TRADING BETWEEN COUNTRIES
LES ÉCHANGES COMMERCIAUX ENTRE LES PAYS

IMPROVING THE BALANCE BETWEEN ENVIRONMENT, ECONOMY AND SECURITY OF SUPPLY OR POWER PLAY?
UNE AMÉLIORATION DE L'ÉQUILIBRE ENTRE L'ENVIRONNEMENT, L'ÉCONOMIE ET LA SÉCURITÉ DE L'APPROVISIONNEMENT OU LE JEU DE LA PUISSANCE ?

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1 Introduction / Introduction

The European energy market is strongly interconnected both economically and technologically. In this market it is the providers and the buyers – the stakeholders – who together determine the energy and cash flows and who are responsible for environmental pollution. This market is also influenced by social aspects such as the environment, levels of prosperity etc. Governments (European, national and local) influence these aspects by passing laws and introducing regulations. Thus they realize their own objectives.

Each stakeholder in this scenario has his own interests and the interplay between all the stakeholders and their individual interests determines the workings of the energy system – part of which is the energy market. These interests, or strategic goals, can be split into:

1. Security of supply: a clear strategy leading to good short-term and long-term availability in respect of technology and “fuel” and product affordability;
2. The economy: produce and deliver at minimum cost and with maximum profit margin;
3. The environment: limit environmental pollution and aim for the highest possible level of sustainability.

This paper will discuss how far the electricity trade between the Netherlands, Belgium, France and Germany and the planned cable connections between Netherlands–Norway and Netherlands–UK can contribute to the realization of these strategic goals. The applied methodology is also suitable for larger and/or other areas.

The EU Energy Policy [9] is geared to deregulation and privatisation in the expectation that freedom of choice for buyers will stimulate competition between the providers and hence yield more cost-effectiveness, lower prices, different product offerings, improved service levels and security of supply.

The EU Environmental Policy [6,7] is geared to making the energy supplies as sustainable as possible and minimizing pollution.

The Energy Policy and the Environmental Policy are essentially at odds with each other as long as people work with economic models based on short-term market relationships even though this contradiction can be resolved by incorporating future shortages and environmental effects in the price.

1.1 The challenge / Problématique

1.1.1 Introduction / Introduction

The ultimate aim of this study is to determine how far free trade in a level playing field situation between the above countries can contribute to the attainment of the three strategic goals of Security of Supply, the Economy, and the Environment. A distinction will be drawn between the limitations/implications of the current situation and the expectations in the long term.

1.1.2 Security of Supply / Sécurité de l’approvisionnement

- Various EU member states, including the Netherlands, have become major net importers of electricity [Eurelectric]. This system works as long as local shortages can be covered by importing surpluses from other countries. However, investment in generation capacity has been very low in all countries in recent years (EU 2000 – 2002, 0,2% (Eurelectric)) while the demand for electricity continues to grow (2000 – 2002, 3,1% (Eurelectric)). As a result, the remaining surplus capacity is shrinking fast in some countries. The investment climate has deteriorated due to unpredictable price trends, lack of knowledge of the new trading systems and the consequences of the Kyoto Protocol (emissions trade, covenants), and uncertainty about regulation. According to EU Commissioner for Transport and Energy, L. de Palacio [10], in the next 20 years alone an additional 600 GW will be needed in the EU. This means building 750 large power stations from scratch or as replacements. If the poor investment climate continues, security of supply could be threatened in the longer term.

- It is important to establish which organization bears ultimate responsibility for security of supply, the composition of the production park and the relationship with the electricity grids so that the required transport can be guaranteed.

1.1.3 The economy / Économie

- In the expectation that a properly functioning energy market is the best guarantee for realizing the three strategic goals the EU has decided that the member states must fully deregulate their energy markets by 01-01-2007 [9]. However, no decisions have been taken on how the markets are to be organized or how they are to operate. It is unclear how the current markets work and whether the EU goals are being met.
- The current import and export flows are based mainly on the differences in marginal costs between countries. Given that producers are often only partly reimbursed for their capital expenditure and that new production capacity is needed in the coming years this system is bound to collapse, triggering a rise in the market prices. There is no insight into the economic importance of the import/export and the further expansion of the interconnector capacity in an energy market which is based on a level playing field.

1.1.4 The environment / Environnement

- The EU is committed to the targets of the Kyoto Protocol and is issuing directives on how to achieve them. Nationally, these targets have been translated into a broad set of measures. Various mechanisms are being applied such as environmental taxes, energy saving, fuel adaptation, efficiency improvements and sustainability incentives, but due to the differences between the member states they are all standing in the way of a level playing field. The differences in environmental policy determine how the supply side and the subsequent total environmental pollution will develop and the level of the eventual EU-wide environmental pollution.
- Not all the measures need to be implemented within national borders. Joint Implementation (JI) and Clean Development Mechanisms (CDM) allow part of the targets to be realized abroad. At present a system for CO_2 allocation and CO_2 emissions trading is being prepared. The current mandatory Cap and Trade system sets separate limits for each EU country, which will lead to huge differences in the countries' starting positions.

1.1.5 Regulation / Réglementation

There is at present no level playing field because of differences in the legislation and regulations of the various countries and in the structure of the energy sector. In a free market this will lead to differences in starting positions and competitiveness.

2 When does a real level playing field exist? / Quand peut-on parler réellement de conditions de jeu égales (level playing field) ?

According to the literature, which includes [1], [4] and [11], the following conditions must be in place before a level playing field can exist in the EU:

- Similar and simultaneous deregulation of the electricity markets;
- Similar rates for grid access for all the market players;
- Fully transparent electricity markets;
- No or equal government incentives in relation to fuel policy;
- Similar encouragement for renewable energy and heat/power;
- Similar taxes and levies which affect the cost price of the product;
- Similar environmental targets for emissions, cooling water limits and CO_2 allocation;
- Similar licensing systems for building production capacity.

Briefly, you can say that anything that exerts a dissimilar influence on the cost price of the product undermines the basic conditions for a level playing field. Obviously, some differences will always exist between countries in terms of e.g. geographical location, population density, levels of industrialization, climatic conditions, the availability of natural resources, and the structure of the economy. This paper will analyse only the first four conditions for a level playing field.

The current forms of energy conversion exhibit significant differences from the perspective of the three strategic goals. This is shown in Table 2.1.

	Security of supply		*Economy*			*Environment*	
Supply options	*Availability*	*Controllability*	*Investment costs*	*Fuel costs*	*Operational costs*	*CO_2 emission*	*Potential for cogeneration*
Natural gas	++	++	+	- -	*0*	-	++
Coal	+	+	*0*	-	-	- - -	+
Nuclear energy	*0*	+	-	*0*	- -	++	*0*
Water energy	--	+++	-	++	+	++	- -
Wind	--	- -	*0*	++	*0*	++	- -
Biomass	++	*0*	-	- -	-	+	++

Table 2.1 Supply options from the perspective of the three strategic goals. / Tableau 2.1 Options d'offre en fonction des 3 objectifs stratégiques.

3 Current situation regarding the three strategic goals and regulation / Situation actuelle en fonction des 3 objectifs stratégiques et de la réglementation

3.1 Security of Supply / Sécurité de l'approvisionnement

3.1.1 Introduction / Introduction

Security of supply is determined by the balance between electricity supply and demand along with developments in the longer term and the availability of primary sources of energy.

3.1.2 Current situation regarding the supply in the six countries / Situation actuelle en ce qui concerne l'offre dans les différents pays

Figure 3.1 shows the total net generation capacity, the share of the various energy types and the peak demand for each of the six EU countries.

