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RENEWABLE ELECTRICITY AND LIBERALISING MARKETS

Phase 1: Inception Report

The REALM Research Group

The members of the REALM Research Group that contributed to this report are:

AUSTRIA
G.Bitzan (Draukraft)
H.Reisinger (Verbundplan)

DENMARK
N.I. Meyer (DTU)

GERMANY
I. Kuehn (ZEW)

GREECE
K. Delkis (NTUA)
K. Perrakis (NTUA)
P. Capros (NTUA)

THE NETHERLANDS
G.J. Schaeffer (ECN)
P. Koutstaal (ECN)

UNITED KINGDOM
M. Bess (ESD)
C. Croockall-Fallon (ESD)

Preface

This report and its appendices are based on the official Inception Report of the REALM project that has been submitted to the European Commission by the co-ordinator of this project, ESD. It included Country Briefing Papers as appendices. The Chapters of this report have been written by Mike Bess, Chris Crookall-Fallon and Gerrit Jan Schaeffer. These Chapters are based on the underlying Country Briefings, present in the Appendices, which have been written by Kostis Delkis, Kostis Perrakis and Pantelis Kapros (Greece), Hubert Reisinger and Gernod Bitzan (Austria), Niels Meyer (Denmark), Isabel Kuehn (Germany), Mike Bess and Chris Crookall-Fallon (UK) and Paul Koutstaal and Gerrit Jan Schaeffer (The Netherlands). The main changes with regard to the original document are the omission of project-specific information, such as the minutes of the Kick-Off Meeting and the detailed work tasks for next steps in the project.

Abstract

The Renewable Electricity and Liberalised Markets (REALM) project (contract No. JOR3CT-98-0290) is a project with a contribution from the European Commission Directorate for Research and Development. It aims to systematically investigate the position of renewable electricity against the background of liberalising markets from the perspective of the electricity sector. The project started in May 1998 and will be concluded in October 1999. Participants come from six different European countries: UK, The Netherlands, Germany, Denmark, Greece and Austria.

The first task of the project has been to make an inventory of the state of liberalisation and renewable energy policies in the participating countries. For this purpose each partner in the project has produced Country Briefing Papers with detailed information on the state of electricity liberalisation and renewables in each of the six partner countries. The briefing papers:

- describe the background and position of renewable energy in the electricity sector of each partner country,
- describe the process and the driving forces in electricity sector liberalisation,
- identify the background, basic concerns, expectations and interests of the utility partners,
- outline the project partners' ideas on survey strategies.

This report reflects the contents of these Country Briefing Papers, which are added integrally as attachments.

The inception report has functioned as a starting point for the other activities in the project:

- Baseline Survey among the European Electricity Utilities.
- Risk and Opportunity analysis for the European Electricity Utilities.
- Individual Country/Utility Position Papers.
- Integrated European Renewable Electricity Action Plan.

The findings of this report can be summarised as:

- All partner countries have liberalised, or are in the process of liberalisation well beyond the EU directive (i.e. Member States are liberalising more rapidly and to a further extent than set out in the electricity directive).
- Liberalisation provides utilities with a range of risks, benefits and opportunities,
- Some countries are further along the liberalisation path than others. However, 'liberalisation' means different things in different countries.
- There is a variety of incentive schemes for renewables within the member states of the European Union. The same is true for the degree of penetration of renewables.
- There are various definitions of what counts as renewable electricity in the different member states. Sometimes there are even different definitions within member states.

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1. INTRODUCTION

Liberalisation and the stimulation of renewable energy currently are among the main issues in the European energy sector. During the last years the European Commission has issued several documents that address them. Common Rules for the Internal Electricity Market have been put forward by a Directive of the European Commission, issued in December 1996. Another important official document with regard to the topic of the REALM-project is the White Paper on Renewable Sources of Energy, issued by the Commission in November 1997. In this White Paper an indicative target of a 12% contribution from renewable energy to the gross energy consumption in the European Union was set for 2010. The current renewable energy share is 6%. The White Paper assumes that the larger part of this target (about two-thirds) will come from the electricity sector. With a 40% share of electricity in the gross energy consumption of the EU, the 12% renewable energy target means a 20% target for renewable electricity.

The combination of a liberalising electricity market and ambitious targets for renewable electricity provides a challenging context for the European Commission, the Member State Governments as well as for the electricity sector. Governments are seeking for new policy instruments that are adapted to the new or coming liberalised situation, while firms in the electricity sector have to develop strategies in order to be able to compete on the market.

Within the framework of this context a research project has been formulated by the Directorate on Research and Development of the European Commission, the Renewable Energy And Liberalising Markets (REALM)-project. This project started in May 1998 and will be concluded in October 1999. It takes the perspective of the electricity sector itself as a starting point. The main goal of this project is to assess the role of renewable energy in the strategies of firms in the electricity sector within the context of the process of liberalisation of the European electricity market. Consultant partners from six countries (Austria, Denmark, Germany, Greece, The Netherlands and The United Kingdom) form the core team of this project. Associated to them are one or more utility partners from the same countries. The project consists of different phases and is finally supposed to contribute to the formulation of an Integrated Action Plan for the implementation of renewable energy in the strategies of European utilities, including suggestions on appropriate incentive schemes and policy measures.

This report covers the first phase of the project and puts together valuable information on the state-of-the-art with regard to liberalisation and policies with regard to renewable electricity in the six participating countries. This information is based on the individual Country Briefings that have been added as appendices to the report.

The report starts with a description of the consultant partners and the utility partners associated with them. A description of the current status of renewable electricity and the legislative frameworks follows. A short summary of the main findings will conclude this report.

2. DESCRIPTION OF PROJECT PARTNERS, THEIR OBJECTIVES AND PERSPECTIVES

2.1 Verbund (Austria)

Verbund is the major generator of electricity in Austria (responsible for about 50% of Austria's total production, 75% of which is from renewables) and also owns the high voltage transmission grid. It is owned by the Republic of Austria for 51%. It also provides technical and planning services to the electricity sector in Austria.

In Austria there are five kind of players on the electricity market: generation utilities, independent power producers (IPPs), distribution utilities, the electricity consuming industry and the government, who sets the rules. The government has made a commitment for a 13% reduction in greenhouse gas emissions, which only can be achieved when the presently high level of renewables is maintained and further increased. However it is not really clear how the market share of renewables can be held in the future. This is of major interest to Verbund. It is of crucial importance to Verbund to understand how the share of renewable energy in Austria's electricity generation can be maintained. It is also important for Verbund to understand the dynamics of the new electricity and energy market liberalisation in order to understand how to plan for changes, and how to optimise those changes in the best economic and social sense.

2.2 DTU (Denmark)

DTU (Danish Technical University) is the largest technical university in Denmark. The research group participating in the REALM project is linked to the Department of Buildings and Energy. DTU published a commentary on Danish energy policy in 1998. This commentary emphasises the impact of liberalisation on the Danish energy policy. Government will come up with a new energy law in early 1999. There is considerable lobbying for setting the agenda for this new law, and considerable debate in the press. The official target of the Danish government is that renewables should cover 35% of total energy by year 2030; wind power is planned to cover 40-50% of electricity demand by the same year.

2.3 ZEW (Germany)

ZEW (Zentrum für Europaischen Wirtschaftsforschung) is a research group that has been involved in the whole field of integration of renewable energy into the European market. They believe that integration of renewables is possible in a liberalised electricity market. However, the key question is how to accomplish this. ZEW would like to see if there are viable new strategies for renewables developers and electricity utilities, succeeding or supplementing Germany's Electricity Feed Law/EFL. They are interested in the potential costs and benefits of European-wide renewables support options.

2.4 ICCS/NTUA (Greece)

ICCS/NTUA (National Technical University of Athens) has good links with the electricity and governmental sectors. NTUA has carried out studies for the Greek government and the EC on the effects of renewables in Europe, and in the field of liberalisation. They are working with the EC to set the framework for regulating renewables in the new, liberalised marketplace. ICCS/NTUA have modelled the European electricity sector and have integrated renewable energy into their work. They have extensive links with Greek and other EU companies and institutions concerned with renewable energy and the environment. Other work includes modelling technological change and its environmental and economic effects (in which ESD and ECN are also participating), and the role of renewable energy in the electricity sector.

2.5 ECN Policy Studies (The Netherlands)

ECN is the national energy research institute in the Netherlands and employs about 700 people. At the business unit Policy Studies a scientific staff of 50 persons are involved in energy policy studies for the national government, the energy sector and European contractors. It has been involved extensively in renewables. It is very active in studies on electricity liberalisation in The Netherlands. ECN is interested in the type of policies needed in liberalised markets if governments and the European Union want to stimulate renewables. ECN believes that, without stimulation from the side of the government, further growth in renewables in The Netherlands will be seriously hampered.

2.6 ESD (UK)

ESD is active in renewable energy and electricity in the UK and in Europe. ESD works closely with a number of UK generators following up the Non-Fossil Fuel Obligation (NFFO), the UK's major renewables support instrument. ESD is working on the issue of utilities and demand side management in liberalising electricity markets in Europe (under a DGXII project), and on related projects world-wide. Renewables and the electricity sector will be transformed over the next few years in the UK, making a very interesting mix of opportunities and risks for utilities and renewables in utilities.

3. UTILITY PARTNERS' OBJECTIVES AND PERSPECTIVES

3.1 Draukraft (Austria)

Draukraft, is a generator of electricity. It is a sub-organisation of Verbund. Draukraft wants to see how other countries, utilities and groups are responding to the new European Electricity Directive, the White Paper on Renewable Energy and the new competitive situation in Austria and the rest of Europe.

Austria is undergoing the first steps of liberalisation, opening the market for consumers with more than 40 GWh of demand per year - meaning all 16 of Verbund's large customers. The whole structure of competition, laws, prices, etc. are under review, and there is considerable uncertainty over what will happen as the new competitive, liberalised EU regime comes into play. Draukraft believes it will, together with the other generators of Verbund, be commercially disadvantaged by the changes, and its approach is to reduce costs and look for co-operation in the face of this competition.

3.2 Elkraft (Denmark)

Elkraft was established in 1978 as a co-operative whose members are SK Power Company and The City of Copenhagen. It has the task of co-ordinating Eastern Denmark's supply of electricity and co-generated heat in such a way as to achieve balance between security of supply, competitiveness and care for the environment.

Elkraft is an association of producers and distributors. Elkraft covers approximately 40% of the Danish electricity market. Elkraft supports the policy of the Danish government concerning strategies for electricity sector liberalisation. They have been active in developing new planning methodologies in relation to energy planning for a sustainable development. They have recently been promoting renewable energy, especially in relation to offshore wind farms.

DTU has worked closely with Elkraft over the years, and Elkraft is very interested in the REALM project. Elkraft is an active partner in the project, and three planning experts from Elkraft will take part in the project.

DTU has been active with utilities and government in setting the framework for renewables in a liberalised market. In June 1996, the Danish government passed a new energy law ('L486'), which anticipates the possibility of introducing Public Service Obligations (PSOs) in a liberalised market. Under this law, priority is given to renewables and combined heat and power (CHP) in the electricity supply system. After a period of about 18 months for notification in the European Commission, L486 was finally accepted and went into operation from January 1998.

There are forces in Denmark pushing for faster electricity market liberalisation, including the Danish Association of Industries and the Danish Ministry of Industry. Of the two major utilities in Denmark, Elkraft is pursuing a measured approach to liberalisation, ar-

guing that social and environmental targets should not be compromised through moves to achieve economic targets.

3.3 PreussenElektra (Germany)

PreussenElektra supplies electricity to some 15 million people within a surface area that covers a good fifth of Germany. Via affiliated and associated companies PreussenElektra sells electricity to one-fourth of the German population (20 million people) and covers one-third of the area in Germany. It supplies energy to industrial customers as well as to regional and municipal utilities. These take care of further distribution of electricity to the consumer. They transport electricity via their own high and extra-high voltage grids.

PreussenElektra is owned 100% by VEBA AG in Düsseldorf. In addition to energy supply, subsidiaries of the VEBA Group are engaged in a variety of industrial and trading activities. The VEBA Group holding company is responsible for the Group's strategy and is the agent in the capital market.

PreussenElektra is the second largest utility in Germany and the fourth largest in Europe. Most of their production capacity is in northern Germany, however. PreussenElektra have been relatively financially disadvantaged by the large renewables development in northern Germany, which they are obliged to support through the Electricity Feed Law (EFL). However, they do envisage a future in which nuclear generation is frozen and 'global warming' is proven. From a commercial perspective it might be acceptable to absorb more renewables production, if renewables could be promoted outside the framework of the EFL in a way that would be more commercially equitable.

3.4 Enersys (Germany)

Enersys is an energy service company in the southern part of Baden-Wuerttemberg that was founded to promote renewable energies and energy efficiency. They are a daughter company of the Kraftwerk Laufenberg utility. Enersys is trying to sell energy services (heat and electricity) to consumers. They rent and operate equipment (e.g., CHP under biofuels, solar collectors, etc.). They are trying to build up their market, with reasonable success. Enersys is interested to see how an EU-wide or national scheme that promotes renewable energy might help to overcome some of the obstacles they face in the market.

3.5 Public Power Corporation/PPC (Greece)

PPC is a monopoly supplying electricity all over Greece. There are a small number of IPPs in Greece, some generating electricity from renewables. Renewables account for approximately 4% of PPC's electricity supplies. Most of this electricity is generated from hydropower resources, while biomass, wind and solar account for the remainder. Incentives to promote renewables have included tax breaks, incentives, and EU supports. The electricity market will be liberalised from 2001, except for the islands where production and consumption of electricity is small. The cost of generating electricity in the Greek islands is among the highest in Europe, and accounts for a major part of PPC's expenditures.

3.6 EnergieNed (The Netherlands)

EnergieNed is an association of all the distribution utilities in The Netherlands. Several financial incentives to stimulate renewables have been introduced by the Dutch government over recent years, from capital cost subsidies to tax exemption measures. The Dutch Parliament has accepted the new electricity law in August 1998, that liberalises the electricity market, at a faster pace than set out by the EU electricity directive. By January 2007 all consumers will be free to choose their suppliers.

The Electricity Law 1998 has several points on renewables in liberalised markets, including the ability of government to force utilities to meet renewable targets. The utilities have said they will achieve 1.7 TWh of renewable electricity production in the year 2000 (compared to 0.66 TWh in 1997, representing primarily 325 MW of wind installed[1]) without being forced by the government. EnergieNed has already voluntarily defined strategies to meet this quota, and has recently introduced a green labelling system, somewhat similar to 'tradable permits', which is creating considerable interest internationally.

3.7 The Association of Electricity Producers/AEP (UK)

AEP is an association of over 100 members, including the largest electricity suppliers and some of the smallest. 60% of its members are generators, and 50% have interests in renewables, including institutional members such as the British Wind Energy Association/BWEA, the British Hydropower Association, the British Landfill Gas Association, etc. AEP is working closely with government in the liberalisation process, and seeks to promote the development of renewable sources of electricity in the many government reviews of the national electricity trading arrangements and renewable energy support measures which are currently underway.

[1] The Netherlands generated 2.1 TWh of electricity through waste incineration in 1997, and 0.1 TWh from landfill gas in 1997. While these are considered by one definition to be renewable energy sources, the target set is for renewables under the 'restricted definition' (i.e. 'all energy in the form of electricity, heat or fuel that is generated by local renewable energy sources, after correction of possible use of energy for its generation.').

4. RENEWABLE ELECTRICITY STATUS AND LEGISLATIVE FRAMEWORKS

4.1 Background to, and state of renewable electricity legislation

The history of renewable electricity development, the current size of installed capacity and the mix of technologies varies widely between the member states profiled (Germany, Denmark, Austria, Greece, the Netherlands and the UK). The key factors driving the development of renewables have changed over the years. For almost all countries, the oil shocks of the 1970s added tremendous impetus to the development of renewables, primarily as a means to achieve more security of energy supplies.

Later, other concerns began to dominate the development of renewables. Environment concerns began to manifest themselves during the 1970s. Policies and legislation geared towards promoting renewables to address the environment began to appear during the 1980s. Environmental concerns remain the most potent source of support for renewables in Europe today, although other concerns, such as regional development, opening energy markets to smaller players, exports and employment have grown in importance.

One common theme amongst all six countries has been, and continues to be, the predominant role played by electricity utilities as a mechanism for achieving social and political targets. That is, EU governments have chosen to use electricity utilities as instruments of their renewable energy policy, and consequently the utilities have proven to be one of the most important, the fastest and the most dynamic means for bringing on large amounts of renewable energy relative to any other sector or economic actor[2]. Most legislation regarding renewables in the six partner countries focuses primarily on the electricity sector. This seems likely to continue. But, as described in more detail in Section 4.2, it is not at all clear that this reliance on electricity utilities to meet national renewable energy targets can continue to achieve desired results in an open, liberalised electricity market, certainly not without substantial government support and direction.

4.1.1 Austria

Austria is unique among the project partner countries, with some 75% of electricity demand met by renewable energy in the form of hydropower. Other renewables account for about 12% of total energy demand, including a very high installed capacity of solar thermal. The origins of Austria's hydropower development lie in national planning after the Second World War. Security of supply has been a key issue in Austria's politics and government policy since the 2nd World War.

The oil price shocks of the 1970s underlined the importance of this strategy. Furthermore, Austria's rejection of the nuclear energy option, and its almost total lack of fossil fuel resources, left it with little alternative but to develop its renewable energy resources.

[2] It is important to distinguish between different actors in the electricity industries of Europe. The role played by generators, suppliers and vertically integrated utilities will be different. Even when new renewable energy developments are dominated by small independent producers (for example the case of wind power in Germany) the utilities still play a key enabling role.

Its abundant hydropower resources provided Austria with the opportunity to reduce its international energy dependency, and, as environmental issues grew increasingly important, those resources also allowed Austria to pursue an aggressive environmentalist approach.

Table 4.1 *Austria's energy supply (1970 to 1995)*

Supply of electric energy	1970	1980	1990	1993	1994	1995
River and treshold river power plants	13.091	19.011	21.413	24.283	23.522	24.793
Storage power plants	6.205	8.004	8.683	11.051	10.721	10.962
Hydropower supply of electric utilities	*19.295*	*27.015*	*30.096*	*35.334*	*34.243*	*35.754*
Hardcoal	304	24	3.982	2.192	2.419	3.286
Browncoal	1.890	2.473	2.278	1.026	904	1.459
Fuel oil	1.132	4.249	1.264	1.390	1.489	1.064
Natural gas	2.878	2.580	5.872	5.097	5.896	6.284
Others	17	15	32	25	29	17
Thermal power supply of electric utilities	*6.220*	*9.342*	*13.428*	*9.730*	*10.738*	*12.111*
Supply of hydropower	194	226	447	684	701	710
Supply of thermal power	108	110	78	138	145	224
Supply of own generation utilities	*302*	*337*	*525*	*822*	*847*	*934*
National Supply	*25.818*	*36.693*	*44.048*	*45.886*	*45.827*	*48.799*
Supply from railroad authority (OEBB)	7	2	3	3	3	3
physical Electricity exports	1.303	3.156	6.742	8.005	8.167	7.232
Total of supply	*27.128*	*39.851*	*50.793*	*53.893*	*53.998*	*56.034*

4.1.2 Denmark

Denmark has practically no hydropower, and renewables were not investigated as viable sources of energy until the 'oil crisis' of 1973/74. Against initial resistance from the electricity utilities, and following some years of public debate on alternative energy development plans, the government concluded a series of agreements with Danish utilities requiring them to install certain amounts of renewable generation capacity in specific technologies.

During the late-1980s and early-1990s, the focus of Danish energy policy changed from being driven primarily by economics and security of supply, to being driven by environmental concerns. Special attention has been paid to CO_2 emissions. The Danish Energy Plan of 1990 ('Energy 2000') set an objective of a 20% reduction in CO_2 by 2005, compared to 1988 emissions. This position was confirmed and strengthened in the latest energy plan entitled 'Energy 21'. Energy 21 sets the objective of 'placing Denmark in a position to maintain and enlarge its role as a pioneering country for global, sustainable development.'

In this regard, two long-term national objectives have been formulated:
- a 50% reduction of CO_2 by year 2030,
- a 1%/year increase in the share of renewables leading to 35% by 2030.

Denmark's renewable energy policy is unique in Europe. It is characterised by considerable consensus in which the public, private industry (particularly renewable energy equipment manufacturers), renewable energy suppliers, and the government have worked out strategies that address key issues of environment, socio-economic development, and exports. This has resulted in Denmark leading the world in wind technology development

and exports (over 75% of all international wind equipment exports originate in Denmark). While the electricity utilities have not always shared the enthusiasm of many of their government colleagues, they have still been active participants in Denmark's renewable electricity development.

Wind power especially has developed in this way. The phenomenal growth of renewable electricity in Denmark was supported by an alliance of consumers, non-governmental organisations (NGOs) and academics, and was backed up by official energy plans emphasising renewables and energy conservation. Wind power now dominates renewable energy sources for electricity, but biomass also features prominently. Today, the installed wind capacity in Denmark is some 1,100 MW, generating more than 6% of Danish electricity demand. Official plans call for wind electricity capacity to increase to 1,500 MW by 2005 and to 5,500 MW by 2030.

4.1.3 Germany

In Germany, renewable energies (excluding large-scale hydropower) contribute only about 1,5% to current electricity production, despite support through government legislation (specifically, the Stromeinspeisungsgesetz, or Electricity Feed Law (EFL)). Enacted in 1990, and updated in 1994 and 1998, the EFL has required utilities to pay a set premium price to any generator of renewable electricity in a utility's service area. This has resulted in a rapid increase in renewable generation, particularly wind generation, in recent years. Germany now has more wind electricity generation capacity than any country in the world, with over 1.7 GW of capacity installed since 1995.

The EFL has obliged electricity utilities to purchase electricity generated from wind, solar, hydropower, sewage or landfill gas, and biological residues from agriculture and forestry. With the most recent update in April 1998, the EFL was expanded to include electricity from all types of biomass. Utilities have to buy renewable electricity at prices of between 80% and 90% of the average specific utility revenues. The EFL has been resisted by German utilities as unfair. Given the fact that renewable energy resources are not evenly distributed throughout Germany, some utilities have been required by the EFL to purchase large amounts of electricity from renewables (because of the large amount of renewable resource in their area), while others have had to purchase very little.

