European internal electricity market – What next?

Konstantin Petrov
Christian Hewicker
François Boisseleau
Pier Nabuurs

KEMA, Arnhem, Netherlands(*)

Key words: electricity market, market concentration, network infrastructure, transmission constraints, transparency, regulation, unbundling, network access

(*)**Konstantin Petrov** is an energy economist and electrical engineer with major expertise in the area of market design, regulatory economics and pricing. Mr. Petrov joined KEMA Consulting eight years ago, after working for a German Consulting company in the area of pricing, corporate planning and companies' valuation for energy utilities. Konstantin worked in more than 25 countries in Europe, Australia, Asia, South America and North Africa.

Being both an engineer and an economist by education, **Christian Hewicker** is an expert focusing on the design of liberalised electricity markets, with particular emphasis on the interrelation between technical and commercial functions. Mr. Hewicker has considerable working expertise in Western Europe, the Balkans, the Baltic and the Russian power markets. Prior to joining KEMA Consulting, Mr. Hewicker was responsible for international network access at E.ON Trading.

François Boisseleau is an economist by education. He is an expert on the issue of market monitoring and market design in wholesale electricity markets. Before joining KEMA in 2003, Mr. Boisseleau worked with The Dutch Regulator (DTe) as an economist for the Market Surveillance Committee (MSC). With KEMA he has been involved in different projects related to the design of trading arrangements, market monitoring, network use charging and privatisation in several Western and Eastern European countries. Since June 2007, he joined Suez-Electrabel in Brussels. As a senior analyst within corporate strategy he works on market analysis for major investment decisions.

Pier Nabuurs is an electrical engineer and telecommunications expert by education. In 2002 he joined KEMA as Chairman of the Executive Board and CEO. Furthermore, he is chairman of the European Technology Platform SmartGrids, a member of the Dutch Taskforce Energy Transition and a member of the Netherlands Academy of Technology and Innovation. Before joining KEMA Mr. Nabuurs worked in different management functions at Océ and Philips.

KEMA
P.O. Box 9035
6800 ET Arnhem
Netherlands
T +31 3 56 24 00, F +31 3 89 24 77
E contact@kema.com
www.kema.com

1. Introduction

2006 has been a very active year in the development of electricity markets worldwide. In the US a dual philosophy for electricity reforms remains. On the one hand Texas, PJM and California keep moving ahead in designing competitive arrangements. On the other hand a large number of states continue to rely on vertically integrated utilities which are completely regulated. The Middle East and Asia in addition to their restructuring process are facing large demand increases, requiring multi-billion-dollar investments. In Africa and Asia progress is not homogeneous and varies from country to country.

In Europe the liberalisation process was moving forward driven by the European Directives implemented in the EU states. Together with security of supply and environmental protection, implementation of competitive energy markets has also been one of the main objectives of EU energy policy. A competitive internal market for electricity has been progressively implemented across the European Union since 1999-2000. This process aims at increasing competition in electricity generation and supply leading to enhanced efficiency, which is closely associated with lower production costs and ultimately lower electricity prices.

The sector inquiry and the country reviews conducted by the European Commission (EC) during 2006 showed that progress has been achieved. However, there are still a number of issues that need to be resolved in order to achieve an adequately operating internal electricity market.

The EC energy package from 10th January 2007 is a set of concrete proposals for action in the energy field and arises in reaction to the Green Paper published on 8th March 2006. The Green Paper "A European Strategy for Sustainable, Competitive and Secure Energy", on the one hand, identified the main problems that the European energy sector faces and, on the other hand, suggested possible actions to meet key objectives, including security of supply, environmental sustainability and competitiveness towards a unified European Energy Policy. The motivation of the EC package is the need to identify new measures or a strengthening of existing measures to reach the targets (in line with the "Lisbon Strategy" and "Kyoto Protocol") and their underlying objectives. The EC package deals with the main issues on energy policy (renewable electricity, internal electricity and gas market, sector competition, sustainable power generation from fossil fuels, nuclear energy, gas and electricity infrastructures and energy technology) and an

action plan for energy efficiency in Europe.

