Chapter 10
Power exchanges: cornerstone for "market" regulation

The absence of an effective market design at the European level, coupled with the patchwork of electricity markets operating at the national level has been shown fundamentally to affect the creation of an integrated electricity market within the EU. In this chapter we analyze the role of power exchanges for achieving this goal. We will consider a broad definition of regulation which includes promoting competition through market design and preventing unfair trading practices through market monitoring. We emphasize the importance of power exchanges for monitoring market performance and market design developments. We present the interests and drawbacks of the recent works realized by the European Commission and other European associations such as the European association of transmission system operators and council of European energy regulators with respect to power exchanges. Finally we present some guidelines for the creation of a "European" framework for market regulation based on effective market monitoring using power exchanges that in turn will help effective market design to develop.

10-1 Redefining regulation

10-1-1 Introduction

The process of introducing competition in electricity markets is often called a "deregulation process", a term which can be interpreted at a first glance, as the removal of any form of regulation. However developments in wholesale electricity markets shows that the introduction of competition in electricity markets requires the setting up of new types of regulation. The term "regulation" is commonly used in the literature and in practice, but how it is defined and used can vary widely. With respect to economic literature (Baumol *et al*, 1982) and to electricity markets, "regulation" is commonly used to define the regulation of the natural monopoly elements[1]. However regulation has a broader meaning. The Oxford Dictionary of Economics defines regulation as:

"A rule individuals or firms are obliged to follow: or the procedure for deciding and enforcing such rules […] These may be designed to promote public health and safety […] They may be designed to promote competition and prevent unfair trading practices […] In the last resort regulation relies on legal sanctions […]"

For the purpose of this chapter we use this broad definition of regulation which includes promoting competition, preventing unfair trading practices and in the last resort using legal sanctions. In this section we will briefly present the "traditional" concept of regulation with respect to regulation of the natural monopoly (10-1-2). Going into the details of this concept as they apply to electricity markets is beyond the scope of this work, however it is useful to provide an outline of the main principles. Subsequently, we argue that to achieve competitive electricity markets it is necessary to consider a broader definition of regulation including "market" regulation and not only "monopoly" regulation (10-1-3). The purpose of "market regulation" is not to (re) introduce price controls or any other type of direct regulation but rather to establish the rules of the game through "ex-ante

regulation", i.e. market design, supervising the functioning of the markets through "continuous regulation", i.e. market monitoring, and ensuring competitive outcomes through "ex-post regulation", i.e. antitrust policy. We do not elaborate on the latter because once the specificity of the electricity industry is recognized, the way antitrust policy deals with dominant market positions should be similar to other industries.

We first elaborate on the issue of ex-ante regulation applied to the European electricity markets and show that this part of regulation has been, and is still being, widely overlooked in the liberalization process. In particular we focus on the recent work realized by the European Commission and other European association such as the European association of transmission system operators and council of European energy regulators with respect to power exchanges. Though power exchanges are often mentioned in these works, their potential role has not been fully recognized (section 10-2). Subsequently, we suggest how power exchanges can be used to implement market regulation in Europe by facilitating market monitoring. Finally several recommendations with respect to designing a really integrated market based on power exchanges are presented (section 10-3).

10-1-2 "Classical" regulation

The economic literature on utility regulation concentrates on the regulation of the natural monopoly elements. Hence, a large amount of the literature has focused on the definition of the natural monopoly concept (Schamalensee, 1979; Braeutigam, 1989; Viscusi *et al*, 1992). The purpose of regulation in the electricity sector is to prevent natural monopolies abusing their market power (Joskow and Schmalensee, 1983; Littlechild, 2001). Before liberalization the vertically integrated utilities were subject to regulation as a whole. After

[1] After liberalization, the "classical" natural monopoly elements in the electricity industry are energy transmission and distribution grids because the cost of two or more firms building a grid to serve the same customer would be prohibitive.

liberalization the main purpose of regulation has become the distribution and transmission of electricity while production and sales have become competitive ("deregulated") businesses.

According to Baumol and Sidak (1994) the purpose of regulation is *"protection of the public from the detrimental consequences of inadequacies of competition".* The main problem faced by regulators is the asymmetry of information between the regulator and the regulated utility (Loeb and Magat, 1979; Baron and Myerson, 1982, Laffont and Tirole 1993; Shleifer, 1985). The regulator is always confronted with information disadvantage concerning the true costs of the firm it has to regulate.

