Liberalization and Environmental Policy in the European Electricity Market

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This paper deals with the environmental aspects of the electricity industry in the European Union against the background of the recent proposals for the liberalization of the European electricity market. These proposals, as well as the main features of the power industry in the EU member states, are discussed. Existing and planned environmental policies for the electricity sector are considered. It is concluded that liberalization as such is not a threat to the environment, and may even create better competitive opportunities for environmentally friendly ways of generating electricity. However, liberalization will have to be accompanied by regulations, incentives and the provision of information in order to stimulate energy saving, 'cleaner' power generation and renewables.

Cet article étudie l'industrie de l'électricité dans l'Union Européenne sous les aspects environnementaux dans le contexte des récentes propositions de libéralisation du marché de l'énergie électrique européen. Il discute de ces propositions ainsi que des principales caractéristiques de l'industrie de production d'énergie électrique dans les États membres. Les politiques existantes en matière d'environnement ainsi que celles à l'état de projet dans ce secteur y sont examinées. L'étude parvient à la conclusion que la libéralisation de l'économie en tant que telle n'est pas une menace pour l'environnement et qu'elle pourrait même créer un marché concurrentiel plus favorable aux méthodes de génération d'électricité qui respectent l'environnement. Il convient cependant que cette libéralisation soit accompagnée de règlements, d'encouragements et de mesures informatives destinés à stimuler les économies d'électricité et une production d'énergie "plus propre" et renouvelable.

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1. Introduction

There was a strong impetus towards integration of the European Union (EU)[1] in the late 1980s. The ideal of a completely free flow of goods and services, as well as factors of production, within the EU is still not realized, but significant steps forward have been made. The liberalization processes have been accompanied by standardization and harmonization in various areas, including energy and environmental regulations.

Recently, the liberalization initiatives of the European Commission (EC, the "board" of the EU) have been extended to areas where state involvement in economic processes has traditionally been considerable and national markets are sometimes heavily protected, notably traffic, telecommunications and energy. Until now, the progress made with these proposals has been mixed, depending on the

1/ At the time of writing this article, the EU consisted of 12 member states: Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom. As of January 1, 1995, Austria, Finland and Sweden have joined the Union. This article only refers to the 12 "old" member states

strength of the interests involved (vested interests seeing their established power threatened versus new suppliers looking for market opportunities).

This paper deals with one of the liberalization proposals: the draft Directive[2] on common rules for the internal market for electricity. It will look especially at the environmental consequences which the implementation of this Directive could have and at the opportunities for member states and electricity companies to ensure an environment-friendly electricity supply in a liberalized context.

In section 2, the main elements of the draft Directive are presented and the background to the liberalization of the electricity market is considered, including the specific circumstances in some of the member states. Some other elements of EU energy policy are discussed as well.

Section 3 contains a brief review of the energy-related environmental policy in the EU and its member states. The degree to which harmonization of this policy has already taken place, or is likely to occur in the near future, will receive special attention.

The environmental consequences of a free market for electricity are considered in Section 4. As we shall see, these consequences are not straightforward, but depend to a large extent on the conditions under which the liberalization takes place.

Section 5 concludes the article with some suggestions for policy makers who want to secure a "clean" power supply in an institutional and regulatory environment involved in a process of rapid change with an unknown outcome.

2. The Electricity Sector in the EU and the Liberalization Proposals

The structure of the electricity supply industry in the EU shows large variations among member states. It ranges from a largely centralized system in France, with a state-owned, almost monopolistic supplier (EdF), to a recently privatized, reasonably competitive system without any central planning in the UK. Between these extremes, various combinations of types of ownership, planning and organization can be found in the different member states (see McGowan (1993) for an overview).

A similarly large variety is present in the fuels used for power generation, as Table 1 illustrates. These differences partly reflect variations in natural endowments, and partly national policy objectives (such as preference for domestic fuels or diversification). Figure 1 provides some general information on specific features of the electricity industry and policy in each member state.