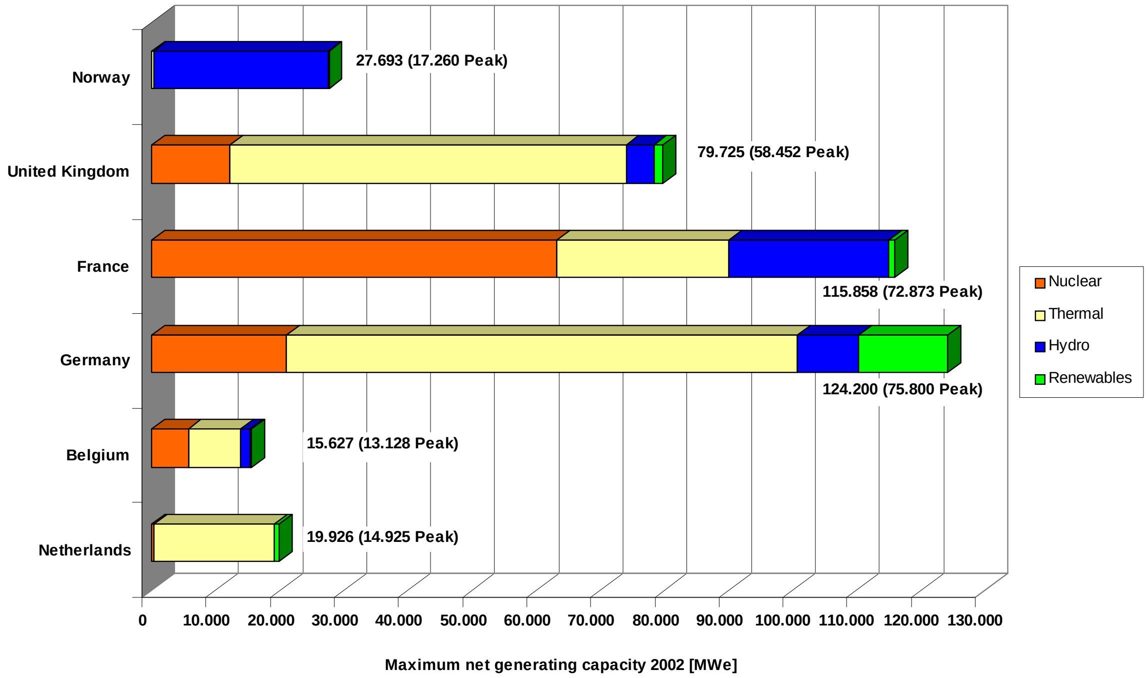

Figure 3.1 Capacity, peak demand. Source: Eurelectric, UCTE , Nordel, Electricity Association (UK) [14] / Figure 3.1 Capacité, Demande de pointe. Source : Eurelectric, UCTE , Nordel, Electricity Association (Royaume-Uni) [4]

Germany and France have by far the largest net generation capacity, followed by the UK, Norway, the Netherlands and Belgium. The difference in generation parks is immediately visible in the figure. France, Germany and Belgium have relatively large volumes of cheap nuclear capacity while the Netherlands has scarcely any and Norway has none at all. In Germany the generating capacity consists of around 35% lignite and coal; in the UK this stands at around 35%, while Belgium and the Netherlands have a coal capacity of around 20%. At approximately 72% of the total capacity in place, the Netherlands has the largest volume of gas-fired capacity; around 40% of this is heat/power cogeneration capacity.

3.1.3 Current situation regarding the demand in the six countries / Situation actuelle en ce qui concerne la demande dans les différents pays

We can gain insight into the relationship between supply and demand in the six countries by means of supply curves in which the peak demand is shown as a vertical line. Figures 3.2 - 3.4 (Scheepers, *et al*, 2003 [11]) show the domestic generation units in ascending order of costs for the Netherlands, Germany and France. These are what shape the supply curve. The costs of a unit are represented by its fuel costs. This is justifiable as fuel costs account for 85 - 90% of the marginal costs (fuel, operation and maintenance costs). The differences in costs are caused by the applied generation technology and the associated fuel costs at that moment in time. Hydro capacity and nuclear capacity normally have low fuel and marginal costs compared with gas capacity. Coal capacity is usually somewhere between the two.

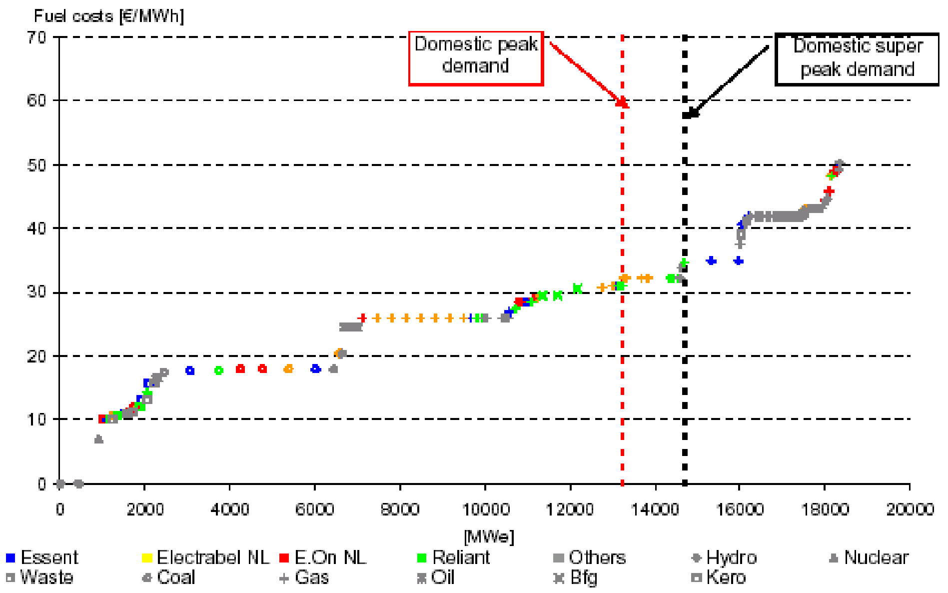

Figure 3.2 Supply curve for the Netherlands 2001. Source: ECN / Figure 3.2 Courbe de l'approvisionnement aux Pays-Bas 2001. Source : ECN

Superpeak demand is defined as the maximum demand during 200 hours of the year. Peak demand occurs around 1/3 of the year. The capacity for peak demand and superpeak demand can be derived from demand curves of the various countries, as published in the Statistical Yearbook of UCTE. It is unclear whether these demand curves incorporate all the capacity. Small-scale capacity and private-business capacity, in particular, are included in the supply curves but not in the demand curves; hence, the demand curves should be studied with caution. This applies particularly to Germany (Scheepers *et al*, 2003) and the Netherlands (van Eck *et al,* 2002) which have relatively high levels of small-scale cogeneration capacity. A correction has been introduced for Germany in Figure 3.3 (Scheepers, *et al*, 2003). The upward correction for the Netherlands in Figure 3.2 should amount to more then 2,000 MWe (the gas engine capacity of around 1,500 MWe is not incorporated in the supply and demand curves for the Netherlands).

The capacity in the shown supply curves is nameplate capacity; this means that no allowances have been made for the non-availability of units, limitations in generation capacity due to higher external temperatures, declines in generation capacity due to heat delivery etc. If this is taken into account the curve shifts to the left. This lowers the supply and means that the total demand needs to be met by deploying relatively more expensive generation capacity or by imports.
Imported electricity is not incorporated in the supply curve figures. If this were the case and if the cost price of imported electricity were low (e.g. lower than the costs of gas-driven units) the supply curve for the Netherlands would shift from a capacity of around 6,000 MW to the right. This means that the total demand can be met with relatively cheaper generation capacity.