In practice, *rates of return* and *price cap* regulation represent the two basic regulatory schemes for controlling prices (Berg *et al*, 1998). Under rate of return regulation the regulator defines a set of rate that ensure the firm will recover incurred expenses plus a risk-adjusted return on its rate based. The flaws of such regulation are well known. The most important one relates to over-investment incentives when the rate of return exceeds the cost of capital because revenues are linked to costs (Averch and Johnson, 1962). Price cap regulation guarantees prices rather than returns (Littlechild, 1983). Under price-cap regulation, also known as CPI-X schemes, the regulator defines an initial maximal price, the price-cap, at which the regulated firm can sell its service[2]. The regulator may allow the price-cap to be adjusted over time by a predetermined adjustment factor, the efficiency factor, external to the firm to simulate the pattern of competitive markets. The main issue in price-cap regulation is thus the determination of the level of the price-cap and the value of the efficiency factor.

In conclusion, regulation of the natural monopoly is dominant in the literature covering the concept of "regulation" in the electricity industry. From a theoretical

point of view the discussion focuses on the different interests and drawbacks of the two main approaches, i.e. rate of return versus price-cap, and on the constraints faced by the regulators, i.e. asymmetry of information. Numerous comparative studies reveal the differences in applying these concepts in practice (Joskow and Rose, 1989; Gilbert and Kahn, 1996; Midttun, 1997). Yet little attention has been paid to regulation in a broader sense with respect to designing and monitoring markets.

10-1-3 "Market" regulation

"Market" regulation as mentioned above refers to promoting competition, preventing unfair trading practices and at the last resort defines legal sanctions. Concretely market regulation consists firstly of defining the rules of the game, and secondly enforcing obligations and monitoring performance (figure 10-1). Such regulations are necessary in electricity markets for two reasons. First because electricity is physically different from all other commodities but also, and this is the most important reason, because the well functioning of any market, e.g. commodities, stock exchanges, labor markets etc, involves a minimum level of regulation. For instance, financial markets which are often cited as the most competitive markets are heavily regulated[3].

Figure 10-1: "Market" regulation

In contrast to most goods and commodities where markets have existed for some time, in some cases centuries, and have evolved over the years, electricity

[2] The regulated firm's price increase is limited to the rate of inflation, estimated by the Consumer Price Index (CPI), less an agree efficiency factor ("X") based on expected productivity improvement. Hence the price cap scheme restricts price increases to "CPI-X".

[3] See for instance the impressive amount of rules governing the New York Stock exchange, available at www.nyse.com/regulation/

markets were created in the last decade of the twentieth century following political decisions to liberalize markets. As a start to this process a set of regulation principles, dealing with the "market design of the industry structure"[4], was adopted. The focus of early regulations was on the separation of production from transport and third party access to the network. In Europe these principles can be found in the electricity Directive 96/92[5]. However, regulations concerning the detail rules of the market design and monitoring principles are missing in this document. In Chapters 8 and 9 we have shown that the emergence of power exchanges at national levels, and the absence of a common consistent market design at the European level with respect especially to transmission pricing, represent an important reason for the low level of integration found in the European electricity markets. A first important part of market regulation is to produce a market design which can be considered as ex-ante regulation because the design process must be done before any interaction on behalf of market participants. The threat of market power due to a high level of concentration[6] and the inter-temporal features of electricity gives rise to a need to monitor performance and this represents a fundamental step before sanctions can be brought for possible abuse of market power. Since designing electricity markets is a controversial issue, as showed by the theoretical debates and the international experience, effective market monitoring will require the efficiency of the market design to be assessed on a regular basis. With time this should give rise to proposals for corrective measures. This regulation can be considered as continuous regulation because it analyzes on a regular basis the outcomes of markets.

From an intellectual point of view it would appear logical to start with market design, then market monitoring, and based on the outcome of the monitoring, improve the market design. This is the logical sequence when starting from scratch. However in practice, regulation bodies do not start from scratch they are

[4] See chapter 3
[5] See chapter 2

confronted with the actual conditions, i.e. actual market designs, and need to consider these initials aspects. Hence, accurate market monitoring of the actual situation needs to be considered first. Subsequently, based on the outcome of market monitoring, the regulatory bodies can go on to improve the market design. Since it is difficult to get every thing right at the outset, it is worth noting that these two aspects of market regulation are dynamically interrelated, i.e. after an improvement in market design, monitoring is again necessary to assess the performance of the new market design which in turn may lead to recommendations for further changes in the market design and so on.