Until recently, the interference of the EU in the electricity industry has been limited. In the wake of the oil crises in the 1970s, some attempts were made to limit the EU's dependence on imported fuels and to diversify the fuel mix in electricity generation. Furthermore, several programs stimulated the development and application of energy saving technologies and renewables.

In the late 1980s, the drive towards a single internal market gained pace. It became clear that the power suppliers (until then protected by national or regional monopolies) might also become subject to the rules of competition and free trade. The challenge for the electricity industry comes from two sides.

The first consists of a "juridical" route. The EC has started legal action, based on competition rules in the Treaty of the EU, against five member states that maintain monopolies on electricity imports and exports. Furthermore, several cases have been put before the European Court of Justice, relating to the lack of competition in the electricity sector. In one of these cases, the Court has recently ruled that the "normal" EU competition rules apply to the electricity sector in principle, although they may be tempered when distribution companies are entrusted with public service duties (such as the obligation to provide electricity to all consumers in a region at uniform tariffs) (Hancher, 1994).

2/ A Directive is a piece of EU legislation which has to be implemented by the member states in their national legislation.

Figure 1: Electricity Industries in EU Member State

Belgium: Electricity supply is dominated by one private firm, Electrabel. The other large producer, state-owned SPE, is increasing its market share. Power supply is largely nuclear, but there is now a moratorium on new capacity. The share of coal is gradually declining, and imported coal is now being used; expensive domestic coal production has ceased. New power plants under construction are all gas-fired. Cogeneration is becoming more popular, giving rise to joint ventures between industry and public utilities.

Denmark: Denmark has 12 regional production companies, owned by the distributors. The two transmission companies, Elkraft and Elsam, are influential in investment planning. Electricity production is largely coal-based, but natural gas and renewables are expected to grow. The government is stimulating CHP (including a further increase in the already extensive district heating networks).

France: Electricité de France is the (almost) monopolistic power producer, transporter and distributor. It is state-owned and its planning decisions are under government control. A large nuclear program has been implemented in the past 20 years. Surplus baseload power is now being exported to many countries. New capacity being planned is also largely nuclear, although gas will gain in importance. Despite its position as a net exporter, France is opposed to liberalization of the European electricity market. Nonetheless, EdF is very active abroad, including in Eastern European countries.

Germany: The electricity sector includes a very large number of firms, both state-owned and private. Among these, there are some very large power producers, such as RWE, PreussenElektra and Bayernwerk. German power production is to a large extent based on subsidized domestic coal. Lignite is still the dominant fuel in the former GDR, but many lignite-fired plants are being closed down for environmental and efficiency reasons. Nuclear energy is quite controversial and decisions on the construction of new nuclear plants have been postponed. As German electricity prices are the highest in the EU, the large power consumers are much in favour of TPA, whereas the German producers are opposed. The latter, however, are actively involved in trans-frontier activities.

Greece: The state-owned Public Power Corporation is completely vertically integrated (its activities range from mining to electricity distribution) and controls most of the Greek electricity system. The share of coal and (domestic) lignite in power generation, as well as gas (to be imported from Russia and Algeria), is increasing, that of oil decreasing. Greece aims at closer links with the other EU countries. Presently it has no connection with the UCPTE power grid, but a planned underwater cable will link the Greek system with Italy.

Ireland: The state-owned Electricity Supply Board is responsible for production, transmission and distribution. It is presently undergoing a restructuring and will lose its generation monopoly. Power generation used to be quite inefficient (peat being an important fuel), but nowadays the fuel mix is more diversified and efficiency has grown. The feasibility of a connection between the Irish electricity grid and the British one is under consideration.

Italy: The major player on the Italian energy scene is ENEL, which is still state-owned but in a process of privatization. ENEL has a monopoly over export, import and distribution, and coordinates generation and distribution. Italy is a large net importer of electricity. Nuclear power has been abandoned, and half of the electricity generation is now based on oil. The share of gas is expected to increase strongly. Since 1990, there has been some room for independent producers to offer their (surplus) power to the public grid.

Luxembourg: Luxembourg has hardly any production capacity and is therefore mainly depending on imports of electricity. There are some small-scale hydroelectric and cogeneration plants.