New legislation introduced in April 1998 seeks to 'cap' the amount of electricity from renewables any single utility is required to purchase. This was done to limit the financial burden of the utility which has to buy that electricity. However, it is not clear what effect this will have on the development of renewable energies, particularly in light of additional market liberalisation legislation. The utilities say that they will offer electricity from all available sources if it is economically viable and if there is sufficient demand.

Table 4.1 *Shares of renewable energy sources in electricity production in Germany in 1997*

Renewable Energy Source	Installed capacity [MW]	Net Electricity production [GWh]	Share of total [%]
Hydropower (incl. pumped storage)	4590	15800	3.4
Wind energy	1970	2970	0.6
Biomass	400	879	0.2
Photovoltaics (on the grid)	25	11	0.002
(Waste Incineration)	(530)	(2110)	(0.5)
Total	7 500	21800	4.7

The target set by the German Ministry of the Environment mentioned in several programmes is to double the share of renewables in energy supply by 2010 compared to 1997. However, this is not a target agreed upon among different ministries and parties, i.e. it is not the official policy. Germany is one of the EU member states which has prevented the target set in the EU's White Paper on Renewable Sources of Energy to become binding.

4.1.4 Greece

Greece has the third largest net contribution of electricity from renewables within the EU. Approximately 10% of total electricity demand is from renewable sources, provided mainly by hydropower. Some 40 MW of wind power have been installed over the past five years. The state electricity utility, Public Power Corportation (PPC), dominates ownership of renewable capacity, and until 1985 no other producers were permitted. Now some independent power producers (IPPs) own renewable generation capacity, but all sales of power from this plant must be made through PPC.

Historically, the deployment of renewables was prompted by the oil crises of the 1970s. Greece's vulnerability during this period led the government, through the PPC, to develop indigenous resources, primarily hydropower. This became one of the central features of Greek energy policy. In more recent years, environmental concerns have also driven the PPC's development of renewables. An important issue for Greece, uniquely among the team partners, is the relative isolation of the power distribution network and its lack of cross-border interconnection with other EU countries, which has influenced PPC planning for renewables. On the other hand, wind development in the autonomous island systems is also limited due to stability and operating constraints of the conventional oil units used for electricity generation.

The legislative framework for promoting renewable electricity in Greece rests primarily on the following:

1. The 'Economic Development Law (EDL) (1982. 1990, and amended in 1998) provides 45% - 55% subsidies for target renewable investments, reduced loan interest rates, tax credits, and increased depreciation rates for private investments in electricity from renewables.
2. The 'Law for regulation of electricity generation from renewable energy sources' as amended in 1994. The main provisions of L.2244/94 are as follows:

a) Two categories of electricity producers are defined: autoproducers (APs) and Independent power producers (IPPs).
b) Capacity limits are set to 50 MW for IPPs.
c) APs compensate electricity consumption from the PPC. network with production from RES (up to 80-90%).
d) Licensing procedures are simplified.
e) Tariffs are correlated with the kWh selling prices (70-90% of the retail price).
f) PPC has to buy all energy produced, as allowed by the technical constraints of the system, under 10-year contracts.
g) The penetration of intermittent RES in island grids is limited to 30% of peak load of previous year.
h) PPC remains the exclusive supplier of third parties with electricity.

An additional instrument for the renewable electricity support and development is the '2nd Framework Support Programme (1994-1999)'. This programme sets out investments in renewables on the order of Euro 190 million, coming from the European Union, and national and private investments. One third of this budget is dedicated to wind energy for electricity generation.

4.1.5 The Netherlands

The Netherlands has adopted innovative approaches for increasing the generation of renewable electricity. However, renewables are currently relatively limited, accounting for less than 3% of total electricity supply. While the Dutch produced some 2.76 TWh of electricity from renewables in 1997, 2.1 TWh of this was from waste and landfill gas. Both of these have been excluded from the definition of 'renewables' under some of The Netherlands' most recent environmental and energy regulations[3]. This leaves The Netherlands with 325 MW (0.45 TWh in 1997) of wind, a small amount of solar PV and hydropower. The target of EnergieNed and the utilities, which has been set under pressure of the Government, is 1.7 TWh per year in the year 2000. Also a national target for renewable energy has been set. For the year 2020 The Netherlands have a target of 10% renewable energy which translates into 17% renewable electricity.

Table 4.2 *Dutch situation in 1997 for renewable electricity*

Renewable resource			Domestic electricity production (96.1 TWh)	avoided	Domestic energy consumption (2945 PJ)
	[MW]	[TWh]	[%]	[PJ]	[%]
Wind	325	0.45	0.47	3.8	0.13
Solar PV	4,4	0.01	0.01	0.09	0.00
Hydropower		0.1	0.10	0.9	0.03
Waste incineration		2.1	2.19	17.9	0.61
Landfill gas		0.1	0.10	0.9	0.03
Domestic biomass	0	0	0	0	0
Import biomass	0	0	0	0	0
Import renewable electricity	0	0	0	0	0
Total		2.76	2.9	23.6	0.8

[3] These forms of energy however are included in the European definition of renewables as used in the European White Paper.

Currently there are two definitions in use in the national discussion on renewable energy in The Netherlands. The first is the definition given in the Government's 'White Paper on Renewable Energy'(1997). This states that renewables are those forms of energy that are 'converted into secondary energy sources without making any demand on finite reserves'. This definition includes wind energy, solar electric, solar thermal, geothermal, hydropower, biomass as well as acquifer energy storage, ambient heat delivered by heat pumps and waste incineration.

Another definition has been put forward in the 'Protocol on the monitoring of renewable energy' that has been established on the instigation of the Novem (the Dutch governmental agency for environmental and energy research) and EnergieNed. This definition sates that renewable energy is all energy in the form of electricity, heat or fuel that is generated by local renewable energy sources, after correction of possible use of energy for its generation. The most important differences between the two definitions is that in the first definition incineration of non-organic waste, industrial heat pumps and imported renewable sources (e.g. from Norwegian large hydropower plants) is included. The second definition excludes these sources. The first definition is called the 'broad definition' and the second definition the 'restricted definition'. Current utility renewable energy targets fall within the 'restricted definition. The 1700 GWh target for the year 2000 will fall under the restricted definition.

4.1.6 The United Kingdom

The UK has one of the lowest renewable energy penetration rates in all of Europe. Excluding large-scale hydropower, renewables account for less than 2% of all electricity generated in the United Kingdom. Traditionally, large supplies of indigenous coal, and more recently, the rapid development of the UK's natural gas reserves, have powered the country's electricity sector. A large nuclear power generation capacity has also overshadowed renewables development.

The 1970s oil shocks had very little effect on stimulating renewables in the UK. Unlike Greece, Austria and Denmark, who have few non-renewable energy resources, the UK's ample supply of fossil fuels served to stimulate more development and exploitation of those fuels rather than renewables. The UK moved quickly to develop its offshore oil and gas reserves during the 1970s, and as environmental concerns grew, the country shifted rapidly out of coal electricity generation to gas electricity generation. This 'dash for gas', particularly with the removal of the EC's restrictions on gas for electricity generation, led to the tremendous growth of gas electricity generation during the 1990s.

Britain's moves towards market liberalisation during the late-1980s and early-1990s provided renewable electricity its first major opportunity in modern times. Government sought to prepare the way for privatising the nuclear industry by creating the 'Non-Fossil Fuel Obligation/NFFO' in 1990. A 'Fossil Fuel Levy' was exacted on domestic consumers for every kilowatt hour of electricity consumed. It was originally intended to be paid into a pool that would assist the privatisation of the nuclear electricity industry. Environmentalists seized the opportunity to support renewables through the NFFO, and managed to convince government to extract 5% from the overall Fossil Fuel Levy revenues to pay for renewable electricity development.

NFFO was a politically acceptable tool for developing renewables. Consumers hardly notice the Fossil Fuel Levy. NFFO works by obliging utilities to accept offers from suppliers of renewable electricity within certain price bands set by the Electricity Regulator. The premiums provided for renewables were not paid by the utilities to the suppliers. Rather, the pool of funds raised by the obligation on consumers (5% of the NFFO for renewables) meant that utilities were generally willing to enter into supply contracts with renewable generators, as this added little to their operational costs, and nothing to their investment costs.

To date, NFFO has brought on nearly 400 MW of renewables, of which nearly half are from landfillgas and other wastes, and the rest from wind and small hydropower. Planning issues, and resistance to large-scale wind farms, coupled with environmental concerns for hydropower development, have slowed the NFFO down considerably. Most of the projects approved for financing under the NFFO since 1991 have not been realised due to these, basically political, factors.

The current British government is committed to a major acceleration of renewable energy development. It plans to set a target of 10% of renewables by 2010. However, it has yet to put much of its enthusiasm into practice. This stems from the highly privatised and decentralised nature of the electricity industry. Government lacks the ability to force industry to develop renewables. The NFFO is essentially a cross-subsidy from consumers to industry which, essentially costs the electricity utilities nothing. Unless government is willing either to provide major subsidies to the utilities, or to change legislation to force utilities to purchase renewable electricity, other, more innovative mechanisms and the marketplace are going to be necessary to accelerate the use of renewables in electricity generation.

Thus, the UK provides the rest of Europe with an interesting model. On the one hand, it has privatised and liberalised its electricity markets faster than any country in Europe, and perhaps the world. One the other hand, government lacks the power, short of moral suasion and regulation, to encourage or force the electricity sector to accelerate renewable energy development. In short, the UK mirrors most of the same issues facing governments and electricity utilities when it comes to the issue of how to promote renewables at a faster pace in electricity markets that are increasingly competitive, and over which governments have less and less control.

4.2 Electricity sector liberalisation

Each of the six countries have embarked upon ambitious renewable energy programmes over the past several years. Denmark's legislative programme for renewables goes back further than any of the other six, while the UK's legislative framework for market liberalisation goes back further than the other six. The renewable energy legislative framework in all six countries is currently undergoing major change. The Dutch are introducing some of the most innovative trading mechanisms under their new Electricity Law/EL (Elektricitetswet), while Germans are currently only discussing their legislative framework for supporting renewables.

Legislative action has been very dynamic in the field of electricity market liberalisation over the past two years. This is set to continue over the next several years as new players enter the marketplace, and as new 'rules of the game' are established. Legislation in all

six countries has exceeded the liberalisation targets set in the Commission's electricity directive, but electricity markets still differ substantially from country to country, as each balances issues such as economic and social equity with economic growth and development, with consumer protection and price reduction with environmental protection. This dichotomy of issues represent the diversity of European Member States' political and economic situations, as well as the state of electricity market development in each.

4.2.1 Austria

In Austria, electricity sector liberalisation is affected most by the 'Elektrizitäts-wirtschafts- und Organisationsgesetz' (Electricity Business and Organisation Law), referred to as the ELWOG. The ELWOG was passed by the Austrian Parliament in July 1998. It contains the following that bear most on electricity sector liberalisation:

- The main goal is to reduce prices.
- A secondary goal is to increase the market penetration of renewables.
- With respect to unbundling, the law requires only an organisational but no legal separation of generation, transmission and distribution within a utility.
- The major Austrian generator Verbund remains 51% under state ownership.
- Major industrial consumers and utilities with own transmission grids have access to the grid (and the right to purchase electricity from whoever they chose).
- Medium sized industrial consumers and other distribution utilities will be allowed access to the grid in a step-by-step fashion to the year 2004.
- The model for the access will be the so-called 'Regulated Third Party Access', which foresees publicly-announced regulation of transmission tariffs by the government.
- Electricity from hydropower will have priority access to the transmission grid, but must be offered at market prices. This means that access for a power producer can be denied if there is enough hydro capacity. The payment for the hydro energy will be only depending on the market price and not on the costs for generation of the producer.
- A higher price for renewables might be fixed by the regional governments after consulting all affected parties (utilities, independent producers, the chamber of commerce, and the trade unions).

What is clear in Austria is that the new directive exposes its relatively small market to major international forces. The uncertainty surrounding developments in such markets as Germany (in particular) or France is having a major effect on market policy development in Austria. This, in turn, will certainly affect the development and commercial deployment of renewables in Austria.

4.2.2 Denmark

Danish energy policy gives highest priority to environmental concerns and the establishment of a sustainable energy development. The Danish electricity market differs in this respect from most other EU members. Given these considerations, the government, with the support of a wide range of groups and members of the public, is introducing 'Public Service Obligations' (PSOs). PSOs are primarily a response to the EU electricity directive, and the development of the PSO mechanism was decisive in the acceptance of the directive by the Danish government. It is unclear, however, whether the exploitation of PSOs will be sufficient to preserve the present Danish energy polity that strongly favours renewable electricity.

The Danish electric utility sector is characterised by some special features. In principle, Danish utilities are owned by the consumers and they operate according to a non-profit principle. They are obliged by law(early-1990s) to carry out an Intergrated Resource Planning (IRP) process in collaboration with the Danish Energy Agency before major new investments in the supply sector can be made. Finally, Danish utilities have been promoting combined heat and power/CHP plants (combined with district heating) in order to obtain high fuel efficiency. Several of these specialities may run into problems in relation to the rules of a liberalised energy market.

In June 1996, the Danish government passed a new energy law ('L486'), which anticipated the possibility of introducing PSO's in a future liberalised market. In L486 priority is given to renewables and CHP plants in the electricity supply system. After a period of about 18 months for notification in the EU Commission, L486 was finally accepted and went into operation from January 1998.

L486 implements the minimum requirements for the opening of the electricity market in accordance with the EU directive. This implies that customers with a demand of more than 100 GWh per year are free to choose their supplier. At present, there are only six private companies which fulfil this requirement. In addition, Danish utility companies with a sale of more than 100 GWh per year have been included in this category.

The Danish government is presently under pressure from several interest groups promoting faster liberalisation. L486 is regarded as a preliminary law as a number of questions have still not been settled. The Danish Energy Agency has been working for the past year or so on a more comprehensive energy law, which is planned to be published in draft form in March 1999.

The Danish utilities have been preparing themselves for the liberalised market by establishing new organisations to handle the system operations and by alliances among existing distribution companies. These alliances are new, and it is not clear how they will develop. What is clear is that new organisations will develop in the new marketplace. What is not clear is what shape they will take, or what their commitment to renewable energy will be. Likewise, in this rapidly changing environment, it is not clear what policies the government will have at its disposal to promote renewables and ensure their prominence in the electricity sector.

4.2.3 Germany

With the biggest economy in the EU, and with several of the largest private and vertically-integrated electricity utilities in Europe, electricity sector liberalisation in Germany was never going to be easy. This has been borne out over the past years as Germany seeks to align itself to the new European Union electricity market imperatives.

Since April 1998, Germany has liberalised the electricity market almost completely (on paper). The new Energiewirtschaftsgesetz (Energy Trading Law) came into effect. There is no step-by-step liberalisation, as was visualised in the EU Directive. Rather, the market is officially opened to all consumers. The law establishes a universal access to the grid rule, since all reasons for the refusal of full access are listed and the burden of proof is imposed on the network owner. Yet, there is no scheme worked out in the new Energy

Law for how to deliver the electricity via the existing infrastructure, while reimbursing the various parties for their contribution in a rational and transparent way.

To prevent regulation by the government, the electricity industry and their big industrial customers agreed on a 'Verbändevereinbarung (VVD)' (voluntary agreement of associations). It fixes the criteria for how to determine the transmission charges and was ultimately signed end of May 1998. The VVD will first be in force up to 30 September, 1999. Although technically the agreement is not strictly binding for the members of the associations, but a recommendation only, it can be assumed that it will be the baseline for the calculation of transmission as well as distribution charges.

The reform of the Energy Law is not off the political agenda. The debate has restarted after the parliamentary elections in September 1998. Moreover, actions against the new Energy Law have been brought to the Federal Constitutional Court as well. All in all, there is considerable change and uncertainty in Germany's electricity sector, as there is in other parts of Europe.

Utilities are still vertically integrated. It is not clear what will happen with the large utilities, whether they will buy up small distribution utilities, or consolidate into larger oligopolies. At the moment, German energy utilities are concentrating their planning efforts on preparing for the deregulation of electricity markets. Quite understandably, environmental protection is not a primary concern of the utilities under the current regulatory framework. As competition in Europe increases, their strategies are aimed increasingly at how to retain, and expand, their market shares. So long as transmission remains structured within this vertical structure, the prospects for developing relatively small-scale renewable electricity producers to sell to consumers both within the regions in which they generate electricity, and to customers in other utility regions, are not particularly bright.

4.2.4 Greece

Electricity sector legislation has been enacted in Greece in compliance with the EC electricity directive. The first step of deregulation will cover 23% of the market, and is scheduled to be in place by February 2001. Greece's new electricity legislation foresees far-reaching restructuring of PPC. PPC will lose the exclusive rights for electricity generation from conventional fuels in mainland Greece. It will continue to own the transmission system as well as to own and operate the distribution system. However, the new legislation requires the transmission system to be operated by a separate, independent entity. In the autonomous islands systems, PPC will continue to have exclusive rights only on the transmission and distribution systems.

In June, 1998, a preliminary version of the legislation concerning electricity market liberalisation was compiled by the Ministry for Development. According to this legislation, initial market liberalisation is foreseen in 2001. This will concern only the mainland system. In the autonomous island systems, liberalisation will be restricted to the generation system.

The key points of the 1998 legislation are:

- Access to the grid: Access to the grid is provided by the system operator to designated owners of electricity generation or trading licenses. The system operator has exclusive access to the transmission grid.
- Degree of vertical integration of utilities: PPC will be split into separate and independent entities covering generation, transmission and distribution.
- Number and type of consumers who are free to choose their suppliers: From February 2001, consumers with demand of 100 GWh/year or more on mainland Greece will have the right to enter in agreements with any electricity supplier.
- Degree of government intervention in the market: The license for electricity generation is awarded by the Ministry for Development, following the opinion of the Electricity Regulator. For electricity supply purposes, eligible consumers will obtain their licenses from the Ministry for Development, following the Regulator's decision.
- Degree of openness to imports from and exports to other countries: There is no explicit reference to imports and exports as far as Eligible Consumers or APs/IPPs are concerned. However, the draft legislation requires that the electricity supplier should have adequate generating capacity installed within the member-states territory.

4.2.5 The Netherlands

According to the new Electricity Law of 1998, the Dutch market is liberalised in phases as regards the eligibility of consumers to chose their suppliers. Table 4.3 shows which customers will be free to choose their suppliers at which date.

Table 4.3 *Scheme for liberalisation of the electricity market*

Type of Customer	Year of free status	Number of customers	Electricity demand in 1995 [%]
Yearly use > 2MW	1998	650	33
yearly use < 2 MW	2002	54.350	29
connection > 3.80 Ampère			
connection < 3.80 Ampère	2007	6.720.000	38

Access to both the high-voltage grid and the distribution networks is regulated on the basis of regulated Third Party Access (TPA). The Electricity Law states that entry should be free and non-discriminatory. Network owners are therefore obliged to publish tariffs and the technical requirements for use of the network.

In addition, network administration will be vested in a separate company, although this company can be part of a holding which also includes production and/or supply of electricity (legal unbundling). However, the creation of a separate company for network management should ensure that this is independent of other activities of network owners such as the supply of electricity.

A special supervisory bureau has been set-up. It is called the Dienst Toezicht en uitvoering Electriciteitswet, DTE (Agency for supervision and implementation of the electricity law). DTE will supervise and regulate the activities of the network owners. Network tariffs (for the transmission of electricity) will be allowed to rise in line with the consumer price index, minus an efficiency deduction.

Moreover, network owners will only be allowed to make a modest profit, given that network management is a monopoly activity with low risks on investments. DTE will probably become a specific chamber within the Dutch competition authority, NMa (the equivalent of the German Bundeskartellamt or the British Monopolies and Merger Commission).

Household consumers and small businesses will only be free to choose their suppliers in 2007. Therefore, the Dutch Minister of Economic Affairs will supervise the tariffs set by the distribution companies for captive consumers. The supply tariff will be subject to a yearly efficiency deduction. These will be fixed for three to five years.

4.2.6 The United Kingdom

Over the past year, the Electricity Regulator (OFFER) has been reviewing electricity trading arrangements in the UK. This is part of a process to improve competition in the UK electricity generation market. In July 1998 OFFER published proposals for a new trading system for electricity in the UK. These proposals have wide-reaching implications for the trading of renewable electricity.

Currently most electricity in England and Wales is traded through the 'electricity pool'. Put simply, this is a wholesale market system where electricity generators bid a price for generation on a daily basis. The National Grid Company (which holds the monopoly on all electricity transmission) is then responsible for ensuring that all electricity demand is satisfied. The demand then determines how many generators will be needed and allowed to sell to the pool. The 'strike price' is the price that the marginal plant has bid to sell to the pool. All generators are then paid this price, the 'Pool Purchase Price (PPP)'.

Currently in England and Wales there are a few large generators. Due to the size of these generators it is felt by the Regulator that these companies could control the market, and keep the price of PPP artificially high. OFFER wish to improve the current trading system so that the influence of individual generators on the pool price is reduced.

Therefore, the Regulator is proposing a system that is based on the Nord Pool (the Scandanavian pool), where the market is much more liquid and is run more like a financial market. This means that the existing Electricity Pool, where all electricity is traded, would no longer exist in its current form. The implications of this is that more flexible suppliers (those suppliers who can bring on or take off supply quickly) will be able to command higher prices and a better position in the marketplace. This could disadvantage suppliers with intermittent sources (e.g. wind).

Most of the UK's non-large hydro renewable generation is sold under NFFO contracts. This means they are guaranteed a fixed price for their output. However, at the end of 1998 some of these contracts will end and these generators will have to operate in the new open market. Under the current system, they can expect to get at least the pool price for their output. They may also expect some income from the benefits related to their proximity to consumers.

However, under the new proposal, the pool price would no longer exist. Therefore, intermittent generators would probably only be able to sell into the market to meet peak demand or supply shortfalls. Their income is likely to be lower than at present, and the

price offered for their generation will be variable. Under NFFO, prices are fixed during the life of contracts. These and other factors could have major negative effects on some renewable energy generators.

Because of these issues, the Regulator recognises that renewable generators will require some special consideration and mechanisms. However, they have made no proposals concerning how renewable generation will be treated under the new, more liberalised, market. Proposals will be put forward to a working group for consideration, and AEP will prepare a working document for this group to consider.

5. CONCLUSIONS

The findings of this report can be summarised as follows:

- All partner countries have liberalised, or are in the process of liberalisation well beyond the EU directive (i.e. Member States are liberalising more rapidly and/or to a further extent than set out in the electricity directive).
- Liberalisation provides utilities with a range of risks, benefits and opportunities.
- Some countries are further along the liberalisation path than others. However, 'liberalisation' means different things in different countries.
- There is a variety of incentive schemes for renewables within the member states of the European Union. The same is true for the degree of penetration of renewables.
- There are various definitions of what counts as renewable electricity in the different member states. Sometimes there are even different definitions within member states.