On 15th February the Commission presented the energy package, the first concrete measures for an action plan as well as the status quo of competition in the European gas and electricity sectors. The approach adopted to deal with the energy package contains two phases: individual communications submitted by Energy Ministers which have account of the specificities of each country; and adoption of an action plan based on the results from the first phase.

This paper deals with a number of selected topics from the EC energy package that relate to the establishment of an internal electricity market and functional competition.

2. Price Development

Due to the varying speeds in the liberalisation process, including the establishment of organised wholesale markets, wholesale electricity prices are available to a different extent for individual countries. Figure 1 below illustrates the development of wholesale prices in a total of 9 countries, although over different periods.

For instance, while corresponding prices are available for a longer period of time, e.g. Norway and the UK, in other countries prices are available only for limited period of time. In Norway and Sweden, there was a strong decrease in wholesale prices from 1996 to 2000, followed by a significant increase thereafter, and a slight reduction from 2003 to 2004[1]. This upward trend in the period after 2000 can also be observed in most other European countries, namely Denmark, Finland, France and Germany. In contrast, prices in the UK decreased only moderately between 1995 and 2000 before showing a steep fall until 2002, followed by a partial recovery in 2003/2004. Spain[2] represents a remarkable exception as it has experienced rising prices until 2002 but decreasing prices since.

[1] For the Nordic countries, this evolution is closely correlated with the hydrologic situation with high precipitation in 1997-2000 and low precipitation in 2002-2004.
[2] Unlike other organized markets that are based on voluntary power exchange, the Spanish market is based on a 'quasi-mandatory' pool system.

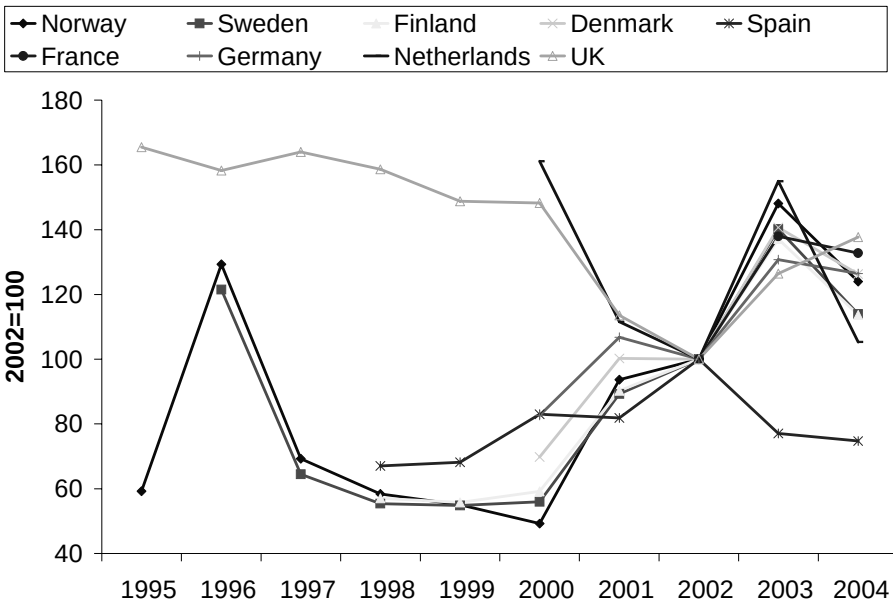

Figure 1: Nominal wholesale prices based on national power exchanges (2002=100)

Note: Prices used are annual simple averages of day-ahead hourly prices. UK prices are based on the pool selling price (PSP) for the period 1995-2000 and the Base load Price Assessment for day-ahead prices from the Heren Report for the period 2001-2004

Source: KEMA Final Report, Review of European Electricity Prices, Study for Eurelectric, 2005.

