States.

It is clear, in this respect, however, that the EU Treaty rules, and in particular those with respect to state aid, will continue to apply to such schemes. In the medium to long term it is likely that the application of these rules will progressively lead, in any event, to the development of a single market, i.e. systems that permit the effective trade and thus competition in renewable generated electricity. Thus, a clear option in this respect is not to provide for Community action in the form of specific legislation leading towards specific "single market" provisions at this stage, but to permit this to evolve over time.

Whilst this approach would have clear advantages as mentioned above, it would suffer from the disadvantage of maintaining a certain level of regulatory uncertainly, as changes to national systems may result over time as a consequence of legal action under the state aid rules. This uncertainty, inter alia, may discourage new investment in renewable electricity generation.

Two further possible disadvantages of such an approach might be that (i) in the absence of a pro-active approach by the Community towards the creation of an effective single market in this area, the development of an effective single market would undoubtedly take much longer, depriving the Community of the benefits that would flow from a single market during this interim period, and (ii) during this interim period the difficulties of the contemporaneous co-existence of different and, from a trading viewpoint, probably incompatible schemes, would continue to exist.

Option 2: Proactive creation of a single market through Community action

Under this approach one might envisage the adoption of a basic Community framework, probably in the form of a Directive. Member States would have to ensure that, after an appropriate transitional period, their direct support schemes for renewable generated electricity would comply with a number of basic requirements, in

such a manner that would ensure that the different schemes were sufficiently compatible with one another, permitting effective trade and, thus, competition.

In the light of comments received following the publication of this report, the Commission will further consider which of these basic options should be pursued.

III. POSSIBLE CONTENTS OF A COMMUNITY PROPOSAL

1. Basic Options

In the event that it would be decided to adopt a pro-active approach, another fundamental option would need to be addressed with regard to the type of system necessary or appropriate to produce an effective single market. In fact there are three basic types of mechanisms that might be envisaged in this respect, quota-based schemes, fixed renewable premium schemes, and "mixed" schemes:

Option 1. Quota-based schemes

Such competition-based schemes are designed on the basis of setting a quota at governmental level, and via a competition-based mechanism, ensuring that this quota is filled through competition between different renewables suppliers. The tendering-based schemes in the United Kingdom and Republic of Ireland are examples of such a mechanism. The green-certificate approach to be implemented in Denmark and the Netherlands, is an alternative.

Under such an approach, therefore, all Member States would have ensure that their schemes followed these basic characteristics of ensuring competition between Res-electricity suppliers, and permitting trade between Member States. Evidently, within this requirement, the maximum possible freedom would be left to Member states to decide the type of competition/quota mechanism best suited to its particular circumstances, providing, however, that it provided for equivalent results in terms of promoting effective competition and trade.

Option 2: Fixed-premium schemes.

Under such option, Member States would be required to modify, if necessary, their systems, to ensure that they pursued a fixed-premium-based approach. Again, under such an approach, Member States should be left with the maximum possible freedom to determine the specific details of their national scheme provided, however, they would result in equivalent price levels, and permit trade between Member Sates.

Option 3: Mixed schemes

Under such an approach, Member States would be free to choose between the two types of schemes mentioned above. The function of a Community instrument, therefore, would be to endeavour to lay some basic principles that Member States would need to follow to ensure that the schemes were functionally compatible; permitting, therefore, competition and trade to exist.

It is at present uncertain, however, if or how such an approach might work in practice. The co-existence of competition/quota-based schemes and premium-related schemes presents a number of problems with respect to their compatibility. This issue, in

particular, will be further examined in the light of the comments received following publication of this text.

2. Supplementary Issues

In the event that Community proposals would be put forward, a number of additional elements will need to be carefully examined to ensure that the scheme (i) would enter into force effectively and (ii) would result in the minimum possible difficulties for existing producers. Amongst such measures, the following merit careful consideration.