The reader who wants more detail on these issues in specific countries is referred to the appendices. Together with these appendices the Inception Report forms a valuable basis for the next phases of the REALM project.

AUSTRIA

Country briefing paper

CONTENTS

A.1 Summary

About 75% of the electricity demand in Austria is produced from hydropower. This situation is unique among the other countries represented in the project with regard to the high share of renewable electricity.

The motivation to build such a high capacity of hydropower lies not only in energy economic reasons but has also societal causes. Renewable resources like hydropower and biomass are nearly the only domestic energy resources of Austria. To reduce import dependence and to boost the domestic job market, an intensive hydro plant construction program, which has started right after World War II has created the present high capacity of hydro power. As a result, the independence of the Austrian nation from electricity imports is low and the quality of the Austrian electricity system is quite high.

But the high share of hydro power has also its price. Referred to the available capacity, investment costs are very high and have to be depreciated over a long period of time (50 years). At currently very low fossil fuel prices the competition with natural gas fired combustion turbines and combined cycle power plants is very hard.

As a member of the European Union Austria is required to implement the directive 96/92/EG concerning the liberalisation of the internal electricity market in Austria. This process is on the way, the national law (ELWOG = Elektrizitaets-Wirtschafts-Organisations-Gesetz) is adopted by the parliament (July 1998) and becomes effective in February 1999. The main goal for this law is to guaranty good quality electricity at low prices for all consumers, industrial and households. A secondary goal is to further increase the high share of renewable resources for electricity generation. How these two competing goals can be achieved will be subject to negotiation in the years to come.

The dividing of vertically integrated utilities into Generation, transmission and distribution is already on the way or almost completed. For the electric utilities this means major changes. Old monopolies are abandoned and protected markets will soon face competition.

The public opinion supports renewable energy sources in general but is often against hydropower because of its environmental impact (unnatural water regulation and use of untouched landscape). Biomass is widely used for heat generation. Other renewable sources like wind or photovoltaic electricity generation are technologically available but have not achieved high market shares because of economic and climatic restrictions.

From the generation companies point of view, renewables offer great possibilities but also high risks. To get more insight on the impacts of those possibilities, especially with respect to competitiveness on the liberal electricity market is the main goal of this study. A further goal is to achieve some strategic orientation in the present environment of legal, organisational, structural and economic uncertainty.

A.2 Background to Renewable Energy in the Austrian Electricity Sector

About 75% of the Austrian electricity demand (56,376 GWh in 1996 '[1]) is generated from renewable energy sources, of which the biggest share (approx. 97%) is provided by hydropower plants. With this high percentage Austria has a leading place in the European Community. About 65% of the technical potential are exploited. A further increase of the market share is restricted by the high investment costs, stringent environmental regulations and the resistance of the public opinion against big projects.

The complementary 25% of electricity is generated in thermal power plants. Austria has developed the 'Hydro-thermischen Verbundbetrieb' which means a combination from hydro and thermal power. The load management is organised from a central dispatching centre in Vienna/Austria. In the last decades this system proofed to be very reliable and was one of the fundaments for a considerable economic welfare of the country.

From 11300 MW hydro power plants approximately 600 MW are small (<5 MW). There is a potential for a further 300 MW of small hydro [4].

Renewable energy from other sources than hydropower have gained importance especially during the last 5 years. Solar thermal energy for warm water supply has already reached a remarkable value. Today more than 1 million m² of solar panel are in operation, most of them in warm water supply for households or swimming basins. The accumulated thermal generation from this technology reaches now about 350 GWh per year.

Biomass is also an important factor in Austria. Nowadays about 12% of the primary energy in the country is supplied from biomass. Generally the biomass is fired in small household units or in small district heating systems (359 units with a total installed capacity of 490 MW_{th}). In terms of electricity production from biomass there are some research projects, including the cofiring of biomass to thermal power plants and combined heat and power plants. At current fuel prices an industrial power generation primarily based on biomass is not economical unless it is combined with burning of waste.

The use of landfill gas and biogas for electricity production is wide spread but accounts only for a small amount of electricity. The total potential of electricity production from biomass is estimated to be 1230 GWh/a of which 25% might be activated by 2008 under favourable frame conditions.

Wind energy in Austria has a potential in certain windy areas of the country. The total technical potential is estimated to be 4550-6000 GWh/a. So far, 52 wind power stations have been put to operation with a total capacity of 20.3 MW, starting from only 10 kW in 1993. In 1997 32.2 GWh of electricity were produced and 20 units with a total capacity of 8.5 MW were added. Under favourable market conditions up to 200 MW of wind power might be achieved till 2005, then producing 60-300 GWh/a [2]. As long as the situation is not clear concerning the tariffs for selling wind energy in the liberalised market a future development can not be foreseen.

The development of photovoltaics for electricity generation in Austria is similar progressive as the use of wind energy. Figure A.1 shows the exponential growth of photovoltaics installed capacity in the years 1988 to 1994 [3]. In 1997 the capacity reached 2.14 MW at growth rates of 0.4 MW/a. It is estimated that under proper frame conditions (increased

supply tariffs, investment subsidies and support programs) about 50 MW could by achieved by 2008 [4]. The use of photovoltaics can be economic in remote areas like mountain huts, where expensive transmission lines can be saved.

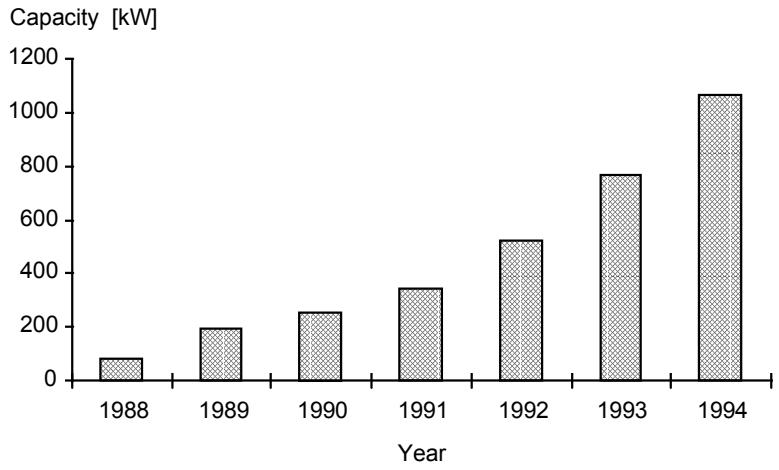

Figure A.1 *Development of Photovoltaics in Austria*

Till 1997 the producers of small hydro plants, wind generators or photovoltaic systems had privileged tariffs for their energy supply. The crucial criteria for a further development of these renewables will be the political will to subsidise these energy sources.

The present power production of renewables in Austria, the estimated additions till 2010, the estimated total potential and the costs are shown in Table A.1.

Table A.1 *Renewables for Electricity Production in Austria*

	Historic data			Additions till 2010		Total potential for additions		Cost (invest+O&M+fuel)
	[MW]	[GWh]	[year]	[MW]	[GWh]	[MW]	[GWh]	[Euro/MWh]
Large hydro	10600	34000	1996				16000	64-100
Small hydro	600	2300	1994			800	4000	65-160
Geothermal	0	0		7	49			
Photovoltaics	2.14	0.4	1997	50	27	not limited	not limited	340-650
Wind	20.3	32	1997	260	390	3500	4550	44-150
Biomass (total)		75.2	1997	123	308	500	1230	58-160
of which Biogas		1.9	1997					
Biomass		22.3	1997					
Sewage Gas		51	1997					

Source: Renewable Energy in Austria 1998; Bundesministerium für wirtschaftliche Angelegenheiten; Vienna, 1998; Heindler; EVA; in Standard 28.10.1998; Gilli, P.V.; Gutachten zum Weissbuch Erneuerbare Energien; 1998.

To give an overview on the total system the Table A.2 shows the development of the Austrian electricity supply from 1970 to 1995.

Table A.2 *Balance of Austrian electricity supply from 1970 to 1995*

Supply of electric energy	1970	1980	1990	1993	1994	1995
River and treshold river power plants	13.091	19.011	21.413	24.283	23.522	24.793
Storage power plants	6.205	8.004	8.683	11.051	10.721	10.962
Hydropower supply of electric utilities	*19.295*	*27.015*	*30.096*	*35.334*	*34.243*	*35.754*
Hardcoal	304	24	3.982	2.192	2.419	3.286
Browncoal	1.890	2.473	2.278	1.026	904	1.459
Fuel oil	1.132	4.249	1.264	1.390	1.489	1.064
Natural gas	2.878	2.580	5.872	5.097	5.896	6.284
Others	17	15	32	25	29	17
Thermal power supply of electric utilities	*6.220*	*9.342*	*13.428*	*9.730*	*10.738*	*12.111*
Supply of hydropower	194	226	447	684	701	710
Supply of thermal power	108	110	78	138	145	224
Supply of own generation utilities	*302*	*337*	*525*	*822*	*847*	*934*
National Supply	*25.818*	*36.693*	*44.048*	*45.886*	*45.827*	*48.799*
Supply from railroad authority (OEBB)	7	2	3	3	3	3
physical Electricity exports	1.303	3.156	6.742	8.005	8.167	7.232
Total of supply	*27.128*	*39.851*	*50.793*	*53.893*	*53.998*	*56.034*

Source: VEOe (Verband der E-Werke Oesterreichs)

A.3 Liberalisation: Factors, Policies

The directive 96/92/EG the European Community has given the guideline for the future development of the electricity sector within the European Union. The goal is to introduce liberal market mechanisms in the traditional regulated and protected market of some few monopolists. This should lead to lower prices for electricity for all customers and therefore increase the competitiveness of the entire industry in the Union.

The first step is to be made by unbundling the three main functions of the electricity business. In the future generation, transmission and distribution have to be independent from each other so that it will no longer be possible to shift money from one division to the other. Each division has to be profitable by itself.

Figure A.2 shows the players in the liberalised market to be created.

FUTURE STRUCTURE OF ELECTRICITY MARKET AND NEW PARTICIPANTS

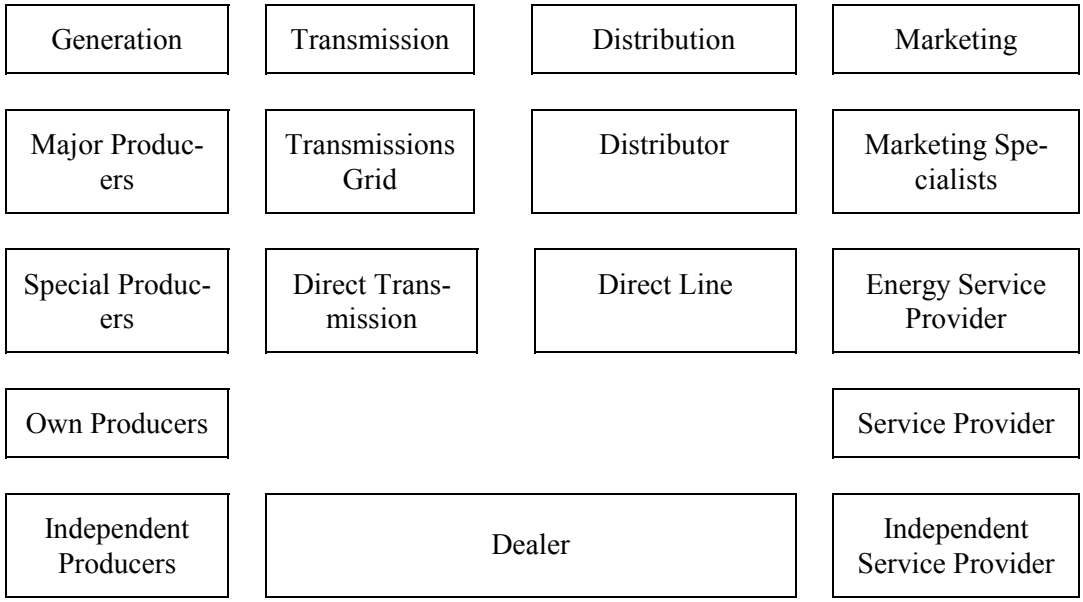

Figure A.2 *Participants in the liberal market*

The EU-directive requires the national parliaments to issue national laws on the introduction of the deregulated market, till February 19, 1999. The creation of the liberal market does not need to occur at once but also can be implemented step by step.

In Austria the national law which is applicable for this matter is the so called 'Elektrizitätswirtschafts- und Organisationsgesetz' further on referenced as ELWOG. As of July 1998 the ELWOG is passed by the parliament. It contains the following regulations:

- The main goal is to reduce prices, a secondary goal is to increase the market penetration of renewables.
- With respect to unbundling the law requires only an organisational but no legal separation of the generation, transmission and distribution divisions of a vertically integrated utility. A separate financial balancing of the different divisions is required.
- The major Austrian generator Verbund stays with 51% in public ownership.
- The designated customers, which have access to the grid, are industrial consumers and utilities, which have an own transmission grid. The other distribution utilities will be introduced as designated customers step by step until 2004. The model for the access will be the so-called 'Regulated Third Party Access', further on referenced as rTPA. This model foresees a publicly announced regulation of the transmission tariffs by the government.
- Electricity from hydropower facilities will have priority access to the transmission grid but must be offered at market prices. This means that access for a power producer can be denied if there is enough hydro capacity. The payment for the hydro energy will be only depending on the market price and not on the costs for generation of the producer.
- A higher price for renewables might be fixed by the regional governments after consulting all affected parties (utilities, independent producers, the chamber of commerce, and the trade unions).

Figure A.3 gives an overview about the schedule for the liberalisation of the electricity market in Austria.

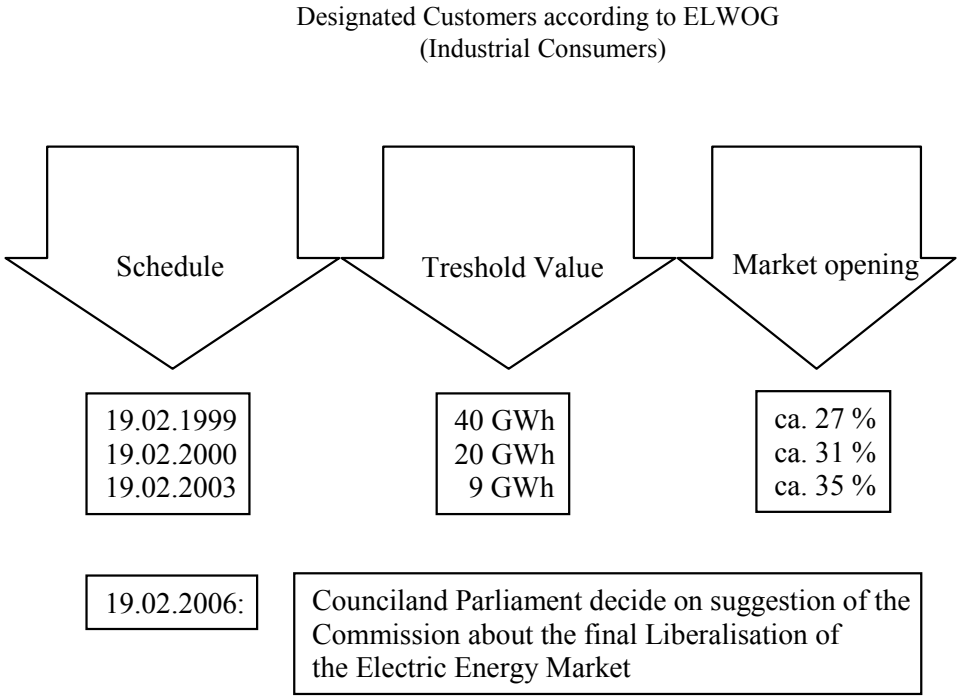

Figure A.3 *Schedule for opening the electricity market in Austria*

As the ELWOG has not fixed the decisions, the discussion on 'stranded investments' is prolonged. Stranded investments are those costs that result from non-market conform investment decisions in the past. Often such investments cannot be recovered by revenues from electricity sales on the future liberalised market. Austrian hydropower plants were not built for electricity supply reasons only but also to create jobs, to reduce emissions from alternative plants, to reduce import dependence or to improve the water street Danube for international traffic. The high investment costs especially of the latest hydro power plants were economic only, when these social benefits were taken into account. Now there is an intensive discussion who shall pay for these social benefits in future.

On the whole it can be said that the ELWOG is an attempt to follow the EU directive without changing much of the Austrian policy of direct public influence on the electricity market development and without reducing the influence on the operation of the utilities. The ELWOG is also the attempt to promise lowered electricity prices and improved efficiencies without lowering the level of social benefits and without clarifying who will pay for the social benefits in future. As between energy consuming industry and energy supplying utilities, no broad consensus could be achieved on all aspects of electricity system regulation, much space is left for future negotiations, but also for a high level of uncertainty. When ELWOG becomes effective Austria has gone maybe 50% of the way from the state regulated to the market force regulated electricity supply system.

A.4 Driving Forces in Renewable Energy in Electricity

There is a very strong green movement in Austria. Opinion leaders in Austrian TV or Newspapers propagate a further development of renewable energy sources. Two major ways of thinking can be observed. These opinion leaders mostly discuss the possibilities of photovoltaic electricity generation or wind generation. These technologies have a very good reputation in the public.

The potential for photovoltaic electricity generation is as considerable as the installation costs are. Additionally the supply and the demand curve do not fit together. The electricity production from photovoltaics is stochastic, driven by weather conditions, daily and seasonal changes. This is especially a problem, when the produced electricity is used for lighting or heating purposes. The solar technology for electricity generation has therefore developed a certain importance only in low energy intensive and isolated applications, like in remote areas of the Austrian mountains (skiing huts). Also in some professional applications, like microwave radio or mobile telephones, solar powered technologies are the solutions of the choice. In areas however, where photovoltaic energy production is coupled to the public grid, this technology is still far from being economic, though much research is made in Austria to achieve a progress in this situation.

The technical hydropower potential has been developed up to 65% in Austria. In 1984 a big protest movement prevented the construction of the biggest Danube (Hainburg) power plant in the area of a national park along the Danube. Being more cautious with public opinion and green movement, in 1993 Verbund succeeded to achieve a positive plebiscite for the construction of the Freudenau hydro power plant on the Danube river in Vienna. Only as the plant was almost finished the discussion about the high investment costs of such facilities started.

Without rewarding the hydropower facilities for the social benefits, the construction of new (big) hydropower plants are not seen as being economic at the low prices of alternative energy sources like natural gas. Current projects of Verbund with respect to hydropower therefore go into the direction of improving the efficiency of existing plants.

The other types of renewables, small hydro, biomass, photovoltaics, ambient energy, have a much better image in the public opinion as being positive for the environment. Driven by the green attitude of the public all utilities invest money in research of new technologies like wind or photovoltaic generation.

A.5 Background to Verbund

The Republic of Austria consists of 9 states (regions). Verbund is owned by the Republic of Austria by 51%. Each of the states owns an electric utility as well. Verbund was founded after the second world war and organised the construction of the electrical infrastructure consisting of the major power plants (hydro and thermal) and the national transmission lines.

Verbund operates and owns the following length of transmission lines in Austria:

[km]	1986	1996	2001
110-kV	1040.6	1003.5	961.5
220-kV	1781.2	1714.1	1562.1
380-kV	774.6	894.2	1186.2

In 1996 Verbund, as the major electricity supplier in Austria, supplied about 51.4% or 24,645 GWh of the electricity production in Austria. Verbund sells electricity to a total of 16 distributors (state owned electric utilities) and industrial customers.

At the moment the prices for electricity are regulated by the government whereas the setting of the price is only depending from the costs of the utility. In Austria this has lead to comparably high tariffs for industrial consumers and to comparably low prices for households.

The tariffs for energy from independent power producers using renewable technology are regulated as well, and different from state to state, depending on the willingness of the utility to subsidise the technology.

The sources of primary energy for the Verbund electricity production are shown in figure A.4.

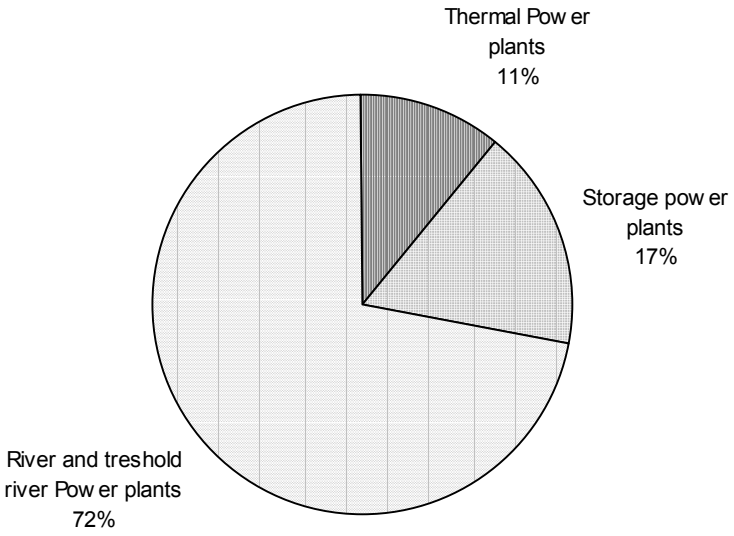

Figure A.4 *The Verbund power generation system*

Verbund and the other state owned utilities are vertically integrated companies, each of them operating in at least two of the three functions generation, transmission and distribution. The use of nuclear power for electricity generation is forbidden in Austria since a plebiscite in 1978.

A.6 Past and Current Policies towards Renewables

Renewable energy has a long tradition in Austria and Verbund. After the second world war Verbund started to construct the hydro power plants in Kaprun (Storage Power Plant) and Ybbs – Persenbeug (River Power Plant), famous as the first big projects after the resurrection of Austria and a symbol of the new republic´s vitality. These power projects were the backbone of the electricity supply in those days. In the sixties and seventies the hydropower capacity was continually developed.

Especially the River Power Plants at the Danube River were constructed as multi purpose facilities. This means, that in addition to the electricity production the necessity of the higher water level for save navigation on the Danube was considered as well as the function of flood protection and the provision of recreational facilities.