The observed decreases of prices till 2000 in the majority of the countries can be explained through the deregulation of electricity markets and the existence of surplus of generation capacity. The situation was especially challenging for the CHP plants, which inevitably encountered difficulties to generate sufficient revenue when both heat and power prices were low. Today, the situation is quite different. Not only are electricity prices higher, but heat also commands a better price because gas has become more expensive. Gas prices increased by 25% - 50% between 1995 and 2004[3]. In particular, a strong increase between 1999 and 2001 was observed, followed by a relatively stable price level thereafter. Larger industrial CHP plants have benefited most from the changed market conditions due to the higher efficiency of their gas turbines.

[3] This is base on EUROSTAT data for gas users with an annual consumption of 41860 GJ and a load factor of 200 days (1600 hours) for different EU countries. See KEMA Final Report, Review of European Electricity Prices, Study for Eurelectric, 2005.

The rising prices after 2000 were caused by a number of reasons including insufficient investments in new generation capacity, surging fuel prices (gas, electricity and oil), increasing governmental taxes and introduction of CO2 emission trading scheme and low competitive dynamic in electricity markets.

Figure 2 below indicates that coal and oil prices have increased by approximately 60% and 50 - 100% respectively. Oil prices show a higher volatility, with a limited increase or even a decrease in the first years, followed by a steep increase since 1999. In contrast, coal prices generally decreased until 1999 but have dramatically increased since 2002.

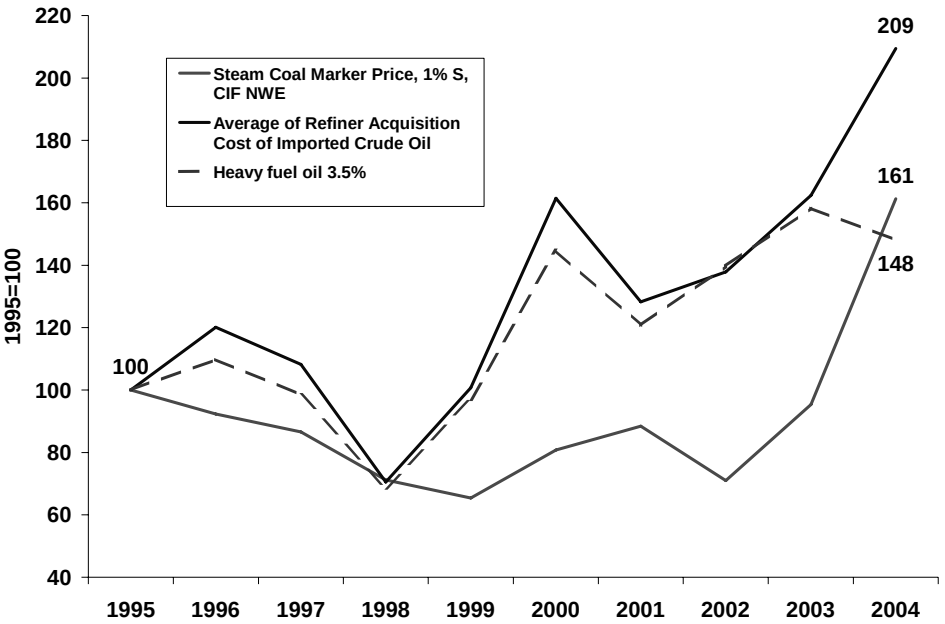

Figure 2: Evolution of oil and coal prices (1995-2004) based on nominal prices in Euro Source: KEMA Final Repor, Review of European Electricity Prices, Study for Eurelectric, 2005.

3. Market fragmentation, transmission infrastructure development and congestion management

The competitive market conduct depends on the strength of the transmission system and the capacity of interconnectors between regions and countries. Interconnectors facilitate cross-border transport of electricity between different regions and countries and are a pre-requisite for an adequately operating internal electricity market. Congestion fragments markets into smaller zones behind the congested interconnections, and within these zones. In this way congestions reduce the size of the relevant market, increase the concentration and its vulnerability to market power.

Congestions have been continuously observed in the EU internal electricity market. The main reasons for congestion include network constraints both at cross-border lines and within the network of individual countries (complexity of planning and authorization process, lack of harmonized planning in case of multi-planning projects), as well as insufficient regulatory incentives for extension of cross-border interconnections.