Netherlands: There are four regional production companies, taking care of large scale production. Together they own SEP, which is responisble for transmission and investment planning, and has a *de facto* import monopoly. Domestically produced gas is likely to remain the major fuel, as gas-based CHP projects (often

initiated jointly by industry and distribution companies) are booming. The nuclear option is presently politically unfeasible. "Clean" coal technologies may also play a role in the future. A 250 MW pilot coal gasification plant has been started recently.

Portugal: The formerly state-owned company EdP (now partly privatized) owns most of the production capacity and has a monopoly over import and transmission. The government is encouraging independent producers to participate in the system. Foreign electricity companies are participating in the construction of new power plants. Portuguese electricity demand is the fastest growing in the EU. The share of oil in power generation is expected to fall; that of gas to increase. Imports (mainly from France and Spain) will also grow. Together with the UK, the Portuguese government is a firm supporter of TPA.

Spain: The electricity industry is to a large extent privately owned. There are a few large production companies, of which Iberdrola and ENDESA are the most important ones. Many distribution companies are linked to these producers, but legislation is being drafted to separate generation and distribution. REDESA controls transmission and imports. New coal-fired capacity is presently under construction, including an IGCC (coal gasification) plant. The share of gas is expected to grow, at the expense of nuclear power.

United Kingdom: Since 1990, the UK electricity industry has been liberalised and (largely) privatised. Two private companies, National Power and PowerGen, now dominate conventional large scale production, but nuclear capacity is still state-owned. Transmission (including the operation of a 'wholesale market' for electricity) takes place through the National Grid Company, and distribution is by 12 Regional Electricity Companies. Electricity production is still tightly bound by contracts to domestic coal production, but investments in new generation capacity (including those by independent producers) are almost exclusively gas-based (the 'dash for gas'). Power production based on non-fossil fuels (including nuclear power) is being subsidized by a 'fossil fuel levy' on all electricity sold. The UK is a strong supporter of the electricity market reforms proposed by the European Commission.

(Main sources: IEA (1993), and McGowan (1993).)

The second and possibly more powerful threat to the sheltered markets of the electricity industry is the regulatory route. The EC has drafted several regulations, of which the most important is the proposed Directive for Common Rules for the Internal Market in Electricity (CEC, 1991/1993). Initially, this proposal implied full competition at the production level and access to the transmission and distribution networks for all producers and large consumers on reasonable conditions ("Third Party Access", TPA). These proposals have met with a lot of criticism, both from most of the member countries and from public utilities. The arguments used against competition and (especially) TPA mainly related to the fear that long-term investments would be discouraged and security of supply would become endangered. The European Parliament asked the Commission to harmonize rules in the areas of taxation and environment (thus creating a "level playing field") before embarking on liberalization.

The EC presented its revised proposal on December 7, 1993. In this new draft, member states have the opportunity of maintaining a kind of central planning of production capacity, by opting for a system in which the necessary production capacity is determined centrally, and is open for tendering on the basis of objective and non-discriminating criteria. These criteria may include, among others, environmental demands and the type of fuels to be used. Furthermore, a system of "full" TPA will not be introduced. Instead, the draft Directive proposes negotiations between the prospective user and the manager of the transmission or distribution network. Of course, the network manager may not abuse his power in these negotiations. But it is clear that this "negotiated" TPA offers more opportunities to refuse access (in particular, if it would make it impossible for the network operator to fulfil his "public service" obligations regarding the security, regularity,

Table 1: Fuels used for power generation in EU countries, 1991
(% of total electricity production per country)

	coal	oil	gas	nuclear	hydro and renewables
Belgium	27	3	9	60	0
Denmark	91	4	2	0	0
France	10	3	1	74	13
Germany	59	3	7	28	3
Greece	66	25	0	0	9
Ireland	39	16	25	0	5
Italy	15	48	18	0	16
Luxembourg	75	4	4	0	12
Netherlands	34	5	55	4	0
Portugal	33	34	0	0	30
Spain	39	7	1	36	18
UK	65	9	1	22	1

Source: IEA, 1993

quality, and price of power supplies).