The political opinion was, that the overall importance for the hydro electric facilities in terms of employment and independence from imported primary energy sources justified the decision to erect the expensive plants

It was also very important in Austrian public opinion to reduce dependence on imports of fossil energy carriers by installing sufficient domestic hydro capacity. This opinion also justified high spending in redundancy and high quality equipment. Those efforts were rewarded by a stabile and save electric power supply over the years.

By the time the electric utility infrastructure reached its maximum growth (in the mid 1970s to mid 1980s) many small hydro facilities were seen as inefficient and thus shut down, supported by targeted utility programs.

In the recent years small and mini hydro facilities were reopened as same states and their electric utilities introduced good tariffs for the produced electricity from renewables. Nevertheless there is still a remarkable potential for the revitalisation of old and deteriorated small hydro facilities.

In the last ten years increasing efforts were made not only to reinstall small hydro power but also to develop different other renewable technologies for electricity production like wind power or solar power (see above).

Aside of efficiency improvements in existing hydro power plants Verbund can refer to following current projects:

- cofiring of wooden biomass in a coal power plant (St. Andrae),
- cofiring of biogas derived from wood gasification in a coal power plant (Zeltweg),
- research on the improvement of wind power plants,
- projects on the improvement and application of photovoltaics in mountainous areas.

Figure A.5 expresses the development efforts of Verbund in 1997. In this year Verbund carried out research projects for 100 Million Austrian Schillings (equals to 7.25 Million Euro).

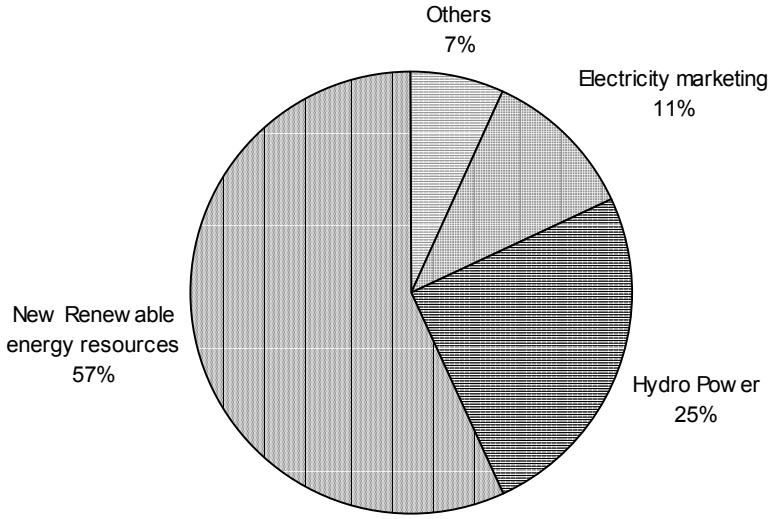

Figure A.5 *Allocation of Verbund research investments*

A.7 Key Issues

Hydroelectric facilities are the backbone of the countries electric energy supply. The Austrian utilities have to compete in the liberalised market with this already existing infrastructure. As consequence measures will be necessary to increase the fitness for competition. Figure A.6 shows strategic options for improving the competitiveness. Among those customer orientation and product diversification, both possibly implemented by a promotion of renewables.

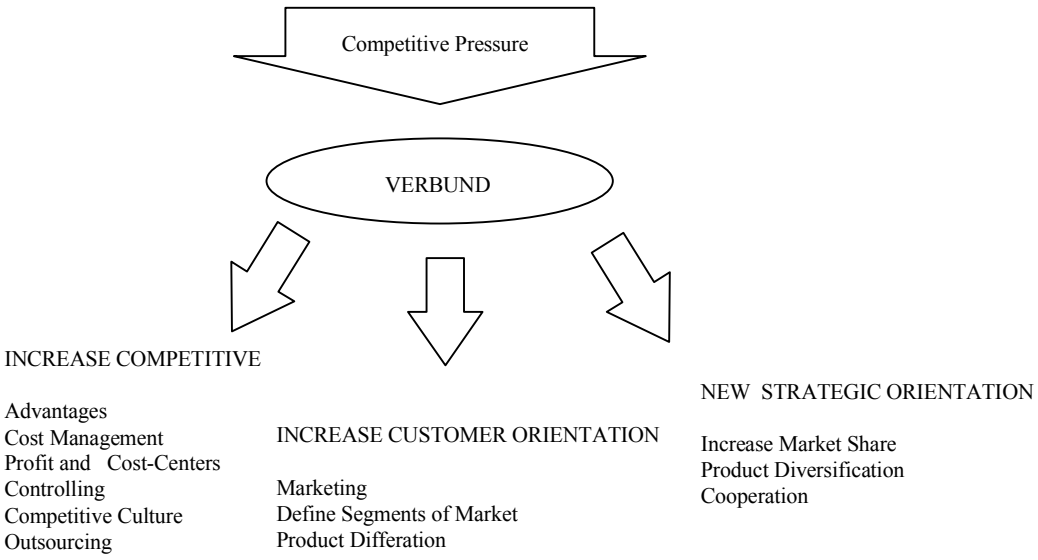

Figure A.6 *Strategic options for the future development of Verbund*

The most important driving issue for us is the uncertainty of the ELWOG. The ELWOG is more like a framework for further decisions than an explicit regulation on what is allowed and what is not allowed. It gives the minister the mandate to negotiate with affected parties, utilities, the chamber of commerce, trade unions, etc., specific regulations on the electricity market organisation throughout the next 4 to 6 years. This leaves a lot of possibilities how the market will develop in that time. It cannot be foreseen how the electricity prices will develop and it cannot be foreseen how tough competition will affect the market penetration of renewables. Given this high level of uncertainty, from Verbund´s point of view, it is difficult to develop long term strategies for the company and its attitude towards renewables.

A main problem for renewable energy sources is the weak information level in the public. Opinions in TV or newspaper are very often biased by partially wrong information, which results from the lack of technical knowledge from the authors. It should therefore be a main issue to provide sufficient information to media to achieve a rational decision process.

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DENMARK

Country briefing paper

CONTENTS

B.1 Summary

The Danish part of the REALM project is managed by Department of Buildings and Energy, Technical University of Denmark (TUD) with the electric utility association ELKRAFT as a partner. Professor Niels I. Meyer, TUD acts as Danish project co-ordinator. ELKRAFT is a planning and co-ordinating association for the Danish electric utilities east of the Great Belt. These utilities are responsible for nearly half of the Danish electricity supply.

TUD and ELKRAFT have had close contacts for a number of years concerning planning methodologies for a sustainable energy development, with special emphasis on renewable energy sources. This gives a good basis for their co-operation in relation to the REALM project. Both groups have been involved in energy planning for two decades and they have extended experience in relation to exploitation of renewable energy sources in the electricity supply system. The two groups have been actively involved in official Danish energy planning including co-operation with the Danish Energy Agency in a number of programmes.

The two groups have been in close contact with the ongoing work of the Danish Energy Agency concerning a new energy law in relation to the liberalised energy market. The first draft of this law was published in July 1998, followed by later drafts in December 1998 and February 1999.

Both groups have contributed to a report published in June 1998 by the Danish Committee for Sustainable Energy (advisory to the Danish government). An overview paper in this report by Professor Meyer has pointed out a number of possibilities and barriers for renewable energy in a liberalised energy market. This paper includes proposals to overcome the barriers, e.g. by taking advantage of the so-called Public Service Obligations (PSO's).

An essential part of the project time in May, June and July has been related to preparation for the kick-off meeting in Brussels and to the production of the present Briefing Paper.

B.2 Background to Renewable Energy in the Electricity Sector

Denmark has no hydro power (no mountains) and little attention was paid to renewables as part of the electricity supply until after the 'oil crisis' in 1973/74. In 1975 the Danish Academy of Technical Sciences worked out a report with proposals for a Danish wind power programme [1]. In the following year the first official Danish energy plan was published [2]. This plan included proposals for an extensive nuclear power programme. Later in 1976 an alternative energy plan was published by a group of energy experts from Danish universities [3]. This plan did not include nuclear power but proposed to exploit renewables and especially wind power to a larger extend. This proposal was mainly supported by Danish NGO's from the energy and environment sector, while the electric utilities were supporting nuclear power and were sceptical towards renewables.

During the second half of the seventies the first Danish wind turbines were developed and implemented based on the so-called 'Danish concept' exemplified by the 200 kW

Danish 'Gedser Mill', in operation from 1959 to 1967. The Gedser Mill showed great reliability, and the same basic concept was used in the modern development of Danish wind turbines in the seventies and eighties.

The first generation of industrial wind turbines in the late seventies were relatively small (typical 22 kW) but the size was steadily increased during the next two decades, preserving the main technological features (horizontal axis, three blades with stall control). A more detailed description of the Danish wind power development up to the mid-nineties has recently been given by Meyer [4].

An early programme concerned with larger wind turbines was sponsored jointly by the Danish government, the EU Commission and the Danish utilities. Two 630 kW stall-controlled turbines were sited near Nibe in northern Jutland in 1978-79. Their rotors have been tested both with fibreglass construction and with cantilevered, wooden blades. However, the influence of this programme on the Danish wind power development has not been significant

An important element of the Danish wind power strategy was the establishment of a government test and certification station in 1978 at Risø National Laboratory. This center has guaranteed the technical quality of Danish wind turbines and has laid a secure basis for the subsequent Danish export adventure in wind power.

In 1981, a wind atlas for Denmark was published, based on the pioneering work of E.L. Petersen and co-workers at Risø National Laboratory [5]. Simple computational procedures described in the atlas make it possible to estimate the wind distribution over inhomogenous terrain.

A second official energy plan including nuclear power was published in 1981 by the new Danish Ministry of Energy [6]. Two years later a second alternative energy plan was published by a group of energy experts from Danish universities [7]. The alternative plan introduced new planning methodologies and included detailed proposals concerning energy conservation and exploitation of renewables, especially wind power and biomass. The plan excluded nuclear power. Again, the alternative plans were met with scepticism from Danish utilities that were still supporting nuclear power.

In order to promote a steady growth of installed wind power capacity, an agreement was made in 1985 between the Danish government and the electric utilities. According to this agreement, the utilities were committed to install 100 MW in wind farms over the following five years. This agreement was fulfilled with two years delay by the end of 1992. Another 100 MW agreement came into effect in 1990 to be implemented before the end of 1993. Again a delay of about two years occurred, mainly due to problems in finding suitable sites for the wind farms.

A similar agreement between government and utilities was set up in 1993 concerning the use of biomass for electricity production. This agreement obliged the utilities to use 1.2 million tonnes of straw and 0.2 million tonnes of wood in central electricity plants before the year 2000. In 1996 a total of only 0.3 million tonnes of biomass was used for this purpose and the programme had run into technological problems, especially related to corrosion from combustion of straw. As a consequence, the agreement was adjusted in 1997 where more flexible targets were introduced.

A law concerning Integrated Resource Planning (IRP) was introduced in 1994. According to this law, utilities are obliged to carry out analyses based on IRP methodology before major investments in new supply systems. This includes comparison with alternative solutions based on energy conservation and renewables. Since that time, Danish utilities have invested relatively large resources in the development of IRP methodologies for concrete projects.

In 1985, the Danish Parliament decided that nuclear power should not be part of the Danish energy supply system. This decision was followed up in 1990 and 1996 by two official energy plans with strong emphasis on renewables and energy conservation [8,9]. Wind power plays a dominant role among the renewable energy sources for electricity, but other sources like biomass and biogas are also included in these plans. In early 1999 the installed wind capacity in Denmark amounts to about 1,400 MW covering more than 9% of Danish electricity demand. According to the official plans, the capacity should be increased to 1,500 MW by year 2005 and to 5,500 MW by year 2030.

Regulations and agreements that allow independent generators to produce power and sell it to the grid are central issues for the promotion of wind power and electricity from other small-scale renewable sources. Historically, Danish utilities have had little experience in handling dispersed, small-scale technologies, such as wind turbines. They have traditionally been focusing on large-scale conventional power generating systems. As a consequence, most Danish utilities have been sceptical about wind power as a serious element in the supply system, and they have not been interested in offering favourable tariffs for wind electricity.

On this background, the promotion of wind power in Denmark has needed either government regulations for relevant tariffs or voluntary agreements between electric utilities and wind power producers. Already in the late seventies the first agreement was set up between the Association of Danish Electric Utilities (DEF) on the one side, and the Danish Wind Power Association together with Danish wind turbine producers on the other side. This agreement has been renegotiated several times during the period up to 1992. The main principle has been that the utilities should pay between 70% and 85% of their net customer price (excluding charges and taxes) for the wind electricity. This net price corresponds approximately to the sum of the utility's production and distribution costs, which will vary somewhat over time due primarily to varying coal prices.

After some disagreements, especially over conditions for grid connections of wind power, the Danish government in 1992 introduced regulations for these conditions and for the tariffs for power from renewables. Today, wind turbine owners typically are payed 85% of the utility net price amounting to about 0.042 ECUs per kWh. On top of this tariff from utilities, the private wind producers receive a tax refund (environmental credit) from the government of about 0.036 ECUs per kWh. The total payment is thus around 0.08 ECUs per kWh.

During the eighties, siting constraints were not a serious barrier to the penetration of wind power in Denmark with its population density of about 120 per km^2. However, when the penetration passed 2% of the total electricity demand, local opposition started to grow, especially in relation to large wind farms. This opposition has contributed to the acceleration of a new offshore wind programme.

The first offshore wind farm in Denmark was made operational in September 1991. The site is at Vindeby, north-west of Lolland in the Baltic Sea. The wind farm consists of eleven 450 kW turbines positioned in two rows at water depths between 2 and 6 m. The distance from shore varies between 1.2 km and 2.4 km, while the distance between turbines is about 300 m.

A second offshore wind farm was made operational in October 1995. It is sited at Tunø Knob in the sea between Jutland and the island of Samsø. The total capacity is 5 MW based on ten 500 kW turbines. The operational experiences from the first two offshore wind farms have been good, and the electricity production has exceeded the expected level. Based on these experiences and favourable economic analyses for wind farms with new 1.5 to 2 MW turbines and new types of platforms [10], the Danish government has proposed an ambitious offshore wind programme [11]. During the first decade, five farms totalling 750 MW are planned with electric utilities as the main investors. During the second phase up to year 2030, the total offshore capacity is planned to be expanded to 4,000 MW.

During the last five years or so, Danish utilities have become more positive towards systems based on renewable energy, especially offshore wind power. The planning section of ELKRAFT has worked out analyses and scenarios for a sustainable energy development in eastern Denmark [12], and utilities associated to ELKRAFT have managed the installation of the first offshore wind farm in Denmark (and the World) at Vindeby in the Baltic Sea.

B.3 Liberalisation: Factors, Policies

Danish energy policy gives highest priority to environmental concerns and the establishment of a sustainable energy development. This is different from most other EU members, where economic considerations typically are given highest priority. On this background, the introduction of so-called Public Service Obligations (PSO's) in the EU directive on electricity liberalisation was decisive for the acceptance of the directive by the Danish government. It is unclear, however, whether the exploitation of PSO's will be sufficient to preserve the present Danish energy polity.

B.3.1 Special Danish energy problems

The Danish electric utility sector is characterised by some special features. In principle Danish utilities are owned by the consumers and they operate according to a non-profit principle. In addition, Danish utilities are obliged by law from the early nineties to carry out an Intergrated Resource Planning (IRP) process in collaboration with the Danish Energy Agency before major new investments in the supply sector. Finally, Danish utilities have been promoting CHP plants combined with district heating in order to obtain high fuel efficiency. Several of these specialities may run into problems in relation to the rules of a liberalised energy market. More details are given in refs. 14 and 15.

Already in June 1996, the Danish government passed a new energy law ('L486'), which anticipated the possibility of introducing PSO's in a future liberalised market. In L486 priority is given to renewables and CHP plants in the electricity supply system. After a

period of about 18 months for notification in the EU Commission, L486 was finally accepted and went into operation from January 1998.

L486 implements the minimum requirements for the opening of the electricity market in accordance with the EU directive. This implies that customers with a demand of more than 100 GWh per year are free to choose their supplier. At present, there are only six private companies which fulfil this requirement. In addition, Danish utility companies with a sale of more than 100 GWh per year have been included in this category.

The Danish government is presently under pressure from several interest groups who wish a faster liberalisation. The pressure comes in particular from the Association of Danish Industries and surprisingly also from the Ministry of Industry which claims that there are appreciable economic gains involved in a faster liberalisation. The two utility associations have different viewpoints in this connection. ELSAM is in favour of a faster liberalisation, while ELKRAFT agrees more with the present governmental strategy.

L486 is regarded as a preliminary law as a number of questions have still not been settled. This applies e.g. to the organisation of the future System Operator and the rules for establishing new power plants. The Danish Energy Agency has been working for the past two years on a more comprehensive energy law. The first draft was published in July 1998 and subsequent drafts have appeared in December 1998 and in February 1999. The Danish government is aiming at broad political consensus concerning this new law, and it is anticipated that a final decision will be made in the Danish Parliament during the Spring of 1999.

The Danish utilities have been preparing themselves for the liberalised market, e.g. by establishing new organisations to handle the system operations and by fusions and alliances among existing distribution companies. West of the Great Belt, ELSAM has established an organisation called Eltra to manage the transmission, while ELKRAFT has established an organisation called Elkraft System.

Especially in the ELSAM region, there are vivid activities concerned with new alliances between the 100 or so existing distribution companies. In the ELKRAFT region, the distribution is dominated by two large companies: NESA and SEAS. The Danish utilities in the western part of Denmark have recently set up alliances with Swedish companies such as Vattenfall and Sydkraft.

A special export problem is related to the Danish targets for reduction of CO_2 emission. For decades there has been exchange of electricity between the Nordic countries. Over the years, this import/export of electricity has more or less balanced out. In dry years with low capacity of hydro power in Norway and Sweden, Denmark has had a net export of electricity, and vice versa when there was a surplus of hydro power in Norway and Sweden.

In the past few years, however, Denmark has had relatively large net exports of electricity, and this tendency seems to continue. The problem in this connection is that the Danish export is mainly based on coal fired power plants and this increases the CO_2 emission in Denmark in contradiction to the official Danish reduction targets. So far, no solution has been found on the Danish dilemma. It has been proposed, that an agreement should be sought with the other Nordic countries such that the CO_2 emission is accounted for by the final customer country. The Danish Minster of Energy has announced that if such an

agreement can not be reached, then it may be necessary to introduce decreasing quota for CO_2 emission from Danish power plants, perhaps in connection with the introduction of tradable CO_2 quota on the European market.

B.4 Driving Forces in Renewable Energy in Electricity

As outlined in section E.2, the driving forces behind the Danish exploitation of renewable energy have primarily been NGO's in the environment and energy sectors together with independent energy experts from universities. The utilities have mostly been sceptical or directly negative towards an extended use of renewables in the electricity sector.

From about 1990, the Danish government has been strongly supporting a sustainable energy development, and this has influenced the attitude of the utilities who are now actively promoting renewables, especially offshore wind power.

Detailed analyses have been carried out by the Danish Energy Agency concerning the potential of wind power. Taking into consideration a number of environmental and practical constraints, the official estimate is, that there is an offshore wind power potential of more than 15 TWh per year, and a landbased potential of around 4 TWh. This is enough to cover more than two thirds of the estimated future Danish electricity demand. On this background, systems constraints rather than the estimated wind power potential are expected to limit the exploitation of wind energy in Denmark.

Additional electricity supply is planned to be based on combustion of biomass and biogas. The analyses are not so detailed in this case, but the potential is probably larger than 5 TWh per year. From a systems point of view, the contribution of electricity from biomass is important, due to the easy storage of biomass energy.

In a longer time perspective, there is a large potential of electricity from PV's and a more limited potential of wave power in the Danish part of the North Sea. A preliminary estimate of Danish wave power indicates a potential of about 1-2 TWh per year.

B.5 Background for the utilities

B.5.1 Organisation

Elkraft was established 1978 as co-operative whose members are SK Power Company and The City of Copenhagen. As a collaborating body, it has the task of co-ordinating Eastern Denmark's supply of electricity and co-generated heat in such a way as to achieve balance between security of supply, competitiveness and care for the environment. Elkraft consequently has the following common tasks:

- Planning and environmental activities,
- Research and development,
- Load dispatch of power and heat,
- Import and export of electricity,
- Pool accounting and billing,
- System operation.

In Denmark's new Electricity Supply Act, Elkraft is designated as transmission system operator for Eastern Denmark. In consequence of this, a new unit Elkraft System was established at the beginning of 1998. The new unit is – independently of the rest of the organisation – responsible for the tasks concerning system operation.

A number of energy utilities in Eastern Denmark are participating in the planning work within The Elkraft Co-operation. This collaboration includes all Eastern Denmark's distributors, the two power companies SK Power and Copenhagen Energy (KB), the two large heat transmission companies CTR and VEKS as well as the co-ordinator of energy collaboration in Eastern Denmark - Elkraft.

By means of the pool-based economy, the production system is optimised as an integrated system, independent of ownership structures. Power stations are usually located where the heat is needed, and wind turbines are placed where wind conditions are good. Correspondingly, the pool-based economy is applied when activities on the demand side are to be carried out. The combination of a pool-based economy which ensures a distribution of costs and benefits, and an integrated resource planning which guarantees that the objectives are achieved in the most cost effective way, enables a flexible and efficient implementation of the planning.

B.5.2 The current role of renewables in the generation system

Currently wind power, as the most important source of renewable energy supplies approx. 3% of electricity consumption in the Elkraft area, a figure that is expected to rise to approx. 13% by 2005. (Most of Danish wind potential is situated in the western part of the country).

Biomass is currently used in three CHP plants. A new biomass boiler is under construction in connection with a new gas fired CHP plant in the Copenhagen area.

B.6 Past and current policies towards renewables

B.6.1 National objectives

During the late eighties and the early nineties, the focus of Danish energy policy changed from economics and security of supply to environmental related questions. Special attention has been given to the CO2-emission, and in connection with the official Danish energy plan of 1990 ('Energy 2000') an objective of a 20% reduction by 2005 compared to 1988 emissions was adopted. The position was confirmed in the latest energy plan 'Energy 21'from 1996, which has the intention to 'place Denmark in a position to maintain and enlarge its role as a pioneering country for global, sustainable development.'

In line with this, two long-term national objectives were formulated.

- a 50% reduction of CO_2 -emission by the year 2030,
- a 1%/year increase in the share of renewables, leading to 35% by 2030.

