

**ELECTRICITY LIBERALIZATION IN THE EUROPEAN UNION:
BALANCING BENEFITS AND RISKS**

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I. Introduction

In the European Union three objectives are today considered as priorities, although their respective importance can vary among countries. These are common objectives but the weight given to each of them is not the same in each country because energy endowment and local constraints are different. This is why it is difficult to implement a common energy policy today in Europe. These objectives are:

1. the search for competitive energy; confidence in the market mechanisms is the rule, but the energy access cost must reflect the positive and negative externalities and the role of the government should be limited to creating the conditions for such an approach through CO2 emissions trading, green or white certificates etc...
2. the search for supply security, in order to give the priority to national resources and to encourage the diversification of imported energy sources. In 2006 the European Union (25) imported 56% of its energy needs and this rate will increase in the near future.
3. The fight against global warming aiming to implement joint and cooperative policies among other countries, in the hope of preserving a threatened environment considered as a “common public good”.

The search for an acceptable trade-off between these three targets constitutes a major challenge for Europe today. The ambitious program recently adopted (European Council early 2007) aims both at reducing the energy intensity of GDP by 20% in the year 2020, and satisfying primary energy consumption with renewable sources (hydraulic, wind, biomass, solar energy) by up to 20% at the same time.

For electricity generation the main debate is about the optimal “mix” of fuels to be used. Coal, oil-fuel and natural gas are polluting sources. Hydraulic capacity is limited inside Europe and nuclear energy is a questionable solution for many countries, particularly because of waste management.

Liberalization of the electricity sector is now a reality in Europe. Promoting competition, privatization and ownership unbundling of energy businesses is a permanent “credo” for the European Commission. But this liberalization is contested by many European consumers who hold it responsible for the electricity price increase observable over the past four years. This increase has been particularly noticeable in countries like France where electricity prices have been traditionally low (II). The liberalization has also been accompanied by a vast privatization process as well as mergers and acquisitions between European operators, in the context of sometimes friendly and sometimes hostile takeover bids. Many consumers fear that this industrial reorganization will end up eventually in the creation

of a private oligopoly whose market power will lead to new price increases. The development of transnational electrical interconnections should logically lead to more competition and a certain harmonisation of prices paid by the end user of electricity. This price convergence between end consumers will see the transfer of surpluses between European operators; some will be losers and others will be winners (III). But this interconnection is often insufficient in order to reduce the market power of producers. Paradoxically it would appear to even affirm the market strength of some of them (IV). In conclusion, we think that this liberalization opens up many questions about electricity price setting and industrial restructuring which Europe is undergoing at present (V).

II. Is the increase in the price of electricity a result of market liberalization?

The search for competitive energy is the main priority but the implementation of a single market for electricity in Europe seems unable to cut energy prices. For the European consumers more competition must lead to lower prices. But we observe today higher electricity prices everywhere. Since 1 July all European consumers can choose their gas and electricity supplier. It is the consequence of a very long and chaotic evolution which has progressively cut the legal monopolies responsible for electricity and gas production and distribution. These monopolies, often public, were generally established just after the Second World War to encourage the reconstruction of Europe. The Treaty of Rome in 1957 had planned liberalization for all commodity markets, energy included. The European Directives, adopted in 1996 for electricity and in 1998 for natural gas, have implemented three complementary measures (see Percebois, 2003):

1. the progressive eligibility of energy end-users, industrial users initially and then more generally, including households, today;
2. third party access to the transmission and distribution of gas and electricity networks. These networks are considered as “essential facilities”. Thus open access is the rule and each supplier may use such networks when it pays a fee fixed by an independent regulatory commission. The regulated postage stamp pricing system is imposed now in Europe for electricity and it involves fixing a toll independent of the distance separating the supplier and the consumer. The toll depends both on the power capacity reserved and the rate of utilization of this capacity and it is generally paid at the exit of the network. In order to avoid foreclosure behaviour, the rule “use it or lose it” is now imposed by the European Commission for reserved capacity.
3. unbundling of electricity generation, transmission and distribution activities; legal unbundling is currently the rule but the European Commission now requires ownership unbundling

Liberalization will imply a convergence of electricity prices for all European consumers at least if any congestion is observed on the networks (see Percebois 2007). This convergence obviously requires the removal of bottlenecks that still subsist in electricity interconnections among European countries. In the recent past, before liberalization, the price of the kWh was generally fixed by the government, or at least with its agreement, and this regulated tariff was calculated by the (public) incumbent in charge of electricity generation and distribution. The customer had to pay a fixed premium each year and bills were proportional to the quantity of kWh consumed, and the price of this kWh was relatively stable over time. The total tariff was:

$$T = A + pQ$$

Where T is the tariff paid each year, A a fixed premium proportional to the power subscribed, p the price of the kWh and Q the quantity of kWh consumed during the period. The price p was higher during peak periods and lower during off-peak periods, in relation to the variable cost of the marginal power station necessary to balance supply and demand. This is the consequence of the well-known “merit order” rule (see Boiteux, 1960). This price p was revisited by the public authorities once or twice each year, no more. Now, after liberalization, for consumers opting for market prices, the price paid for a kWh is partly linked to the price observed on the electricity spot market (wholesale spot market). Practically 40% to 50% of the price paid by an eligible end-user is now variable, 50% to 60% of the price being stable because it corresponds to the fee paid for access to the transmission and distribution networks. And this fee remains fixed by the regulatory commission. The variable part of the kWh price varies each hour and each day in relation to the conditions observed on the wholesale spot market. The various spot markets are well connected now in Europe, at least when transmission interconnections are not saturated. This is the case with France, Germany, Belgium and the Netherlands. We observe today that the German electricity spot market is the leader for this area (see graph 1 showing a very good correlation between the German and the French electricity spot market prices).