The EC proposals were discussed by the EU energy ministers last May, but an agreement has not yet been reached.

3. Environmental policy regarding the electricity sector in the EU

Since 1986, the Treaty of the EU has provided for a common environmental policy. Nevertheless, large differences between the member states continue to exist. Several factors account for this:

- common rules exist only for a limited number of environmental issues;
- member states often are allowed to apply more stringent requirements than the EU standards ("minimum harmonisation");
- the EU regulations often allow for exemptions and transitional periods;
- member states do not always implement EU regulations promptly or enforce them adequately.

Regarding the electricity industry, the major environmental concern is air pollution, especially due to the use of fossil fuels. In the 1980s, the focus was mainly on the acidifying substances SO_2 and NO_X. In 1988, the EU adopted the Large Combustion Plant Directive (LCPD), which defined emission limits for these two substances for new plants, as well as overall emission reduction targets. The LCPD is due to be revised shortly, taking into account the outcomes of the new SO_2 protocol, as agreed upon in Geneva. A new LCPD will probably also contain standards for existing plant, and will tighten the limits for new plant according to Best Available Technology (BAT). Presently, large differences exist between member states regarding the treatment of existing plants. The northernmost EU countries (especially Germany) have already implemented a costly emission reduction program, whereas other countries have hardly invested anything in pollution abatement at existing power plants (see Figure 2).

In recent years, the attention of environmental policy makers has shifted to the "greenhouse gases," in particular CO_2. The EC aims at stabilizing CO_2 emissions by the year 2000 at the 1990 levels. This objective is quite a challenge, as "autonomous" growth in this period is projected at 11% (Leydon, 1994). Here again, there are large differences in the objectives and strategies of the various member states (see Figure 2).

The policy of the EU regarding CO_2 reduction primarily aims at stimulating energy conservation and improving energy efficiency

Figure 2: Environmental Policy in the EU Electricity Sector

Belgium: In 1991, the electricity producers Electrabel and SPE entered into an agreement with the authorities on the reduction of acidifying emissions. In the period 1980-2003, SO_2 emissions will have to be reduced by 80-85% and NO_x emissions by 40-45%. These targets can quite easily be achieved because of the growth of nuclear capacity in the 1980s and the increasing role of gas in the 1990s. Specific environment-oriented measures only play a modest role in the fulfilment of the emission reductions.

For CO_2, a 5% emission reduction target over the period 1990-2000 has been established in 1991. Whereas this objective is not very likely to be reached for the economy as a whole, the electricity sector will probably be able to comply with it, again due to the increasing role of gas at the expense of coal in power generation.

Denmark: The latest targets for the reduction of acidifying emissions from power stations are 77% for SO_2 and 50% for NO_x over the period 1980-2000. These figures seem to be attainable by upgrading some FGDs, limits on sulphur in coal, and by substitution of gas for coal.

The 'Energy 2000' plan calls for an ambitious 20% CO_2 emission reduction from fossil fuel use over the period 1988-2005. Energy consumption (including electricity) is heavily taxed in Denmark, and the taxes are partly based on carbon content. CHP, natural gas, biomass and wind energy are being encouraged. Electricity suppliers are active on the demand side to promote energy conservation by way of providing information, financing and subsidies.

France: Due to the large share of nuclear power, emissions from power plants in France are already relatively low. Nevertheless, in January 1993, EdF signed a protocol with the Minister of Energy containing measures to reduce SO_2 and NO_x emissions at some fossil fuel fired plants.

For CO_2, the French policy objective is stabilisation at the 1990 level. In the electricity sector, this is to be attained by investments in new nuclear plant, hydro and renewables, as well as by means of demand side management.

Germany: During the 1980s Germany invested heavily in SO_2 and NO_x abatement at power plants. Over the years 1984-1992, some 20 billion DMarks were spent on air pollution in the electricity sector. By mid-1996, all power stations in the former GDR will also be retrofitted with FGD and NO_x reducing devices. In this way, Germany will be able to comply with its international emission reduction obligations.