B.6.2 Policies regarding renewables

Wind power

Wind power is regarded a very important means of CO_2-mitigation in Denmark, by authorities as well as by Elkraft. With an installed capacity now exceeding 1400 MW and covering over 9% of electricity consumption on a national scale, windpower now plays an important role in the generation system. The greater part of the windpower capacity is situated in the western part of Denmark, mainly due to better wind conditions. Thus only approx. one quarter of the national capacity is within the Elkraft area, half of this privately owned, the other half owned by the companies within the Elkraft Co-operation. In the western part of Denmark the electricity companies own only about 20% of the capacity, while 80% are privately owned.

The Elkraft Co-operation has played an active role in the development of wind-power. The role has for one part been to create a demand for larger and more efficient windturbines and, on the other hand, to participate in R&D's programmes concerning wind turbine technology and systems-integration including windpower-forecast-systems.

Recently, the electricity companies in Denmark have entered into an agreement with the energy authorities to promote a demonstration programme for offshore wind power consisting of five sites each 150 MW, 750 MW in total. Elkraft has a share of 450 MW in this programme.

Moreover several studies on integration of windpower in the Nordic and the Baltic energy systems have been undertaken.

Biomass

Since the mid-1980's Elkraft has been gaining experience with establishment and operation of small-scale and medium-scale CHP-plants, followed by work on introduction of biomass in large primary power stations. Some data are given in Table B.1.

Table B.1 *Existing and planned biomass fired CHP in the Elkraft area*

	Commissioned/ planned [year]	Fuel	Electric capacity [MW]	Heat capacity [MW]
Haslev	1989	Straw	5	13
Slagelse	1990	Straw + Waste	11,8	28
Masnedø	1995	Straw	8,3	20,8
Maribo/Sakskøbing	2000	Straw+ Wood	10,5	20,2
Avedøre 2	2001	Straw+ Wood	45	80

CHP-plants within the Elkraft Co-operation include three biomass fired CHP-plants currently in operation, and another two in the design phase and expected to go into operation within the next couple of years. Strong efforts are made in several R&D-projects comprising energy-crops, high temperature corrosion, gasification and pyrolysis.

Following an agreement in the Danish Parliament from 1993, the electricity companies are obliged to use 1,4 million tonnes of straw and woodchips per year in large and small-

scale power plants by year 2000. Due to technological problems, the target year has, however, been made more flexible.

Other renewables
The Ministry of Environment and Energy has recently launched new development schemes for wave- and solar-energy, but the ESI is so far only superficially involved. Several distribution companies are running PV-demonstration schemes individually.

B.7 Key issues

Official Danish energy policy is supporting a sustainable energy development with an essential contribution from renewable energy sources. The key issue is therefore to carry out a critical analyses of the barriers and possibilities in relation to fulfilment of the official targets - in spite of conflicting interests, especially in relation to the future liberalised energy market.

A special analysis will be carried out in relation to the proposal for a new energy law which has been negotiated since the summer of 1998. The content of this law will be decisive for the possibility of continuing present Danish energy policy.

Another key issue is to relate Danish experiences to those of the other partners in the project and thereby to contribute to the formulation of strategies of international relevance.

Danish energy policy has traditionally been characterized by a large degree of openness. As a consequence we do not find serious difficulties in relation to obtaining the necessary information and documentation. This also applies to information from the utility sector.

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GERMANY

Country briefing paper

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C. Political framework in Germany

C.1 Background to Renewable Energies in the Electricity Sector

With the exception of hydropower, renewable energies contribute less than 1% to the current electricity production in Germany. At the moment, German energy utilities concentrate their planning efforts on preparing for the national and EU-wide deregulation of electricity markets. Electricity from renewable sources is examined in pilot projects and in some cases offered to customers in so-called 'green electricity' programs at additional cost. There are no plans to expand the use of renewable energies to an extent anywhere near the targets set in the EU's White Paper. The reason given for this are the high costs of the respective technologies. At the same time, the utilities stress that they will offer electricity from all available sources if it is economically viable and if there is a sufficient demand.

Quite understandably, environmental protection is not a primary concern of utilities in their function as enterprises, especially if they are about to face unprecedented competition in the future. Nevertheless, technological progress, which is economically necessary, will most probably lead to simultaneous benefits for the environment as it was the case in the past. However, this will not suffice to reduce CO_2 emissions to the necessary extent.

The German Ministry of the Environment has formulated the target to double the share of renewable energies in the German energy supply. However, there seems to be no support by other ministries for such a move.

Table C.1 *Shares of energy sources in the net electricity production in Germany in the year 1994 [10]*

	Installed capacity [GW]	Electricity production [GWh]	Share [%]
Hydropower	8.2 [1]	18,000	4.3
Wind energy	0.8 [2]	900 [2]	0.2
Biomass	0.3	500	0.1
Photovoltaics	0.012	5	0.001
Solar-thermal electricity	0	0	0
Nuclear energy	22.5	142,000	33.6
Fossil energy	68.4	260,000	61.7
Sum		*≈ 421,000*	

[1] Including pumped storage.
[2] Numbers for 1995: 1.3 GW – 2500 GWh [2].

In Germany, especially the wind energy sector used to develop rapidly over the last years (cf. Figure C.1). For the energy use of biomass, there are a number of pilot plants. However, the dynamics of this technology does not even come close to a development comparable to that of wind energy.

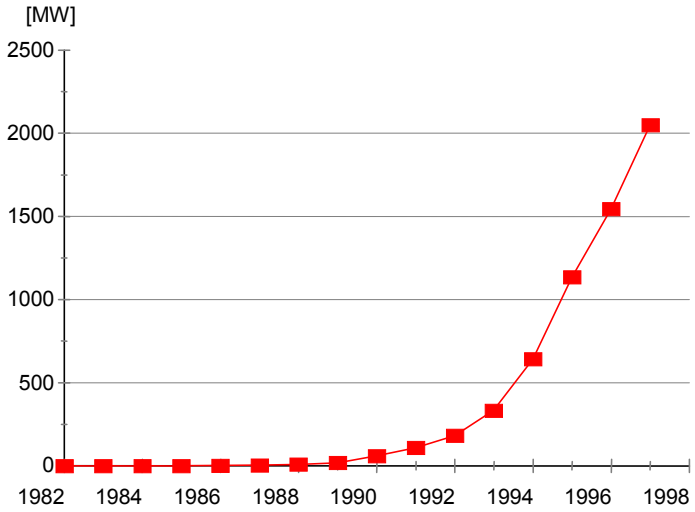

Figure C.1 *Development of the installed wind energy capacity in Germany ([3]; value for 1997: own estimate)*

C.2 Liberalisation Policies

On the 29th of April, 1998, the new 'Energiewirtschaftsgesetz' [6] (New Regulation for the Energy Law) came into effect. On paper, Germany has now already liberalised its electricity market almost completely. The traditionally closed supply areas ceased to exist. There is no step-by-step liberalisation, as was visualised in the EU Directive concerning common rules for the internal market in electricity. Rather, the market is officially opened to all customers. Section 6 of the EnWG obliges the operators of the electric grid to allow the transmission to all customers. It establishes a universal access to the grid rule, since all reasons for the refusal of full access are listed and the burden of proof is imposed on the network owner. Yet, there was no scheme worked out in the new Energy Law for how to deliver the electricity via the existing infrastructure, while reimbursing the various parties for their contribution in a rational and transparent way.

Under the pressure to find a consensus between each other and to prevent regulation by the government, as foreseen in the bill, the electricity industry and their big industry customers agreed on a 'Verbändevereinbarung (VVD)' (voluntary agreement of associations). It fixed the criteria for how to determine the transmission charges literally in the last minute. The VVD between the 'Bundesverband der Deutschen Industrie e.V. (BDI)' (Association of German Industry), the 'Verband der Industriellen Energie- und Kraftwirtschaft (VIK)' (Association of the Industrial Energy and Power Sector) and the 'Vereinigung Deutscher Elektrizitätswerke (VDEW)' (Association of German Electric Utilities) was ultimately signed end of May 1998. It will first be in force until 30 September, 1999. Although technically the agreement is not strictly binding for the members of the associations, but a recommendation only, it can be assumed that it will be the baseline for the calculation of transmission as well as distribution charges.

The existence of the VVD practically means that the utilities are still vertically integrated. They still control the transmission grids in their areas. Moreover, it is not clear what will happen with the large utilities, whether they will buy up small distribution utilities, or consolidate into larger oligopolies. As in other parts of Europe, there is considerable change and uncertainty in Germany's electricity sector. Concentration processes are for sure, though.

End of June 1998, the parliamentary group of the Social Democratic Party (SPD) and three Länder brought an action against the new Energy Law to the Federal Constitutional Court. Local authorities and municipalities have already announced that they will do the same based on Art. 84 Abs. 1 GG (need for an approval by the 'Bundesrat' (Upper House of Parliament)) and on Art. 28 Abs. 2 GG (right for self-governance of local authorities and municipalities). Municipalities fear to be pushed out of the market as a consequence of concentration processes. There are ecological deficits of the new Energy Law in addition. Therefore, the SPD has declared that the reform of the Energy Law would be set on the political agenda again if they will win the parliamentary elections in September.

Already in the process of the political debate on the new Energy Law, the German opposition party strengthened the point that the Single Buyer approach, which was introduced in the EU Directive under the pressure of the French government, and the Negotiated Third Party Access (NTPA) system are evenly possible solutions. The Verband kommunaler Unternehmen (VKU) (German Association of Municipal Utilities), for example, fought for that option as well. As a compromise, the municipal electric utilities were given the permission to make use of the option in their supply areas for a transition period until 2002. A respective paragraph was included in the new Law.

C.3 Driving Forces in Renewable Energies in Electricity

The German 'Law on feeding electricity from renewable sources into the public network' (Electricity Feed Law – EFL or 'Stromeinspeisungsgesetz') of 1990 demands that any electricity generated from wind energy, solar energy, hydro-power, sewage or landfill gas, and biological residues from agriculture and forestry has to be bought by the public electricity utilities at fixed rates [4,5] Exempted from the EFL are installations using sources other than wind or solar energy which have an installed power-generation capacity of more than 25 MW, installations which are publicly owned by more than 25%, and small utilities for which the average electricity price would change significantly.

The German Electricity Feed Law (EFL) rules that electricity produced from several renewable energy sources has to be bought by public utilities at prices between 80 and 90 per cent of the average specific utility revenues. After an update of the law in 1994, the price paid for electricity from wind and solar installations is 90 per cent of the average specific utility revenues which came up to 0.17 DM/kWh in 1995. For the other sources, 80 per cent of the average revenues (i.e. 0.15 DM/kWh) is paid [1]. These payments are likely to decrease due to decreasing average revenues. An attempt to include fossil-fuel

fired cogeneration of heat and power into the EFL was dismissed. Without the EFL, electricity from renewable sources would be paid for according to an agreement between energy utilities and their associations, which is based on avoided costs differentiated in winter high tariff, winter low tariff, summer high tariff, and summer low tariff.

A new update of the EFL in April 1998, which was linked to the New Regulation of the Energy Law, has brought some important changes. Section 4 of the Law introduces an upper 'cap' of five percent. As soon as the amount of electricity which may be supported under the EFL surpasses 5% of the total kWh sold annually in the supply area of the electric utility, the grid operator is obliged to reimburse the additional costs. This was done to limit the financial burden of the energy utility which has to buy that electricity. This limit may turn out to be a major bottleneck for the future development of wind energy as it will probably be exceeded in some areas as early as 1999 or 2000. Moreover, the EFL was expanded to electricity from all types of biomass what might give a push to the development in this sector. In practice, there had been a differentiation problem before.

The German Electricity Feed Law has triggered a substantial increase in renewable electricity generating capacity in Germany. The EFL has so far induced a booming of wind energy and started encouraging developments in the utilisation of biomass and landfill gas. However, it is unclear whether this development will continue since there is considerable uncertainty about the future market conditions. First, there is the problem of the cap of 5% just mentioned. Second, the rules for obtaining building permissions have been changed. And third, there is a rising resistance by the local public to wind energy converters. Moreover, within the context of the liberalisation, the EFL is not a mechanism that is likely to be continued. First, there will no longer be a single regional utility which can be made responsible for buying the electricity and second the inhomogeneous regional distribution of renewable energy sources may lead to substantial distortions of the newly created competitive market. Furthermore, the EFL is criticised by the European Commission as a subsidy which distorts trade among EU member countries and which does not induce competition among the technologies it supports, because payments are not decreasing.

Members of Parliament have stated to be aware of the problem and claimed that another incentive scheme should be introduced which is more in line with the new rules of a liberalised market. Alternatives for the future support of renewable energy sources, which have been discussed in the political area include a modification of the EFL, requiring utilities and/or end users to produce and/or buy a certain quota of renewable energy in their portfolio, market-based subsidies schemes involving calls for tender, and voluntary commitments of utilities.

Besides the EFL, some other instruments to promote renewable energies already exist in Germany:

- In addition to the federal law, the state of North-Rhine Westphalia has allowed its utilities to raise customer prices for electricity by as much as 1% to pay for electricity from renewable sources. The revenues may even be used to pay full-cost based tariffs to owners of photovoltaic installations. Many of the other Länder also have programmes.
- A programme to support renewable energies was adopted by the Federal Government with DM 100 million for the period 1995 to 1998.
- There was a 250 MW wind demonstration programme.
- Solar thermal and PV campaigns (1000 roofs) have had an important impact.

C.4 Utility Industry In Germany

C.4.1 The Utilities PolicyTowards Renewable Energies

In Germany, the electricity industry is one of the most powerful sectors of commerce, economically and politically. As early as 1976, the German Monopolies Commission had criticised the electricity supply industry as belonging to economic sectors without competition. This was not always the case. Before World War II more than 16,000 public electric utilities existed in Germany. In the 1950s there were about 3,500 in West Germany alone. Today there are about 900, of which the public electricity supply comprise 706 utilities. In 1994, the public utilities invested around DM 14 billion and employed almost 200,000 people.

On the national level, there are the nine companies shown in Table C.2. They dominate the market. All of the companies of the 'Verbundwirtschaft' are interconnected through capital links. They are joint members of the Association 'Deutsche Verbundgesellschaft e.V.'

The EFL is based on a broad consensus in the political arena, but heavily criticised by the German industry, and especially the electric utilities, as unnecessary and harmful. The utilities complain that they have to pay for tasks which should be covered by society as a whole. They have offered a voluntary agreement to use more renewable energies instead of legislatory action. Arguments put forward in favour of the law stressed that it does not represent a subsidy, but a refund for mitigated environmental damages. Vice versa, it can be argued that costs for avoided damages are distributed to the energy users according to an indirect implementation of the polluter-pays principle. Anyhow, the EFL is currently under attack in several law suits, but it is rather unlikely that it will fall in the legal area. On the other hand, environmental groups demand higher sell-back rates, up to full-cost based tariffs for photovoltaics, and to include cogeneration of heat and power with fossil fuels.

Table C.2 *Electric utilities in Germany and their electricity sold to other utilities and end users in billion kWh 1996 (VDEW 1997)*

Utility	kWh sold (× 1 billion)
RWE Energie AG, Essen	127.4
PreussenElektra AG, Hannover	62.1
Vereinigte Energiewerke AG (VEAG), Berlin	50.0
Bayernwerk AG, München	39.1
Vereinigte Elektrizitätswerke Westfalen (VEW) AG, Dortmund	33.8
Badenwerk AG, Karlsruhe	21.1
Energie-Versorgung Schwaben (EVS) AG, Stuttgart	21.0
Hamburgische Electricitäts-Werke AG (HEW), Hamburg	14.2
Berliner Kraft- und Licht (Bewag) AG, Berlin	13.5
Total	*382.2*

C.5 Background to the Partner Utilities

ZEW has two utility partners: PreussenElektra, the second largest utility in Germany and the fourth largest in Europe, and ENERSYS. ENERSYS is an energy services company that was founded to promote renewable energies and energy efficiency (e.g., combined heat and power/CHP). PreussenElektra supplies electricity to some 15 million people within a surface area that covers a good fifth of Germany. Via affiliated and associated companies PreussenElektra sells electricity to one fourth of the German population (20 million people) and cover one third of the area in Germany. PreussenElektra supplies energy to industrial customers as well as to regional and municipal utilities. These take care of further distribution of electricity to the consumer. They transport electricity via their own high and extra-high voltage grids. The 380 kV extra high voltage grid is part of the European interconnected grid.

PreussenElektra is a 100% subsidiary of VEBA AG in Düsseldorf. In addition to energy supply, subsidiaries of the VEBA Group are engaged in the sectors of chemicals (Hüls AG), oil (VEBA Oel AG), trading, transportation and services (Stinnes AG, Raab Karcher AG and VEBA Immobilien AG) and since 1995 also in the telecommunications sector. The Group members are responsible for their operation, the holding company, however, is responsible for the Group's strategy and is the agent in the capital market.

VEBA AG is one of Germany's major companies with a market capitalisation of around DM 61 billion and 450,000 shareholders. VEBA shares are among those 30 so-called ‘blue chips’ that fix the German share index DAX.

Since the company was founded in 1927 the scope of their activities has extended noticeably. Today PreussenElektra is engaged in district heating, gas and water supply as well as waste management either directly or indirectly via affiliated or associated companies. The sector of energy services and consulting is growing more and more important. PreussenElektra operates coal and gas-fired power stations, nuclear power plants as well as hydropower stations. More than half of the electricity produced in the

PreussenElektra Group is supplied by coal-fired power stations. Around one third is supplied by nuclear power stations. The primary sources of energy used to generate electricity are coal, nuclear power and lignite. In addition, small quantities of natural gas, oil and hydroelectric and wind power are also utilised. In their description PreussenElektra notes that ‘wherever economically viable we make use of renewable energies’.

The contribution of hydro for electricity generation amounts to about 500 millions kWh/year. PreussenElektra does nowadays not see further potential for hydro in its supply area, since the economically viable potentials have already been used. On the other hand, the number of wind farms has been growing, in particular in the coastal regions. Most of the production capacity of PreussenElektra is in northern Germany. In the catchment area of the daughter company Schleswag, the utility has some of the greatest amount of renewable electricity in Germany. PreussenElektra argue that they are discriminated against under the EFL by having so much renewable energies, while other national or international utilities do not have similar amounts. According to press releases, they pay an additional DM 300 million every year for renewable energies due to the EFL. Therefore, PreussenElektra considers the 'Stromeinspeisungsgesetz' to be unfair and contravening against the constitution.

The electricity industry, which has been integrated up to now, will be divided according to the individual parts of the value-added chain with varying levels of competition, i.e. generation, supra-regional transmission, regional distribution, sales and related services. PreussenElektra's decentralised structure which has grown over years offers a sound basis for this development. The company began to prepare a comprehensive restructuring of the Group in 1997 with the aim of separating strategic and operational functions, bundling of competence and independently operating business units of different value-adding components.

ENERSYS is an energy service company in the southern part of Baden-Württemberg. It is a daughter company of the Kraftwerk Laufenberg utility. ENERSYS is trying to sell energy services (heat & electricity) to consumers. They rent and operate equipment (e.g., CHP under biofuels, solar collectors, etc.). They are trying to build up their market with reasonable success.

C.5.1 Motivation of Partner Utilities

PreussenElektra as all other utilities is facing a new big challenge: the liberalisation of the German and European electricity market will create lasting changes in the German energy economy system. In their outlook, PreussenElektra explain how they are prepared and where they see the challenges (http://www.preussenelektra.de/):

We have consistently developed from being a utility to becoming a provider of energy services and thus are well prepared for the changes in the market. A close co-operation with regional utilities through economic participation guarantees customer contacts.

Even in the future we will be in the position to offer electricity at favourable prices by extensive utilisation of nuclear energy, by use of an intelligent energy mix and by close co-operation with our Scandinavian partners. In addition to securing our position in the national electricity market we are also strongly engaged in the heavily growing markets in Eastern and Northern Europe.

Thus, PreussenElektra is very interested in questions concerning the impacts on market liberalisation of the European electricity sector. The utility also focuses its efforts on co-operating in a wide variety of research projects to develop new energy sources as well as ways to use energy more efficiently and rationally.

PreussenElektra does consider a future, in which they might not have permission to build new nuclear reactors, and where there is indeed 'global warming'. PreussenElektra views, from a commercial perspective, that it might be acceptable to take in more renewable energies, if they could be promoted outside the framework of the EFL in a way that would be more commercially equitable.

The ENERSYS society for energy systems plans, builds and operates energy systems, in particular centralised and decentralised heat generation and distribution plants with a clear emphasis on renewable energy sources and the rational use of energy. ENERSYS has several years of experience with combined heat and power stations, boiler plants, heat pump plants, windmills and heating grids. Currently, several heat generation plants on the basis of wood chips are installed for a local heating system. The objectives of cost-effectiveness, energy efficiency and local environmental protection are equally ensued.

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GREECE

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D.1 Greece

The Public Power Corporation (PPC) is the public entity responsible for the generation, transmission and distribution of electricity in Greece. PPC is vertically integrated and produces 97.5% of total electricity demand of the country. Concerning renewables, PPC is the owner of the total large-hydro installed capacity and most of the small-hydro installed capacity (in the order of 2,800 MW) as well as about 25 MW (62 %) of the installed wind capacity, totalling 40 MW. Two small hydro plants (totalling 1.5 MW) belong to municipalities. Under PPC ownership are also about 250 kWp of photovoltaics. The total generation from renewables covers about 10% of total electricity demand of Greece. In year 1997 electricity generation from small hydro was 142 GWh while for large was 3933 GWh and 55 GWH from Wind.

According to the preliminary version of the relevant legislation, and complying with EC Directive 96/92, the first step of deregulation of the electricity market in Greece (23% of the market) is scheduled for 19 of February 2001. Additionally, the legislation foresees restructuring of PPC; PPC will loose the exclusive rights for electricity generation from conventional fuels in the mainland system of Greece while it will continue to own the transmission system as well as to own and operate the distribution system. The transmission system will be operated by a separate, independent entity. In the autonomous islands systems, PPC will continue to have exclusive rights only on the transmission and distribution systems.

It is likely that the deregulation of the market will not strongly affect the exploitation of renewables in the islands (mainly wind energy) due to the high potential and the high cost of electricity generation from conventional fossil fuels. In the mainland system concerns about the future of renewables arise due to competition in generation and the generally lower generation costs. This situation leads to the need for policy measures in favour of renewables, which will simultaneously be compatible with EC Directive 96/92 and legislation in the other member-states in order to avoid market distortions.

D.2 Background to Renewable Energy in the Electricity Sector

Electricity generation from hydro and wind energy in Greece is performed by PPC, Autoproducers (APs, that is entities generating electricity for their own needs but also selling any surplus back to the grid), and Independent Producers (IPPs), that is entities generating and selling it directly to the grid).