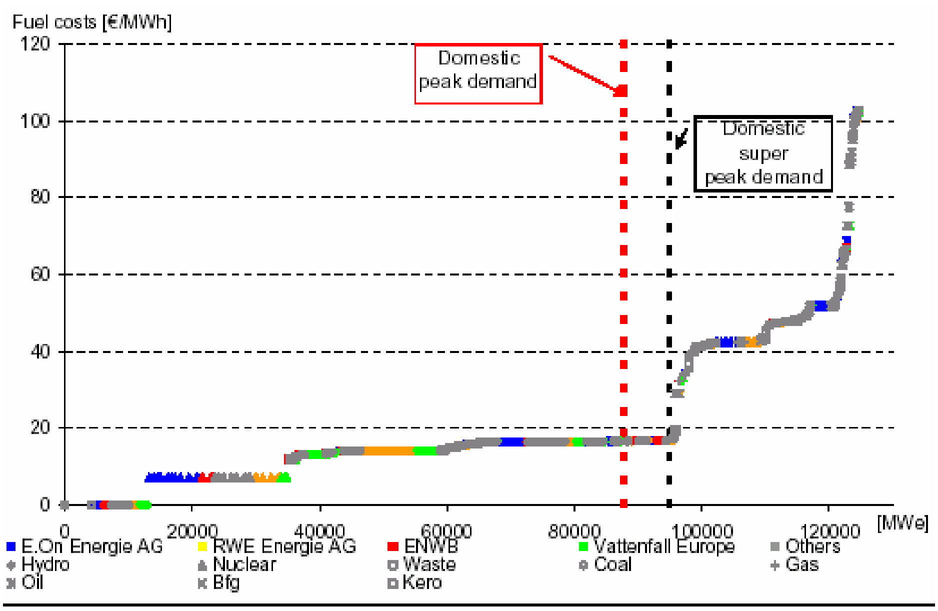

Figure 3.3 Supply curve, Germany 2001. Source: ECN / Figure 3.3 Courbe de l'approvisionnement en Allemagne 2001. Source : ECN

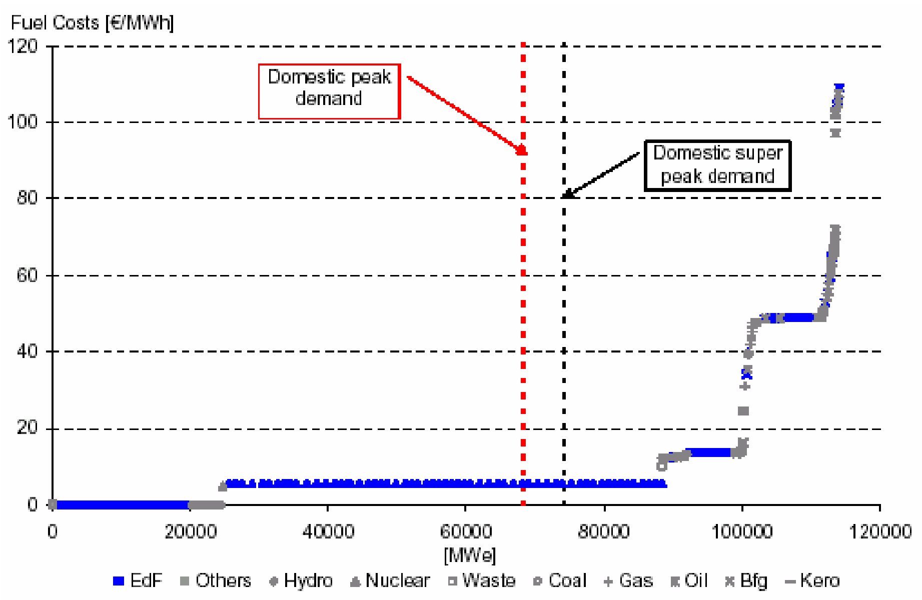

Figure 3.4 Supply curve, France 2001. Source: ECN / Figure 3.4 Courbe de l'approvisionnement en France 2001. Source : ECN

The supply curve for the Netherlands is an ascending line whereas the supply curves for France and Germany are much flatter over a wide radius and show exponential rises towards the end. This is mainly caused by the fact that France and Germany have a lot of typical baseload capacity, such as nuclear, lignite (Germany) and coal. The differences in the supply curves for the three countries and the relationship between demand and supply invite cross-border trade in electricity.

3.1.4 Current import/export situation in the different countries / Situation actuelle de l'importation/exportation dans les différents pays

Large-scale import/export of electricity takes place between five of the six EU countries in the study. Figure 3.5 shows the import/export for 2002.

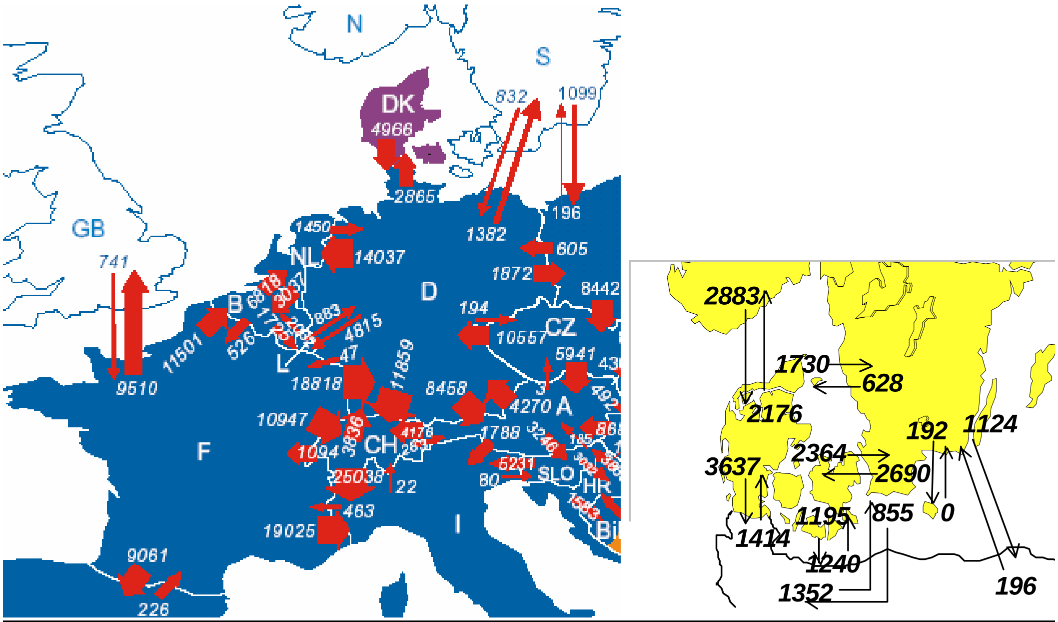

Figure 3.5 Import and export of electricity in 2002 in the EU countries in the study (Source: UCTE, Nordel) / Figure 3.5 Importation et exportation d'électricité en 2002 dans les pays de l'UE étudiés (source : UCTE, Nordel)

However, it is more interesting to look at their net imports and exports. This is shown in Figure 3.6.

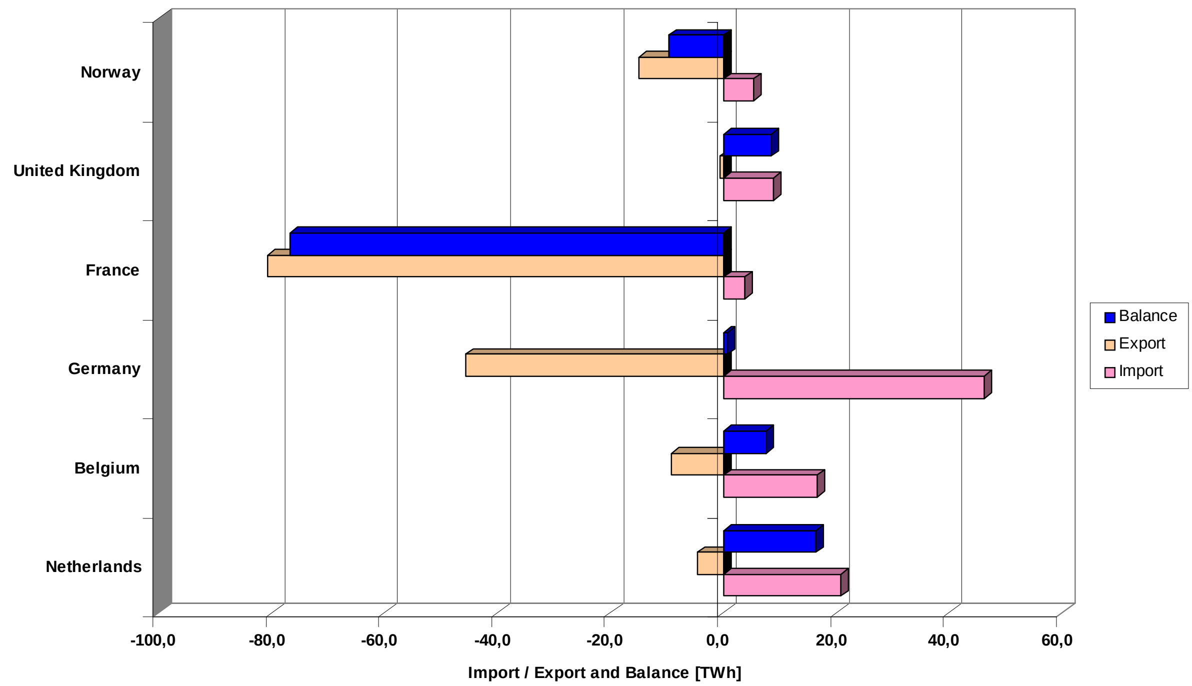

Figure 3.6 Import / export and balance 2002. Source: VDEW, Eurelectric / Figure 3.6 Importation / exportation et solde 2002. Source : VDEW, Eurelectric

France is by far the largest net exporter (-76.8 TWh) of electricity, followed at a distance by Norway (-9.7 TWh). Germany exports but also imports a lot of electricity, especially from France, with the result that the import/export balance for Germany is a mere -0.7 TWh. The Netherlands (+16.4 TWh), Belgium (+7.5 TWh) and the UK (+8.5 TWh) are net importers.