2.1. Definition of renewable sourced electricity

For the purposes of any action in this area, the definition of RES-electricity would be crucial. As one of the underlying objectives of any proposal would be to maximise the effectiveness of support schemes for renewables generators across the EU, it is vital that the definition of renewables results in only those renewables producers that need support, actually receiving it. The following issues, in particular, merit careful consideration:

Large Hydro

Electricity produced from hydro power plants is, clearly, electricity generated from a renewable source. However, there are reasons for excluding large hydro (i.e. with an installed capacity above 10 MW) from the scope of the definition of RES-E for the purposes of a Community proposal:

- In general, electricity from large hydro plants is competitive with electricity produced from conventional fuels. Most large hydro plants have been in operation for many years, which means that the initial investment has been amortised. It is important, for the development of the European RES sector, that support schemes encourage the development of otherwise non-economic RES generation. They should not provide windfall profits to already competitive RES production.

- The potential development possibilities of large hydro are limited due to environmental constraints. The White Paper on RES only projects a potential increase in the capacity of 10% in large hydro in 2010 compared to the 1995 level. Any necessary support to exploit this potential should therefore be given outside the scope of any Community proposal, i.e. via specific state aid.

Waste

The potential inclusion or exclusion waste raises a number of important issues:

- The contribution of non-organic waste does not provide the same environmental benefits as other RES-generators.

- On the other hand, subject to appropriate processing techniques, the combustion of non-organic waste is environmentally preferable to its disposal via land-fill provided the energy is recovered.

- The production of electricity from organic waste can be highly efficient and competitive. Some representations received by the Commission have argued that the support of organic waste in the same context of an overall EU Directive on RES-E support schemes would detract from efforts to support and develop such renewable technologies as wind.

- In principle, any Community instrument provided it is in line with Community legislation on waste recycling should permit Member States the maximum possible freedom to determine the choice of energy sources they wish to make up the overall renewables supply to their market.

These issues will be further examined and assessed in the light of the reactions to this Working Paper.

2.2. Transitional periods

The introduction of a single market for RES-electricity based on competition would need to be gradual (i) to ensure that no dislocation in market growth resulted from abrupt regulatory change, (ii) to provide all Member States with the possibility of using other support schemes to build up initial renewables generation levels to the point that an internal market based system could be effectively introduced, and (iii) ensure that environmental objectives, such as the Kyoto commitments, are achieved.

An interim period – or long transposition period – would therefore need to be provided for during which it would need to be specified that Member States would be free to maintain in force the support schemes that they consider most appropriate in order to increase existing RES-E level to permit the effective introduction of a single market.

The precise length of such a transposition period will need to be determined, if necessary, in the light of the comments received on the basis of this Working Paper.

Furthermore, in order to guarantee that the introduction of the single market does not, taking account of the particular situation in certain Member States, cause particular problems, it might be appropriate to provide an additional mechanism whereby Member States could apply to the Commission for an extension to the above mentioned "automatic" transposition period. Thus the length of the transitional period would be sufficiently flexible so as to ensure that Member States' environmental goals such as the Kyoto commitments are not jeopardised.

2.3. Small isolated systems, and newly emergent market segments

Any proposal will need to pay particular attention to small isolated electricity systems and newly emergent market segments, characterised by immature technologies. Depending on the particular circumstances of the case in question, a single market based system might not be the most appropriate manner to deal with the particular issues and difficulties in question. For example, with respect to newly emergent market segments, the level of supply might be so limited, or so concentrated, it would be ineffective to endeavour to develop a competition-based market in the short to medium term.

2.4. Transitional regimes ("stranded costs")

In order to ensure the effective introduction of internal market based schemes, it may well be necessary and appropriate for rather wide-ranging transitional regimes – or stranded cost schemes - to be introduced at national level. With the introduction of the internal market, prices will fall. For numerous renewable sourced electricity generators which have previously entered the market and operated under higher, fixed price schemes, such lower price levels may threaten their viability. The market exit of non-obsolete renewable sourced generating facilities cannot be the objective of any potential proposal. Thus, Member States may judge it necessary, during a fixed time period, to provide separate additional mechanisms for the continued support of existing market participants, such as the maintenance of fixed feed-in tariff schemes for these suppliers, or other specific support mechanisms. Such mechanisms will of course have to comply with the State aid rules of the Treaty. Any legislative proposal in this area would need to make adequate provision for the approval of such mechanisms where necessary.