A 25% reduction of CO_2 emissions is being aimed at over the period 1987-2005. Part of this can be realized relatively easily by improving the very poor energy efficiency in the eastern part of the country. A national CO_2 tax will be introduced, independent of EU decisions on the matter. Furthermore, a comprehensive program, covering a wide range of CO_2 reduction options has been started. The electricity producers want to contribute by using highly efficient generation techniques, expanding nuclear capacity, and importing hydropower from Norway.

Greece: Under the LCPD, Greece is allowed some increase in SO_2 and NO_x emissions over the 1980 levels, because of its relatively backward economic position in the EU. New power plants, however, have to comply with the emission limits of the Directive.

Regarding CO_2, no official national policy objectives exist, but a general increase in emissions by 25% over the period 1990-2000 is foreseen. The PPC expects an increase from electricity production by 27% over the same period, while production itself will grow by 44%. This relatively limited CO_2 increase is due to the anticipated growth in the share of gas, hydropower and renewables in electricity generation.

Ireland: To reduce SO_2 emissions from electricity generation, ESB resorts to the use of low-sulphur fuels. NO_x reduction is achived through the installation of low-NO_x-burners on all new, and some existing coal and gas fired plant.

The Irish CO_2 abatement strategy, published in 1992, aims at limiting the growth of CO_2 emissions between 1990 and 2000 to 20%. ESB has limited opportunities for CO_2 reduction, as it has no access to nuclear power or electricity import, hydro potential has already been fully utilized, the share of gas is already high, and it is required to continue the use of a certain amount of peat. Nevertheless, it is running supply side

(including a 6.45 MW wind farm) and demand side energy efficiency programs.

Italy: The Italian utilities are implementing a program to abate acidifying emissions from power plants, including more expensive measures such as FGD and SCR at some existing plant. The emissions of SO_2 are expected to decrease by 67% between 1990 and 2000, those of NO_x by 30%.

Italy has agreed in principle to stabilize its CO_2 emissions in 2000 at the 1990 levels. ENEL aims at limiting the growth of its CO_2 emissions between 1990 and 2000 to 19%, while expecting a 40% growth in electricity production over the same period. Apart from reshuffling fossil fuel input (more gas), demand side measures are taken and the use of hydro and geothermal power will be intensified.

Luxembourg: Given its small electricity production sector, Luxembourg has few opportunities for realizing emission reductions at the supply side directly. The CO_2 targets (stabilization in 2000 at the 1990 level and reduction in 2005 by 20%) are to be reached by means of stimulating energy efficiency, renewables, and CHP.

Netherlands: An agreement between SEP and the government, signed in 1990, should lead to SO_2 and NO_x emissions in 2000 being 90% and 60% lower respectively than in 1980. The agreement includes investments in FGD at a Polish lignite-fired power plant.

The Dutch government aims at reducing CO_2 emissions in 2000 by 3-5% compared with the 1989/90 levels. The electricity sector expects that it can stabilize CO_2 emissions in 2010 at the 1990 level, despite a 40% growth in electricity demand. Apart from measures like efficiency improvement, energy saving and CHP, SEP also has started to compensate for CO_2 emissions by reforestation programs abroad.

Dutch distribution companies run their own environmental program, financed in part by a charge on electricity bills.

Portugal: New plants have to comply with the LCPD (requiring, a.o., FGD on all new coal-fired plants). For existing plants, no measures to combat acidification are foreseen, except the retrofitting of low-NO_x burners in coal-fired plants and (after 1998) the use of low-sulphur fuels.

A growth of CO_2 emissions over the period 1990-2000 by 30-40% is foreseen, due to rapid economic expansion. Although the Portuguese electricity industry will take several measures for improving energy efficiency and the use of renewables, the government considers the growth in greenhouse gas emissions justified with a view to the relative backward position of the Portuguese economy in comparison with other EU countries.