The economic logic based on the “merit order” rule requires the market price to be equal each hour to the variable cost of the kWh produced by the “marginal power station” allowing equilibrium in the market. During a large part of the year, this “marginal power station” is a coal or gas power station, usually a German one. The price of natural gas is dependent on the price of oil in Europe because a large proportion of natural gas (more than 50%) is imported through long term contracts from Russia, Norway, Algeria etc... Long term contracts include escalation clauses between oil product prices and gas prices. Hence high price for oil means high prices for natural gas and indirectly high prices for electricity.

Electricity liberalization is not directly responsible for this situation but the development of interconnections, which is a consequence of such a process, may be considered as partly responsible for it. Moreover the energy liberalization was, at the beginning, implemented in a context of low prices for oil, gas and coal. Today the price of oil is high. It is the main reason why the market price of electricity is much higher than the former regulated price of kWh, even in countries such as France where the nuclear share of electricity generation is very high (78% of electricity generation is from nuclear energy in France). In the past, regulated French tariffs were fixed according to the cost of a nuclear kWh because nuclear power stations were the “marginal power station” during a large part of the year. France is now a large exporter of electricity during off-peak periods but it has become a net importing country during peak periods and increasingly during midway periods. Consequently, in the European wholesale electricity market, and in a context of large interconnections between France and Germany, the French nuclear power stations are no longer the “marginal power plants”, except when electricity demand is very low. The price of the European kWh is now largely dependent on the cost of gas turbine power stations, generally German ones. If nuclear generation was higher in Europe, in Germany at least, nuclear power stations could be the “marginal supplier” during a larger part of the year. But, because of a lack of investment in nuclear energy, gas and coal power stations have become “kWh price makers”. Consequently, the electricity price is now largely dependent on the oil price. Moreover, electricity companies operating a large proportion of nuclear power plants,

such as EDF in France, may now sell at a profitable price (the cost of a kWh generated by a gas turbine), the kWh produced by cheap nuclear power stations. The gap between these two prices may be considered as a “nuclear rent” and some people think that such a mark-up constitutes unjustified windfall profits.

The market price of the kWh paid by an end-user who has opted for eligibility is, since the beginning of 2004 in France for instance, higher than the regulated price, based on the nuclear cost, and eligible customers who have invoked eligibility in the past sometimes regret their decision today (see graph 2). The possibility of reverting to former regulated tariffs being refused by the Regulatory Commission, these customers consider that liberalization is a failure. In principle, regulated tariffs will be forbidden from the year 2010 in Europe, except of course, fees for network access. The French parliament has nevertheless ceded to consumer lobby groups and voted a law in December 2006 which establishes an “optional return tariff” valid for two years (TaRTAM), and accessible to professional consumers who lodge a request before the end of June 2007. This new regulated tariff is temporary and higher than the previous regulated tariff (by approximately 23%) but it remains below the spot market price (see graph 2). The coexistence of these two prices (market price and return tariff) is not sustainable in the long run as it distorts competition. The European Commission considers that this regulated return tariff and in a more general manner all regulated tariffs for the end consumer are contrary to the spirit of the Treaty of Rome founded on price freedom and it has recently begun legal proceedings against France (but also against other countries such as Spain) to demand the removal of these tariffs. For Brussels, these regulated prices are too low, as they are calculated on the operating costs of power stations that are already paid off, and they do not reflect the kWh production costs of a power station allowing for the renewal of the electricity production park in Europe (this replacement cost corresponds to the long run marginal cost). kWh prices which are too low will not justify new investment and for this reason Europe is running the risk of being in a situation of under capacity as far as electricity production is concerned in the near future. Optimists think however that this under capacity will increase the kWh price in the spot market which will encourage operators to invest in new power stations. In the case of over investment, prices will once again fall and we will see a “boom and bust” type scenario. The consequence would be extreme market price volatility. That is, actually, what we are seeing today. Electricity prices on the spot market are very sensitive to climatic issues, to industrial activity, to surges in domestic consumption and to changes in the prices of Co2 permits. The price of a tonne of Co2 has fluctuated strongly on European markets (going from 30 Euros to less than 1 Euro in a few months, before recovering to 15 Euros for forwards transactions) and that had repercussions on the price of the thermal kWh. The fact that electricity cannot be stored largely explains the spot market volatility. A “let the market do the job” approach implies acceptance of very high spot prices of electricity at peak times, particularly for a commodity with low demand and supply price-elasticities. To this is added the fact that electricity producers can have an interest in adopting strategic behaviours, aiming essentially at withholding market capacity in order to make the equilibrium price increase (see Green 2004). For the moment, Brussels is only suspicious and has not managed to prove that this has actually happened. It must be said that operators run the risk of heavy penalties should this be proven.

III. Is the increasing interconnection of electricity markets a surplus transfer factor between economic agents?

The convergence of the electricity spot prices, due largely to the development of interconnection capacities, is perceived as a drawback by consumers who are afraid of losing

a cost-based comparative advantage. Thanks to nuclear energy, the French consumer who benefited from low electricity prices has now to pay higher prices due to the implementation of a single market (at least for consumers opting for eligibility, but it will be the case for everybody in the near future when regulated prices are abolished). A simple example illustrates transfers of surplus between consumers and suppliers when interconnections are implemented. In terms of surplus some consumers are winners and others are losers; it is the same for producers.