2.5. Certification of origin

In addition to, and independently of, the issues raised above, in order to permit trade between Member States to take place effectively in practice, a certification system might be necessary. Such a system would permit purchasers to be certain that the electricity acquired is generated from renewable sources. In the absence of such a system, not only would it be difficult for potential importers to identify RES producers, but the "multiple sale" of RES produced electricity may pose a problem.

Whilst a single EU certification system and control and verification mechanism might in many respects be the most effective approach to this certification issue, at least at an initial stage it appears that it would be appropriate to allow each Member State to be responsible for issuing the certificates to RES producers in its territory. The certificates would be mutually recognised.

It would have to be accepted, however, that the issue of fraud in this area might be a problem that would need to be avoided *ab initio*. The certificates in question would be valuable and, without appropriate control procedures, susceptible to fraud. To permit effective mutual recognition it is important that mutual confidence would develop. To

encourage and develop this, one might envisage that (i) Member States might be legally obliged to put into place appropriate mechanisms to ensure certification is both accurate and reliable; (ii) Member States might be obliged, by a given date, to produce a yearly report outlining the measures taken to ensure that fraud does not exist; (iii) the Commission, on the basis of national reports, might produce a regular overall report; and (iv) a "Follow-up Group" of national experts, which could be created in the context of any proposal, could consider, at least annually, experience in this area, and any measures or improvements that might be appropriate. It may, eventually, have to be assessed if it would be necessary to legislate at Community level to reduce the administrative burden of having 15 different national systems of certification of origin.

2.6. Minimum support levels for RES-electricity

In the event that it would be decided to take a pro-active approach toward the creation of a single market, the question also arises whether it would be appropriate to set some obligations on each Member State with the objective of ensuring a minimum level of support for renewable generated electricity in each country. In the event that any Community framework would be based on quotas/competition, this might be in the form of a minimum quota or consumption level which each Member State would be obliged to attain. In the event that a fixed price/premium system would be pursued, some obligations might be envisaged as to the methodology of fixing the price premium, or indeed, its level.

The reasons for such approach might be based on the concern that, in order for a competitive and effective internal market for RES-electricity to develop and to be easily and effectively introduced, a minimum critical mass of RES sourced electricity in all EU countries might be viewed as an important element. Furthermore, in order to limit trade distortions due to different prices of electricity across the EU resulting from different levels of RES-electricity support in different Member States, it may equally be appropriate to ensure a minimum level of RES-electricity support and generation across the Community. For these reasons, it might be said that there is a case for minimum RES-electricity support levels or minimum tariff considerations that all Member States would have to achieve within a given time frame.

Such an approach would also be consistent with, and a major step forward towards, the meeting of the EU's objectives in the environment and energy fields. Not only would such an approach be fully consistent with the White Paper on RES, which was welcomed by the Council, and which sets an objective of 12 % RES of total energy use by 2010, it would also lay the foundations for the achievement of the climate change commitments accepted by the EU at Kyoto. In order to meet these commitments, significant change will need to take place, and to a significant extent this change will need to be centred on the EU electricity industry. The manner in which the necessary reduction is made is primarily a matter to be dealt with at national level.

In these respects, therefore, the introduction of common minimum RES-electricity consumption levels or minimum tariff considerations would contribute towards the EU's environmental and energy policies in this area. However, it should be underlined that the Commission has reached no conclusion on the appropriateness or necessity of including any minimum and binding consumption levels or minimum tariff consideration within any possible proposal. There are also arguments in favour of leaving this issue to subsidarity. The Council has welcomed the White Paper on renewable sources of energy which fixes an indicative target of 12% renewable energy in the overall E.U. energy balance by 2010. It is for each Member State, however, to decide how to contribute to the achievement of this objective.

Similar considerations relate to each Member States' approach towards the achievement of its sub-commitment within the EU's overall climate change commitments. Clearly, all Member States will significantly increase their consumption of Res-generated electricity as an integral part of the package of measures that they will take to meet their commitments and their support of the White Paper. However, one might argue that Member States should be left entirely free in the determination of the overall package most suited to their individual circumstances.

The Commission will further examine this issue in the light of the reactions to this working paper.