Figures 3.2 - 3.4 can help explain the electricity flows for the six countries as shown in Figure 3.5. France has a relatively large volume of surplus nuclear capacity (see Figure 3.4). Some of this capacity can be used for the German market in particular and, to a lesser extent, for the Belgian and the Dutch market. This causes a shift to the right by the German supply curve due to the import from France and makes relatively cheap coal capacity available in Germany. Part of this cheap coal capacity can then be used for the Dutch market. This is also the main reason behind the electricity trade between Germany and the Netherlands. If France were hit by a shortage for some reason or another, then less electricity could be exported to Germany. There would then be no shift in the supply curve for Germany. Only the more expensive gas and oil capacity would then be available for export from Germany. In that case there would be no difference in price compared with the Netherlands, so import by the Netherlands would be pointless. The Netherlands would then have to cover the demand with its own generation capacity. In the longer term the cross-border trade in electricity will decline because of the decrease in the existing surplus capacity. Continuation of the poor investment climate would also contribute to that trend.

3.1.5 Fuel availability and logistics / Disponibilité des combustibles et logistique

The EU Green Book clearly indicates that the EU is becoming increasingly dependent on imported fuel. As the only non-member of the EU among the six countries, Norway is in a unique position compared with the other five in the study as its own electricity and heat supply are almost entirely hydro-driven. Norway also looks set to be a net exporter of natural gas and oil for a long time to come. All the other countries are net energy importers. Admittedly, there are still large coal stocks but these cannot compete on the world market. Only the Netherlands will continue as a net exporter of natural gas for several years. The UK will soon become a net importer of oil and natural gas. All the other countries are almost entirely dependent on import for oil and natural gas. All the countries are entirely dependent on import for uranium. The potential for hydro energy is highly limited and is virtually being utilized to the full as it is. The availability of biomass and waste for generating energy is also highly limited. And, the development of sustainable options and new technologies is costing more and taking longer than was anticipated. But, the demand for energy continues to grow. All of this is sufficient reason for concern and research so as to bring about the best possible allocation of resources.

3.1.6 Conclusion / Conclusion

Thanks to France’s present huge surplus capacity of nuclear energy, the six countries can fully engage in cross-border electricity trading. However, trading activities are likely to decline in the long run as the surplus capacity runs out and if the investment climate remains poor. The continued growth in electricity consumption combined with increasing EU dependence on imports for its primary fuel supplies give rise to concern about security of electricity supply for the EU in the long term.

3.2 The economy / Économie

3.2.1 Introduction / Introduction

In theory, a transparent and properly functioning market should give the best results for the three strategic goals, but how does this pan out in practice?

3.2.2 Energy price comparison / Comparaison du prix de l’énergie

Many agencies have published comparisons of the energy prices of the various countries (Eurostat, EnergieNed, Dte, [4]). These reports are often used by interest groups and politicians to achieve their own short-term objectives. They may, for example, want low rates for industry or to block/stimulate certain supply options. These reports cannot, however, be used in this analysis because the starting conditions are different for each country: wide variations exist in the age and composition of the production parks, the regulations, the taxes/levies, the market structure and the availability of resources. The grids may or may not be separate from the production. In addition, the behavior of the market players is strongly focused on marginal costs, even though investment decisions are based on overall costs.

3.2.3 What kind of markets can be identified? / Quelles sortes de marchés peut-on distinguer ?

A recent survey by Delft University of Technology (Boisseleau, 2004 [2]) defines the Market = Wholesale Market = Marketplace + OTC and Power Exchanges as one type of market place and draws the following conclusions about the European energy market:

- There is no single transparent EU market. Theoretically, what is needed is more interconnector capacity and one EU TSO, but it is still uncertain whether this would be economical and whether the theoretical price models for standard markets with product storage can be applied to the electricity markets. Each electricity market is part of a larger system. Politically, a single EU market would be very risky because any major failure would have disastrous economic and social consequences.
- The separation between transmission and energy markets has led to inefficient transmission pricing.
- EU Directive 96/92/EC [9], which outlines the legal context for the deregulation of the electricity industry in Europe, only provides a general framework for the creation of a single market. It does not mention institutional arrangements, such as organized markets.
- The biggest part of the market (>80%) is bilateral, tailor-made and based on confidentiality.
- The OTC and the Power Exchange are used mainly for maintaining a short-term balance in the market.
- Integration is good between power exchanges and bilateral markets on national level but poor on international level.
- The traditional economic price theory does not work and there is insufficient knowledge on how the whole system operates.

The analysis in this paper is strongly based on further research concerning these conclusions.

3.2.4 Conclusions / Conclusions

There is no transparent EU market; decisions are taken mainly on the basis of marginal costs, which exclude environmental evaluations; the traditional price theory does not work; and there is no real benchmark for assessing the various countries. There is no theoretical ground for the economic desirableness of big international electricity trading.

3.3 The environment / Environnement

3.3.1 Introduction / Introduction

The EU is committed to the Kyoto targets [6]. Nationally, these have been translated into a large number of environmental policy measures. The differences in environmental policy determine how the supply side and the associated overall environmental pollution will develop as well as the eventual levels of EU-wide environmental pollution.
At present, a scheme is being prepared for CO_2 allocation and CO_2 emissions trading. The caps for each EU country in the current mandatory Cap and Trade system will create wide differences in the starting positions of the various countries.

3.3.2 The Kyoto targets / Objectifs de Kyoto

In the Kyoto Convention the EU pledged to reduce greenhouse gases by 8% compared with 1990 [6]. This target applies to the first phase of the protocol (2008 – 2012). Figure 3.7 shows how it is divided among the six EU member states in this study. It also shows the distance-to-target indicator (DTI), which determines the deviation of actual greenhouse gas emissions in 2001 from the linear path between 1990 and the Kyoto Protocol target for 2008 – 2012, if only domestic measures are applied. It is clear from the figure that, out of the six EU countries in this study, Germany and the UK are well on course, France is more or less on course and the Netherlands, Belgium and Norway are trailing behind. The EU has also set indicative targets for each member state in respect of the electricity share generated from renewable sources in the gross electricity consumption [7].
The compulsory reduction targets can be attained in various ways. This paper will be limited to the targets relating to the energy sector.