10-2 Difficulties for designing and monitoring markets in Europe

10-2-1 Introduction

To date, little attention has been paid to market regulation in Europe and most work has focused on implementing the EU electricity Directive 96/92. However, market design and market monitoring are important for the creation of well-functioning markets. In particular it is important to keep in mind how these two aspects of market "regulation" are dynamically interrelated, i.e. market design must pay attention to potential behaviors of market participants and the monitoring of these behaviors is a necessary step for the identification of design flaws and proposals for corrective measures. In focusing only on legal aspects the EU Directive has overlooked these aspects. Indeed, the Directive provides *"a framework is the loosest sense of the word: its objectives are laid down in general terminology and moreover, Member States are given a substantial degree of choice in how they are about introducing more competition into their electricity markets. Indeed the margin is so substantial that it would seem possible for the determined anti-market countries to avoid introducing any meaningful degree of competition at all"* (Hancher, 1997). Thus, in the absence of any guidelines on what the European electricity market should look like, an integrated market has failed to develop[7] and this can largely be attribute to the

[6] See chapter 7
[7] See chapter 8

fact that market design, e.g. the rules and functioning of wholesale markets, transmission pricing etc, have not receive due attention[8].

In the face of this lack of guidelines a large part of the electricity market design, e.g. power exchanges, has been done at the national level and left to the principle of subsidiarity. The central problem is that, in presence of different designs in each country, national markets may be hard to integrate as their varying designs will prevent this (Smeers, 2001a). Nonetheless, important efforts have been produced at the European level mainly by the association of transmission system operator (ETSO), the association of regulators (CEER) and through reports the European Commission has commissioned to assess the implementation of the Directive and to suggest recommendations for improvements. Roughly speaking works by ETSO and CEER discuss issues that are not addressed in the Directive, while work by the European Commission provides analysis on the progress of the liberalization process.

The Directive deals with primary conditions necessary for the creation of a market, unbundling, TPA etc. Since it is difficult to get everything right at the outset and since dealing with details of market design make little sense before addressing the primary conditions, one would expect that work produced after the implementation of the Directive would have pay attention to the issue of market design. Unfortunately, the EU Commission has focused mainly on the implementation of the Directive without paying attention on the issue of market design. While the "Florence process"[9] did not address the issue of market design in general but focused only on one specific issue of market design: cross-border trade, i.e. international congestion management and compensation mechanisms for cross-border flows. Moreover, it is worth noting that the recommendations defined in these works have no legal power and thus their implementation is voluntary due to the absence of any legal authority to impose them. Thus while

[8] See chapter 9

market design at the European level was not addressed in the Directive of 1996, most of the recommendations which have followed firstly they have not addressed all issues related to market design. Secondly in the absence of any legal power they have failed to impose common features on the European electricity markets.

In this section we look at the EC and Florence process work, which have followed the Directive and shed some light on their shortcomings with respect to market design and the potential role of power exchanges at the European level (10-2-2). Since one practical way to detect problems in market design is to ensure effective market monitoring, we shows that the approach followed by the European Commission to supervise the development of the liberalization process is poorly suited for assessing the creation of an integrated electricity market (10-2-3). Finally, we analyze recent work by the EC and by ETSO which provides interesting insights into what will be the next important issues on the agenda of the European liberalization process and the expected role of power exchanges (10-2-4).

10-2-2 Actual market designing: EC and Florence process

The problems related to the creation of a European electricity market were first identified by the European Commission in their second report on harmonization requirements (EC, 1999). While the first report only addressed the issues of energy taxation and environmental aspects (EC, 1998), the second report recognize that there might be areas *"which are not specifically address by the Directive, but nevertheless might require harmonization or at least which deserve regulatory attention to guarantee the proper and efficient functioning of the internal electricity market"* (EC, 1999). For this purpose the report focuses on three issues: the risk of creating 15 liberalized but separate markets, the need for regulation of electricity networks at the European level, and the need to ensure a

[9] The "Florence process" is a forum convened by the European Commission to monitor and discuss the implementation of the Directive

level playing field at the European level. With respect to market design, two aspects of the report are of particular interests.