IV. TECHNICAL AND PLANNING PROCEDURES

1. Introduction

Aside from the issues indicated above, a number of potential constraints to further Res-electricity generation across the E.U. have been identified by producers, and brought to the attention of the Commission as areas in which possible EU action might produce positive benefits. These areas, which will be further examined in the light of comments received following publication of this paper, are:

2. Administrative and planning procedures

One major barrier to the further development of RES electricity in the EU is the administrative and planning procedures that potential generators must meet. This has been highlighted by a number of representative organisations responsible for differing RES producers.

Articles 4-6 of the Electricity Directive provide the basic rules in this respect, providing notably that where an authorisation procedure is followed, the rules must be objective and non-discriminatory. However, it should be noted that these rules, often developed for both large generation projects and small RES projects alike, place a significant burden on RES producers given their smaller size, both overall and in terms of average generation site. In these circumstances, and given the need to encourage the opportunities for RES producers to produce throughout the EU, harmonisation in this area would be likely to produce significant benefits. However, there would also be a number of disadvantages to such an approach. The planning procedures vary significantly from Member State to Member State, and take into account the very different environmental, demographic, and federal structures across the Community.

In such circumstances, and with due regard to subsidiarity, it does not appear appropriate at present to adopt specific harmonisation in this area. An effort to make progress in this area might well nonetheless be contemplated. One might envisage, in this respect, agreeing that all Member States:

(i) review the existing measures, planning and administrative, that potential RES producers must meet, to determine which action, if any, can be taken to reduce the regulatory barriers to increasing RES production such as (a) the setting up of a single reception point for authorisation applications (b) ensuring co-ordination between the different administrative bodies involved and the establishment of reasonable deadlines (c) the establishment of a "fast-track" planning procedure for RES producers, (d) the possibility of establishing mechanisms under which the absence of a decision by the competent bodies on an application for authorisation within a certain period of time automatically results in an authorisation, (e) the production of specific planning guidelines for RES projects, (f) the establishment, at national, regional or local level, of development plans indicating sites suitable for establishing new capacity for generating RES electricity and (g) the introduction of training programmes for the

personnel responsible for the authorisation procedures, and (ii) to publish a report in this respect, outlining the conclusions reached as to what action, is to be taken.

3. Grid connection and reinforcement issues

Renewable electricity (RES-E) generators wishing to feed electricity into the grid have to be connected, which may require expensive installations, especially for wind electricity, which are often located in areas remote from the grid. Connection costs may thus considerably increase the investment costs and inhibit the development of installations. This is particularly the case, due to the small size of renewable generators: the connection costs represent a significantly larger part of the total per site investment for a RES-E installation than for a conventional plant.

In addition, as new generators are connected, strengthening of the grid, i.e. installation of new or upgraded power lines may be necessary. The question of who has to pay for these grid-strengthening investments may affect the rate of uptake of RES-E in general.

On the other hand, the connection of a new generator can have benefits for the grid system; if connected at the appropriate part of the system, a new generator can reinforce the grid system by its mere existence and would thus stretch or assist the network. Consequently, reinforcements intended by the grid-operator become unnecessary or can be postponed.

To function properly, an internal market in electricity would have to provide a level playing field for all existing and potential producers of electricity. This requires that charges put on renewable generators related to the grid-system correctly reflect the economic costs and benefits associated with the connection, in order to avoid that connection and grid-system costs become unfairly prohibitive.

It should be noted that the Electricity Directive in Article 7(2) provides for Member States to ensure that technical rules and operational requirements concerning the connection of generators to the transmission grid are developed in an objective and non-discriminatory manner and are published. However, a comparable provision regarding the distribution system does not exist.

It has been suggested, notably by some representatives of renewables producers, that as a general rule, connection costs of renewable generators should be borne by the grid operator, to facilitate deployment of RES installations. It is doubtful, however, whether this approach can be considered appropriate. In fact, it would lead to a situation where the distance to the grid would be irrelevant to potential investors. Such an approach would thus encourage non-economic installations. On the contrary, to ensure the correct development of the RES sector in the EU, it is important that all relevant investments are fully taken into account, including grid connection costs.

It does not seem appropriate to set mandatory rules on cost sharing with regard to connection and other grid system costs at the European level. However, measures

might be appropriate to ensure that the rules at Member State level comply with some general and common EU – wide principles:

- the full costs and benefits associated with the connection of a new RES-installation should be made transparent ;

- future benefits to the grid-system, such as avoided or postponed reinforcement, should be taken into account ;

- there should be rules foreseeing compensation payments if subsequent electricity consumers connecting to the grid benefit from a grid asset (connection or strengthening) associated with and paid for by a first consumer connecting to the grid.