Two countries, Home (H) and Abroad (A), face the same electricity demand $D = 100$ MWh for a given period t (i.e. instantaneous demand at the given hour). Country H benefits from a comparative advantage in terms of generation cost compared with country A, due to a large proportion of nuclear power stations. The demand function is $p = aQ$ in country H and $p = bQ$ in country A with $a = 1/4$ and $b = 1/2$. The equilibrium price p is thus 25 euros per MWh in country H and 50 euros per MWh in country A. In the absence of any cross-border exchanges, the consumers have to pay 2500 euros to the national electricity producers in country H whereas those of country A have to pay 5000 euros for an identical quantity.

Let us assume now that there is a unique competitive market uniting the two countries, without any bottlenecks in the interconnections. At price p , the Home and abroad producers supplies are $4p$ and $2p$ respectively. The total supply is thus $6p$ for a total demand of 200 MWh, which gives us an equilibrium price $p = 33.33$ euros per MWh. At that price, the supplies of the Home and Abroad producers are 133.33 MWh and 66.66 MWh respectively, a quantity of 33.33 MWh being exported from Home country to country A.

Let us assume that the interconnection between the two countries is now limited to 10 MWh (per hour) i.e. 10% of the total demand of a country. This 10% figure was the target of the European Commission for the year 2005 and we observe that many European countries have benefited from a lower rate until now. The Home producers will now supply 110 MWh, the foreign ones only 90 MWh and 10 MWh will be exported from country H to country A. In country H the equilibrium price will be $p = 110/4 = 27.5$ euros per MWh whereas in country A it will be $p = 90/2 = 45$ euros per MWh. The Home exporters will obtain windfall over-profits equal to 175 (10 MWh sold at 450 euros in country A instead of 275 in country H).

We observe that in terms of surplus the interconnection between country H and country A is a drawback for home consumers and foreign producers but constitutes an advantage for foreign consumers and home producers (see table 1). If we consider the total surplus variation at a national level (adding consumer's and producer's surplus variations) we may observe that country H benefits from a net advantage, the positive surplus variation of home producers being higher than the negative surplus variation of home consumers. On the contrary, the foreign country A experiences net negative surplus variation, the negative surplus variation of foreign producers being higher than the positive surplus variation of foreign consumers. From a collective point of view, the two countries considered together, earnings of the export country compensate exactly for losses of the import country and the total surplus variation is nil. Surplus transfers are the consequence of the implementation of a single market.

We can consider that the increasing interconnection between the German and French spot electricity markets allows the German consumer to make the most of lower prices during off-peak hours when the French price is the leader price and France is a net exporter of electricity. However, faced with that increased interconnection, the French consumer who has signed a market price contract is forced to pay for his electricity at a higher price during full hours and peak hours, when the German price is the leader price in the market and France

becomes a net importer of electricity. This is even truer given that the weight of the German spot market is markedly stronger than the French spot market. In 2005, 86 TWh were exchanged on the German spot market compared with only 25 TWh on the French spot market. The vertical integration of production and supply operations does not encourage incumbent operators such as EDF to intervene in the wholesale markets, the day-ahead market in particular. This explains the low liquidity of these markets. Let us remember that in these two countries, the majority of exchanges on the wholesale market are over the counter transactions (OTC). The day-ahead market only represents a very small proportion of the wholesale market. As for the interconnection capacities, they are attributed today through an auction system and are no longer subject to the “first come, first served” rule. Thus the long term export contracts between EDF and its foreign partners are no longer given the priority. The interconnection capacity between France and Germany is, besides, rarely saturated, partly because exporters do not anticipate the spot price differential between the two markets. Transmission auctions take place before the spot market auctions. Thus when trading at the interconnector auctions, electricity operators do not know the outcome of the spot market. Theoretically with rational expectations the price for the transmission capacity has to be equal to the differences between the two spot market prices (Home and abroad). But due to uncertainty and wrong expectations this price will differ from the equilibrium price. Poor anticipation of the German and French spot market prices can lead French producers to hold insufficient interconnection capacities so that at equilibrium, the German price is higher than the sum of the French price and the interconnection toll.

IV. Is the market power of producers a threat to competition?

The interconnection of the European electricity markets originated in the 1950s with the creation of the Electricity Producer’s and Transporter’s Coordination Union (UCPTE which became UCTE since production liberalization), as a result of security concerns and largely to avoid “black-outs” thanks to mutual help between countries. This interconnection is today perceived above all as a means to promote exchanges, including competition. This interconnection theoretically reduces market power of incumbent operators. This is especially true in countries where the weight of incumbent operators was very high from the start. Table 2 gives the values of the HHI Index (Hirschmann-Herfindhal Index) in some European countries before and after the consideration of potential interconnection levels. The HHI Index is obtained by adding the square of the market shares of the various operators present in the market. An HHI close to 10000 is characteristic of a monopolistic market, while an HHI close to 1000 corresponds to a competitive market. The HHI is calculated here on the basis of installed electric power, not on the basis of quantities of electricity sold in each country. We can hypothesize that the volume of interconnection is totally consumed and this takes place as an advantage to competitors to the national operators. We can see that the impact of the interconnections is real but remains rather modest. Thus the value of the HHI falls from 8592 to 6505 in France before and after interconnection. The reduction is hardly more noticeable in Belgium, a country that is strongly interconnected since the HHI value falls from 8307 to 5332. In Italy, the HHI value falls from 4150 to 3544 before and after interconnection. In Spain, the HHI reduction is modest as the interconnection rate with the rest of Europe is only slight, passing from 2790 to 1945. In Germany, where the interconnection rate is similar to France’s, (see Table 3) the HHI value, which was weak before interconnection (1914), sees a slight reduction to 1160 once interconnections have been accounted for. Only the UK seems unaffected by interconnection, and it must be stated that the HHI value is from the very start quite low (1068) as the structure of the production park is segmented and spread over several operators. The interconnection rate is also one of Europe’s weakest (only 3% of the installed

power in the country). At the moment, national regulators and the European Commission are calculating the HHI value in each member country. In the long run these interconnections will be developed further and there will be a true single European electricity market and the HHI calculation will be able to be made for the European Union itself as the relevant market.