One, according to the EC, the central issue in the creation of a single electricity market is limited in terms of market design to access to interconnection capacity, while others aspects of market design, e.g. trading arrangements, wholesale market design, marketplace design, balancing mechanisms, power exchanges etc, are not mentioned. The assumption here is that a harmonized European framework for cross-border trading would be sufficient for the creation of an integrated market. However the report is silent on the other aspects of market design especially those at national level, e.g. power exchanges. Hence the main criticism that can be made is that it may make little sense to coordinate the different national markets if their design does not permit this to be done (Smeers, 2001b). For instance assuming a harmonized and efficient framework for cross-border trading at the European level, it appears difficult to integrate a market with a pool (e.g. Spain), with one with a voluntary exchange (e.g. France) and one without any organized marketplace (e.g. Belgium). The main assumption of the EC behind this report is that dealing with cross-border trade is sufficient to create an integrated market while the other aspects of market design are not mentioned. Hence with respect to market design at the European level it is worth noting that all attention and effort has been focused on cross-border trades.

The second interesting aspect of this report is the fact that it sheds light on what are seen as the two alternative approaches for dealing with harmonization issues. The first approach can be defined, as a "consensus" approach while the second one is a more traditional "legal" approach. In the consensus approach, the EC relies on consultation between parties and tries to reach a unanimous consensus. The second approach is more traditional since the EC will use regulatory instruments via for instance the creation of a "European Regulator". The advantages and disadvantages of these two approaches are also well described in this report.

At a first glance, the consensus approach appears to be faster because it does not require the creation of new institutions, treaties or rules. However such approach has two major drawbacks. First it requires that all parties agree, which means all Member States and the Commission. This is difficult, as demonstrated by the several years of considerable negotiations required to reach unanimous agreement before the first Directive was defined. It is thus difficult to determine how long such a process will take. Second assuming that unanimous agreements can be reached on specific points the question is whether the decisions would be applied. Indeed without there being a legal authority empowered to enforce application of the decisions it would be left to the Member States, and if a Member State refused to apply a decision, the EC would not have the legal power to impose it.

The "legal" approach would require the creation of new regulatory instruments at the Community level. In contrast to the consensus approach this approach would require new institutions that will first need to be defined and second, to be approved by the different authorities such as the European Council, the European Parliament and the Members States. The main disadvantage of this process is that it could take years of negotiations to be finalized. The major advantage is that once such a new instrument was in place, it would provide the EC with the clear power of a legal authority specifically designed to impose decisions at the European level. The EC does not present any preference between the two approaches in the second report (EC, 1999). However the following shows that in practice, a clear choice has been made in favor of the consensus approach to "designing" the European electricity market.

In response to the problem of cross-border trading, the EC initiated the creation of the European energy regulatory forum (EERF), also called the "Florence forum". In this forum, representatives from the council of European energy regulators (CEER), from the European transmission system operators (ETSO), from network users (Eurelectric), from the European federation of energy traders

(EFET), and other interested parties, market participants, power exchanges etc, discuss issues regarding the creation of the European electricity market. This forum does not address the issue of market design in general but focuses only on one specific issue of market design: cross-border trade, i.e. international congestion management and compensation mechanisms for cross-border flows. ETSO has produced several papers on this topic examining different approaches to solving the problems (ETSO, 1999; 2000a-b; 2001a-g; 2002a-c). of congestion management and compensation mechanisms for loop flows.

Two aspects of ETSO work are of particular interest with respect to the role of power exchange in market design. One, it appears that, according to ETSO, the role of power exchanges should be limited. While they have examined different approaches to congestion management, such as auctions, market splitting, redispatching etc, the nodal pricing approach has received no attention. It is surprising that the experiences of PJM, which provide an interesting solution for dealing with transmission pricing, have totally been left out of the discussion. Furthermore market-splitting which is as a simplified approach to nodal pricing has been rejected because it was thought to be impracticable. Two, the separation of energy and transport which gives rise to a need to define Net Transfer Capacity (ETSO, 2000a) is regularly presented as a problem because these capacities depend on the transactions that use them. While this problem has been recognized in several ETSO papers (ETSO, 1999; 2001c-f), the logical solution, combining these two products, is not considered.

