# Mid-term Perspectives for the Western/Central European Electricity Market

By Reinhard Haas, Christian Redl and Hans Auer*

**Introduction**

The restructuring process of electricity markets in Europe started in the late 1990s and is still going on. This process was triggered by the Directive 96/92/EC of the European Parliament and of the Council concerning common rules for the internal market in electricity (EC, 1997).

This article will analyse the recent developments in the liberalised Western and Central European electricity markets and discuss future developments with respect to system adequacy, reliability and security of supply.

**The European Electricity Market(s)**

A major objective of liberalising the European electricity supply industry was and still is the creation of one common market. Yet, currently this area consists of several sub-markets separated by partly insufficient transmission capacity and differences in access conditions to the grid. Another major obstacle for a joint competitive European market is the low number of competitors resulting in a general lack of competition in virtually all local and national wholesale as well as retail electricity markets and also because barriers to entry and incentives to collude remain too high. Additionally, increasing horizontal integration with natural gas supply is observed. Hence, the paramount objective is still to construct competitive markets while – at the same time – ensuring a reasonable level of grid reliability and supply adequacy (Haas et al., 2006).

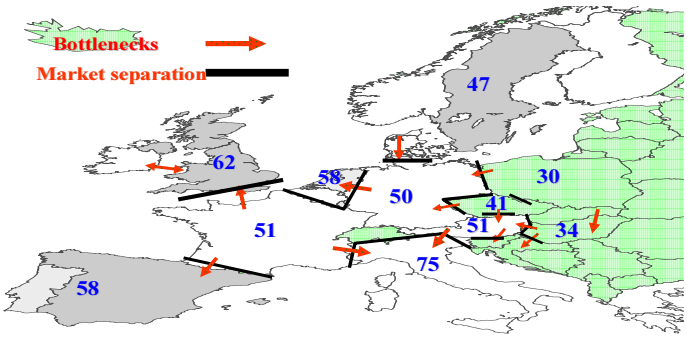


*Figure 1*
*Average Wholesale Electricity Prices in EUR/MWh and Transmission Grid Bottlenecks in Europe in 2006.*
Source: Power Exchanges

Figure 1 depicts the average wholesale prices in these different sub-markets in 2006 due to cross-border transmission bottlenecks or other exchange barriers (e.g., long-term contracts).

The most important sub-market is the Western European market comprising Austria (AT), France (FR), Germany (DE), and Switzerland (CH).[1] As these countries are not separated by permanent cross-border transmission capacity bottlenecks, electricity can be traded virtually without limitations between these countries. This, in turn, causes prices to converge due to arbitrage reasons (see Figure 2). The European Energy Exchange (EEX), located in Leipzig, is the leading exchange in this sub market. Hence, when modelling EEX prices the whole EU-4 electricity sub market consisting of the mentioned countries has to be considered.[2] Additionally, Figure 2 shows monthly spot market prices for other Continental European countries. Historically, Dutch power prices (NL) are on the upper end but due to the mentioned market coupling with France and Belgium (see Footnote 1) prices converged in 2007. On the other side, prices in Eastern Europe (especially Poland – PL) form the lower end.[3]

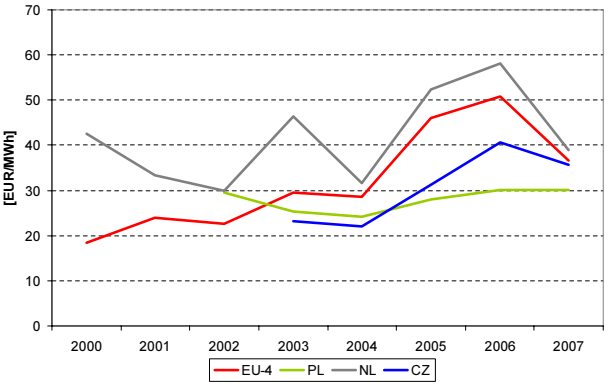


*Figure 2*
*Development of Wholesale Spot Market Prices in Western and Central Europe.*
Source: Power Exchanges

To assess the performance of a liberalised electricity market it is of important interest how electricity prices have developed after restructuring. Therefore, a major question for further investigations is whether these prices are a competitive outcome. That is to say, whether these prices do reflect the marginal costs of the generation set or whether they are increased by some kind of market power.