As regards the benefits RES-electricity installations can provide to the grid system in terms of avoided system losses, it might be appropriate to require that Member States ensure that these benefits are fully reflected in the relevant tariff systems.

V. CONCLUSION

The objective of this paper has been to highlight the numerous options available to the Community in addressing the issue of renewable sourced electricity generation and the internal market for renewable-generated electricity. As can be seen from the above, these options can be divided into two main issues. First, is Community action in the form of a Directive or other initiative necessary to meet the EU's objectives in this area? Second, if so, what approach would be appropriate? In the light of the comments received on the basis of this paper, the Commission intends to reach conclusions on these issues as soon as practicable, and, if necessary, to present appropriate proposals.

ANNEX

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Annex I:

Wind Power Installed Capacity (MW)

	1990	1992	1995	1997
Austria	0	0	1	20
Belgium	5	4	4	5
Denmark	343	458	617	1111
Finland	0	1	6	12
France	0	1	3	9
Germany	48	183	1137	1966
Greece	2	17	27	28
Ireland	0	7	7	50
Italy	3	7	22	99
Luxembourg	0	0	0	3
Netherlands	57	109	257	330
Portugal	1	3	8	29
Spain	7	46	115	455
Sweden	7	20	67	122
UK	10	50	200	322
Total EU	**483**	**905**	**2471**	**4661**

Sources: Eurostat, EWEA, and BTM Consult

Annex II:

Electricity generated from Res in % of total electricity consumption

	Res electricity in % of total consumption							
	incl. Large hydro				excl. Large hydro			
	1990	1994	1996	1997	1990	1994	1996	1997
Austria	62 .8	70 .6	66 .0	n.a.	n.a	9 .0	8 .7	n.a.
Belgium	1 .2	1 .1	1 .1	1 .0	n.a	0 .9	0 .9	0 .9
Denmark	2 .4	5 .6	6 .3	n.a.	2 .4	5 .6	6 .3	n.a.
Finland	24 .0	25 .0	24 .1	n.a.	8 .8	10 .2	9 .2	n.a.
France	14 .8	19 .3	15 .5	n.a.	1 .7	2 .4	2 .2	n.a.
Germany	4 .9	4 .5	4 .4	4 .5	n.a	2 .2	2 .3	2 .4
Greece	5 .0	6 .5	10 .0	8 .6	0 .2	0 .3	0 .4	0 .4
Ireland	4 .8	5 .1	4 .0	n.a.	n.a	0 .7	1 .1	n.a.
Italy	13 .9	18 .0	16 .5	16 .0	3 .7	4 .7	4 .7	4 .5
Luxembourg	2 .1	2 .4	1 .6	n.a.	2 .1	2 .4	1 .6	n.a.
Netherlands	1 .4	2 .0	2 .8	3 .5	1 .4	2 .0	2 .8	3 .5
Portugal	35 .0	36 .2	44 .6	n.a.	3 .3	4 .8	4 .7	n.a.
Spain	16 .9	15 .5	23 .8	n.a.	n.a	2 .6	4 .0	n.a.
Sweden	51 .4	42 .9	38 .2	n.a.	n.a	4 .1	5 .3	n.a.
United Kingdom	1 .8	2 .1	1 .6	1 .7	n.a	n.a	0 .7	0 .9
Total	13 .5	14 .4	13 .5	n.a.	n.a	n.a	3 .0	n.a.