3.1. Network infrastructure development

The gradual establishment of the internal market led to a remarkable growth of cross-border trade in electricity. As a result, although many countries have internally densely meshed networks with mostly adequate capacity, market actors are increasingly facing congestion on several cross-border lines, limiting their opportunities to exploit the existing economic export and import potential between different markets. Networks are operating closer to their physical limits each year, with an ever increasing risk of temporary supply interruption. Many countries and regions are still energy islands, largely separated from the rest of the internal market.[4] Improvement measures have been sought for through a series of EU policies. These policies aim at supporting the development of an effective energy infrastructure in Europe, including identifying and prioritizing infrastructure projects[5], providing a framework for increased coordination (in planning

[4] This holds in particular for the Baltic States and the new Member States in South-East Europe. KEMA (2005), Analysis of the network capacities and possible congestions of the electricity transmission networks within the accession countries, study commissioned by the European Commission Directorate – General Energy and Transport.

[5] E.g. in its Guidelines for Trans-European energy networks (TEN-E Guidelines), the EU has identified a large number of infrastructure projects (projects of common interest) whose completion should be facilitated and speeded up. Decision No 1364/2006/EC (OJ L 262, 22.9.2006, p. 1).

and development process), streamlining the authorization process, monitoring progress in the implementation, improving network access conditions.[6]

While these measures would definitely contribute to accelerating the development of network infrastructure, they will not be sufficient per se and should be supported by a more effective framework for congestion management and regulatory incentives.

3.2. Congestion management and regulatory incentives

While several market-based methods have been considered, e.g. explicit auction, implicit auction, market splitting etc, in practice the most popular market-based option for congestion management is explicit auction. According to this model the two TSOs of the systems between which congestion exists sell their interconnector capacity to the party with the highest bid. The auction can be designed in different ways with regard to bidding mechanisms and time periods for auctioning (days, weeks, months, years). The explicit auction can be carried out on a load-flow and non-load-flow basis. The flow-based auctions are superior and include not only the typical commercial part but account also for the simultaneous physical constraints on the different transmission borders resulting from possible schedules of cross-border exchanges. The allocation of revenue resulting from the auction among the TSOs concerned remains the most essential issue and it is immediately associated with the regulatory incentives to extend the interconnection and relief congestions.

In cases of allocation of interconnection capacity with separate auctions at single borders, only one or two TSOs are involved in each auction. Accordingly, the sharing of auction revenues is usually based on simple distribution rules (equal division between the respective TSOs). The situation becomes more complex in the case of a coordinated flow-based auction. In such a regime, the auction revenues are the result of a simultaneous clearing procedure for all borders (considered) in the coordinated region. The revenue allocation is not a conventional question.

The recent dry runs for coordinated flow-based auctions in the SEE region experimented with three types of allocation of revenues based on: shadow

[6] Communication of the Commission to the Council and the European Parliament, Priority Interconnection Plan, Brussels, Jan. 10, 2007

prices, absolute usage of interconnectors and relative usage of interconnectors.[7] The methods were compared in terms of revenue stability, continuity with the NTC-based congestion management and creating incentives to offer and extend the transmission network. Although the second method was preferred, the conclusions remain strictly preliminary. However, it is essential that the revenue distribution should provide continuous and sufficient incentives to the TSOs, in particular related to increasing transmission capacities and efficient utilization of the existing and new assets.

4. Non-discriminatory network access

Timing and location of transmission maintenance outages and investments can significantly impact individual generating facilities, providing an incentive for combined network operators to schedule these events in a manner that may harm rival generation. The network operators may have few incentives to develop network investments and provide connection to new entrants in the overall interest of the market. The proposal of the UCTE on how to avoid blackouts in the future after the European black-out on November 4th, 2006, contains more controlling statements than action to secure supply while further liberalizing the market.