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See footnotes at end of text.

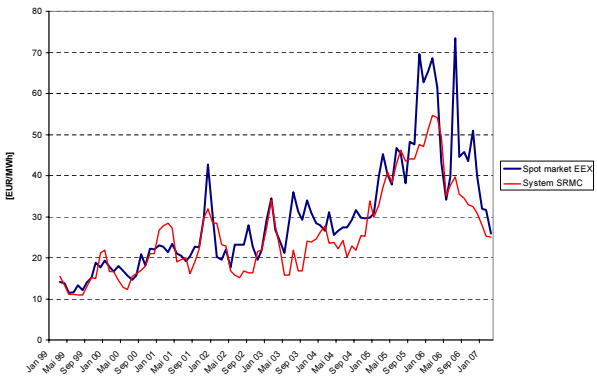


*Figure 3*
*Evolution of Electricity Prices and System Marginal Costs in the Regional Market AT+CH+DE+FR from 1999-2007.*
Source: EEX, BAFA, UCTE, own calculations

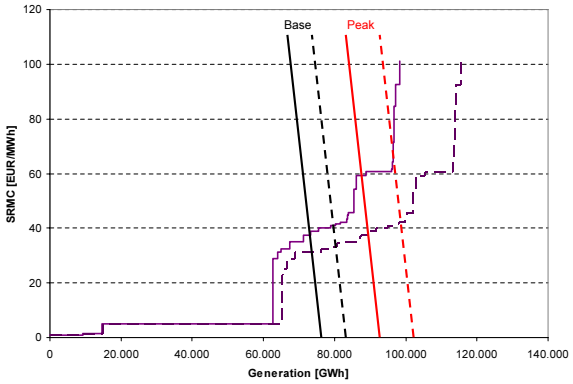


*Figure 4*
*Merit Order Curve for the EU-4 Electricity Market (AT+CH+DE+FR, solid lines) and for the EU-4+2 Market (AT+CH+DE+FR+CZ+PL, dashed lines) for May 2006 and Corresponding Electricity Demand.*
Source: UCTE, BAFA, EEX, own calculations

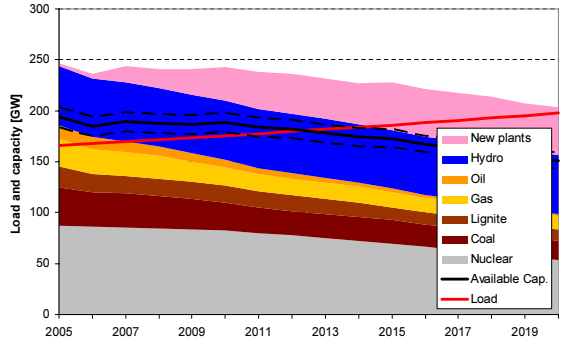


*Figure 5*
*Trends of Generation Capacity and Load in the EU-4 Market.*
Source: Platts, national statistics, own calculations

**The "Old" Western European EU-4 Power Market**

In competitive markets, marginal generation costs are relevant for price formation. Due to the dominance of fossil fuelled power plants in the EU-4 power market, primary energy prices and $CO_2$ emission allowance prices crucially determine the development of power prices. Besides parameters directly affecting generation costs of thermal plants, also production of infra-marginal technologies (e.g., hydro run-of river and nuclear power) indirectly influences price formation. For instance, in years of increased hydro availability run-of river plants can increase their production. Therefore, ceteris paribus, increased hydro generation replaces conventional electricity in order to meet given electricity demand which corresponds to a shift of the merit order curve to the right. As a result wholesale prices decrease when hydro generation increases.