Until 1985 PPC had the exclusive right for generation, transmission and distribution of electricity in Greece. The Law 1559 of ’85 allowed to some entities the generation of electricity to ‘Autoproducers’, in order to cover their own needs. Any surplus of electricity occurring to grid-connected APs should be sold back to the grid, at prices which had been criticized as rather low. On the other hand, PPC was obliged to buy that energy, unless technical reasons did not allow the transmission and distribution of this energy to consumers. L.1559/85 allowed electricity generation from renewables by APs in the following cases:

For the exploitation of wind, solar, biomass and wave energy, via the installation of autonomous systems, without capacity limitation in case of autonomous systems or up to three times the installed demand capacity of the AP in case of grid-connected systems.

For the exploitation of hydro potential, via autonomous small hydro systems, of capacity up to 5 MW, and under the condition that the specific project has not been included in the PPCs 5-year development program. In case of a grid-connected unit, the installed capacity should not exceed the double of the installed demand capacity of the AP.

Law 2244/1994 replaced L.1559/85. The main provisions of L.2244/94 are as follows:

- Two categories of electricity producers are defined: autoproducers (APs), and Independent producers (IPPs).
- Capacity limits are set to 50 MW for IPPs.
- APs compensate electricity consumption from the PPC network with production from RES (up to 80-90%).
- Licensing procedures are simplified.
- Tariffs are correlated with the kWh selling prices (70-90% of the retail price).
- PPC has to buy all energy produced, as allowed by the technical constraints of the system, under 10-year contracts.
- The penetration of intermittent RES in island grids is limited to 30% of peak load of previous year.
- PPC remains the exclusive supplier of third parties with electricity.
- Additionally, penalties for low cos ö and reactive power demand are foreseen. The cost for the extension of the grid or any reinforcements of the power lines are born by the RES developers.
- Under this Law, more attractive tariffs for the isolated systems of the islands are foreseen. The current tariffs for RES electricity sold by IPPs to PPC are shown in the next Table.
- Existing applications were developed during the last twenty years under financial incentives such as those provided by various EU Programmes (Demonstration, Mediterranean Integrated Programmes, VALOREN, THERMIE) and investment subsidies provided by the Greek Government.

The legislative framework for promoting RES applications was defined by:

- The Economic Development Law - EDL (L.1262/82 and 1892/90, and 2601/98 which provided 45 - 55% inv. subsidies, reduced loan interest rates, tax credits, increased depreciation rates) for private investments in electricity from renewables, and
- The Law for regulation of electricity generation from RES (1559/85), as analysed above, which allowed for electricity generation by entities other than the Public Power Corporation, such as co-generators, auto-producers (APs) and Local Authorities, the last with the restriction to sell all electricity produced to the PPC.
- The Law for regulation of electricity generation from RES (2244/94), as analysed above.

An additional instrument for the RES development is the 2nd Framework Support Programme (1994-1999), within which the Operational Programme for Energy foresees 190 MECUs (EU, national funds and private funds) for RES projects. About one third of this budget is devoted to wind energy.

Table D.1 *Buy-back tariffs for RES electricity in Greece [GDR/KWH) as of January 1995*

			APs (energy: 70 % of kWh selling price)	IPPs (energy: 90 % of kWh selling price)
Autonomous Island Grids	energy (all voltage levels)	18.62	23.94	
	Low Voltage (220 / 380 V)	energy	18.62	-
	Med. Voltage	energy	15.06	19.36
Interconnected system	(6.6, 15, 20, 22 KV)	capacity	-	497 * ó (50% of sell tariff)
		peak zone	9.84	12.65
	High Voltage (150 KV)	med. zone	6.82	8.77
		low zone	5.05	6.50
		capacity (peak one)	-	1129 * ó (50% of sell tariff)

ó coefficient: 0.5 for wind and solar units
0.7 for small hydro units
0.9 for geothermal and biomass units

It is expected that by the year 2000 the total market for wind generators in Greece will exceed US $500 million and that wind generators of capacity exceeding 150 MW will have been installed. The majority of the new windparks will be created by the private sector. While a significant amount of this total may be installed on islands, windparks of 10-30 MW are also planned by Independent Power Producers in the mainland. Currently, pending applications by Independent Power Producers for wind energy development and licenses granted exceed 250 MW, with more than 70 MW foreseen for the mainland (interconnected) system.

D.3 Liberalisation: Factors, Policies

Recently (June 1998) a preliminary version of the legislation concerning electricity market liberalisation in Greece was compiled by the Ministry for Development. According to this legislation, a first market liberalisation is foreseen for 19 of February 2001. This will concern only the mainland system, while in the autonomous island systems liberalisation is restricted to the generation system. Main points of this initial legislation are the following:

D.3.1 Access to the grid

Access to the grid is provided by the System Operator to entities, which are owners of license for electricity generation or electricity trade. The distribution system Operator has access to the Transmission System.

D.3.2 Degree of vertical integration of utilities

PPC will split in separate and independent entities.

D.3.3 Number and type of consumers who are free to choose their suppliers

From 19/2/2001, consumers of over 100 GWh/year within the interconnected (mainland) system of Greece have the right to enter in agreements with suppliers of electricity.

D.3.4 Degree of government intervention in the market

The license for electricity generation is awarded by the Ministry for Development, following the opinion of the Regulator. For electricity supply purposes, eligible donsumers obtain a license from the Ministry for Development, following the opinion of the Regulator.

D.3.5 Degree of openness to imports from and exports to other countries

There is no explicit reference to imports and exports as far as eligible consumers or APs/IPPs are concerned. However, the draft legislation requires that the electricity supplier must have adequate generating capacity installed within the member-states territory.

D.4 Driving Forces in Renewable Energy in Electricity

The main issues concerning the political and legal framework for RES in Greece have been analysed above.

Concerning potential for wind and small hydro, brief analysis follows:
Wind potential in Greece is estimated to 3 TWh /year, distributed geographically as follows:

Continental Greece	1.60 TWh / year
Evia island	0.95 TWh / year
Other islands	0.45 TWh /year
Total	3.00 TWh / year

Source: CRES and ICCS/NTUA estimates

This potential, 3 TWh/year, may be exceeded if the Aegean islands (mainly the Cyclades islands complex and Crete) become interconnected to the mainland grid. Concerning small hydro potential, the techno-economic exploitable potential is estimated to 800 MW, 2.5 TWh/year, assuming a 30% capacity factor (source: CRES and ICCS/NTUA estimates).

D.5 Background to the Utility

Public Power Corporation (PPC), a vertically integrated company, was established in 1950 as state owned public utility with the exclusive right of generating, transmitting, and distributing electricity in Greece. PPC, the largest corporation in Greece, is also the owner and operator of major lignite mines. It was founded with the purpose of securing a reliable and economic supply of electric power at lowest possible cost, achieved through the development of domestic energy resources. Key figures for PPC follow (1997):

Installed capacity

	[MW]	[%]
Lignite-fired	4900	49.3
Oil-fired	2046	20.6
Gas-fired	160	1.6
Renewables		
Hydroelectric/large	2764	27.8
Hydroelectric/small	40	0.4
Wind	25	0.3
Total	9935	100.0

Power system

	[MW]	[%]
Mainland	8901	89.6
Crete	410	4.1
Rhodos	239	2.4
Other islands	385	3.9
Total	9935	100.0

Net generation & net imports

	[GWh]	[%]
Lignite-fired	27,710	66.8
Oil-fired	7,205	17.3
Gas-fired	216	0.5
Renewables		
Hydroelectric/large	3,933	9.5
Hydroelectric/small	138	0.3
Wind	34	0.1
Imports	2,294	5.5
Total	41,530	100.0

Sales

	[GWh]	[%]
Residential	12303	33.8
Industrial	12270	33.6
Commercial	7869	21.5
Agricultural	2283	6.2
Others	1805	4.9
Total	36530	100.0

As mentioned before, PPC produces 97.5% of total electricity demand. Concerning renewables, PPC is the owner of the total large-hydro installed capacity and most of the small-hydro installed capacity (in the order of 2,800 MW) as well as about 25 MW (62 %) of the installed wind capacity, totalling 40 MW. Two small hydro plants (totalling 1.5 MW) belong to municipalities. Under PPC ownership are also about 250 kWp of photovoltaics. The total generation from renewables covers about 10% of total electricity de-

mand of Greece. In year 1997 electricity generation from small hydro was 142 GWh while for large was 3933 GWh and 55 GWH from Wind.

After the first energy crisis, the development of endogenous resources (lignite and hydro potential) became at the cornerstone of the Greek energy policy. New renewable energy technologies (NRETs, mainly PV, wind, geothermal), but also small hydros, become of concern to the PPC since the early 80s, mainly due to environmental concerns and the possibilities provided by new energy conversion technologies to further exploit indigenous energy resources.

Even since the 70s, PPC gave priority to large hydro plants (with reservoirs), mainly due to the significant economies of scale involved but also due to the multiple purposes of these plants (frequency control, peak shaving, irrigation, etc). Concerning wind energy, from the utility point of view, until recently this was considered a technology 'near to commercial maturity'. Thus PPC followed a step-by -step approach, also in view of its main objectives to maintain high system reliability and meet load demand at reasonable costs.

Further on, and in line with this approach is a significant operating constraint of the interconnected (mainland) system of PPC; lying at the south-east end of Europe it was always designed capable to operate in an autonomous mode, i.e. not relying on (the existing) interconnections with Albania, Yugoslavia and Bulgaria. These interconnections serve mainly economic and emergency purposes. Thus, priority given to intermittent energy resources (wind energy and small hydro) development for electricity production was necessarily limited. On the other hand, wind development in the autonomous island systems is also limited due to stability and operating constraints of the conventional oil units used for electricity generation. It is expected that advanced control systems will allow increased wind energy penetration in the island grids where, apart from being environmentally friendly, wind energy is also among the least cost options for electricity generation (high wind potential, high electricity production cost from oil).

During the 80s and until mid-90s, PPC installed more than 20 MW of wind capacity, mainly in the islands. As stated previously, most of these installations were co-funded by various Programmes of the EC. Apart this source of funding, the attractive buy-back tariffs for renewable energy in Greece and subsidies provided for related investments (see above) will also reflect to PPC via joint ventures with the private sector.

D.6 Key issues

PPC is currently under restructuring: the relevant legislation dealing with this issue and the major issue of market deregulation / liberalisation in Greece is not foreseen to be finalised before the end of the year. This creates uncertainties at this moment concerning the importance that will be attributed to renewables by the new organisational structure of the utility to be formed.

In addition to that, the competition itself that will be introduced in the near future in the electricity generation sector is not in favour of renewables, given their current costs and the average generation cost from conventional fuels in the mainland system in Greece.

The factors mentioned above do not allow at present the formation of a detailed strategy on how the 12% target of renewable energy by 2010 will be reached, at least not within the mainland system.

The situation is different in the islands, where the electricity sector is not to be fully liberalised: PPC will retain the exclusive rights for transmission and distribution but not for generation. Thus, given the high RES potential (solar, wind) and the high generation cost from conventional (oil) units, RES and mainly wind energy are expected to increase their share in these places.

As a conclusion, the key issues for Greece at this stage are:

- PPC is currently under restructuring.
- Relevant legislation implementing PPC restructuring and market liberalization (following EC 96/92 Directive) is currently under discussion within relevant bodies (Ministry, PPC, Association of Greek Industries, Association of IPPs, etc.).

These two issues result in difficulties in defining the utility's role for RES development in the immediate future.

THE NETHERLANDS

Country Briefing Paper

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E. BACKGROUND TO RENEWABLE ENERGY IN THE ELECTRICITY SECTOR

E.1 Organisational structure of the electricity

E.1.1 Historical background

Historically the utilities in the Netherlands were owned by local authorities and vertically integrated. During the years several utilities started to co-operate on the production side and in the late 1980's some 15 vertically integrated electricity utilities existed. These companies were owned either by the local authorities of the larger cities either by the regional authorities of the provinces. They delivered electricity either directly to the end users, or to local distribution companies that were owned by the local authorities. In the late 1980's there were about 70 of this local distribution companies, which were often, but not always, horizontally integrated companies, delivering electricity as well as gas and water to the end users. The utilities that produced electricity collaborated on the national level in the form of the Dutch Electricity Generation Board (Sep). Sep was responsible for the national transmission grid and co-ordinated the planning for the construction of new power plants for which it published each two years a report containing a 20-year electricity demand forecast and a 10-year power plant construction plan, which had to be approved by the national government. In the late 1980's several developments, such as a continuing number of mergers between the distribution companies and discussions on the conditions for and the degree to which outsiders could get access to the grid, lead to the restructuration of the electricity sector by the Electricity Law of 1989. Until mid-1998 the situation in the electricity sector was based on this law.

E.1.2 The pre-1999 situation

The most important aspects of the 1989 Law are

- The separation between distribution and production companies in the electricity sector.
- The obligation for the distribution companies to accept electricity from IPP's against the distribution company's avoided costs.
- The introduction of a tariff structure that allows for price differences between the production companies and between the distribution companies.
- The possibility of horizontal shopping, i.e. the freedom of large end users to choose for another than their regional distribution company to purchase their electricity from as well as the freedom of distribution companies to purchase their electricity from other production companies than their regional production company.
- The allowance to distribution companies to produce electricity by renewables and small scale CHP. The law stated that distribution companies could bring into operation plants below 25 MW without consulting the production companies and plants up to 100 MW in consultation with the Sep.

There are 4 central electricity production companies: UNA in the north-west, EPON in the north and the east, EPZ in the south and EZH in the south-western part of the

Netherlands. They co-operated in the Sep, which was responsible for the transmission grid, the import and export of electricity, and the co-ordination of the production planning of the production companies. The 10-year construction plan had to be approved by the national government. Attempts to form one national large electricity production company have failed in 1998.

In the last decades many mergers among the distribution companies have taken place. In 1998 there are 23 electricity distribution companies. These mergers have continued since then. In early 1999 five distribution companies together had a market share in the electricity distribution sector of 99%.

There are large differences between the sizes of the distribution companies. Some of them are small and still attached to one town or region, but most of them cover large regions, sometimes as large as the regions of the production companies. Most of these companies are horizontally integrated, although still mono-gas utilities exist. All the energy distribution utilities co-operate in their branch organisation EnergieNed.

The production companies were obliged to sell the electricity from the power plants first to the Sep against standardised fees that reflect the production costs. The Sep levels the costs of the different production plants and sells back the electricity to the production companies against one national basis tariff (LBT) which includes the coverage of Sep's own costs (a/o maintenance of the transmission grid). The production companies sell the electricity to the distribution companies against a slightly higher tariff than the LBT, reflecting their distribution costs. These tariffs, the regional basis tariffs (RBT's), might be different between the production companies, but because of the competitive pressure, these differences have turned out to be minor during the last decade. Finally the distribution companies sell the electricity to the end users against a tariff that reflects the distribution costs.

To circumvent the requirement of the 1989 law that distribution companies cannot construct power plants with a capacity larger than 100 MW, the distribution companies have set up many joint ventures with industrial firms for the construction of small and large scale CHP-plants (up to about 400 MW). Decentralised electricity generation capacity (mainly CHP) has grown from a little over 2000 MW in 1989 to 5300 MW in 1997 (26% of the total generating capacity in the Netherlands). Decentralised electricity generators produced approximately 26,000 GWh in 1997 (30% of total electricity generation).

The exponential growth of decentral CHP in the early 1990s led to a temporary moratorium on new CHP-plants in 1994, because the total capital costs of the national electricity system were feared to become far too high. Since then the tariff contracts between the distribution and production companies have been adapted to accommodate for this problem. Another result of the growth of decentral CHP is that almost all construction plans for central power plants have been cancelled. Currently the production companies are also collaborating with large industrial firms to construct CHP plants, since it is the only way to extent their production capacity.

E.2 Renewables

E.2.1 Definition of renewables in the Netherlands

Currently there are two definitions in use in the national discussion on renewable energy. The first is the definition given in the 'Action Programme Renewable Energy' (1997) according to which sources are renewable if they 'are converted into secondary energy sources without making any demand on finite reserves'. This definition includes wind energy, solar electric, solar thermal, geothermal, hydropower, biomass as well as acquifer energy storage, ambient heat delivered by heat pumps and waste incineration. Another definition has been put forward in the 'protocol on the monitoring of renewable energy' which has been established on the instigation of the Novem (the Dutch governmental agency for environmental and energy research) and EnergieNed: Renewable energy is all energy in the form of electricity, heat or fuel that is generated by local renewable energy sources, after correction of possible use of energy for its generation. The most important differences between the two definitions is that in the first definition incineration of non-organic waste, industrial heat pumps and import of renewable sources (e.g. from Norwegian large hydropower plants) is included, which is not the case in the second definition. Therefore the first definition is called the 'broad definition' and the second definition the 'restricted definition'.

E.2.2 Market penetration of renewables

Table E.1 *Dutch situation in 1997 for renewable electricity*

Renewable resource			Domestic electricity production (96.1 TWh)	avoided	Domestic energy consumption (2945 PJ)
	[MW]	[TWh]	[%]	[PJ]	[%]
Wind	325	0.45	0.47	3.8	0.13
Solar PV	4,4	0.01	0.01	0.09	0.00
Hydropower		0.1	0.10	0.9	0.03
Waste incineration		2.1	2.19	17.9	0.61
Landfill gas		0.1	0.10	0.9	0.03
Domestic biomass	0	0	0	0	0
Import biomass	0	0	0	0	0
Import renewable electricity	0	0	0	0	0
Total		2.76	2.9	23.6	0.8

If non-electricity options are included (such as domestic open hearths fired by wood) then the percentile contribution of renewables to the domestic energy consumption defined by the broad definition is about 1%. The largest contribution from renewables comes from sources that are not included in the restricted definition. The current contribution of renewables in the sense of the strict definition to the Dutch energy consumption is negligible.

E.3 Liberalisation: Factors, Policies

E.3.1 Policy background

In 1997, the Dutch Minister of Economic Affairs, who is responsible for energy policy, presented the new Electricity Law (EL) to the Dutch parliament (Elektriciteitswet). The

EL describes the new policy framework for a liberalised Dutch electricity market. The new EL was introduced in order to implement directive no. 96/92 of the EU concerning the internal market for electricity and because of changing ideas with regard to the role of the market in electricity supply. The EL was passed in Parliament in June 1998 (consequently, officially the law is now called the Electricity Law 1998).

In addition to the EL, a so-called 'Algemene Maatregel van Bestuur' (a kind of general directive) has been introduced to the parliament which addresses in more detail tariffs for captive customers and rules and tariffs for transport of electricity on the national grid (Electriciteitsbesluit 1998). The parliament has accepted the EL, except for the part that proposes to regulate these tariffs by AMvBs. The parliament wants to keep involved in this process. In early 1999 discussions on this issue were still going on. As long this issue is not solved the Electricity Law of 1989 still applies to tariff setting issues.

E.3.2 The Electricity Law of 1998 and the AMvB

In the EL, the Dutch market is liberalised in phases as regards the eligibility of consumers to chose their suppliers. Table E.2 shows which customers will be free in the choice of their supplier at which date.

Table E.2 *Scheme for liberalisation of the electricity market*

Type of Customer	Year of free status	Number of customers	Electricity demand in 1995 [%]
Yearly use > 2MW	1998	650	33
yearly use < 2 MW	2002	54.350	29
connection > 3.80 Ampère			
connection < 3.80 Ampère	2007	6.720.000	38

In the Netherlands, a higher percentage of consumers will be free to choose their suppliers than is required by the EU directive on liberalisation of the electricity market. Access to both the high-voltage grid and the distribution networks is regulated on the basis of regulated Third Party Access (rTPA). Entry should be free and non-discriminatory. Network owners are therefore obliged to publish tariffs and the technical requirements for use of the network. In addition, network administration should be vested in a separate company, although this company can be part of a holding which also includes production and/or supply of electricity (legal unbundling). However, the creation of a separate company for network management should ensure that this is independent of other activities of network owners such as the supply of electricity. With regard to the transmission grid a new organisation, called TenneT, has emerged from the Sep.

A special supervisory bureau is set-up, the so-called Dienst Toezicht en uitvoering Electriciteitswet, DTE (Agency for supervision and implementation of the electricity law), which will supervise and regulate the activities of the network owners. Network tariffs (for the transmission of electricity) will be allowed to rise in line with the consumer price index, minus an efficiency deduction. Moreover, network owners will only be allowed to make a modest profit, given that network management is a monopoly activity with low risks on investments. DTE will probably become a specific chamber within the Dutch competition authority, NMa (the equivalent of the German Bundes Kartellamt or the British Monopolies and Merger Commission).

Household consumers and small businesses will only be free to choose their suppliers in 2007. Therefore, the Dutch Minister of Economic Affairs will supervise the tariffs set by the distribution companies for captive consumers. The tariff is composed of a network tariff, regulated as specified above, and a supply tariff. Distribution companies are not allowed to ask a transmission price different from the network tariff, however they are allowed to demand a supply price which is lower (but not higher) than the supply tariff, which will be based on market prices for electricity and changed periodically. The supply tariff is subject to a yearly efficiency deduction, which will be fixed for three to five years.

The Electricity Law contains three (optional) measures aimed at promoting renewables (other documents contain more specific measures). First, producers and distributors should in general stimulate efficient and sustainable energy production and consumption. Large firms are required to report their activities every two years. Second, a rate will be set for which small producers of renewable energy can sell electricity to the network (in addition, they will receive the 'regulating energy tax' (REB) which has to be paid on electricity and gas). Third, there is an optional requirement that a certain amount of total electricity consumed will be provided by renewables (this percentage has not been specified in the EL). This measure will only be taken if targets for renewables are not met on a voluntary basis. The measure will take the form of certificates which distributors or consumers have to hand over to the authorities to prove that they have delivered or used a certain amount of renewable electricity. The Dutch association of distributors, EnergieNed (ECN's partner in the REALM project) has set up such a system to promote the use of renewables on a voluntary basis, see section E.7.

Table E.3 below provides an overview of the main elements of liberalisation in the Netherlands

Table E.3 *Electricity market liberalisation in the Netherlands*

Issue	Regulation
Access to grid.	Regulated TPA
Degree of vertical integration of utilities.	Legal unbundling.
Number and type of consumers who are free to choose their suppliers.	Completely free as of 2007.
Degree of government intervention in the market.	Tariffs for supply to captive customers are set by the government, yearly efficiency reduction.
Degree of openness to imports from and exports to other countries.	Open to imports, although imports from less liberalised countries could in principle be limited through the reciprocity clause in the EU directive.