Although the current legislation requires legal and functional unbundling, the EU's view is that ensuring reliable and non-discriminatory access conditions and an adequately operating competitive electricity market is not sufficient. Two new alternatives have been proposed: ownership unbundling and establishment of Independent System Operators (ISO).[8]

While ownership unbundling may eliminate perverse incentives resulting from the common capital control over regulated and competitive activities, it may also lead to undesirable consequences. It may reduce or completely remove the inherent synergies between networks and generation / supply activities. It may reduce the implementation of innovations, needed for integration of renewable and distributed resources. Moreover, ownership unbundling on the distribution level may lead to deterioration of quality of supply. Network companies have been sensitive to customer demand for

[7] ETSO (2006), Flow-Based Coordinated Auction, Dry Run in SEE Region, June.
[8] Communication of the Commission to the Council and the European Parliament, Prospects for the Internal Gas and Electricity Market, Brussels, Jan. 10, 2007.

higher quality, as this also affects their profitability in other competitive business areas. Thus, the absence of a requirement to fully separate network business from the competitive business areas may positively affect quality performance (spill-over effects).[9]

On the transmission level, the ISO model is not a new concept and has been applied in a number of wholesale markets including USA, Australia, South America and also in Europe (Hungary, Italy, Greece). The main idea is to separate the network operators and to prevent discrimination between independent power plants and own generators (in terms of operation and dispatch), which is identical with the current arguments of the EC.[10] One should consider, however, that the ISO model requires new interface rules between the system operation and transmission activities, as they will belong to separate organizations. In particular, difficulties may arise in the coordination and decision-making process with respect to operation, planning, maintenance and construction activities. E.g. the level of transmission constraints and the associated cost depends on all the above-mentioned activities and can be influenced by both organizations (system operator and transmission assets owner), of course depending on the specific definition and allocation of activities. The reasons for transmission constraints may be dual: in the short term they depend on system operation (responsibility of the ISO organisation); and in the medium and long term they depend on the investments in the transmission network (responsibility of the transmission assets owner). Therefore, the ISO model will require precise and clear definition of the responsibilities and interfaces between the new organisations.

5. Market concentration and transparency

Market concentration is not only a feature for the individual national markets but must also be perceived as a feature of the increase of multinational alliances in the power sector in Europe. During the most recent years the biggest European utilities continue increasing their stakes in companies in other European countries, which is the logical and probably

[9] Such positive spill-over effects have been observed in Italy. These spill-over effects provided incentives to supply adequate quality levels. Ajodhia V., Malaman R., Schiavo L. (2004), Quality regulation of electricity distribution in Italy: an evaluation study, in Energy Policy, Nov. 2004.

[10] Another reason for usage of the ISO concept is the existence of multiple transmission service providers on one integrated interconnected wholesale market and the resulting coordination needs (e.g. PJM Interconnection in the USA and NEMMCO in Australia).

anticipated consequence in the growing integration of the European electricity market.

In its last sector inquiry the EU Commission concludes that at the wholesale level electricity markets remain national in scope, and generally maintain the high level of concentration of the pre-liberalisation period. This gives scope for exercising market power on power exchanges, forward and balancing markets. It is well-known that the ability to exercise market power is correlated albeit imperfectly with a producer's market share.[11] The results of the sector inquiry show how difficult it is to analyze competition in electricity markets. While it is beyond the scope of this paper to discuss the sector inquiry exhaustively, we will discuss some of its findings below, which can be interpreted from two different points of view.

The "critical" observers will notice that the sector inquiry does not conclude whether any abuse of market power and anti-competitive behaviour has been taking place during the period under investigation. Indeed the findings of the inquiry mainly report well-know facts, allegations by participants and conventional solutions.[12]

The "optimistic" observer will welcome the recognition of market design and transparency as key factors for adequately operating markets. Indeed a central problem is that, with different designs in each country, national markets failed to integrate. Until recently little attention was paid to market design and transparency in Europe and most work focused on implementing the different EU electricity Directives. At the beginning of the European liberalisation it was assumed that third party access and a harmonized European framework for cross-border trading would be sufficient for the creation of an integrated market. Hence, in the absence of common guidelines for market design each country implemented its own arrangements. In practice this has lead to incoherent nomination procedures, balancing markets with different products, different auction designs etc. This lack of harmonization leads to incompatibility between

[11] A firm with a very small market share is more likely to see demand as relatively price elastic and the supply of other firms as relatively price elastic over the range of output that it might contemplate removing from the market or offering to sell only at a high price. In contrast a firm with a larger share of the market is more likely to be able to lower its output or raise the offer price on part of its output in a way that is difficult for demand to adjust to because the firm's action constitutes a significant share of the entire market production. Likewise, other companies may find it much more difficult to replace the output reduction of a large firm without themselves running into production constraints that would drive up their own costs.