Figure 3 shows the comparison of realised EEX spot market prices and modelled system marginal costs. The model shows a close correlation of prices and costs from 1999 to 2001 with a structural break in December 2001. Prices and costs diverge between June and October 2002 and between June 2003 and November 2004. This mark-up suggests following interpretation. Müsgens (2004) argues in an analysis of the German wholesale market: "The difference between marginal costs and prices is attributed to market power. …there is strong evidence of market power in the second period from September 2001 to June 2003". In late 2006 and early 2007 prices again significantly diverge from the competitive benchmark model.

Taking a closer look at electricity supply, one can identify a strong convexity of the merit order curve with a high slope of the supply curve when approaching system capacity limit. Figure 4 depicts the merit order curve of the EU-4 power market for May 2006. About 50% of total generation stems from power plants with low short run marginal costs. These comprise run-of river hydro power plants, "new" renewable plants which are subject to national support schemes and, finally, nuclear power plants.[4] Generation costs of fossil fuel power plants are much larger resulting in a huge jump in the merit order curve whereas the ranking of conventional thermal power plants changes depending on the prevailing fuel and $CO_2$ price level.

As in many electricity markets that have been liberalised, most European countries started liberalisation with significant excess capacities in generation – built up in the time of regulated area monopolies. Indeed, it was a common motivation and driver for introducing competition.

Yet, excess capacity in generation plays a core role in the restructuring process of an electricity supply industry. If utilities compete with excess capacity in generation – which also depends on transmission capacity - the price they receive for electricity will be equal to their short term marginal cost. Under perfect competition without remarkable excess capacities the price will not rise above the long-run marginal costs of new technologies. But if there is no competition or a too tight capacity the price can be substantially higher than both marginal costs especially when demand is inelastic to price.

Figure 5 depicts the currently looming developments of load and generation capacity.[5] In recent years spare capacity decreased continuously in the EU-4 sub-market (spare capacity = net capacity minus maximum load). In this context, variations and uncertainties in available capacities play a crucial role as indicated by the dashed black lines in Figure 5.

Currently, transmission constraints have a substantial impact on the separation of sub- markets in Continental Europe. Hence, another important prerequisite for a sufficiently wide market would be that there is sufficient transmission capacity to neighbouring regions, increasing the number of potentially competing generators. Figure 6 depicts the situation at cross-border transmission lines for the year 2006.

The effects of extending the EU-4 market by completely integrating the markets of the Czech Republic (CZ) and Poland (PL), both electricity exporting countries, will be analysed in the following. A precondition for this market extension in the short run is making more cross-border transmission lines available due to a reduction of long-term contracts.

However, apart from lacking incentives for TSOs to invest in new interconnector capacities, the sector inquiry by the European Commission notes that a significant proportion of existing cross-border lines is still allocated on the basis of long-term contracts (EC, 2007).[6]

For example, at the Austrian-Czech border 150 MW of interconnector capacity for 2007 were auctioned in winter 2006.[7] This relates to 40 to 60% (with respect to summer and winter values) of Net Transfer Capacities (NTC) for 2007 published by the European Transmission System Operators (ETSO). Results of this auction yielded a capacity price of 4 EUR/MWh reflecting market participants' expectations on wholesale price differences.