Spain: The National Energy Plan (PEN-91) aims at reducing SO_2 emissions from large combustion plants by 42% over the period 1980-2000, and at reducing NO_x emissions to 263 kilotons. These targets go beyond the LCPD requirements. Apart from measures like low-NO_x burners and low-sulphur fuels, Spain invests in cleaner coal technologies, such as fluidized bed combustion and coal gasification.

A 25% growth in CO_2 emissions over the period 1990-2000 is envisaged for the Spanish economy. PEN-91 contains a Plan for Energy Savings and Efficiency, including a larger role for gas, renewables and cogeneration in electricity production.

United Kingdom: With the privatization of the electricity industry, both major producers of 'conventional' power (National Power and PowerGen) were obliged to retrofit 4000 MW of coal plant with FGD equipment. This is presently being implemented, although part of the program may be cancelled because the rapid substitution of gas for coal is already reducing SO_2 emissions drastically. Furthermore, some of the larger coal plants are being equipped with low-NO_x burners.

The UK's objective for CO_2 is to bring emissions in the year 2000 back to the 1990 levels. The introduction of VAT on residential fuel and power is expected to contribute to energy saving. Furthermore, the government aims at 1500 MW electricity generating capacity based on renewables in the year 2000. Presently only 5% of the proceeds from the fossil fuel levy is spent on renewables (the other 95% go to nuclear power), but this percentage should increase.

(Main sources: IEA (1993); UNIPEDE (1994).)

through a number of programs and funds, such as JOULE, SAVE, and THERMIE. The ALTENER program is meant to promote the use of non-CO_2 emitting fuels, in particular bio-fuels. Within 10 years, the share of renewables in electricity production should triple to 8%.

These measures are not sufficient to achieve the stabilization objective. The EC has therefore taken the initiative to introduce a combined carbon/energy tax. This tax should be introduced in steps, reaching a final level of 0.7 ECU/GJ and 9.4 ECU per ton of CO_2 in the year 2000.[3] Electricity from small hydropower plants and renewables would not be taxed. However, power produced by large hydro and nuclear plants, although not leading to CO_2 emissions, would be subject to the tax. The EC obviously does not want to favour these generation options too much, as they have their own environmental and safety risks. Exempting nuclear power from the tax would also have been politically unfeasible, as it would have benefited the countries with the most nuclear power (France and Belgium) too much.

In order to protect the competitiveness of energy-intensive European industry, the introduction of the CO_2/energy tax has been made dependent on similar measures in other OECD countries (primarily the US and Japan). Therefore, even in the improbable case of agreement on the tax among EU member states, its actual adoption in the near future is still very unlikely. Individual member states then may decide to introduce their own tax (some of them have already done so), but competition considerations will lead them to confine such a tax to households and other small users.

4. Impact of Liberalization on the Environment

Environmentalists are generally concerned about the environmental consequences of trade liberalization. They fear that the economic growth which it creates will lead to increased pollution. Moreover, they expect governments to become more reluctant to impose stringent environmental requirements on industries which are confronted with international competition. Protagonists of free trade, on the other hand, maintain that economic growth is a prerequisite for society to be able to afford environmental measures, and that competition leads to efficient allocation, including efficient allocation of scarce natural resources (provided the prices of these resources take internal as well as external costs into account). Both lines of argument have surrounded the recently concluded GATT negotiations.

In the particular case of trade liberalization in electricity, the same basic views are being expressed, as well as some specific arguments which relate to the special character of the good concerned.

As a first result of introducing competition on the European electricity market, one might expect lower prices and smaller price differences between the member states (see Table 2 for price levels in 1990). This outcome seems contrary to the EC policy of reducing energy consumption and CO_2 emissions by means of higher energy prices (to be brought about by the CO_2/energy tax). However, two qualifications apply here.