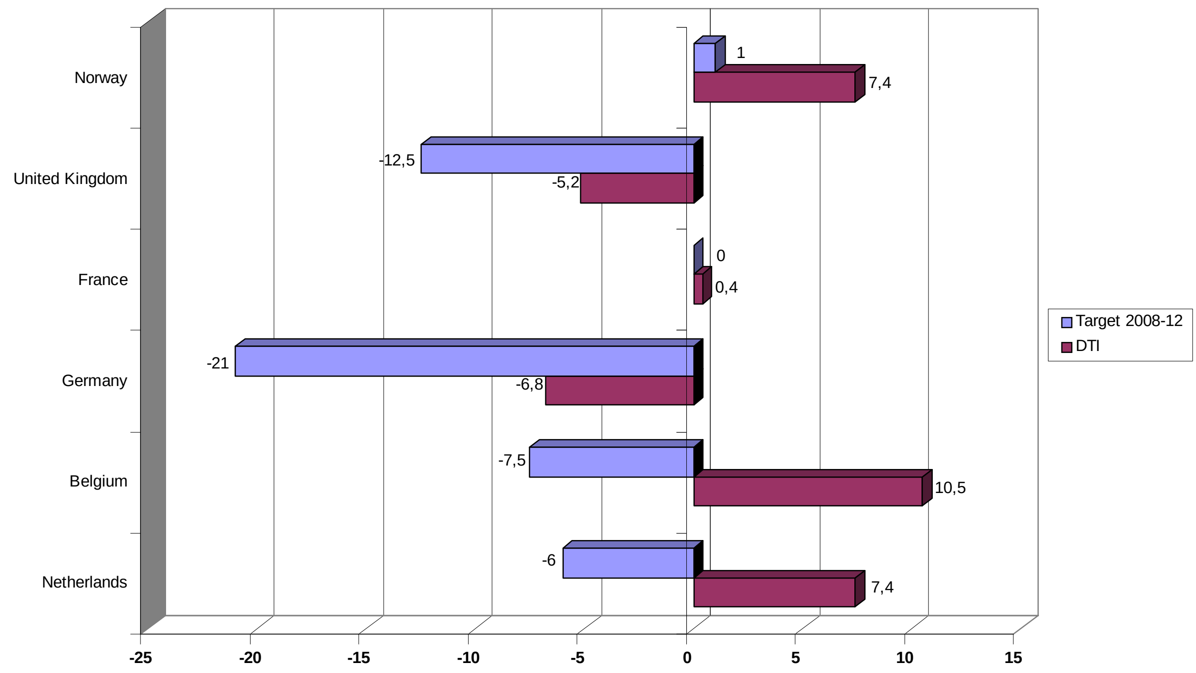

Figure 3.7 Compulsory reduction targets in % for the six EU countries and DTI in relation to 1990 / Figure 3.7 Obligations de réduction des 6 membres de l'UE étudiés et DTI par rapport à 1990

The Netherlands: The Netherlands has struck deals with its electricity production sector to reduce greenhouse gases: a coal covenant and a benchmarking covenant have been agreed with a view to an annual collective reduction of 6 Mton CO_2 in greenhouse gases by 2012. An indicative target of 9% of the gross electricity consumption has been set for sustainable electricity and heat/power cogeneration will be promoted by introducing the MEP scheme.
Belgium: Belgium intends to reduce greenhouse gases by building a massive windpark, introducing bio-fuel and converting two coal plants for biomass incineration. The indicative target for electricity from renewable sources is 6%.
Germany: Germany is well on course thanks, in part, to the large share of sustainable electricity (7.9% in 2003) and the replacement of the former East German lignite plants with modern equivalents. Eventually, the share of sustainable electricity will have to grow to 12.5%. It is unclear how Germany intends to deal with the greenhouse gases that escape when the nuclear plants are closed and replaced by coal and gas capacity.
France: The electricity production sector in France is mainly coal- and hydro-based. Eventually, the share of sustainable electricity in France will have to grow to 21%. This has virtually been attained thanks to the high level of hydro-based capacity.
United Kingdom: CHP technology is one of the key instruments in the energy sector to reduce the emission of greenhouse gases. In 2002 some 4,700 MW of heat/power cogeneration capacity was installed. The target is an installed capacity of 10,000 MW. The share of sustainable electricity in the United Kingdom in 2002 was 3% but it will have to eventually grow to 10%.
Norway: The increase in greenhouse gases versus the Kyoto target is due largely to the economic growth that began in 1990. The emissions from gas and oil extraction and – to a lesser extent – the transport sector and the industrial use of oil have played a particularly strong role in this. As thermal capacity is not used to generate electricity, the energy sector will not feel any effects. This will change, however, if a chronic water shortage were to force Norway to build, say, gas capacity – which would then push up the emissions. Import could offer a solution here; for example, the intended connection with the Netherlands could be used to import electricity during the night and then (partly) export it by day to support the peak demand in the Netherlands.

3.3.3 CO_2 allocation and emissions trading / Crédits et commerce d'émissions de CO2

On January 1, 2005 the EU starts an emissions trading scheme under which industrial businesses and electricity producers will need a license to emit CO_2. Each license-holder will be allocated a CO_2 allowance, which is tradable. The EU directive (European Commission, 2003) on the trading of CO_2 emission allowances requires the countries to submit a plan of allocation for the CO_2 allowances to the EU by March 31, 2004. It is not known at present how this will exactly affect the energy sector.

The Netherlands is one of the few countries to take advantage of the possibility to buy an extra CO_2 allowance through the Joint Implementation and Clean Development Mechanism. This increases the annual scope for domestic emissions. The allocation takes account of new production capacity.

In Germany the energy producers have obtained relatively large CO_2 emission allowances and newly built coal stations will be compared with other coal stations when allowances are granted. Old emission allowances may be retained and traded when power stations are replaced.

Because of the change of government in France the decision on the allocation of CO_2 emission allowances has been postponed. However, the effects are unlikely to make a deep impact on the energy sector because the share of thermal capacity in the overall generation of electricity is limited (see Figure 3.1). This situation will continue as long as France maintains its present level of nuclear-generated capacity by timely replacement of older units.

3.3.4 Conclusions / Conclusions

Four of the six countries still have some way to go before they can meet the Kyoto targets. One way to achieve this is to utilize the scheme for CO_2 emissions trading. The division and allocation of the CO_2 emission allowances to the energy sector in these countries will play a significant role in establishing a level playing field. After all, if new generation capacity is to be built, low CO_2 allowances will bring additional costs because additional scope will need to be bought from elsewhere. Countries where high emission allowances are allocated to the energy sector will therefore have a head start. It is totally unclear whether the CO_2 allocation plans take account of future changes in electricity flows due to economic factors relating to security of supply in the longer term. There is, at present, no extra CO_2 surcharge on imported electricity even though the CO_2 emissions are determined by the way in which the electricity is generated. Hence, the allocation of overgenerous CO_2 allowances to countries with a CO_2-intensive production park is unlikely to act as an incentive to lower the total emissions EU-wide. Moreover, when imports decline, the importing countries in particular will have to fall back on their own generation capacity. If the CO_2 allowances in these countries then prove inadequate and further scope needs to be purchased, it may well be cheaper to invest in another country, but absolutely no consideration is given to optimal allocation of the means of production.

3.4 Regulation / Réglementation

The current regulation situation for the six countries is shown in Table 3.1.

	Declared market opening (%)	Unbundling: transmission system operator/owner	Unbundling: distribution system operator	Regulator	Overall grid tariffs (2002)
The Netherlands	63	Ownership	Legal	ex-ante	average
Belgium	80	Legal	Legal	ex-ante	average
Germany	100	Legal	Accounting	NTPA planned	above average
France	37	Management	Accounting	ex-ante	average
United Kingdom	100	Ownership	Legal	ex-ante	average
Norway	100	Ownership	Accounting	ex-ante	average

Table 3.1 Regulation status, July 2002 – July 2003 / Tableau 3.1 Statut de la réglementation période Juillet 2002 – Juillet 2003

The table shows unequal market deregulation across the six countries. In France, the Netherlands and Belgium the market is not yet 100% free. Deregulation will be complete in the Netherlands on July 1, 2004.

Germany is the only country in the group which does not (yet) have a regulator; Negotiated Third Party Access (NTPA) is used here. It now looks as if Germany will also appoint a regulator to monitor the grid rates.

4 When is it worthwhile to transport and trade in electricity across long distances? / Quand le transport et le commerce d'électricité sur de longues distances est-il intéressant ?

4.1 Introduction / Introduction

Basically, the EU opted for a deregulated energy market because it expects a market that functions well to bring it closer to the three strategic goals and thus improve its competitive position. A distinction should be drawn here between regional markets – where distance scarcely matters at all – and the international market with electricity transports across long distances. This section will address the international market and discuss:

1. factors that stimulate transport across longer distances in the present situation;
2. factors that stimulate transport across longer distances in a level playing field.