E.4 Driving Forces in Renewable Energy in Electricity

E.4.1 Government budgets for renewables

In the coming years the government budget for renewables will be raised by more than a third of the current level. Direct subsidies will be phased out, market stimulation will be promoted by indirect means, e.g. by fiscal measures. The budget for PV will almost be tripled in the coming years, while biomass and wind energy will see their stimulation

budget doubled. The budgets consists of contributions to R&D-programs as well as programs aimed at a better acceptance of renewables in society and at enhancing the knowledge on the different indirect stimulation measures.

Table E.4 *Government direct budgets for renewables*

	1996	1997	1998	1999	2000
Wind	8.6	16.6	16.6	16.6	16.6
PV	12.3	33.1	34.1	34.3	34.3
Waste and biomass	7.5	15.5	15.5	15.5	15.5
Thermal solar energy	6.6	8.6	8.6	8.6	8.6
Solar boilers (subsidy)	6	6	0	0	0
Heat pumps (subsidy)	3	0	0	0	0
Heat pumps	5.3	8.3	8.3	8.3	8.3
Renewable Energy Project Bureau	0	5	5	5	5
ECN financing committed to renewables	10	10	10	10	10
TNO financing earmarked for renewables	1.5	1.5	1.5	1.5	1.5
Economy-Ecology-Technology Program	10	10	10	10	10
Total	70.8	114.6	109.6	109.8	109.8

E.4.2 Financial and fiscal incentives

Regulatory Energy Tax

Since 1997 domestic consumers pay a Regulatory Energy Tax (REB) on their electricity consumption (above a level of 800 kWh/year)of 3.5 cents/kWh, including 17.5 % VAT (appr. 1.6 Eurocents/kWh). The aim of this tax is to stimulate energy conservation. The tax is paid by the consumers to the utilities, which have to transfer it to the treasury. An exception is made for electricity generated by renewables. This rule of exception increases the profitability of renewables. Currently the exception rule applies to all renewables, except waste incineration.

Accelerated Depreciation of Environmental Investments (VAMIL)

The VAMIL scheme allows investors in environmental technologies (defined explicitly by a VAMIL-list) to freely offset their investments against taxable profits, resulting for the investor in an interest benefit. All renewable technologies are included in the VAMIL-list.

Energy Investment Relief Scheme

Since January 1997 investments in technologies that are explicitly defined on a qualifying list (including renewable energy technologies) may be offset against taxable profit at a rate varying from 40% to 52% of the total investment (with a maximum of Dfl 50 million (= approximately. Euro 22.5 million) per investment).

Green Funds

A green fund is a fund that invests money in environmental beneficial projects, which includes renewable energy. Private persons investing in a green fund are exempted from tax on the interest income from that fund. Under the current tax system in the Netherlands this comes down to return on investments criteria that can be about 50% lower than for other investments.

Capital subsidies for private investors in wind turbines
During the last years inspectors of the treasury have not allowed private persons such as farmers to make use of the VAMIL regulation, because investments in renewables (i.e. wind turbines) were not considered as belonging to the core business of farmers. Since March 1998 a capital subsidy of 20% on the investment costs of wind turbines is available for these cases. The budget for 1998 is Dfl 12.5 million (allowing for a subsidy of about 30 MW wind turbines).

Export subsidies
In the framework of the environment and economic independence programme 'MILIEV' a 60% contribution can be granted towards the total transaction costs of market stimulation programmes and transactions involving Dutch technology products.

E.4.3 Regulations

Energy Performance Standard in the Built Environment
A requirement for each new housing project is to calculate the so called Energy Performance Coefficient, which is an indicator for the energy quality of the new-built house. The Energy Performance Standard (EPN) gives the maximum value of the EPC. In 1998 the EPN has gone from the 1997 level of 1.4 to 1.2 and will go to 1.0 in the year 2000. By that year the standards will have become so tight that renewable energy technologies will be cost effective in meeting the standards, except for solar PV, which is still too expensive.

E.5 Policy goals

Table E.5 gives an overview of the current energy-related policy goals of the Dutch government.

Table E.5 *Energy-related policy goals in The Netherlands*

Subject	goal	year
Renewables	3% of electricity	2000
	10% of energy consumption (17% of electricity)	2020
Energy efficiency improvement	1.7%/yr	till 2000
	33%	2020
Greenhouse gases (Kyoto)	-6% (1990)	2010

E.6 Background to EnergieNed

EnergieNed was established in December 1993 as a merger of the three distribution company associations VEEN (electricity), VEGIN (gas) and VESTIN (heat). All distribution companies are member of EnergieNed, which functions as the representative of the energy distribution sector in negotiations with national and European governmental agencies as well as in meetings with societal organisations. About 75 EnergieNed employees support the distribution companies on economic, legal, communication and environmental issues. EnergieNed also performs market research for

its members and it facilitates the dissemination of knowledge and experiences among them.

E.6.1 Past and Current Utility Policies Towards Renewables

The Environmental Action Plan 1991-2000
The Environmental Action Plan (MAP) started in 1990 as a co-ordinate action between the government and the distribution sector to promote energy efficiency and renewables. The current goals of the MAP are the reduction of 17,7 Mton CO_2 and 0,4 billion acid equivalents (NO_x and SO_2) with regard to the 1990 situation. Since 1991 many measures have been taken, including the promotion of CHP, insulation, high-efficiency boilers as well as renewables. The resources required to fund the planned measures come partly from the government and partly from the energy distribution sector. The main part of the sectors own financial support comes from a special levy that varies between 0.5% and 2.5% (with a mean of 1.8%) of the energy bill. The total costs of the MAP has been in the order of Euro 225 million/year during the last years. Wind energy is supported by the MAP-funds at a level of about Euro 30 million/year.

Green electricity
Since 1996 a number of utilities offer customers the choice to buy Green Electricity (also known by labels as eco-electricity of nature electricity). The surplus customer price for the customers varies per utility, but on the average it is 0,07 Dfl (0,033 Euro). The utilities guarantee that the money raised by the selling of green electricity will be invested in the construction of green production capacity. An independent organisation (like the WWF) controls if the utilities do not sell more green electricity than the utilities have produced or bought. The total amount of green electricity sold has risen from 32,5 million kWh in 1996 to an estimated 122 million kWh in 1998. About 40 000 households (on a total of about 6 million households) and 200 firms bought green electricity in mid-1998.

Since 1998 households that buy green electricity are exempted from the Regulatory Energy Tax (REB) which lowers the consumer price of green electricity (above a level of consumption of 800 kWh/year) with Dfl 0,035/kWh. With an expected increase of the REB in the near future green electricity will be become more attractive to the customer.

E.7 The Green Label system

E.7.1 Introduction

The EL includes an optional measure which requires that distributors provide a certain amount of electricity based on renewables. This measure will be implemented only if the industry does not meet the targets by itself. Early 1998, the association of Dutch distributors (EnergieNed) have introduced a certificate system which establishes a market for renewable electricity, in some respects comparable to tradable emission permits, which should achieve a target of 1.7 TWh electricity produced by renewables in 2000. The first binding target is set for 2000. Up till then the distributors have the chance to get acquainted with the Green Labels, as the certificates are called. It is expected that trading will really develop in the year 2000 when distributing companies have to meet

their individual targets. Below, the Green Label system is described in more detail. Furthermore, the experience to date with the permit system is outlined.

E.7.2 Creation of Green Labels

Each distributing company will be allotted a quota which it has to meet. It does not need to produce the renewable based electricity itself, in order to meet its quota a distributor has to hand over so-called Green Labels. These Green Labels are created by producers of renewable electricity, who receive one Green Label for every 10,000 kWh renewable electricity produced. Renewables in this system are those renewables which receive a rebate from the regulating energy tax (REB, see section 3.2), which are hydro, wind, solar, biomass and gas from landfills. In addition to the Green Labels, producers receive the price paid for the electricity and the REB rebate (see section 3.2). it should be noted that distributors can also create Green Labels themselves by producing renewable electricity.

E.7.3 Green Label Market

The distributors will be prepared to pay a price for the labels because they need the Green Labels to meet their renewables target. What the price will be will depend on the market, on demand and supply. With low supply, price will be high, which will be an incentive for new producers to provide 'green' electricity. Moreover, in theory renewable energy will be provided in an efficient way because those producers who can provide renewable electricity at the lowest price will be able to sell their permits. It is expected that both a spot market and a forward market will develop. On the spot market, distributing companies will buy Labels to fulfil their obligation for the current year, while on the forward market long-term contracts can be negotiated between (new) suppliers of renewable electricity and distributors.

E.7.4 Monitoring and enforcement

The Dutch fiscal administration will certify the labels, which will assure that a Green Label does indeed represent 10,000 kWh green electricity. There is a sanction for those distributors who fail to meet their targets. They are obliged to buy Green Labels at a price which is set higher than the market price from other distributors who have more Green Labels available than required.

E.7.5 Experience so far

The Green Labels where launched in January 1998, although the first binding target is set for 2000. The first two years are trial years in which the Green Label market can be developed. For these two years it is recorded how many Green Labels are created and how many Labels are owned by distributing companies which, combined with their targets, gives an idea about supply and demand. Every month, a nation-wide registration office registrates which new producers of renewable electricity have entered the market, their actual production and production capacity, which Green Labels have been created by whom (including their serial number) and which Green Labels have been bought, including the duration of the contract. This information is partly available on the Green Label website which has been set-up (www.greenlabelned.nl; in Dutch). Labels can also

be bought and sold on this website. Figure E.1 shows the number of Labels created so far (July) in 1998, divided between those sold on long-term contracts and those which are for sale now, and the difference between the amount created and what would be necessary to fulfil the obligation of 2000 (1.7 billion kWh).

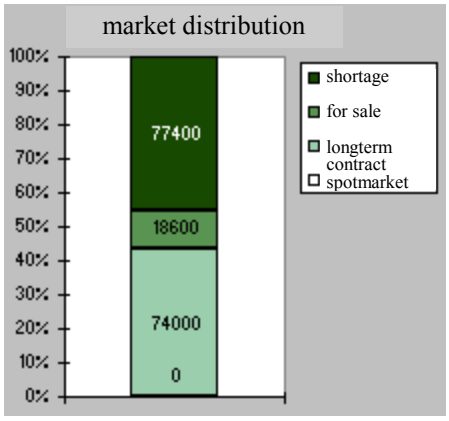

Figure E.1 *(source: www.greenlabelned.nl)*

Figure E.2 shows the difference between individual firms' targets and the number of Labels they hold at the moment. A small number of firms hold excess Labels while a large number of firms still have to acquire Labels.

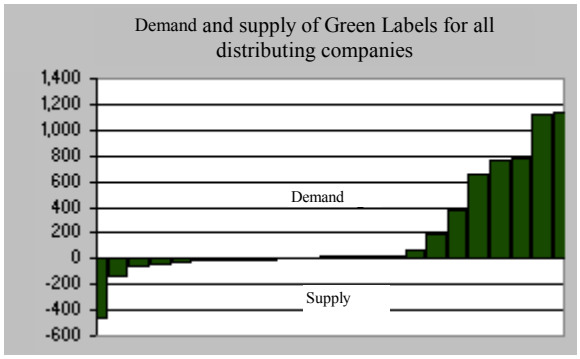

Figure E.2 *(source: www.greenlabelned.nl)*

Figure E.3 provides an overview of the development of renewable electricity in the Netherlands since 1990 and an extrapolation towards the 2000 target of 1.7 billion kWh.

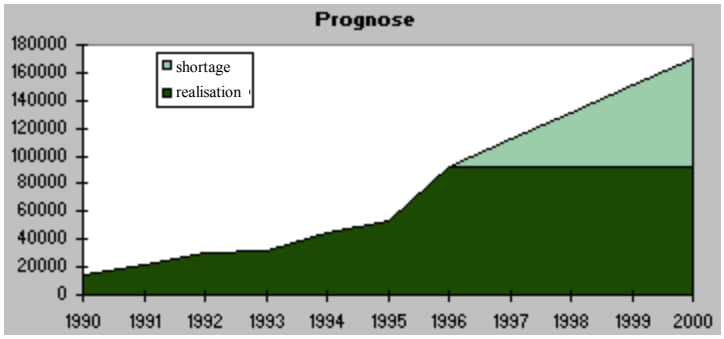

Figure E.3 *(source: www.greenlabelned.nl)*

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UNITED KINGDOM

Country briefing paper

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F.1 Summary

The UK was the first European country to pursue wholesale liberalisation, and the 'British Experience' remains an important and much studied model for the introduction of privatisation and competition in the electricity sector.

Liberalisation of the UK electricity sector was introduced through the 1989 Electricity Act. The market was liberalised in stages; first privatisation and restructuring of the industry, creating a regulator responsible for the overall liberalisation process and allowing customers with a demand over 1MW to choose supplier; then the introduction of customer choice in the over-100kW market. The UK is now going through the final process of opening the market to the sub-100kW market, beginning on 14 September 1998 with completion of this stage planned for May 1999; and finally the re-structuring of the wholesale market.

The electricity market has been the principal market for renewable energy in the UK. The main mechanism for the development of renewable electricity in the UK has been the Non Fossil Fuel Obligation (NFFO). Renewable energy projects have been supported by fixed price contracts, above the market price, between the regional electricity supplier and the renewable generators. The electricity suppliers recover the additional cost by a levy charged on all customers' electricity bills. The NFFO mechanism has been responsible for supporting some 85% of total renewable electricity generation in the UK, which now stands at some 7,340GWh, approximately 2% of UK electricity supply, representing some 540MW of capacity.

Many NFFO contracts are set to run for several more years, and the fifth order of NFFO will probably be announced by the end of 1998. The NFFO 1 and 2 contracts for renewable electricity, representing some 325MW capacity, are now entering the open market as these contracts expire in December 1998. In response to the challenge of entering the open market, the majority of NFFO1 and 2 projects have joined together to create the Renewable Generators' Consortium (RGC), to maximise their negotiating power in selling renewable generation on the open market. It seems likely that the vast majority of NFFO1 and 2 projects will receive contracts in January 1999 from a variety of suppliers, and that these contracts will contain a 'green' premium.

The involvement of the electricity industry in renewable electricity generation has changed over time, In line with the commercial interests of the major players, partially due to structural changes in the electricity industry itself, and partially due to the unknown and untested future opportunities for renewable energy.

Initially the industry saw renewables as a potential future market. Several regional electricity companies set up operations to invest in renewable energy schemes, supported by the NFFO process. These companies were mainly involved in the first two NFFO rounds. Both the electricity industry and related services (banking, legal and technical services) had little experience in this sector, and few of the larger scale investments were profitable. As a result of privatisation of the industry there has been much take-over and merger activity. As a result most regional electricity companies have been restructured and many have a very different ownership structure to when they were first privatised. Where renewables have been identified as 'non-core business', the renewable generation has been sold off to either renewable specialists or one of the larger generators.

After a period of divesting of renewable generation, some suppliers and generators are now taking a renewed interest in the renewable energy market. The driving forces for this are two-fold, one as a result of customer choice, and the other as a security against future government policy. The first is the potential interest of customers in renewable or 'green' electricity. In general suppliers still do not know the level of interest that domestic electricity customers will show in 'green' electricity. However, as a result of the end of NFFO 1&2 contracts and the new availability of renewable generation on the open market, interest in this market and the potential for 'green' sales has grown. For several major suppliers and generators it is worth building a position in this market and waiting to see whether it becomes valuable business.

The second driving force is the UK government's stated target for renewable energy, to have 10% of electricity generated by renewable energy by 2010. Suppliers are unsure how the government will implement policy to attain this target, but one possibility is that all suppliers will be required to purchase some fraction of all electricity from renewable sources. In order to strengthen their commercial position if such a government policy is implemented, some players in the industry are taking action now to secure contracts for renewable energy in the future.

Besides the large established suppliers involved in the renewable electricity market, a very small number of specialist renewable electricity suppliers are set to enter the domestic market when it opens. These suppliers will target what they believe is a significant commercial potential among environmentally-motivated consumers. There is as yet no proof of the size nor value of this market segment.

It is clear that the two most important driving forces in the development of renewable electricity have been the NFFO mechanism (i.e., government support) and the privatisation of the industry in 1989. Today the most important driving forces are still the NFFO mechanism, coupled with potential consumer interest in buying 'green' electricity and the government target of 10% electricity generation by renewables by 2010.

If consumer interest is high and government support strong, renewable electricity will develop quickly on two parallel paths; one in the private sector and one supported by government action. Conversely if consumer interest is low and prices are elastic, and if government chooses to leave development decisions to the market, then future production from renewable electricity could be minimal. The future of renewable electricity development will be much clearer by mid-1999.

F.2 Background to renewables in the electricity sector

F.2.1 Organisational structure of the electricity sector

The recent history of the UK electricity sector may be divided into two periods, pre- and post- the 1989 Electricity Act. The structure of the sector changed radically when the provisions of the Act came into force in April 1990, and indeed the structure has continued to change, as commercial forces have worked on the industry resulting in fundamental shifts in the operation and management of many electricity generation and supply companies.

There are three separate electricity systems in the UK: England and Wales, Scotland, and Northern Ireland. The comparative sizes of the markets are indicated by the respective peak demands in 1995/96: England and Wales 48,811 MW, Scotland 5,849 MW and Northern Ireland 1,515 MW. The English and Scottish systems are interconnected, and there is also a 2,000 MW direct current link between England and France.

Pre-1989 Electricity Act

The structure of the electricity industry in England and Wales up to the 1989 Electricity Act was a state-owned monopoly with generation split from supply, whose structure had been in place for some 40 years.

The industry was dominated by one large generation and transmission company, the Central Electricity Generating Board (CEGB), which sold electricity in bulk to 12 area distribution boards, each of which served a closed supply area or franchise. A co-ordinating body, the Electricity Council, dealt with overall policy matters. In Scotland and Northern Ireland there were vertically integrated boards which also exercised regional monopolies. The CEGB and area boards were charged by government with maintaining high reliability of supply, and were characterised by centrally planned investment, an engineering-led approach and a 'cost-plus' pricing mechanism. Critics of the system and the advocates of a market-led approach, pointed to over-manning, inefficient management and a lack of investment finance in the sector.

Throughout this period little independent power production was implemented. In 1983 the Energy Act made provisions for private producers, giving them the right to use the distribution system and obliged electricity boards to buy privately produced power. However, this was not successful in stimulating private power generation, due to the high use-of-system charges and because payments for privately produced power were set well below the price paid by the electricity boards to the CEGB.

From the 1989 Electricity Act to the present day

The 1989 Electricity Act caused two fundamental changes in the UK electricity sector; the privatisation of almost all the electricity companies and the introduction of competition. After 40 years in the public sector, the change in ownership inevitably caused a large and irreversible impact on the electricity sector; at the time of privatisation many critical commentators warned of the great reduction in workforce which would result, and of the dangers of reduced reliability of supply under a private system. The first of these predictions was accurate, and the second has still to be fully tested.

The restructuring was intended to create a competitive electricity market, financial independence from Government and wider share ownership. To create competition it was essential that the monopoly elements of the business, transmission and distribution, should be separated from those elements which would be competitive, generation and supply. At a time when many countries are looking to deregulate their utility industries and introduce greater competition, it is not surprising that these developments have attracted wide international attention.

The Act legislated for the restructuring and privatisation of the industry, most of which was sold by means of flotation on the stock market. The Act resulted in a change of ownership from the state to private investors, and more significantly the phased introduction of a competitive market.

Regulation
Since duplicate networks are impractical, a system of independent regulation was introduced for transmission and distribution. The Electricity Act created a regulatory system headed by a Director General of Electricity Supply, who is answerable to the President of the Board of Trade in England and Wales and in Scotland, to the Secretary of State for Scotland. The Director General is responsible for ensuring an efficient and competitive electricity market, and for protecting the interests of customers.

Generation
Under the restructuring of the industry in England and Wales, the CEGB was split into four parts as of April 1990. The power stations were divided between two large fossil-fired generators, National Power and PowerGen, and a nuclear generator, Nuclear Electric. National Power and PowerGen joined the private sector, while Nuclear Electric remained in public ownership until 1996.

At the time of privatisation, National Power became responsible for 30,000 MW of capacity, and PowerGen the remaining 18,000 MW of fossil fuel-fired plant. Some 8,400 MW of nuclear capacity previously owned by the CEGB was allocated to Nuclear Electric, and 2,100 MW of hydro-electric pumped storage capacity to the new transmission operator, NGC.

Supply
The 12 area boards were re-named as Regional Electricity Companies (RECs), and sold on the stock market. The RECs are listed below, with their relative size indicated by 1995/96 turnover.

Table F.1 *The Regional Electricity Companies (RECs) turnover in 1995/96 [£ million]*

REC	turnover [million £]	turnover [million €]
East Midlands Electricity	1229.8	1760
Eastern Electricity	2264.5	3240
London Electricity	1278.6	1830
Manweb	n/a	
Midlands Electricity	1438.0	2060
Northern Electric	969.3	1380
NORWEB	1445.8	2070
SEEBOARD	836.1	1200
SWALEC	560.7	800
SWEB	766.6	1100
Southern Electric	1,717.7	2460
Yorkshire Electricity Group	1,426.0	2040

Each REC supplies electricity to a franchise market in its region, although this franchise is planned to phase-out by mid-1999, leaving the market completely open. When the 1989 Act came into force, customers with a maximum demand of 1 MW or more could buy from any supplier. As of April 1994, this non-restricted market was opened to customers with a maximum demand of 100kW or more, and the sub-100kW market is due to be open (at least in some pilot areas of the country) by the end of 1998, allowing all customers the freedom to choose their supplier.

There is good evidence that larger consumers are willing to look beyond their traditional supplier; almost half the total electricity sales in England and Wales are accounted for by consumers buying from suppliers outside their geographic area. It is not yet clear whether this same flexibility will be shown by the domestic (sub-100kW) market when it opens.

Transmission

The ownership and operation of the transmission system was transferred to the newly-created National Grid Company (NGC), which was given a specific remit to facilitate competition. NGC was also given responsibility for administering financial settlement following the trading of electricity in the wholesale competitive market. The 12 Regional Electricity Companies (RECs) became the majority joint owners of NGC until December 1995 when NGC was floated on the stock market.