Table 4 presents the characteristics of the main European electricity producers. Most of these producers are present in several European Union countries thanks to acquisitions through more or less friendly takeover bids. Nine operators represent between themselves 83% of electricity sales in the Europe of fifteen nations, which is far from negligible. Several observations, which would need to be researched further in order to be considered as final results, can be made from this table. It is here sometimes a question more of intuition than of statistically robust results, which would need to be confirmed through an econometric approach.

1. In countries where the proportion of electricity originating from thermal energy is low, which is the case in France, but also partly in Spain, the kWh price is lower than in countries like Italy or Germany where the proportion of classic thermal energy is high. Here we are considering the before tax price paid by the final consumer in the domestic sector (including transmission and distribution network access cost). It is a question of regulated prices determined by governments, or with government approval in countries where such prices still exist (France, Belgium, Spain) or of the average price weighted index paid by a domestic client in other countries. This is because the regulated kWh price is largely dependent in France on the cost of nuclear power plants and in Spain on the cost of hydraulic stations. Network access tolls are not very different from one country to another and the kWh is not sold below its marginal cost as that would be considered as government aid by Brussels and is therefore theoretically forbidden. The UK is an exception: despite the heavy reliance on classic thermal production (Gas and coal power stations), the kWh price remains low. This is explained by the fact that the fuels used in these thermal stations are produced in the country and are not imported as this is the case in Italy and Germany. Another reason is undoubtedly because of the competition between operators which is more dynamic than in other European countries. In Italy, the share of gas and oil-fuel thermal production is very high (73% of the installed capacity for Enel, representative of approximately half the market). The before tax price per kWh paid by a domestic consumer who has not taken advantage of eligibility is approximately 15.5 Euro cents compared with 9 Euro cents in France which is a differential of approximately 72%.

2. The market share of the incumbent operator is particularly high in France (84% for EDF) and in Belgium (75%). It is lower than 50% in the other countries and is noticeably lower in the UK where the market is relatively diversified. These figures obviously corroborate the HHI values previously calculated as far as the installed production capacity of various operators is concerned (estimated in GW). It is worth noting that the calculation of HHI in market share terms on a European scale (based on the data in table 4) would give a figure equal to 1434, which is quite weak. But the significance of this figure remains limited given that the transnational interconnections are not sufficient to ensure real competition across the whole of the European market. We could think that in a country where the market share of the dominant producer is high, the market power would also be dominant giving a higher margin. Therefore, in the case of EDF, its margin will be high as the electricity production cost is low thanks to the nuclear sector, while the kWh sales price increases because of the interconnections with Germany which encourages the sales price to come in line with the kWh produced in German thermal power stations over a large part of the year. If we calculate the mark-up rate by comparing the average sales price on the spot market with the production cost of the French marginal equipment or the regulated French price which

remains aligned with the marginal cost (nuclear in this case) we note that it is particularly high for EDF (59%). In other terms the association of a strong market power, of a power production park which is predominantly nuclear (or hydraulic) and of good interconnection with countries where classic thermal generation dominates allows EDF to rake in substantial profits. This is also the case in Belgium and to a lesser extent in Spain. On the other hand where there is strong competition (the UK) and/or a high kWh production cost (Germany), the mark-up rate observed is noticeably lower. This corroborates the results of the short exercise presented above: the interconnection is advantageous especially for exporters. We must note that there is a relationship between the HHI value and that of the mark-up mentioned here. In a COURNOT type competition regime (competition by quantity), the Lerner Index (which interprets the mark-up) increases with the HHI value since we have the following formula: $(p - \sum s_i c_i) / p = \text{HHI} / \epsilon$ where p represents the market sales price, c_i the operator i marginal cost, s_i the operator i market share and ϵ the elasticity price of the demand.

3. The mark-up rate calculated with turnover (earnings before interest, taxes, depreciation and amortization/turnover), and not in relation to production cost seems very variable from one firm to another. There are several reasons and it is difficult to pass preemptory judgments based on results from only one year. We note a high mark-up rate only for Vattenfall, Iberdrola and EDF, less for Enel and RWE and a particularly modest rate for 2005 for EON, Centrica and Suez. On the other hand there is a strong correlation between this mark-up rate and the investment rate of various operators, as table 4 shows, which is an intuitive result.

4. The process of mergers and acquisitions allowed some incumbent operators to reinforce their position in Europe. This is the case of EDF which repurchased London Electricity in the UK, EnBW in Germany and Edison in Italy. The German corporation EON took control of the British electricity producer Powergen and of the German gas producer Ruhrgas. Its direct competitor RWE repurchased NPower (ex Innogy, ex National Power) in the UK and Thyssengas in Germany. The Spanish company Iberdrola has just taken control of the British electricity producer Scottish Power and the Italian Enel is on the way to take control of the Spanish Endesa, after a counteroffer following EON's takeover bid over Endesa. The merger between Suez and Gaz de France is still a project but it shows that all electricity producers are attempting to invest in the gas industry. Two main reasons may be given: an increasing percentage of electricity will be generated from natural gas in the future. At present, in the European competitive environment, operators must be able to provide a dual offer including both gas and electricity to eligible customers (bundling practice) in order to improve customer confidence.