[12] For instance, one of the findings of the inquiry was that European electricity markets were: (1) concentrated with (2) limited interconnection capacity which (3) gives scope to market power.

markets and is at the root of the poor integration. With the clear statement made by the EU that *"Different market designs hamper market integration"* one may expect that due attention will now be paid to this issue.

Transparency has become a rather popular topic not only because it is mentioned by the EU but as it has been discussed in numerous designated documents[13]. In general it has been argued that the lack of transparency was an important factor hindering competition. In the absence of transparency, discrimination exists between players gaining access to a sufficient level of information (level playing field). The EU regulators consolidate their efforts, via for instance the initiative of mini-for, to coordinate and harmonise the country-specific measures. In particular, it is clear from the inquiry that the regulator should seek to avoid privatization of public data, avoid and/or prevent restrictive definitions of confidential data, and help to define clear rules for the treatment of confidential data. In practice, while most stakeholders agree that transparency has to be improved in most European countries, there still is disagreement on the range of data to be published.

6. Institutional regulatory issues

Both the sector inquiry and the country reviews conducted by the Commission during 2006 have unearthed a variety of specific examples which demonstrate institutional shortcomings of the existing regulatory authorities. On many issues, certain regulators are constrained in their relations with the industry, lacking the appropriate powers and discretion. This is particularly the case for subjects where the regulator is not responsible ex-ante, such as rules for functional unbundling, non-tariff access conditions (connection, balancing), provision of information to network users.
Regulators have, on occasion, been put in a position where their decisions may not align with the objective of creating a single internal electricity

[13] EURELECTRIC (June 2006) "Survey on the Implementation of Market Transparency Requirements in Countries Involved in the Athens Process", Preliminary Results, Ad-hoc Group on South East Europe; ETSO (December 2005): "List of data European TSOs need to pursue optimal use of the existing transmission infrastructure", position paper; ETSO (Spring 2006) "Report on Internet and market information: overview of SEE TSOs' websites", Situation Spring 2006; EURELECTRIC (February 2006): "Position paper on market transparency", position paper; ERGEG (March 2006): "ERGEG Guidelines for Good Practice of Information Management and Transparency Markets" , consultation document; EEX (2006) European Energy Exchange transparency initiative; this initiative resulted in the leading generators in Germany (EnBW, E.ON, RWE Power and Vattenfall Europe) deciding to publish production data from their power plants on the web site of the power exchange; EFET (May 2006) Transparency of information about use of electricity infrastructure, position paper.

market, usually due to direct or indirect influence from national governments. An example of this is inappropriately regulated supply tariffs.

The arguments presented by the Commission certainly bear relevance as all of the areas referred to for lacking regulatory competences constitute essential pre-requisites for establishment of an adequately operating competitive market for electricity. In addition to the suggested strengthening of their institutional power for making ex-ante decisions, the regulators should also continue their coordinated activities on cross-border issues in order to ensure converging national policies.

7. Technological innovations

7.1. Smart Grids

As a result of the increasing production from distributed power generation, the energy flows across Europe are changing, i.e. they are becoming bi-directional and less predictable. Unfortunately, the European power grid was not designed with such flows – or the associated risks – in mind. To address this problem, Europe needs a transmission and distribution grid that is more readily monitored and controlled. A 'smart grid' of this kind would make a major contribution to energy market stability.

7.2. Inter-system communications

In addition to the conceptual framework for market design, the energy systems themselves are also fundamental for the implementation of the market model. This requires the standardization of inter-system communication on the basis of a universal protocol. Standardization needs to embrace not only the technical systems – control centres, substations, etc – but also the administrative systems that handle data interchange between market players. Good protocols reduce error risk and increase market transparency.