Nuclear power

The Government privatised parts of the two state-owned nuclear companies, Nuclear Electric and Scottish Nuclear, in July 1996. A holding company, British Energy, was created and registered in Scotland, with Nuclear Electric and Scottish Nuclear as wholly-owned subsidiaries. Both companies continue to operate as separate entities, with their own boards of directors. Scottish Nuclear operates its two advanced gas-cooled reactor (AGR) plants in Scotland and Nuclear Electric its five AGRs and one pressurised water reactor plant in England and Wales. Nuclear Electric's six Magnox plants were transferred to a state-owned company called Magnox Electric.

Electricity trading

Currently most electricity in England and Wales is traded through the Electricity Pool. Presented simply, this is a wholesale market where electricity generators bid a price for generation on a daily basis. The National Grid Company is then responsible for ensuring that all electricity demand is satisfied. The demand then determines how many generators will be needed. The strike price is the price that the marginal plant has bid. All generators are then paid this price, Pool Purchase Price (PPP). Contract for electricity sales are made outside the grid, but the National Grid Company is responsible for centrally dispatching the power to ensure the lights do not go out.

However, the CEGB successor companies are not the only players in the wholesale market in England and Wales. The Scottish electricity companies, Electricite de France and a growing number of new entrants are all now generating electricity for sale. In June and July 1996 6,000 MW of plant previously owned by PowerGen and National Power was leased to Eastern Electricity in agreement with the Director General of Electricity Supply.

All this has led to an increasingly competitive market for base load generation. Forty six generation licences have been issued in England and Wales since privatisation, and there are already 22 independent generators selling electricity into the Pool.

Northern Ireland

In Northern Ireland, the four power stations were purchased by a number of competing generators in 1992. Northern Ireland Electricity (NIE) became responsible for transmission, distribution and supply and was floated on the Stock Exchange in 1993.

Scotland

In Scotland, vertical integration has been maintained in the new structure with the creation of two companies, ScottishPower and Hydro-Electric. As in England and Wales, nuclear generation was assigned to a separate company, Scottish Nuclear.

The results of restructuring

The effects of the restructuring can partly be seen by industry statistics comparing 1989, the last year before restructuring, and 1995, next page.

Table F.1 *UK Public electricity supply system statistics, January to December*

	1989	1995
Electricity Supplied(net) [TWh]	271.714	292.211
Total fuel use for generation		
Coal [%]	64.5	48
Nuclear [%]	23.6	28.4
Gas [%]	0.7	16.7
Oil [%]	9.4	4.8
Hydro [%]	0.5	0.6
Other [%]	1.2	1.5
Net Capacity (major power producers) [MW]	70,327	65,900
Maximum Demand [MW]	53,414	55,611

Data from the Electricity Association

The changes that can be seen in the table are consistent with the application of commercial imperatives following privatisation. While maximum demand and the quantity of electricity supplied rose, net capacity fell, indicating in crude terms that the industry increased its return on assets. Also significant, and much discussed over the last eight years, is the marked increase in use of natural gas in power generation, at the expense of coal and, to a lesser extent, oil. This phenomenon, often termed the 'dash for gas', is an important characteristic of the post-1989 period, and has now resulted in government intervention to (temporarily) prevent the further development of gas-fired plant while encouraging the greater use of coal (see section X).

F.2.2 Renewables

Until the privatisation and liberalisation of the state-owned electricity industry in 1990/91, very little of the UK's electricity came from renewable energy. The exception was Scotland, where hydro-electricity schemes, built and owned by the state electricity corporations, were well-established. Private production of electricity, including renewable-generated electricity, was allowed, but was not encouraged until the 1983 Energy Act, and even then renewable and other independent generation could not flourish because of the cost of using the system, set by CEGB.

The Non-Fossil Fuel Obligation (NFFO) mechanism has been mainly responsible for establishing renewable electricity production in the UK, since its establishment in 1990. Some 85% of renewable electricity production is due to the NFFO mechanism. This is explored more fully in section 3.4 below.

F.3 Liberalisation: factors, policies

The privatisation and liberalisation of 1990/91 involved, among other things, the separation of generation, transmission, distribution and supply of electricity. The separation of these functions was not 100 per cent. For England and Wales, it may be summarised as follows:

Table F.2 *State of unbundling, United Kingdom, 1998*

Utility Function	State of unbundling	Remarks
Generation	Separate and competitive, except for NFFO.	Most distribution and supply companies own some generation.
Transmission	Separate, monopoly.	
Distribution	Separate, monopoly	Owned by some 'Public Electricity Suppliers', who also supply. One PES was recently purchased by a generating company.
Supply	Separate and competitive for 100kW+ customers. Competitive for all customers from 1998/99.	BUT, all of the 'Public Electricity Suppliers' (PES) also own distribution and some own generation. The PESs can supply to over 100kW customers outside their own existing franchise areas. Non-PES supply companies are expected to grow.

Access to the grid (transmission and distribution systems) is open to all who meet the required standards. Since the liberalisation of 1990/91, there has been a large amount of new entry in the generating market. Smaller-scale generation, connected to the distribution system, is a particular growth area. On the supply side, there are now approximately 30 companies operating in the above-100kW market.

F.3.1 Drivers to UK liberalisation

Under the conservative government of the time, the political drivers behind the 1989 Electricity Act were the doctrine of wider share ownership, greater efficiency of use of funds and assets in the private sector, harnessing the forces of competition to force down electricity prices for final consumers, the concept of freedom of choice, and the promotion of innovative service propositions from electricity suppliers.

Until the present Labour Government, elected in 1997, began reviewing the electricity markets, there were few restrictions on generating fuels and technologies in the privatised market place. The previous Conservative Government twice took steps to support the coal industry. The first occurred at privatisation, when the two major generating companies about to be privatised were required to buy specified amounts of British coal. The second occurred a few years later, when, at the expiry of those contracts, the companies were persuaded to sign further contracts for coal, expiring in 1998.

Since the generating market was liberalised, gas has been the fuel of choice for new power projects and this has been at the expense of coal. The declining use of coal in power generation has been a major concern of the present Government. In 1997 the Government began a Review of Fuel Sources for Power Generation. This was concluded in June 1998 and a consultation period for comments on the Government's conclusions

ended on 20 July 1998. The Government's proposals are mainly for very tight restrictions on the use of gas in power generation and for changes to the trading arrangements for wholesale electricity, which it believes will protect coal from the challenge of gas.

Apart from these interventions, the driving forces now at work in the industry are predominantly commercial, not political. There have been a large number of mergers and acquisitions since privatisation, and foreign ownership of electricity suppliers is common. Utility companies from the United States have notably been successful in buying UK electricity suppliers. Furthermore there has been great interest in developing integrated utility companies, offering gas, electricity, telecommunications and water to industrial, commercial and domestic customers.

The business logic behind such offerings is the need to maximise return on the company's operations, which in the case of non-generating utilities is predominantly the administrative systems and staff, marketing and customer services. By offering an integrated service the costs of administration, billing, banking etc. are greatly reduced, and companies are already offering 'dual fuel' tariffs where customers purchase gas and electricity from the same source.

The support for renewable energy through NFFO is another form of intervention by the Government. The fifth obligation (NFFO-5) is currently going through the bidding process, with an Order likely at the end of 1998. The Government is reviewing how it should support renewable energy beyond NFFO-5. An announcement about this review is expected in the autumn of 1998.

Access to the UK markets from other countries is not restricted although there are no non-UK registered companies with licences to supply in the UK. Exports from the UK to markets which are not as open and transparent is less straightforward.

F.3.2 Recent events and trends

There are perhaps 20 government reviews currently underway in the UK electricity industry. There is considerable change in the power sector industry at the moment. The current review on trading mechanisms will examine proposals. There could be four trading markets in the UK, instead of the current pool, where most generated electricity is currently sold. Statements from Government on what will be done to support the coal industry, and the moratorium on gas fired power stations are currently pending. These will both have effects on the renewable energy industry.

F.3.3 Review of energy sources for power stations

In December 1997, the then President of the Board of Trade, published the terms of reference for the Government's Review of Energy Sources for Power Stations, to look at medium and longer-term scenarios for the development of generating capacity and sources of fuel supply. The Government announced preliminary conclusions of its Review in June 1998, and proposed a policy to restrict new entry to the power generation sector, and to presume against allowing new gas-fired plant to be built. The industry regulator, the Director General of Electricity Supply, has challenged the government's view, on the basis that it threatens competition and consumer prices. There have been obvious objections from power sector companies.

F.3.4 Review of electricity trading arrangements

Government has proposed that the existing arrangements, i.e. the wholesale electricity pool, should be replaced with trading arrangements more like those in commodity markets and competitive energy markets elsewhere. These include:

Forwards and futures markets operating up to several years ahead, if required. These would be organised by independent market operators as required by market participants and would evolve in response to demand.

A short term bilateral market, operating from at least 24 hours to about 4 hours before a trading period, to give market participants the opportunity to 'fine tune' their contract positions by trading a range of standardised products.

A balancing market from about 4 hours before a trading period to enable the National Grid Company as System Operator to balance generation and demand, and resolve any constraints on the transmission system by accepting bids to buy and sell electricity.

A settlement process for calculating a price to recover the costs of dealing with imbalances and for charging generators and suppliers who were out of balance. They would provide stronger incentives than at present for generators and suppliers to meet their commitments.

The implications of this review, and the new trading arrangements which are implemented, are critical to the future development of independent renewables generation in the UK. This point is taken up further in section 3 below.

F.4 Driving forces in renewable electricity

F.4.1 Review of electricity trading arrangements

Currently in England and Wales there are a few large generators: National Power, PowerGen, Eastern Electricity, British Energy, Scottish Power and Scottish Hydro. The industry regulator (OFFER) feels that, due to the size of the first three of these generators, they can exert control over the market, and keep the price of power artificially high. OFFER therefore wishes to improve the current trading system so that the influence of individual generators on the price of power is reduced.

As such they are proposing a system that is based on the Nord Pool, where the market is much more liquid and is run more like a financial market. This means that the existing Electricity Pool, where all electricity is traded would no longer exist in its current form. Instead generators would have firm contracts for power with suppliers for firm volumes and firm prices. A balancing market would exist from 24 hours ahead up to real time, where the settlement of firm commitments would adjusted for any imbalances.

The implication for generation that can directly match their supplier's demands, i.e. have flexible outputs, is that such power stations will gain a better price for their output in the market. However, the value of output from generators that have a fixed or intermittent output will be considerably lower, as any supplier will have to deal in the balancing mar-

ket up to 24 hours before real time, to balance any shortfalls (under-generation) or spill (over-generation) from the generators they have contracted to.

Currently most renewable generation in the UK is sold under NFFO contracts in England, SRO contracts in Scotland and NINFFO contracts in Northern Ireland. This means they receive guaranteed fixed or index-linked prices for all their output. However, at the end of this year some of these contracts will finish and these generators will have to deal in the open market. Under the current system, they can expect to get at least 'pool purchase price' (or PPP) for their output. They may also expect some income from the embedded benefits related to the position and input voltage of their generation.

In the future, under current proposals, PPP would no longer exist, and as an intermittent generator renewable generators would probably have to deal in the balancing market. The income from the balancing market in real time, is likely to be lower on average than from the pool, due to its volatility. Renewable generators are also likely to loose some embedded benefits that are associated with dealing outside the pool, (embedded generation) as they have been able to do in the past. The implications of these changes are potentially severe for renewable generators acting in the open market.

Currently OFFER recognise that renewable generation will have to be considered. However, they have no proposals as yet of how renewable generation will be treated. This will be put forward to a working group for consideration, as stated in OFFER's document:

'The implications for existing NFFO contracts and for renewable generators outside of NFFO will need further consideration. As with CHP, some of these issues will be for the Development and Implementation Steering Group, some for government.'

F.4.2 Green trading

A potential growth area in the UK is 'green trading' of renewable electricity. Customers will be offered the chance to buy electricity at a premium price with the promise that it comes from renewable sources. At the moment it is hard to predict what interest will be shown by domestic consumers in such products when the domestic market opens in 1998/99, but some experience has been gained by suppliers who have tried to market 'green' electricity to corporate customers over the last couple of years. Some industry insiders suggest that, at least for corporate customers, the perceived value of such 'green' electricity (i.e. its potential public relations, marketing and 'image' benefits) is not sufficient to justify the greater price, and this market has not grown.

Companies that have already announced green tariffs include Eastern Electricity, SWEB, Renewable Energy Company Ltd and PowerGen. In addition another, WRE Ltd, intends to enter the market in 1999 when the domestic market opens. Preliminary market research shows that up to 15% of UK domestic customers would be willing to pay a premium of up to 10% for electricity generated from renewable sources.

The significance of green electricity trading is that it may offer a new type of market for renewable electricity production, and therefore secure an outlet for renewable electricity generation which does not depend on obligations and subsidies. The full extent of the voluntary green electricity market will not be known for at least one or two years.

F.4.3 Government support for renewables research

From the time of the 1970s oil price shocks, renewable energy research and development in the UK has been supported by government funds, initially to research technologies which were in their infancy, later to develop and prove the technical viability of some technologies, and more recently to enable the market to grow.

Early examples of renewable energy technology research and development which have since been dropped include wave energy, geothermal energy and active solar heating. A more enduring area of research and development has been wind power, which has proven to be a very significant part of the UK's overall installed renewable capacity, despite there no longer being any independent UK manufacturer of wind turbines.

F.4.4 NFFO mechanism

When the electricity industry was privatised and liberalised in 1990/91, the Government introduced, through the Electricity Act 1989, the 'Non-Fossil Fuel Obligation' (NFFO). This was originally intended to raise funds to meet the future costs of decommissioning nuclear power stations which had not been privatised, but a fraction of the total support through NFFO has been used to support electricity generated from renewable sources.

NFFO is a statutory obligation upon the Public Electricity Suppliers /PESs which requires them to buy, at a premium price, funded by a percentage levy on electricity consumers, specified amounts of renewable energy according to Orders set by Government. The renewable energy schemes from which the PESs buy renewable energy are those which compete successfully in a tendering process which leads to contracts for the most competitive producers in each of the technologies specified by the Government. Initial contracts (NFFO-1 and NFFO-2) were awarded for production only until the end of 1998 but later ones (NFFO-3, NFFO-4) were for 15 years. Details of the first four NFFO orders are attached as annex 1.

The NFFO-5 round has received bids from 408 projects with a total capacity of 2579 MW, located throughout England and Wales, plus one in Scotland. The majority of projects involve landfill gas or wind generation, and scheme size ranges between less than 1 MW to over 25 MW. The average bid price is significantly lower than under the previous NFFO Order (NFFO-4) in 1997, with a range from 2.63 p/kWh (3,76 €ct/kWh) to 4.43p/kWh (6.33 €ct/kWh). Contracts for supply will be offered for 15 years, although not all bids will be accepted for the award of contract, and experience suggests that not all those receiving a contract will go through to completion.

NFFO in England and Wales[1] has resulted in the building of some 550 MW of new renewable energy projects out of 2,317 MW which have been awarded contracts. Only about a quarter of the schemes awarded contracts have actually been built. The main reasons for projects not proceeding are a) the 1998 contract barrier for some of the early schemes, b) failure to secure local planning consent and c) technical and financial reasons. NFFO has succeeded in driving down the price of renewable energy and it has made the renewable energy industry more business-like and attractive to investors. In effect, it has established a serious renewable energy industry which, though small, has a reasonable prospect of growing.

Although most renewable energy schemes enter the electricity industry through the NFFO, if schemes are sufficiently competitive, they can enter the industry in the open market. This is rather challenging, as the electricity generating market is highly competitive and driven by fossil-fuelled and nuclear power plant. Nevertheless, some have announced their intention to build schemes which are designed to compete in the open market. Others propose to take advantage of the full liberalisation of electricity supply and offer electricity from renewable energy to customers who wish to specify it.

The future of NFFO is under review as the Government considers how it might meet a target of securing 10 per cent of UK electricity from renewable energy by 2010. The industry regulator has made the following statement: 'The Government is presently carrying out a review of what would be necessary and practicable to achieve 10 per cent of the United Kingdom's electricity needs from renewables by the year 2010. Such a target might be achieved by continuing NFFO support for some technologies, including onshore wind, off-shore wind and energy crops. However, the cost of meeting the target in these ways might amount to some £11 to £15 billion, requiring a Levy rate of between 6 and 8 per cent over about 15 years. It is for consideration whether the benefits of renewable energy justify incurring costs on such a scale.' Critics within the renewables industry have cast doubt on how the regulator has calculated these figures, as he has not necessarily taken into account future reductions in the cost of renewable generation due to economies of scale, and he has chosen a future wholesale electricity reference price which critics believe is too low.

The NFFO mechanism has been a major driving force for renewables in the UK over the past eight years, and will continue to be so with the announcement of the size of the NFFO-5 Order. It is still unclear whether the government will support the NFFO mechanism in the longer term as the main vehicle for developing renewable energy in the UK, although a major support mechanism will be necessary if the UK is to achieve its stated target of renewable energy contribution.

The document 'Fifth Renewables Order for England and Wales', recently published by the regulator, OFFER, is freely available as a back-up document to this briefing either from the OFFER web site (http://www.open.gov.uk/offer/offerhm.htm) or from ESD. It contains full details of all previous orders, details of bids received for the 5th round, and an analysis of the cost of reaching the UK's 10% target by 2010.

F.4.5 National policy goals

The major policy goal for renewable energy is that it should contribute 10% of UK electricity supply by the year 2010. This is in line with government's target of 20% reduction in CO_2 by 2010, on a 1990 baseline. Government recently reaffirmed its target of 20% reduction of CO_2 in line with its commitments prior to Kyoto.

There is strong verbal support at all levels of government for renewables and electricity generated from renewable sources of energy, although this support has yet to be turned into specific policies.

F.5 Utilities' renewable energy policy goals

Few of the 12 Public Electricity Suppliers (PES) are explicitly targeting renewable energy within their policy statements or within their commercial offerings to customers. The exceptions are Eastern Group, Manweb and SWEB. Among the big generators, PowerGen is set to enter the market and the two Scottish companies, Scottish Hydro and Hydro Electric (which has recently announced its merger with Southern Electric) are also likely to be players.

Eastern Group is offering a 'green tariff' through which customers may invest in a trust for future investment in renewable electricity. Furthermore they have a commitment to see renewable energy sources account for 10 per cent of its generating capacity by 2010. They have recently announced an investment in 1MW of new wind power generation in Northern Ireland. Their strategy on renewable development is for wind energy to account for the major fraction of their immediate renewables portfolio, with solar power and biomass being added in the longer term.

Manweb is now owned by Scottish Power, and as such shares Scottish Power's policy goals and renewable energy activities. Scottish Power refers to the challenge of energy sustainability, and although renewables do not feature explicitly in its environmental policy, it refers to itself as a major player in the renewable energy field, principally through its large-scale hydro generation.

SWEB is proactive in the development of renewable electricity sales to consumers through its subsidiary company 'Green Electron'. The company will market 'Green Electricity', generated from renewable sources such as wind, hydro and landfill gas. They have shares in wind farms through the subsidiary South Western Power.

Other RECs refer to a similar set of goals in their stated environmental policies; typically preservation of the local environment (through management of their vehicle fleets, waste recycling, reduction of oil loss from transmission cables and substations), energy efficiency and community involvement.

F.6 Background to the Association of Electricity Producers AEP

The Association has always favoured the arrangements for the support of renewable energy, although it has often been critical of the detail of their implementation. The electricity utilities in the UK have mixed feelings about support for renewables. For example, the PESs are required by the regulator to buy their electricity economically and they have ensured that under NFFO their excess costs are met through income from a levy. Some of them, however, have invested in renewable energy generating projects. Several of the largest generating companies also have subsidiary businesses involved in renewable energy.

F.7 Key issues

The uncertainty about the UK's future mechanism for support of renewable energy is a key issue. The Association has argued that the NFFO is not ideal for all technologies. For

the most competitive, it is perhaps more than is required. For the least developed and more expensive technologies, it is unsuitable. The solution may be different forms of support. Whatever mechanisms are used, they have to fit into a framework where there is the contradiction of a fully competitive supply market and more Government intervention than in recent years. The intervention comes through the Review of Energy Sources for Power Generation and the Review of Electricity Trading Arrangements.

Annex 1. Details of NFFO orders 1-4 (information from OFFER)

Table F.A.1 *Status of NFFOS 1-4 at June 1998*

	Projects contracted		Projects generating		Projects terminated		Projects yet to commission		Completion rates	
	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW
NFFO1	75	152.12	61	141.48	14	7.58	0	0	81%	93%
NFFO2	122	472.23	82	172.60	40	298.49	0	0	67%	37%
NFFO3	141	626.91	56	162.55	2	1.90	83	460.99	40%	26%
NFFO4	195	842.72	8	13.76	0	0	187	828.96	4%	2%
TOTAL NFFO	533	2093.98	207	490.39	56	307.97	270	1289.95	39%	23%

Table F.A.2 *Contracts for the first four orders*

Technology Band	NFFO1 BID price range [p/kWh]	NFFO2 BID price range and average [p/kWh]	NFFO3 BID price range and average [p/kWh]	NFFO4 BID price range and average [p/kWh]
Wind	5.75 - 10.00	- 11.00 9.97	3.98 - 5.99 4.43	- 4.95 3.56
Hydro	3.85 - 7.50	- 6.00 5.06	4.25 - 4.85 4.46	- 4.40 4.25
Landfill gas	3.60 - 6.40	- 5.70 4.75	- 4.00 3.76	2.80 - 3.20 3.01
Waste combustion	5.06 - 6.00	- 6.55 6.20	- 4.00 3.89	- 2.80 2.75
Other combustion	4.43 - 6.00	4.00 - 5.90 5.42	-	-
Sewage gas	4.40 - 6.00	- 5.90 5.16	-	-
Energy crops	-	-	- 8.75 5.62	- 5.79 5.51
MUN and IND waste with CHP	-	-	-	-3.40 3.23
Total	- 10.00 6.50	- 11.00 6.61/7.20	- 8.75 4.35	- 5.79 3.46

Notes

In NFFO1, NFFO3 & NFFO4 projects were paid their bid price. In NFFO2, in each band all projects were paid the marginal price (the 'band price').

In NFFO1 6.50 p/kWh was the average price paid. In NFFO3 4.35 p/kWh was the average price paid. In NFFO4 3.46p/kWh was the average price paid.

Prices referred to are actual prices in money of the day

In NFFO2 6.61 p/kWh was the average bid price, 7.20 p/kWh was the average price paid.

In NFFO1 & NFFO2 prices are for output up to 1998; in NFFO3 and NFFO4 prices are for output for up to 15 years from commissioning.