That capital concentration raises a certain number of questions insofar as according to some observers, there is a risk of the emergence of an electro-gas oligopoly which will control the European market and be likely to set monopoly prices. Obviously, under high competitive market conditions, capital concentration cannot be avoided: the most competitive operators take over the less competitive ones. According to Contestable Markets Theory (see Hogan, 2002), the problem is not dominant position but rather taking advantage of it. Competition is possible even with a small number of actors so long as they do not form market sharing agreements or set common prices. According to the European Commission, these mergers and acquisitions should be at the origin of the emergence of competitive "European leaders" and able to be more resistant to worldwide competition. Brussels expects that new mergers should emerge, as observed in other industrial sectors (telecommunications, aviation, etc.). This will involve the harmonisation of supply conditions for European consumers, in particular industrial ones. These consumers will be able to sign supply contracts with an operator present in several countries, in order to supply their subsidiaries located in various European

countries. On the other hand, Brussels is opposed to mergers between operators belonging to the same country because reducing the market power of “national leaders” implies the setting up of foreign operators. Furthermore, in case of mergers, Brussels and regulators may require capacity selling by way of compensation (“Virtual Power Plants” for electricity and “gas release” for gas; see Moss, 2005). This concentration process is also observable in the UK, where the liberalization of the electricity sector has been carried out for nearly 10 years. After market opening (1999) in the UK, there were 26 electricity suppliers; in 2007, there were only 6. These “big six” are in order of size and in decreasing order: Centrica (British Gas), Powergen (EON), Scottish and Southern Electric, NPower (RWE), Scottish Power (Iberdrola) and EDF Energy. The intense competition at the beginning has been replaced by a more concentrated market structure, starting to get some observers worried (see Wright, 2007).

In its communication of 10 January 2007, the European Commission considers that the weight of incumbent operators is still too high in most European countries with regards to market shares and production capacities, except the UK (see European Commission, 2007 and London Economics Report, 2007). Still according to the European Commission, interconnections are also insufficient to stimulate effective competition. Moreover, some operators have engaged in non-competitive practices such as collusion, predation and foreclosure (see Newbery, 1997 and Smeers, 2004).

1. Both explicit and tacit collusion consist in practising common prices higher than marginal cost and sharing the rent which follows. For example, collusion may take the form of concerted capacity withholding strategy on the electricity spot market in order to reduce the available supply as well as strategic arrangements on geographical division of markets. Brussels has recently accused EON (Ruhrgas) and GDF to be using non-competitive practices in the gas market, both of them avoiding to compete with the other in its original market... Strategic arrangements are not necessarily explicit, particularly on the spot markets where the number of players remains low. We are in the presence of repeated games and each player finally anticipates the strategy of its competitors. As demonstrated by Borenstein and Alii (2002) and Crampes (2002), there is an incentive for producers to choose a capacity withdrawal strategy in order to move from a low demand situation towards a high demand situation. We consider two producers, a and b, holding a production capacity equal to K_a and K_b respectively such as $K_a < K_b$. When the demand in the spot market is lower than the smaller capacity ($D < K_a$), the equilibrium price is equal to the smaller auction made on the market. This is a Bertrand competition that the two operators have an interest to avoid. When the demand is such that $K_a < D < K_b$, the price is equal to the auction made by the bigger producer (b). When the demand is higher than the bigger capacity ($D > K_b$) but remains lower than the overall available capacity ($D < K_a + K_b$), the equilibrium price is equal to the bigger auction made on the market. When the demand is higher than the overall available capacity, we observe a situation of market failure and the market price is no longer defined or it becomes infinite. The two operators are able to anticipate these situations and will play the game by adapting their supply in the market, which may lead to artificially high prices in some cases.

2. Predation consists in practising market prices which are lower than marginal costs, which involves dumping in some segments of the market in order to avoid the entry of competitors, even if it means practising higher prices on other segments of the market in order to compensate for the loss of earnings. According to Brussels, regulated prices constitute a form of dumping insofar as they are not able to secure a return on new electricity capacity investments.

3. Foreclosure consists in benefiting from a privileged position on some segments of the energy chain likely to restrict the entry of potential competitors. This form of barrier to

entry arises from a situation where one operator controls an essential facility, for example a transmission network, whose access is essential for all operators, and takes advantage of its position to distort available capacities or to make access possible while fixing prohibitive access charges. This is the reason why since 2002 the European Commission has required regulated rather than negotiated third party access charges to transmission and distribution networks; an independent commission is in charge of fixing tariffs according to “objective, clear and non discriminatory” criteria. It is also the reason why Brussels requires that “use it or lose it” rule be systematically applied, unused transmission and distribution capacities being put back at the disposal of the market. Finally, this may explain why Brussels insistently requires that the network ownership unbundling becomes the rule in Europe, insofar as investment decisions on networks would be made by favouring the interest of the incumbent operator rather than the market interest. This ownership unbundling requirement is questioned by several governments and some producers which have transmission and distribution subsidiaries as in France, in Belgium and in Germany. That opposition of operators is due to the fact that regulated activities remain very profitable, insofar as the Regulatory Commission attempts to fix network access charges which are incentives for operators to invest. For example, the weight of transmission and distribution activities accounted for 8% of the EDF sales in 2005 but 12% of realized profits (in percentage of the earnings before interest, taxes, depreciation and amortization).