Four years after the starting of the consensus process, and well aware of its limits, its failure with respect to cross-border trade has lead the European Commission to reconsider this approach and move towards the "legal" approach. The EC did not choose this approach in 1998 because it argued that it would requires new institutions which would take times to create. However, the real reason is certainly that the EC did not really have choice in the matter. In particular, the different parties present at the Florence process, but also the

member States were against the creation of such an "EU regulator" which would have reduced their power and would have diminished their control on the decision process. However, in the face of a lack of power to implement the decisions made through the Florence process, the European Commission has made two legislation proposals amending the Directive 96/92 (EC, 2002a) and on conditions for access to networks for cross-border exchanges (EC, 2002b). These are largely based on the Florence process but give legislative power to the EC to implement the reforms. From a legal point of view, these legislation proposals are Regulations[10] which, if adopted, would be directly applicable in all Member States. The issue of congestion management is addressed explicitly (article 6) but it is presented in very general terms e.g. congestion must be addressed on a non-discriminatory, transparent, open manner. Thus, although this work represents a very important step in the market design process, it remains limited because again it only takes into account general principles for cross-border transactions and appears to be rather incomplete regarding any perspective for creating a real integrated market.

In conclusion, the EC and others interested parties have not address the issue of market design in general and have paid little attention to the role of power exchanges focusing instead on the harmonization of cross-border trading arrangements. Hence, in the absence of a real market design approach, the process of harmonization can be considered to be an "ersatz" form of market design. While the "consensus" approach was suppose to be faster, due to it not requiring the creation of new institutions and especially not a "European Regulator", it has proved to be relatively inefficient because any decision making has required a lot of time due to the need to reach a consensus within the interested parties. More importantly the outcomes of this consensus process have not been followed by implementation due to the absence of any legally enforcing power. The best illustration is the issue of the use of market-based

[10] By opposition with Directives which must be transposed into national legislation, permitting Member States to make different interpretations and involving a time lag up to two years.

mechanisms for allocating transmission capacity which has been clearly recognized as a necessity since March 2000 (EERF, 2000b) but has not been implemented at most borders (EFET, 2003). The EC has been well aware of these difficulties since 1999 and recognized the problems of the efficiency of this approach in 2001. The Florence process is described as an "*effective tool in developing consensus on highly complicated issues*" but "*suffers from a number of disadvantages when it is necessary to reach concrete decision*" (EC, 2001a). Three disadvantages are identified: the forum only meets twice a year, full consensus is required, and no procedures exist to implement the decisions. While the two legislative proposals amended in 2002 and the EC Strategy Paper[11] represent an interesting step with respect to the creation of a common European market design, many aspects are still not addressed. An explanation of why the EC has not addressed most of the market design aspects can be found in the way the monitoring of the liberalization process has been done to date.

[11] See 10-2-4

Box 10-1: Regulation No 1228/2003 on conditions for access to the network for cross-border exchanges in electricity

On 26 June 2003, the European Commission published Directive 2003/54/EC concerning common rules for the internal market in electricity (See box 2-1), and Regulation No 1228/2003 on conditions for access to the network for cross-border exchanges in electricity. Regulation (EC) No 1228/2003 is of particular importance for the allocation of interconnector capacity in that it contains new rules on cross-border exchange in electricity. This regulation is aimed at setting fair rules for cross border exchanges in electricity. The objective of this regulation is to harmonize cross-border transmission charges and the allocation of available interconnection capacities. This regulation is divided into three parts: compensation mechanisms for cross-border flows, harmonized principles on cross-border transmission charges, and allocation of available interconnector capacity. By definition this regulation does need to be implemented, it applies. Article 3 of the regulation defines the rules for compensation between TSO. This article states that TSO should be paid for cross-border flows, by source and destination but no extra charge should be paid for transits. According to Article 4 transmission should not be distant related, but can be location related. Article 6 states that no additional cross border tariff should be added, except in the case of congestion. Article 7 treats the issue of merchant interconnectors, which can be exempted for several rules, but the exemption must be granted by the national regulator, this is rather unclear since, by definition, a new interconnector involve at least two regulators.