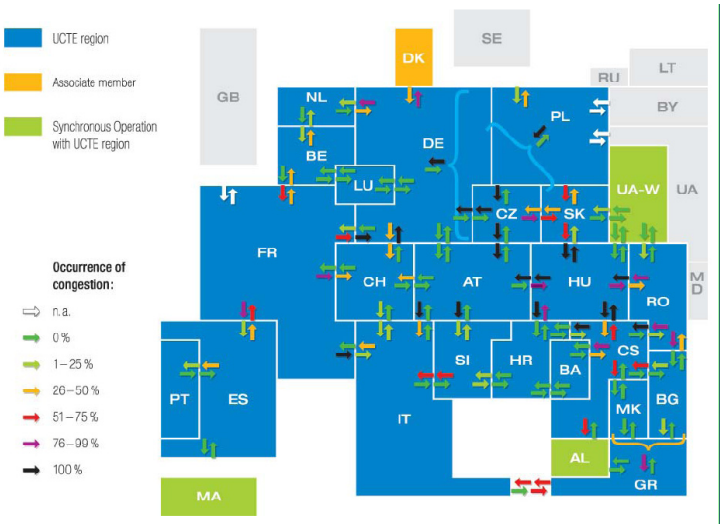


*Figure 6*
*Cross-border Congestion in Continental Europe for 2006.*
Source: UCTE (2007a)

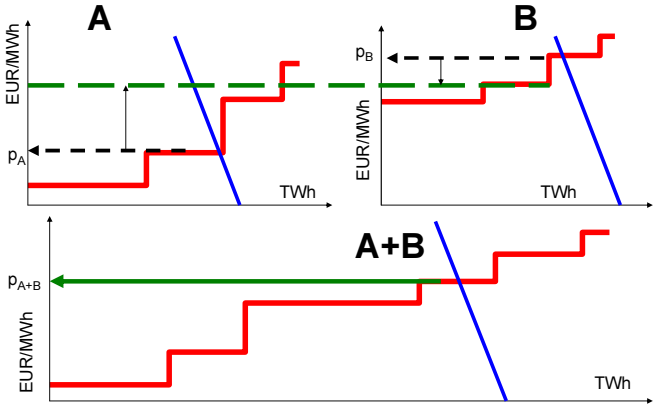


*Figure 7*
*Effects of Market Extension in an Electricity Market*

**"Market Coupling" of the Western and Central European Electricity Markets**

Figure 7 shows the theoretical result of market coupling of a low price market A (with "cheap" excess capacity, e.g., the Czech Republic) and a high price market B (with no "cheap" excess capacity, e.g., the EU-4 market). As a result prices increase in market A which goes along with an increase in producer surplus in market A whereas prices decrease in market B increasing consumer surplus in B. Of course, sufficient cross-border capacities must be made available at low costs.

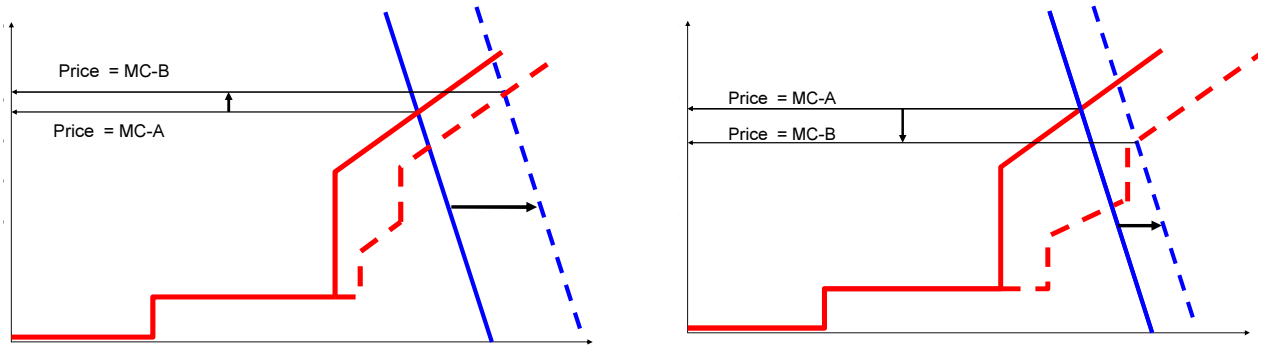


*Figure 8*
*Effects of Integrating a "Short" Country (left) and a "Long" Country (right) in an Existing Market*

Figure 8 depicts the effect of full market integration for two different cases. In the first case, adding a "short" country B – a typical import country with demand exceeding capacities – results in price increases for the extended market compared to the former single market A. On the other hand, when a