As a general rule, the European Commission considers that the number of consumers which have benefited from eligibility is too low (about 15% on average, excepted in the UK where this percentage exceeds 50%). There is no reason for an end user to take the risk of signing a supply contract providing for a price of kWh indexed on the spot market price, in a country where regulated prices remain authorized and are much lower than market price. It could be the case in the presence of a supplier being able to guarantee a stable and low price, which seems to be difficult. In the UK, all consumers are eligible since 1999. In 2006, about 4 million households out of 26 million have changed their electricity or gas supplier; in accumulated values since 1999, there is at least one in two British people who would have used at least once this eligibility (see Percebois and Wright, 2001).

The European Commission expects new investments to be made in electricity production and transmission insofar as it is likely to reduce price in the future, all the more whether it is a question of nuclear plants and transnational high tension lines. However, as it is known, high electricity prices are not necessarily a signal of energy shortage and high costs but they may be explained by the presence of a market power. As a result, given that information, some operators, rightly or wrongly, may have no incentive to invest in new equipment and in case the European Commission has the same opinion, it may take sanctions rather than promoting operator investments. Then it is necessary to precisely analyze the factors at the origin of price increase before making regulatory decisions; moreover, regulators are in a position of inferiority due to information asymmetry regarding capacities really available all the time.

V Conclusion

Liberalization of the electricity sector in Europe is nowadays accompanied by two trends which may appear the opposite of what was expected: an increase in price paid by the end consumer, on the one hand, and a reinforcement of the incumbent operators’ market power, by means of mergers and acquisitions just about anywhere in Europe, on the other

hand. Electricity price increases are widely due to the fact that the price of fossil fuels serving to produce electricity (oil, gas, coal) has also strongly increased. The weight of traditional thermal power is still very high in Europe and operators owning such power plants must at present take into account the acquisition cost of CO₂ permits. In France, where the electricity generation park is based essentially on nuclear and/or hydropower, electricity price increases firstly arise from the strengthening of transnational interconnections which means that the French price depends increasingly on the German price observed on wholesale electricity markets. Natural gas-powered generating plants represent the marginal equipment during the major part of the year; and the generated kWh cost is calculated based on the market leader price. As a result, due to that interdependence between European electricity markets, some consumers bear a net loss of surplus. Electricity price convergence between countries is not necessarily profitable for all consumers. This appears to be a logical fact and may be observed in many areas in the context of globalization. Such increases in electricity prices do not have only disadvantages: it allows operators, such as EDF which have an electricity generation park based essentially on nuclear and/or hydropower, to benefit from substantial rents. It also justifies programmes promoting energy savings and above all generates incentives for operators to invest in new generation facilities. This is the necessary condition for Europe not to be in electricity under-capacity in the future, which would involve more and more frequent “black-outs”.

We should also wonder whether such a price increase is not partly the consequence of the strengthening of the market power of some operators. Mergers and acquisitions are consistent with the development of a big single market in Europe: nowadays, the sphere of influence of firms must be not only the national but rather the European market; it enables them to benefit from economies of scale and harmonized supply conditions for all European customers. Moreover, the development of the European single market allows electricity producers to protect against hostile takeover bids (size is an important factor here). Capital concentration is not incompatible in itself with the persistence of a certain competition in the market. But the important point for the market is to be contestable, in accordance with the Chicago School, and operators have to not overuse their dominant position (see Newbery 1997). In that context, the European Commission and national regulatory commissions must be vigilant and ensure that operators do not adopt strategic behaviours aiming at increasing prices. At the moment, Brussels only suspects but does not have proof of such practices. In order to avoid them, the European Commission has required ownership unbundling and has attempted to reduce the market share of incumbent operators in their country of origin. However, it must be watchful not to weaken the position of the European operators against foreign operators attempting to enter the European market, thanks to liberal market opening laws, whereas they are themselves public monopolies in their country of origin (cf. Gazprom and Sonatrach which attempt to distribute gas or to invest in natural gas-fired power plants in Europe).

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Tables and graphs

Table 1: Impact of electricity interconnections on the consumer's surplus

Indicators	No interconnection (1)	Single market interconnection and no congestion (2)	Limited interconnection (10%) (3)
Home consumers' bill	$100 \times 25 = 2500$	$100 \times 33.33 = 3333$	$100 \times 27.5 = 2750$
Foreign consumers' bill	$100 \times 50 = 5000$	$100 \times 33.33 = 3333$	$100 \times 45 = 4500$
Surplus variation of Home consumers (2)/(1) and (3)/(1)	-	-833	-250
Surplus variation of Foreign consumers (2)/(1) and (3)/(1)	-	+1667	+500
Home producers' revenue	2500	3333 (domestic) + 1111 (exports) = 4444	2750 (domestic) + 450 (exports) = 3200
Foreign producers' revenue	5000	2222	4050
Surplus variation of Home producers (2)/(1) and (3)/(1)	-	+1944	+700
Surplus variation of Foreign producers (2)/(1) and (3)/(1)	-	-2778	-950
TOTAL variation of surplus (national level) (2)/(1) and (3)/(1)	-	Home +1111 Foreign -1111	Home +450 Foreign -450
TOTAL variation of collective surplus	-	0	0

Source: the author

Table 2: Impact of interconnections on HHI indicators

Indicators	France	Belgium	Germany	Italy	Spain	U.K.
Average HHI without interconnectors ⁽¹⁾	8592	8307	1914	4150	2790	1068
Average HHI with interconnectors	6505	5332	1160	3544	1945	1004

Source: European Commission. Energy Sector Inquiry (second phase) p315 (except for Italy: author's estimates)

(1) HHI indicator is based on installed capacity. These results are based on the assumption that all the available transmission capacity would be allocated to competitors and used.