First, it is not clear whether substantial price decreases may be expected after liberalization. These are only likely if major efficiency improvements could be realized, or if electricity 'dumping' could take place (i.e., offering low prices to large consumers at the expense of 'captive clients'). Neither of these outcomes is likely. There are no indications that the European electricity industry is operating in a very inefficient way at the moment. Technical innovations generally get implemented rapidly (although it takes a very long time for their full potential to become utilized, given the long life-span of power plants). Only the use of expensive domestic coal in Germany and the UK causes unnecessary high costs, but these are largely compensated for by means of subsidies which

3/ One European Currency Unit (ECU) is currently worth about 1.21 US$.

Table 2: Electricity prices for end users in the EU, 1990 (ECU/100 kWh; unweighted average over several types of users)

Country	City	Industrial[1]	Households[2]
Belgium	Brussels	9.09	14.21
Denmark	Copenhagen	5.85	12.77
France	Paris	7.69	12.17
Germany	Düsseldorf	10.22	15.82
Greece	Athens	7.47	7.95
Ireland	Dublin	8.93	9.69
Italy	Milano	10.77	12.28
Luxembourg	Luxembourg	9.20	12.48
Netherlands	Rotterdam	7.98	10.98
Portugal	Lisbon	8.42	9.88
Spain	Madrid	9.53	11.64
UK	London	7.56	10.28

1/ excluding VAT (and, in the case of Denmark, other taxes)
2/ including VAT
Source: Calculations based on EUROSTAT

will disappear under a liberalized regime.[4] And dumping of electricity will undoubtedly not be tolerated once the free market takes shape.

Second, although high energy prices may help in reducing energy consumption, it is questionable whether this would be desirable if the high prices were the result of inefficiencies at the production side. Rather than being an argument to maintain protected national electricity markets, the need for higher energy prices would call for linking the liberalization and the introduction of the CO_2/energy tax.

Differences in electricity prices between countries will remain in a competitive European market. One reason for this may be the existence of differences in environmental demands. All large new plants in the EU member states have to comply with the LCPD, but as we have seen, some countries go beyond the LCPD requirements and have also applied emission abatement at existing plants, the cost of which will be felt for many years to come. Furthermore, some countries will introduce energy and/or carbon taxes (or have already done so), whereas others are obstructing the plans to do so at the EU level. In short, a fully harmonized environmental policy with regard to the electricity sector in the EU is not to be expected in the near future.

Could the resulting price differences lead to a massive relocating of power producers to those countries with the least stringent demands, once the barriers for electricity trade have been removed? This does not seem very likely. First, large differences in environmental standards exist between EU member states regarding several other industries. This has not led to large migration streams of polluting industries to the countries with the most lenient standards. Apparently other location factors are much stronger. Moreover, it seems unlikely that the large-scale settlement of power plants producing only for export would be acceptable for the local population. A counter-movement would emerge, leading to a decrease of the differences in environmental demands. Finally, one has to take into account that transport costs may compensate part of the environmental cost differences.

Another effect of a free electricity market could be a shift in the fuel mix used for electricity generation. It is sometimes argued that competition will lead to a shift from capital-intensive, long-term investments to the use of technologies with short payback periods. This may turn out to be environmentally benign (as in the case of substituting gas for coal),[5] but the opposite may as well be true. Risky investments in low-emission technologies, such as nuclear power and coal

4/ It is often suggested that the French nuclear program is also only viable thanks to government support (see, for instance, *The Economist*, 2 February 1991), but this is denied by EdF.

5/ The desirability of the recent 'dash for gas' (which is, as we have seen, also occurring in most of the non-liberalizing EU countries) is sometimes questioned, because of possible future scarcity. On the other hand, it can be argued that this scarcity is not very likely to occur soon, given the huge reserves in Russia. Moreover, an eventual growing scarcity of natural gas will be reflected in higher prices, which in turn diminishes the competitive advantage of gas for power generation in the longer run.

gasification, are less likely to occur in a liberalized market (unless there is some form of government support). Renewables could also find themselves at a competitive disadvantage. Under the latest version of the EC proposal, the electricity network manager may give priority to renewables, waste and CHP, but is not obliged to do so. In the absence of a CO_2/energy tax, electricity from renewables will probably not flourish without additional support or regulations (such as the Non Fossil Fuel Obligation in the UK).