Source: Eurostat
n.a. = non available

Annex III

Prices paid for Res electricity in Member States

1 Germany

In the German feed in law, the price paid to RES-E generators is linked to the average revenue from power supply to the end consumer, excluding VAT. PV and wind get the highest payment, which is 90%. The following table shows the price per kWh paid to independent wind power producers since the introduction of the scheme. In law entered into force on 1 January 1991. The price in 1998 constitutes **16.79 German Pfennig per kWh or € 0.086 per kWh).**

Year	Price in Pfennig
1991	16.61
1992	16.53
1993	16.57
1994	16.93
1995	17.28
1996	17.21
1997	17.15
1998	16.79

Source: Eurosolar, Member State information

2 Denmark

In Denmark, the price for electricity to independent wind power producers constitutes 85% of the net price of a consumer of more than 20,000 kWh per year minus costs for using the grid. The price paid depends on the area and varies between 0.25 – 0.39 DKK per kWh. The average price approximates 0.39 DKK per kWh. On top of this is a subsidy of 0.10 DKK per kWh (reimbursement of the CO2 tax which is levied on all electricity, including electricity from carbon free fuels) and a further subsidy of 0.17 DKK per kWh. Thus the total payment to the wind power producer constitutes 0.53 – 0.66 DKK per kWh (€ 0.0697 - € 0.0885 per kWh) and in **average 0.59 DKK per kWh (€ 0.079 per kWh)**. The price range has remained stable over the last years due to stable electricity prices.

3 Spain

Under the feed-in regulation in Spain RES-E was sold to the grid in 1997 at the following prices:

Small hydro: **11.37 PSE (€ 0.068)**
Wind: **11.48 PSE (€ 0.068)**

(Source: Member State information)

4 United Kingdom

Under the four NFFO tenders organised in 1990, 1991, 1994 and 1997 prices of RES-E have developed as seen from the following table (prices per kw/h):

	Average price wind	Average price all technologies
1990 (NFFO-1)	10.0p	7.0p
1991 (NFFO-2)	11.0p	7.2p
1994 (NFFO-3)	4.8p[12]	4.35p
1997 (NFFO-4)	**3.53p[13] (€ 0.05)**	**3.46p (€ 0.049)**

Source: Renewable Energy Bulletin No 7, Department of Trade & Industry, 25 November 1997

5 Other Member states (most recent data)

Italy: between € 0.083 and € 0.154, depending on technology; after 8 years prices are reduced to € 0.053 for all technologies
France: 0.337 FF (€ 0.056)
Netherlands: 0.08 G (€ 0.036)
Belgium: 2.1 BEF (€ 0.052)
Portugal: 10.8 ESC (€ 0.053)

Source: Member States information

3.1.6 Summary table on current prices paid

To illustrate the situation a potential new investor would face with regard to prices in the above mentioned Member States, the following table gives an overview on current prices per kW/h (in €, based on most recent data):

	D	DK	E	UK	I	F	NL	B	P
€	0.086	0.079	0.068	0.049	0.083	0.056	0.036	0.052	0.053

[12] for investments in wind power capacity above 1.6 MW
[13] for investments in wind power capacity above 0.768 MW

Annex IV: Renewable Energy R&D Expenditure by Country : 1995 ($US million)[14]

	Hydro	Geothermal	Biomass	Wind	Solar H&C	Solar PV	Solar Thermal Electric	Other	Total Renewable
Austria	n/a	N/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Belgium	0.1	0.0	2.5	0.2	0.9	1.2	0.0	0.0	4.9
Denmark	0.0	0.0	8.9	7.0	2.3	0.2	0.0	0.2	18.6
Finland	n/a	N/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
France	0.1	1.3	2.0	0.2	0.3	2.2	0.0	0.0	6.1
Germany	0.0	2.6	2.1	27.2	19.4	40.4	4.6	0.0	96.2
Greece	n/a	N/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Ireland	n/a	N/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Italy	0.0	0.0	9.8	10.1	0.0	22.2	0.0	0.0	42.0
Luxembourg	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Netherlands	0.1	0.1	1.9	6.9	1.8	9.4	0.1	0.0	20.3
Portugal	0.0	0.0	0.4	0.0	0.0	0.1	0.0	0.0	0.6
Spain	0.0	0.0	14.2	33.0	1.3	8.7	8.4	0.0	65.6
Sweden	0.1	0.1	10.3	2.0	1.5	0.4	0.0	0.0	14.4
United Kingdom	0.2	0.0	5.1	5.0	2.8	0.7	0.0	0.4	14.3
Total EU	**0.6**	**4.1**	**59.2**	**91.0**	**30.3**	**85,5**	**13,0**	**0,6**	**283**
Australia	n/a	N/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Canada	0.8	0.1	5.6	1.1	2.0	1.5	0.0	0.0	11.0
Japan	0.0	40.9	6.2	6.7	3.6	80.4	0.0	1.5	139.4
New Zealand	0.0	0.9	0.1	0.1	0.1	0.0	0.0	0.0	1.1
Norway	2.7	0.0	0.9	0.4	0.7	0.1	0.0	0.3	4.9
Switzerland	4.8	2.6	8.5	0.8	11.4	9.8	6.7	0.0	45.0
Turkey	0.0	0.0	0.1	0.0	0.3	0.0	0.0	0.0	0.4
United States	4.9	37.8	59.6	47.1	93.7	87.5	31.5	0.0	393.0*
Total reported	**13.8**	**86.5**	**138.1**	**147.7**	**142.3**	**264.8**	**51.2**	**2.4**	**877.7***