*Figure 9*
*Price Effect of a Hypothetical Market Coupling of the EU-4 and the Czech Republic and Poland.*
Source: EEX, BAFA, UCTE, national reports, own calculations

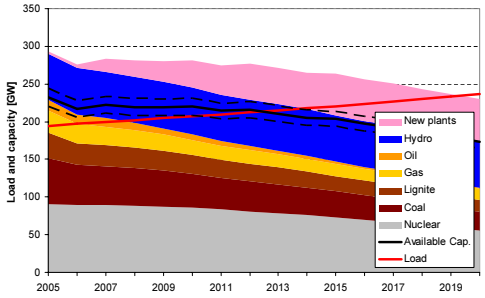


*Figure 10*
*Trends of Generation Capacity and Load in an Integrated Market Consisting of AT, CH, DE, FR, CZ and PL.*
Source: UCTE, Platts, national statistics, own calculations

"long" country B – where demand is less than installed capacities – is added prices decrease for the extended market compared to the single market A.

Finally, Figure 4 also shows the effects on supply when the Czech Republic and Poland become part of the Western European market. Hence, the dashed curve shows the hypothetic merit order for AT, CH, FR, DE, CZ and PL for May 2006. As can be seen, especially in the medium load segment of the supply curve a flattening is the result of the market extension which, in theory, could have the potential of reducing prices in the "old" EU-4 market.

The effects of market extension in the EU-4 countries by the Czech Republic and Poland are shown in Figure 9. Due to the mentioned flattening of the supply curve prices decrease slightly compared to the situation where only AT, CH, FR and DE form the market. Clearly, price increases result from this market extension in PL and CZ.

Clearly, "positive" price effects for the "old" EU-4 countries due to market coupling with the Czech Republic and Poland only occur as long as these two countries have enough excess capacity. The following will show the little likelihood of this scenario.

In Figure 10 the effects of extending the market by the Czech Republic and Poland are shown. Compared to Figure 5 no improvements concerning security of supply can be expected from this market coupling.

Central Europe (i.e., the Czech Republic and Poland in the context of this paper) has adequate generation capacity for the foreseeable future. Nevertheless, after 2010 supply security will also become negatively affected due to lack of power plants being built and pronounced decommissioning of existing power plants (both nuclear and fossil fuelled plants). One remaining major uncertainty in these countries is the magnitude of demand growth.

**Conclusions**

Currently, in Western Europe there is virtually one joint electricity market in Austria, Germany, France and Switzerland with one market price. France and Germany play a key role within this market because of their size and geographically central positions and this market is characterised by a small number of players that dominate the market. This aspect is being reinforced by two others: insufficient transmission capacity is available between adjacent sub-markets; and increasing horizontal integration with natural gas supply.

An extension of this market to Eastern European countries like the Czech Republic and Poland by means of making more cross-border transmission lines available due to a reduction of long-term contracts would lead to a slight decrease in Western European wholesale prices but yield electricity price increases in the Czech Republic and in Poland.

Finally, it is stated that currently in the region still sufficient spare capacities in generation and transmission are available. However, current developments imply upcoming security of supply problems by 2012 in the investigated markets even in case of an extended market.

The definitive litmus test for liberalisation will come in every sub-market in Continental Europe at the point-of-time when the bulk of excess capacities has disappeared and demand has come close to available capacities. That is to say, the most important problem is to provide long term incentives for investments in upgrading and in new generation and transmission capacities, as well as in demand-side efficiency and demand responsive measures. This issue is especially relevant in the context of decentralised vs. further centralised development of the electricity supply system.

**Footnotes**

[1] In the following, this market will be referred to as "EU-4".

[2] In early 2007 implicit auctions between France, Belgium and the Netherlands have been introduced leading to a coupling of these markets thereby effectively removing the market separation in North Western Europe as depicted in Figure 1. Nevertheless, with regard to mid-term supply security perspectives of the Western European market, this coupling does not alter the arguments presented below since both Belgium and the Netherlands are net-importers of electricity.

*(continued on page 31)*