7.3. Smart metering

Ultimately, the purpose of energy market liberalisation is to provide private and business consumers with more choice. Choice-empowered end users shape the market by making decisions about how much energy, what kind of energy and from which supplier they consume.

The provision of smart meters is part of the process of empowering consumers. Today's European utilities are faced with an increasing array of options for advanced or smart metering. Features such as under-glass remote disconnect/reconnect, increased digital communications choices and capacities, and home area networking and appliance interfaces are rapidly becoming standard offers. Encouraged by regulatory drivers and demand response initiatives in Europe, many of the features and functionalities of emerging AMI systems are accelerating the pace of industry innovation. Smart metering enables consumers to better understand, and respond to, retail time-based prices that more closely reflect the costs of the service provided. Consumers that are offered choices on how and when they use energy will become an even greater asset in optimizing and extending the reliability of the utility's infrastructure, particularly if they have the ability to understand the implications of these choices in nearly real-time.

8. Conclusions

Over the past 15 years almost all countries in Europe have restructured their electricity markets. The European experience of electricity restructuring is unique worldwide because it combines two parallel challenges: opening each national market to competition and integrating these markets into a single European market.

Although substantial progress has been made and several lessons have been learned, a lot of work still needs to be done. Even for the early pioneers the restructuring process remains incomplete. Electricity markets do not emerge naturally, they have to be designed. Therefore, the deregulation process has been accompanied by "re-regulation" efforts focusing on drafting and implementing new rules. Third-party access is not sufficient to create a competitive electricity market, establishment of functional market design supported by sufficient network infrastructure and pro-active ex-ante regulation is essential.

Political support is critical in particular because the introduction of competition does not automatically mean "lower prices"; in a context of increasing fuel costs, increasing demand, need for new capacity and environmental obligations, prices may increase.

A final remark, based on the changes in Europe in the past decade, is that the transition from nationally integrated monopolies to a single European competitive market did not just take longer than expected, most likely these markets will always be in a transition phase…like any other market. The EU Energy policy might in the longer term need a completely new design of the European grid, including new architectures, new technology and new regulation.

9. Literature

Ajodhia V., Malaman R., Schiavo L., "Quality regulation of electricity distribution in Italy: an evaluation study", Energy Policy, Nov. 2004

Boisseleau F., Giesbertz P., "Assessing Regulatory Measures in Electricity Markets: The case of VPPs in the Netherlands", conference paper, 2006

Communication of the Commission to the Council and the European Parliament, "Priority Interconnection Plan", Brussels, Jan. 10, 2007

Communication of the Commission to the Council and the European Parliament, "Prospects for the Internal Gas and Electricity Market", Brussels, January 10, 2007

Communication of the Commission to the Council and the European Parliament, Inquiry pursuant to Article 17 of Regulation (EC) N1/2003 into the Electricity Gas and Electricity Sector, Brussels, Jan. 10, 2007

European Commission, "Green Paper - A European Strategy for Sustainable, Competitive and Secure Energy", March 2006

European Commission, "Action Plan for Energy Efficiency: Realising the Potential", October 2006

European Commission, "Communication from the commission to the European Council and the European Parliament- An Energy Policy for Europe", January 2007

European Commission, "Towards a European Strategic Energy Technology Plan", January 2007

European Commission, "Prospects for the Internal Gas and Electricity Market", January 2007

European Technology Platform "SmartGrids", Vision, April 2006

European Technology Platform "SmartGrids", Strategic Research Agenda, March 2007

KEMA, "Analysis of the network capacities and possible congestions of the electricity transmission networks within the accession countries", study commissioned by the European Commission Directorate – General Energy and Transport, 2005

Newbery D., Green R., Neuhoff K., Twomey P. , "A review of the Monitoring of Market Power, The possible roles of TSOs in monitoring for market power issues in congested power systems"

ETSO, Flow-Based Coordinated Auction, Dry Run in SEE Region, June 2006