Source : IEA Energy Technology R&D Statistics, 1974-1995, IEA/OECD 1997.

[14] 'Renewable Energy Policy in IEA Countries, Volume I: Overview. International Energy Agency, 1997, p.29

* Total renewable energy includes US$ 30.9 million in 1995 for policy and management support, program support, resource assessment and other cross-cutting support elements which has not been allocated to the sub-categories.

Annex V: Support of RES electricity outside the European Union

Below, some information on how RES electricity is supported outside the EU is given.

United States

Electricity from RES represented 11.9% of total electricity generation in 1996, of which 2.3% came from non hydro sources.

Since 1978, non utility producers of RES-E have been supported through PURPA (Public Utility Regulatory Policies Act) which obliged utilities to purchase power from RES facilities and co-generators at the avoided costs of the utility. However, as a part of the plan to liberalise the electricity market, it has been proposed by the Clinton administration to replace PURPA by a RPS (Renewable Portfolio Standard) which requires electricity sellers to cover a percentage of their electricity sales with generation from non-hydroelectric technologies. Retail sellers could meet the requirement by generating sufficient renewable electricity themselves, by purchasing tradable renewable electricity credits (RECs) from producers generating more than the requirement or by a combination of own production and the purchase of RECs.

The reason for this change is that (i) a purchase obligation as the PURPA is seen unreasonable in a market without captive customers, (ii) the RPS is based on competition between RES producers and spreads the costs more evenly across the market, and (iii) it avoids the troublesome regulatory determinations regarding avoided costs.

The RPS requirement would initially be set close to the present ratio of RPS-eligible generation but with a projected requirement of 5.5% in 2010. Existing contracts under PURPA would be allowed to continue under the current regulation in order to ease the transition to the competition based system[15].

Furthermore, tax incentives are applied for the promotion of new RES-E. A 10% investment credit is given for most solar technologies and geothermal, a production tax credit supports wind and biomass, and a production incentive credit is awarded to facilities which cannot exploit the tax credit as they do not pay federal taxes. Finally R&D is supported via various programmes administrated by the Department of Energy[16].

Japan

Electricity from RES represented 8.0% of total electricity generation in 1996, of which 2.4% came from non hydro sources.

[15] See below, section III 3.1.5., transitional regimes.
[16] See table 1, in annex.

Increased use of RES is seen as an indispensable instrument to meet the CO2 target of stabilising the emissions at their 1990 level by 2000. Japan has set non-binding targets for RES penetration as follows:

- hydro power should increase to 45500 MW in 2000 and to 57000 MW in 2010;
- geothermal installed capacity should increase to 600 MW in 2000 and to 2800 MW in 2010;
- PV capacity should increase to 400 MW in 2000 and to 4600 MW in 2010;
- wind power should increase to 20 MW in 2000 and to 150 MW in 2010;
- and waste should increase to 2000 MW in 2000 and 4000 MW in 2010.

The Japanese government supports the construction of new RES facilities through subsidies (from 10% of capital costs for hydro plants to 50% for some PV and wind installations). Furthermore, the state provides tax incentives through reduction in income taxes or depreciation allowances and through low interest loans or reimbursement of part of the interest payments.

In addition to financial incentives, fixed prices for PV and wind power have been set equal to end-consumer prices. However, there is no guaranteed market and the production of electricity from these sources is very limited (2 GWh of the total non hydro RES production 23949 GWh in 1996).