4.2 Factors in the present situation / Facteurs dans la situation actuelle

4.2.1 Surpluses and deficits in regional capacity / Déficits et surplus régionaux dans la capacité

A distinction can be drawn between:

a. Permanently available capacity which exists as a result of bad planning or created surpluses and deficits. This type of capacity is not an option for systematic transport and trading. At present, national policy is causing wide differences in the relationship between demand and capacity in the various countries.
b. Temporary surpluses or deficits as a result of variations in the supply of primary energy bearers; typical examples are too much or too little water for hydro power and strong fluctuations in wind levels. Neither of these offers a solid basis for long-term contracts. The technical dimensions of the grids would need to be based on variations in supply. Both situations would necessitate a spot market in which hydro power is predictable for weeks or months and wind only in the very short term. There is a surplus of hydro capacity for a brief period in the spring due to fast-melting snow in Switzerland. So much wind capacity has been installed in North Germany and Denmark that it is leading to temporary surpluses and deficits along with problems with grids and back-up production capacity.

These temporary surpluses and deficits form a basis for the unbalance market.

4.2.2 Calamitous situations due to technical problems / Situations catastrophiques par suite de problèmes techniques

These incidental and short-lived situations are definitely not conducive to systematic trading. The (international) connection grids, which were primarily intended to preclude technical calamities, are more than adequate provided there is enough production capacity in the countries/regions. The TSO's have reached agreement for these eventualities. Only they can determine the extent of potential benefits from intensified cooperation and adaptations to the interconnector capacity. However, this is not a market. Demand Side Management still offers substantial opportunities for steering the demand for electricity, but it receives hardly any attention because it would require partnerships between producers/grids and customers. In the current system of energy supply, such partnerships would be difficult to achieve in the case of strict separation or in 'monopoly situations' where they would be discouraged.

4.2.3 Differences in legislation and regulation between the various regions/countries / Différences de législation et de réglementation entre les régions/pays

If we are serious about European harmonization, differences in legislation and regulation should not give rise to systematic transport. However, the current situation is different and is actually leading to trade. The aim of the international environmental treaties is to reduce CO_2 emissions in the most cost-effective way. This works in a level playing field situation, provided it is not thwarted by rights and obligations left over from the past. The allocation which is currently on the agenda will lead to false competition. The system will only work if identical installations/processes in all the countries have identical rights and obligations. At present a situation is evolving where an installation in, say, the Netherlands will need to buy emission allowances while an identical installation in Germany gets them automatically. This could lead to export to the Netherlands and push up rather than bring down overall costs and environmental pollution. The starting principle must be that the environmental pollution which is actually caused is reflected in the cost price for all the countries. Besides the differences in legislation and regulation the starting position of the countries in both the composition and lifetime of the generating capacity and the ratio between demand and supply are total different. In the short and medium term this will have a great influence on the market positions.

4.2.4 Differences in non fuel costs / Différences dans les coûts de non combustibles

The introduction of the euro has harmonized the financial markets. Only the UK and Norway have not joined the common currency. However, this is not leading to equal financing costs, because public sector companies and large international corporations can obtain finance far more cheaply than the relatively small and possible in the future subdivided Dutch businesses. A 1% rise in the interest rate will, in itself, result in at least a 5% rise in cost price. This makes it almost impossible for private companies and smaller newcomers to compete on the market.
Direct personnel costs for production are limited to a maximum of 10% of the total costs. The differences in personnel costs between the countries are also limited. However, large, strong players do have an advantage as they can negotiate lower prices for hardware and maintenance contracts.

Conclusion / Conclusion

There is no question of a level playing field at the moment. It even appears from first impressions that the bulk of the current trade has come about by the absence of a level playing field. In order to assess the desirability of a free energy market it is therefore necessary to examine the factors in a level playing field.

4.3 Factors in a level playing field / Facteurs dans des conditions de jeu égales

This section will determine whether there are integral factors which would justify large international energy flows if a level playing field really did exist. A brief analysis of the facts will be provided for each factor and followed by conclusions.

4.3.1 Availability and transport costs of fuel and electricity / Disponibilité des combustibles et leur transport comparé à celui de l'électricité

First an assessment will be presented of the costs of transporting **electricity**, **natural gas** and **coal** on the basis of available research findings (Kema,1994 [13]) (see Figure 4.1).

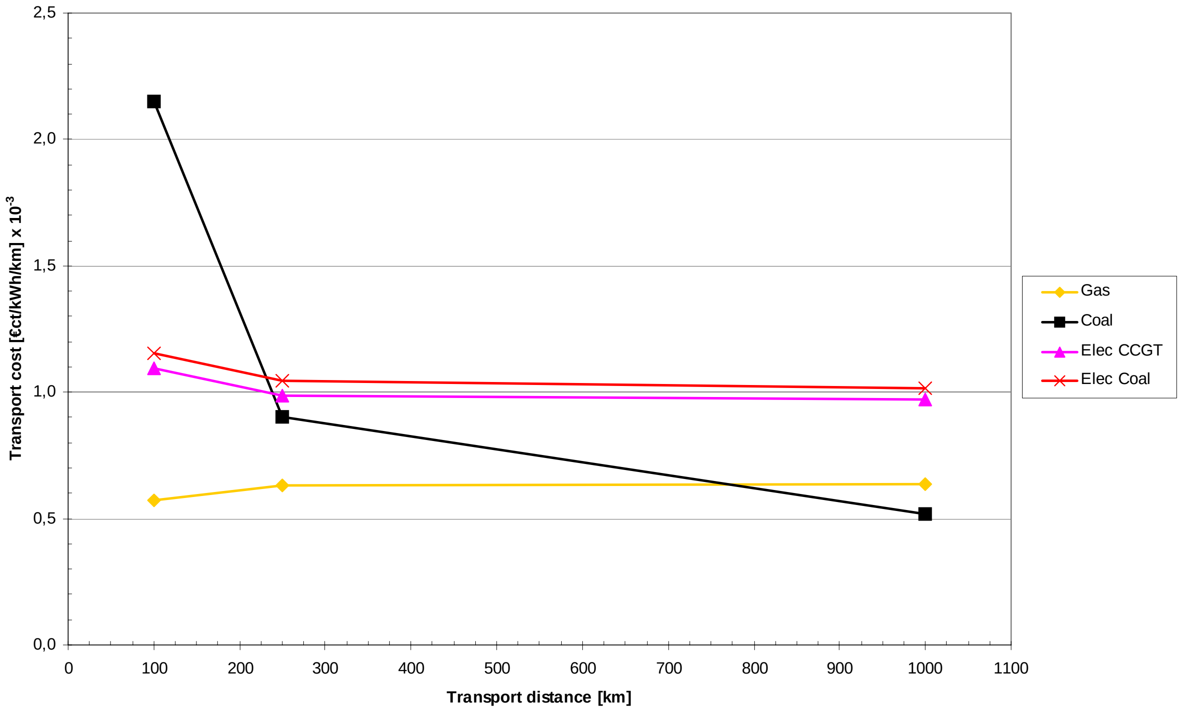

Figure 4.1 Transport costs vs. transport distances (1,000 MWe, 6,000 full-capacity hours) / Figure 4.1 Coûts de transport en fonction des distances de transport (1000 MWe, 6000 heures à pleine capacité)

Briefly, the research findings are as follows:

- The costs of transporting electricity are highest for distances of > 250 km and run almost linearly with the distance and the operating time of delivery. They amount to at least € 0.01/MWh/km for high capacities and operating times of > 6,000 hours. A transport across 1,000 km would already increase the cost price of electricity production by around 25%. This could double for lower capacities and poorer operating times. Electricity transport also has a low environmental score because of the required infrastructure and the transport losses, which amount to at least 6% across 1,000 km. Electricity transport is most expensive when it is for production with a low yield.
- The costs of gas transport are lower than the costs of electricity transport. They run almost linearly with distance and the operating time of delivery. They amount to at least € 0.0065/MWh/km of electricity production for high capacities and operating times of > 6,000 hours. A transport across 1,000 km will result in a rise of approximately 15% in the cost price of electricity production. The environmental effects of gas transport are very limited.
- The costs of transporting coal by inland shipping or rail are lower than the costs of transporting electricity across distances of > 250 km. They are also lower than gas for distances of > 750 km. They are barely dependent on capacity and operating time and become cheaper in proportion to the distance. These costs range from at least € 0.022/MWh/km for 100 km to € 0.005/MWh/km of electricity production for 1,000 km. Coal transport has very little effect on the environment.