Table 3: Interconnection rate of various European countries
(Interconnection capacity in % of installed capacity of the country for the year 2005)

U.K.	3%
Spain	4%
Italy	8%
France	12%
Germany	13%
Belgium	34%

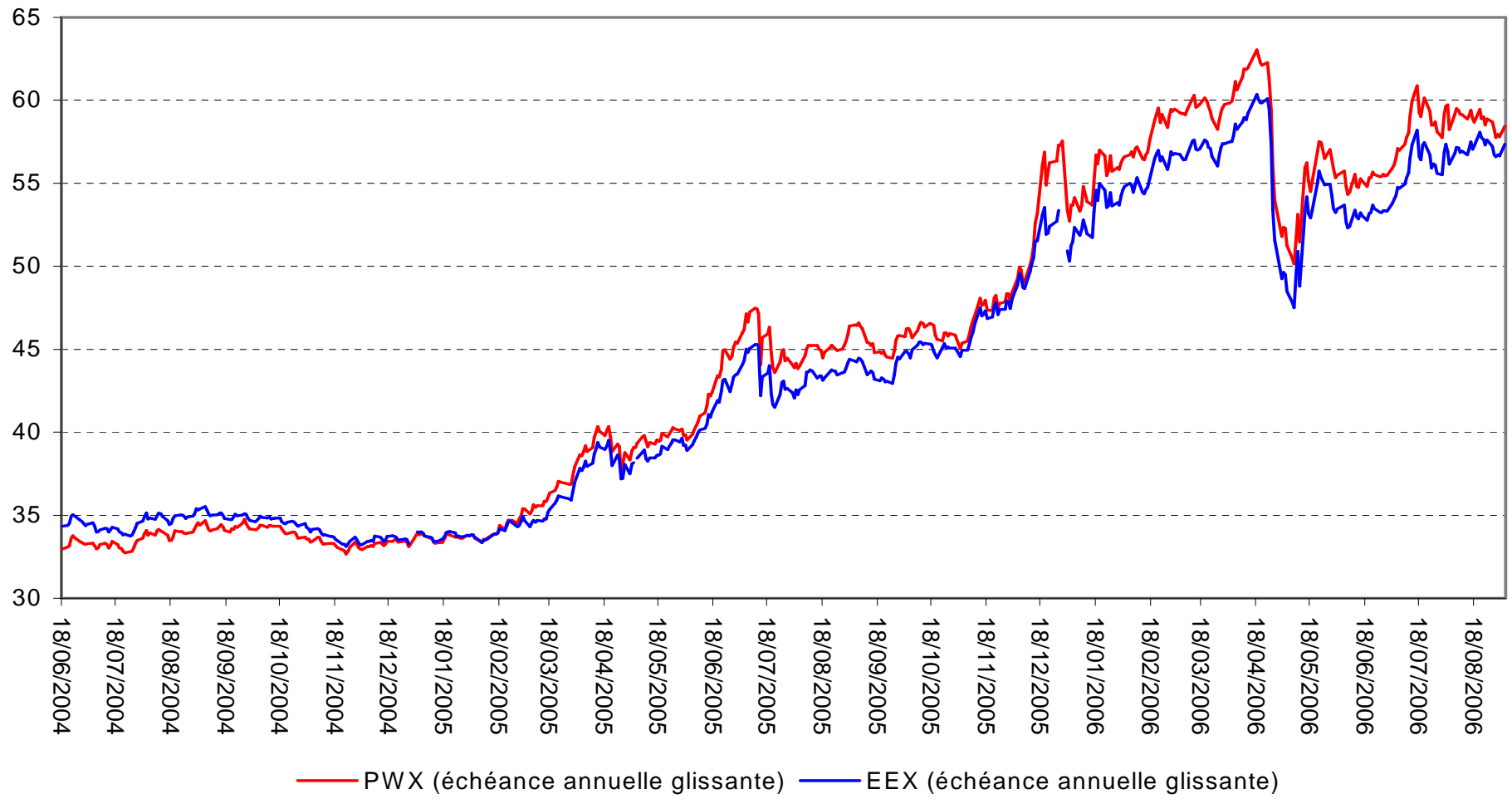
Source: Cap Gemini, 2006

Table 4: The main electricity companies in Europe

Indicators (consolidated activities)	EDF France	SUEZ Belgium	EON Germany	RWE Germany	ENEL Italy	ENDESA Spain	IBERDROLA Spain	VATTENFALL Sweden	CENTRICA U.K.
Sales (2006) (billion euros) ⁽¹⁾	59	45	69	42	39	21	12	15	29
Installed capacity GW (2005)	131	48	54	43	46	39	38	32	3.5
- thermal	31%	60%	68%	74%	73%	67%	35%	41%	100%
- nuclear	50%	12%	21%	15%	0%	10%	14%	23%	0%
- hydro and wind ⁽²⁾	19%	28%	11%	11%	27%	23%	51%	36%	0%
Market share (%) (country of origin) ⁽³⁾	84%	75%	38%	30%	43%	44%	31%	23%	10%
Market share (%) in Europe (15) ⁽⁴⁾	24%	5%	14%	11%	10%	6%	4%	6%	2%
Price of kWh for domestic sector (taxes excluded; regulated or average tariff in euros/MWh) ⁽⁵⁾	90	122	141	141	155	95	95	n.a.	110
Mark-up (spot price - marginal cost in %) ⁽⁶⁾	59%	28%	15%	15%	n.a.	28%	28%	n.a.	13%
Mark-up (in % sales) (2005) ⁽⁷⁾	25.5%	13.2%	16.2%	20.2%	22.7%	n.a.	28.3%	28.8%	14.6%
Investment rates (% sales) (2005) ⁽⁸⁾	10.3%	6.4%	5.8%		10.1%		9.5%	9.9%	5.6%
Main subsidiaries ⁽⁹⁾	- London Electricity - EnBW - Edison	GDF (?)	- Powergen - Ruhrgas	- NPower - Thyssengas	Endesa (?)	-	Scottish Power	-	-