Norway

Close to 100% of the electricity production in Norway is based on hydro power (nearly all production stems from hydro power plants larger than 10 MW). It is an objective that new RES technologies, i.e. bio energy, wind energy and solar energy should increase in importance.

The state supports R&D in new RES technologies and introduction and demonstration projects, especially in new technologies. From January 1999 exemption for investment taxes (7%) will be given for investments in bio energy, wind energy, heat pumps, district heating, wave power and for mini hydro plants (< 1 MW). Furthermore, a subsidy is given to wind power, corresponding to 50% of the electricity tax.

ANNEX VI

Details on the investigations and consultations made

Subsequent to the White Paper on RES and the Harmonisation Report the Commission has analysed in detail the situation with regard to RES-E in the European Union. Existing studies and reports[17] on the design and functioning of current support mechanisms as well as on barriers other than financial, such as administrative procedures and grid-system issues, were consulted.

Furthermore, valuable information was received from Member States, on the basis of a questionnaire sent up by the Commission.

Apart from the above investigations, discussions were held and/or comments received on the issue from many interested parties, such as:

- **Energy Consultative Committee** (comprising representatives of the RES sectors, the electricity industry, environmental organisations, trade unions, employers, consumers etc.)
- European Wind Energy Association (EWEA)
- European Biomass Association (AEBIOM)
- European Small Hydropower Association (ESHA)
- European Photovoltaic Industry Association (EPIA)
- EURELECTRIC
- European Utilities for Renewable Energies (EURE)
- Bundesverband Windenergie (BWE, German national wind association)
- Representatives of individual companies, from the RES sector and from traditional energies
- Greenpeace
- IFIEC (large industrial electricity consumers)
- Members of national parliaments and members of the EP involved in energy matters

In the following the views expressed are summarised briefly:

[17] Examples of studies and reports used: - *IEA*: Renewable Energy Policy in IEA Countries, (June 1998); *E.D. CROSS (Institute of Energy Law, Leiden)*: Legal frameworks for the promotion of wind energy and other renewable energy resources in the EU Member States (1997); *EUROSOLAR*: Legal, technical, administrative and structural conditions for Common Feed-In Rules in the EU for electricity generated with renewable energy sources (RES) by auto-producers (March 1996, APAS study commissioned by DG XII); *ILEX/RAMBOLL*: European Union Member States connection and use of system policies for renewable generators (October 1996, ALTENER study); *C. MITCHELL:* (co-ordinator): The value of renewable electricity (final draft April 1998, JOULE study commissioned by DG XII); *C. MITCHELL*: Renewable Energy in the UK (February 1998); *UK DEPARTMENT OF TRADE & INDUSTRY*: Renewable Energy Bulletin No 7 (25 November 1997); *FORUM FÜR ZUKUNFTSENERGIEN*: Aktionsprogramm Abbau von Hemmnissen bei der Realisierung von Anlagen Erneuerbarer Energien[17] (April 1997)

The **Energy Consultative Committee** gave an opinion on the issue, following intense discussions on the basis of a catalogue of key questions submitted to the Committee by the Commission.

From the bilateral contacts with representatives of the RES sector, it became clear that the sector considers European legislation in the field of RES-E highly necessary in order to ensure that under the new framework conditions of the Internal Electricity Market the RES-E sector can further develop. However, some, in particular from Member States operating currently feed-in-laws, have expressed concerns about the idea of replacing such feed-in-laws by alternative mechanisms in the future. All representatives stressed that apart from the financial question, other barriers, such as planning procedures and grid-system issues, still persist and hinder RES-E development.

The traditional electricity industry is generally favourable to the idea of common Community rules on RES-E. They have emphasised that any rules must be designed in such a way that they ensure surplus costs incurred by the promotion of RES-E to be as low as possible and that equal burden sharing exists, in order to avoid trade distortions.

From other players, such as energy expert parliamentarians non-governmental organisation concerned etc, a wide range of views was received. The most controversial point is the question on whether and how long existing feed-in-systems can persist in the Internal Electricity Market, on which there seems to be no agreement. The need for some kind of EU harmonisation is, however, generally recognised.

Finally, it should be noted that a number of additional studies on the issues are either ongoing or have been commissioned under the 1998 ALTENER call. The results of these studies are expected to provide helpful additional findings on the way forward.