These findings are indicative, but the differences are so great that certain conclusions may be drawn on the basis of the transport costs alone:

- The costs of transporting electricity are so substantial that it is in the interests of the economy and the environment to keep production as geographically close as possible to the demand. Only for distances up to approximately 250 km is it worthwhile to transport coal-based electricity, e.g. from a coal station in a Dutch seaport to the Ruhr area in Germany.
- Gas transport costs around 30% less than electricity transport and is less of an environmental threat. Gas that is destined for electricity production should therefore be transported to areas where a demand for electricity exists. The gas supplies for the six countries in the study could

come from Norway, the Netherlands/North Sea, Russia and, to a limited extent, LNG terminals. Russia and LNG will increase in importance in the future.
- The costs of coal transport across larger distances are by far the lowest, provided the right infrastructure is in place, i.e. waterways. Coal-based electricity should therefore never be transported across large distances; it is better to transport the coal.

Coal: in Western Europe the availability of coal is high but it is all deep mining and therefore not competitive with world market coal.
Lignite: only Germany has large stocks of lignite. On-the-spot production of electricity is the best option, given the large volume vs. the energy content and the fact that the stocks are located in high-demand areas.
Nuclear: the costs of transporting nuclear fuel – including to and from the enrichment plants – and of storing waste make scarcely any impact on the overall investment costs. In addition, Europe itself has no uranium extraction, and – apart from France – it is unlikely that new nuclear power stations will be built in the immediate future.
Wind: production must take place at locations where there is most wind, i.e. at sea, on flat windy land and in windy mountainous regions. This information has already been taken on board and is playing a crucial role in the choice of wind park locations.
Solar: does not play a role in terms of volume at present.
Hydro: the location of hydro-electric plants is determined almost entirely by the potential for reservoirs and, to a much lesser extent, by currents and tides. It will be difficult to further develop the existing potential in Europe, with the exception of Iceland, which still has large untapped resources. Bringing this to Europe would, however, involve large-scale and risky investment. Now that even Norway and Sweden no longer have any surpluses, it looks as if only energy-neutral contracts between these countries and their neighbours offer any prospects for flattening the demand curve. As many contracts like these have already been signed with producers in those countries, scarcely any extra trading scope is available.
Waste: it costs more to transport waste than to transport electricity. Moreover, the electricity produced from waste is marginal compared with the overall demand. So, the waste problem should be addressed regionally, if possible in combination with the delivery of heat, given that the electricity generated by waste incineration installations is low.
Biomass: the same conditions apply to biomass as to waste. Scandinavia is the only region with a substantial supply of biomass, but even there it can only satisfy around 20% of the demand for electricity.
Oil: the share of oil in the electricity supply is falling all the time, largely because of better refinement methods, environmental effects and the low electricity yield. It costs more to transport oil than to transport electricity. Nowadays, oil is preferred only at refineries or at seaports with logistical systems for oil.

4.3.2 The availability of cooling water / Disponibilité de l’eau de refroidissement

The availability of (preferably cold) cooling water offers financial and energy benefits to electricity stations, particularly those with (partly) condensing facilities. Advantages can therefore be gained from locations at sea or near large volumes of flowing water. The best option is, however, maximum heat/power cogeneration, which requires only minimum amounts of cooling water or none at all.

4.3.3 Air and water temperatures / Températures de l’air et de l’eau

Both the energy yield and the maximum capacity are influenced by the temperature of the air and the water. This is especially true of gas turbines, where temperature can make a difference of up to 20%. Cooler areas and areas with good cooling water capacity therefore have a considerable advantage.

4.3.4 Scope for cogeneration / Possibilités de la cogénération

Heat and power cogeneration yields major energy savings. This is why EU policy (see the new CHP directive) and national policy are becoming more geared to the utilization of the residual heat that is released during the production of electricity. Heat delivery can be split into process steam and warm water for heating. Technical factors require heat to be supplied locally. Under the exergy principle, the

European policy on power station sites should be connected with a site policy for industry which could use residual heat. This would also create opportunities for process connections (e.g. utilization of residual gases from industry) and/or allow residual heat to be used for greenhouses or residential areas. These possibilities are being stymied by large international flows of electricity.

4.3.5 Distributed generation vs. large-scale generation / Génération distribuée et génération à grande échelle

Many publications and congresses give the impression that the future lies in local, small-scale generation. In practice, small-scale generation options often run into difficulties and cannot survive without regulation. This is why most new projects are large-scale. It is however clear that the large-scale solutions are more likely to lead to international trade than distributed generation. Distributed generation makes heavier demands on the grids and requires customized building and operation. This is out of the question without extensive regulation.

4.3.6 Fundamental differences in the demand pattern and/or the composition of the supply / Différences structurelles du modèle de la demande et/ou différences structurelles dans la composition de l'offre

The demand pattern is more or less the same in all adjacent countries (see Figure 4.2 and 4.3).

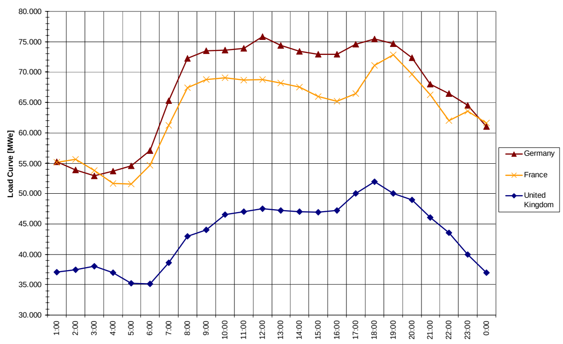

Figure 4.2 Load values Germany, France, United Kingdom as at 18/12/2002 / Figure 4.2 Valeurs de charge Allemagne, France du 18/12/2002
Source: UCTE, Electricity Associaton

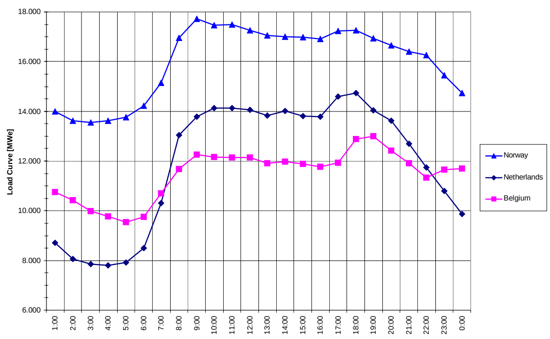

Figure 4.3 Load values Norway, the Netherlands and Belgium as at 18/12/2002 and 16/1/2002 (No) / Figure 4.3 Valeurs de charge Norvège, Pays-Bas et Belgique des 18/12/2002 et 16/1/2002 (No)
Source: UCTE, Nordel

The demand during the night and in the weekend is consistently lower than during the day. Proportionally, the night trough is deepest in the Netherlands and, thanks to a good gas infrastructure, the Dutch demand pattern is least influenced by the demand for electricity for heating purposes. These patterns do not, therefore, provide a reason for large transport/trade flows. On the supply side only Norway exhibits a totally different trend in the form of well-controllable hydro power. However, as there is no longer any permanent surplus capacity, only contracts for daytime export and night-time import would be of any use. Such contracts already exist with Denmark and Sweden and are planned for Finland, Germany, Poland and the Netherlands. Geographically, the UK could also be eligible. Expectations appear to be rather high, given the limited supply. There are scarcely any arguments in a level playing field situation for laying extra cable connections between the UK and mainland Europe.

4.4 Conclusions on the various supply options / Conclusions concernant les différentes options d'offre

The conclusions do not take account of the following shortcomings of a level playing field:

- There is no room for free-wheelers. The energy system calls for long-term investment. The technological and – often – the economic life expectancy for production is at least 15-20 years and often much longer for transport and infrastructure. We are facing an existing situation which can only be gradually adapted.

- No clear statements have been issued on the preferred balance between the economy, the environment and security of supply. The EU is leaving ‘fuel policy’ to the individual member states. However, most of the countries do not have a real long-term fuel policy, so there is no consensus.