Will electricity suppliers under a competitive system still be inclined to promote energy saving, as many of them are doing under the present, sheltered conditions? At first sight, it seems that a profit maximizing (or at least loss avoiding) firm has no interest in reducing its turnover. However, it is often argued that it is not kiloWatt-hours the customers are interested in, but rather energy services. This may be true, but it presupposes that the customer is not fully aware of energy saving opportunities. In other words, it extends the role of the electricity supplier to information supply. In any case, given a certain production capacity in a free market, there is a natural tendency to use that capacity to the maximum possible extent. Under competitive conditions, electricity companies will not differ fundamentally from say oil companies. This could mean that their involvement in energy saving will be taken over by the suppliers of electric and electronic appliances and equipment: much the same as research and marketing on fuel efficiency of cars is now mainly being done by the car producers, not by the oil companies. This example suggests that improvements in energy efficiency are not necessarily dependent on the energy supplier. Rather, under the present conditions the producers of low-energy goods can be said to benefit from the 'free' marketing (and sometimes even subsidies) provided for them by utilities.

A final remark regards the impact of changes in property relationships, often associated with market liberalization. If privatization accompanies the liberalization, governments will have a less direct influence on the electricity sector's decision making. Whether or not this is bad for the environment depends on the present situation. Whereas the authorities now sometimes use their position to impose relatively stringent demands on the electricity sector, under the privatization scheme they will have to treat it like a 'normal' industry. On the other hand, it might well be conceivable that the new property relationships increase the distance between governments and electricity industries, making the former more prepared to enforce environmental regulations than in a situation where they themselves have an interest in the industry.

5. Conclusions

Whether liberalization of the electricity market is good or bad for the environment seems to be an academic and not really relevant question in present-day Europe. First, it is very unlikely that a genuinely competitive electricity market will emerge in the EU in the next one or two decades. Moreover, any moves towards competition will no doubt be accompanied by conditions to ensure the protection of the environment (as well as several other social concerns, such as security of supply for 'captive clients'). In other words, liberalization will probably lead to more regulation; not only to ensure that the market functions efficiently and equitably, but also to enforce the conditions under which suppliers are allowed to operate.

Whatever the outcome of the present liberalization proposals, markets for electricity in Europe will change and probably become more lively. A major reason for this is that the traditional economies of scale in electricity production are becoming less important. For instance, combined heat and power (cogeneration) is sweeping the market nowadays. As this happens to be a relatively energy-efficient and environmentally friendly technology, it is being stimulated by many authorities by way of favourable conditions for access to the power network. The same is true for renewables, although their competitive position is still much weaker. The

increasing supply of electricity from small, independent producers disturbs the traditional long-term planning process by the large monopolistic utilities. They will have to find a new way of incorporating the less predictable supply from small scale sources. Many of them have already realized this and are ready to accept the concept of 'integrated resource planning,' which has been established in the US for several years (Flavin and Lenssen, 1994). The additional uncertainties of introducing competition on the demand side (Third Party Access) are much harder to digest for them.

Although a free electricity market as such is not a threat to the environment, one should be aware of the fact that at present many electricity producers and distributors are environment-friendly, a role they might have to give up once competition gets really tough. On the producer side, large sums are presently invested in R&D and demonstration projects on various forms of 'clean' generation technologies, such as coal gasification (IGCC). Many distribution companies run schemes providing support for energy conservation by their customers. Should a free market eventually become a reality, the rationale for carrying on these will no longer self-evident. Maybe they will be taken over by others, such as the suppliers of generation technology and appliances. But governments will probably have to play a role as well in providing information and stimulating energy conservation.

Finally, regardless of the liberalization process, it is clear that any attempt at reducing the use of (fossil fuel-based) electricity is bound to fail if energy prices remain at their present low level. Given the abundance of fossil fuel reserves, the only way to substantially increase their prices for consumers is by introducing some kind of tax. And given the low price elasticity for energy, this tax would have to be considerable. The prospects for such a tax becoming a reality in the EU (let alone in all OECD countries) are not particularly bright.

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