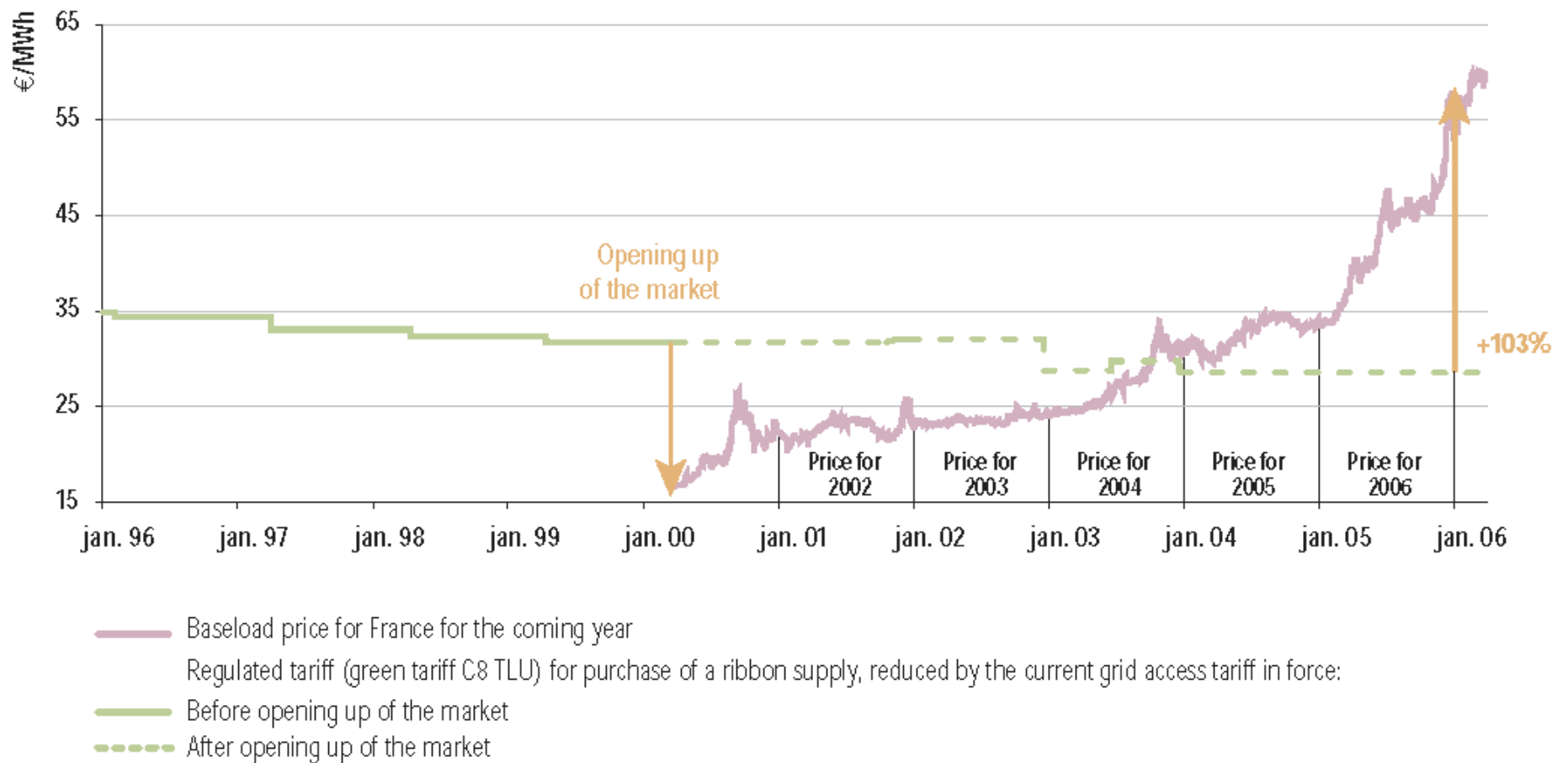
Source: author

- (1) Source: Corporate annual reports. All activities of groups are taken into account here
- (2) (3) and (4) Source: Corporate annual reports and EUROSTAF Report 2006
- (5) Regulated or average tariffs observed in July 2006 for households consuming 3500 kWh per year in euros/MWh. Third party access fees are included but taxes are excluded. With taxes, the figures are 119 for France, 145 for Belgium, 187 for Germany, 211 for Italy, 116 for Spain and 116 for the U.K. Regulated tariffs for France, Belgium and Spain. For Germany, Sweden and the U.K., there are weighted average tariffs estimates. Source: EUROSTAF (2006)
- (6) Price-cost mark up including carbon costs; figures based on load weighted average prices and costs; 2005 figures except 2003 for Belgium. Source: London Economics Report “Structure and Performance of Six European Wholesale Electricity Markets”, February 2007 (Parts 2, 3, 4)
- (7) Financial mark-up in proportion of annual sales. Source: EUROSTAF Report (Les Echos) and Cap Gemini 2006 (p62)
- (8) Source: EUROSTAF (Les Echos) figures and annual reports
- (9) Source: Corporate annual reports



Graph 1: French and German electricity spot prices

(source: Powernext, 2006)



Graph 2: Regulated and spot electricity prices in France

(source: CRE, april 2006)