If there are no transition problems and if there is 100% harmonization, the following conclusions can be drawn:

General: production should be located as near as possible to the demand. This conclusion is also underpinned by the benefits of heat/power cogeneration. The production of steam and hot water is, by definition, locally bound and cogeneration limits the problems with cooling water. Moreover, as a direct relationship between the demand for electricity and steam/heat exists in almost all the regions, the local authorities can steer developments via the site policy. If heat/power cogeneration proves impossible then it is essential to have cooling water on hand. It is then advisable to chose sea or river locations.

For the diverse forms of conversion
Natural gas: the cheapest sites for natural gas are seaports (LNG) and locations close to the natural gas fields and the import infrastructure. Norway, the Netherlands and part of Germany and the UK are in a particularly strong position as far as this is concerned. This is scarcely relevant for Norway as it has plenty of hydro power. For other areas it is cheaper to produce locally based on natural gas than to transport gas-powered electricity.
Coal: the coal stocks in the countries cannot compete with imported world-market coal without subsidies. The cheapest locations are therefore at seaports, especially if they have the right infrastructure. This position will be further strengthened if these locations are connected by internal waterways to areas with a high energy demand. A classic example of this is Rotterdam. For distances of > about 250 km it will be cheaper to transport coal instead of electricity.
Lignite: only Germany has large stocks of lignite. Given the large local demand for electricity and the costs of transporting lignite, local production is the best option.
Nuclear: because of the relatively low costs of fuel transport the location of a nuclear power plant is determined largely by the demand, the availability of cooling water and the required distance from densely populated areas. This makes the starting position more or less the same for all the countries.
Wind: it is impossible to locate the production of wind energy near the demand. Electricity will therefore have to be transported to the point of use. If wind energy is further developed, we will be increasingly faced with regional surpluses and deficits which can only be solved by additional transport infrastructure and backup capacity.
Hydro: this is another case where it is impossible to locate production near the demand. With the exception of Norway there is no local surplus of hydro-powered electricity, so there is no need for transport. Mutual exchange can open up opportunities for countries and regions close to Norway.
Waste: wherever there is waste, there is a demand for electricity. Given the costs of transporting waste local conversion into energy is the preferred option and given the relatively low yield, it is better to employ this method at locations where the heat can also be used.
Biomass: the availability of biomass is restricted and there are no surpluses in any of the regions. In addition, the production of biomass only delivers a fraction of the energy that can be gained by installing solar panels on the same area.

5 How will a real level playing field affect production, the grids and the three strategic goals? / Quelles conséquences auraient de véritables conditions de jeu égales sur la production, les réseaux et les 3 objectifs stratégiques ?

How far can free international trade in a level playing field situation with and without environmental appraisal and with and without strong rises in the price of fossil fuel have a positive influence on:

- Security of Supply
- Energy prices

- Emissions and sustainability.

EU policy is based on high expectations regarding the possibilities of the free energy market. What's more, politicians, buyers and the energy sector have been saying for years that large-scale development of the interconnector capacity and the introduction of an entirely free market will lead to the best results for the whole EU. On the other hand, major producers and national governments are strongly inclined to protect the domestic market and there is a lot of concern as to whether the consumer will be driven into a corner.
The analysis revealed that questions do need to be asked, given that in the six countries:

1. The transport of electricity is almost invariably the most expensive energy transport option and responsible for the greatest environmental pollution.
2. The process steam and heat market is a local market and cogeneration has a lot of advantages compared with divided generation.
3. Except for Norway, none have local surpluses of renewable energy.
4. The costs of producing energy are dictated primarily by the costs of fuel and investment. Hence, in a real level playing field situation there are scarcely any other factors that justify large transports.
5. Security of supply is a separate point. Interconnections between large systems deliver a number of benefits for security of supply, but large flows of energy also carry extra risks of international black-outs.
6. Electricity is regarded as a commodity, which it is not. The quality when it leaves the grid is, in principle, the same, but it is not a product for which an ideal production method can be found. The various conversion methods cannot be compared in terms of technology, costs, availability, controllability or environmental effects. In addition, stock building is not possible and a TSO is needed to regulate the business management. Because all the producers are directly connected, the behavior of one producer/grid operator/customer can affect the whole system. What's more, due to the demand pattern only part of the production resources can be deployed on a basic load basis. Many units need to operate on a controlling or start/stop basis or serve as a direct or indirect backup. This can be realized only by major producers or individual contracts/deployment control.

It is scarcely possible to assess the current efficiency of the individual countries because of the wide variations in production, legislation and regulations, grid charges, the allocation of cross-subsidies (or the absence thereof), and the huge differences in tariff systems and levels for the various customer groups.

6 Conclusions / Conclusions

If we are to achieve a maximum realization of the 3 strategic goals then a level playing field is essential. According to the analysis, this will not lead to one massive international electricity market, as many people predict. A level playing field – including equal implementation of the Kyoto protocol – will prevent the emergence of large trading flows which are based mainly on differences in regulation and eventually lead to higher macro costs. In a level playing field situation the regions with the strongest starting positions are those which have their own sources or – thanks to seaports, good waterways and/or gas infrastructure – good access to fuel import.
The message for the politicians is therefore to leave this dead-end course and stop developing interconnector capacity. Instead, determine the desired balance between security of supply, the economy and the environment. Make clear choices about the required fuel mix on the basis of the available options and then ascertain the regulatory elements and the market structure with the best chances of realization.
New discussions can be launched on whether these advantages will remain in the respective regions and on how to address the financial implications of the chosen 'fuel/environmental mix' and the wide variations in the costs of transport and distribution. Will the countries/regions apply the solidarity principle or will the basis be individual/regional cost allocation?

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Abstract

This paper explores the scope for electricity trading between six western European countries and the potential effects on the three strategic goals of security of supply, the economy and the environment. The approach can also be used for other countries. It begins by analysing the differences between regulation, organization, power stations and market positions of the different countries and assessing their implications for international trading. It then examines the economic position of the different countries/regions in relation to energy powered by gas, coal, lignite, nuclear and renewables on a purely technical, economic and environmental base and assuming the existence of a full level playing field. The results are fed into a model that analyses how far energy trading would promote the realization of the three strategic goals in the different countries. Finally, it offers concrete recommendations on how to create a level playing field and describes its impact on the anticipated trading volumes, the balance between the three strategic goals in the different countries and the required regulation.

Conclusions: for a proper allocation of means of production, a level playing field needs to exist between the countries. Our analysis shows that this will not create a massive international electricity market, as predicted by many market players and politicians. A level playing field – which includes the implementation of the Kyoto protocol – will prevent large trading transactions which are based on differences in regulation and which eventually lead to higher macroeconomic costs.

Résumé

Cet article explore les possibilités du commerce de l’électricité entre six pays de l’Europe de l’Ouest et ses effets potentiels sur les trois objectifs stratégiques concernant la sécurité de l’approvisionnement, l’économie et l’environnement. Cette approche est aussi applicable à d’autres pays. Elle commence par une analyse des différences existant entre la réglementation, l’organisation, les centrales électriques et la position sur le marché des différents pays et une évaluation de leurs répercutions sur le commerce international. Elle se poursuit par un examen de la position économique des différents pays/régions par rapport à l’énergie générée par le gaz, le charbon, le lignite, le nucléaire et les énergies renouvelables, d’un point de vue purement technique, économique et environnemental en partant du principe que les conditions de jeu sont complètement égales. Les résultats sont intégrés à un modèle qui analyse dans quelle mesure le commerce de l’énergie favoriserait la réalisation des trois objectifs stratégiques dans les différents pays. Elle se termine par des recommandations concrètes sur la façon de créer des conditions de jeu égales et par une description des répercussions sur les volumes du commerce prévus, sur l’équilibre entre les trois objectifs stratégiques dans les différents pays et sur la réglementation requise.

Conclusions : l’existence de conditions de jeu égales entre les pays est indispensable à une bonne affectation des moyens de production. Notre analyse montre que cela n’impliquera pas la création d’un immense marché international de l’électricité, comme le prédisent de nombreux politiciens et acteurs du marché. Des conditions de jeu égales, ce qui suppose l’application du protocole de Kyoto, évitera d’importantes transactions commerciales reposant sur les différences de réglementation et entraînant finalement des coûts macroéconomiques plus élevés.