This new regulation represents an important step forward but remains rather vague. For instance TSO are required to offer unused capacity but the fact that TSO must offer capacity does not ensure that the capacity would be actually used. With respect to netting, which is now required, where feasible, under the new regulation, the regulation leaves an important freedom for TSO to interpret the word "feasible". Finally the annex of the regulation provides guidelines for congestion management. These guidelines represent a step forward but they are presented in very general terms e.g. congestion must be addressed in a non-discriminatory, transparent, open manner. Finally the main limit of this regulation is that it keeps the separation between transport and energy. This requires determining available capacity in advance which remains problematic.

10-2-3 Actual market monitoring

According to the article 25 of the electricity Directive 96/92, the European Commission has to submit reports to the Council and to the European parliament concerning harmonization requirements and, if necessary, harmonization proposals for the internal market for electricity. The first report in February 1998 covered the issue of promoting renewable energy and harmonizing taxation regimes (EC, 1998). The second report in April 1999 looked at two important issues: the obstacles for cross-border trade and the problem of ensuring a level playing field in the European electricity market (EC, 1999). In this report the problem of implementing the Directive with respect to creating 15 separate, and rather isolated markets instead of a single market was identified as a major issue. This report taken in conjunction with the Commission staff working papers (EC, 2001a; EC, 2002a), and the communications from the Commission to the Council and European Parliament (EC, 2000a; EC, 2001b-e), represents the monitoring that has been done to date of the internal electricity market(s). However these works focus mainly on measuring the level of liberalization within markets following the principles defined in the Directive but say little about competition in an integrated European Electricity market. Thus just as the harmonization process of cross-border trade mechanism that can be considered to be an ersatz of market design, the monitoring of the liberalization process can be seen as an ersatz of market/competition monitoring.

The European Commission uses several indicators to monitor the liberalization process within the electricity market, however, these indicators only measure the level of liberalization which is different from the real degree of competition. Indeed, the main indicators are directly related to the implementation of the Directive, e.g. legal opening, the number of customers who have changed suppliers, unbundling and third party access. Additionally others indicators such as customer switching, price changes, market concentration, the existence of standardized wholesale markets, i.e. power pools, power exchanges, are also

used to monitor the impact of the liberalization process on competition. While providing interesting insights, most of these indicators appear rather ill-suited or at least incomplete for efficient monitoring of electricity markets with respect to competition, market design and more generally the creation of a really integrated, competitive, market.

The European Commission has develop a *"set of indicators intended to measure the impact of liberalization on European electricity markets*" and aiming "*to identify the principal drivers for effective competition*" (EC, 2001f) to monitor the liberalization process. This important work, developed by a consortium of consultant and academics[12], is representative of the indicators used by the Commission. This analysis provides interesting insights about the liberalization process in Europe having established a robust methodology. However a large majority of these indicators have proved to be relatively uninformative regarding the real extent of competition.

The first indicator used by the European Commission to assess the level of liberalization is the "legal opening rate"[13]. This indicator measures the share of consumers who can choose between different suppliers. For instance, some markets present a legal opening rate of 100% that mean that they are totally open, e.g. Germany, United Kingdom, Sweden, while others present lower opening rates showing that some categories of consumers do not have the freedom to choose between different energy suppliers, e.g. Netherlands, France, Belgium. The limitation of this indicator is that it overlooks practical provisions which can favor or deter competition. For instance, if a market is totally open but if conditions to access to the grid are non-transparent and discriminatory real competition may fail to develop, despite "theoretical opening". A market with a low opening may be more competitive by ensuring easy access for eligible customers. For this reason, to be effective, market opening needs to be

[12] led by Oxera, and supported by the Netherlands Energy research Foundation (ECN), the Energy System Analysis and Planing Group (ESAP) and the ATOM Center from Pantheon Sorbonne University (ATOM).

accompanied by several others factors. Thus, these thresholds are a poor indicator of the level of competition because competition requires a real choice for customers and not just an eligible status.

A second widely used indicator is the "switching rate". The idea behind this indicator is that in a competitive market eligible customers will switch to suppliers who offer better prices than their historical supplier. The first limit of this indicator is related to the lack of information available, i.e. obviously incumbents are reluctant to communicate the number of consumers they have lost. Second, a low level of switching does not necessary reflect the absence of competition because eligible consumers can simply threaten their supplier that they will switch and then renegotiate their contracts at a better price. Such behavior which directly results from the intensification of competition is not taken into account by switching rate.

Changes in prices are another indicator used frequently by the EC. Yet, analysis of price changes is relatively difficult because several elements differ between countries, e.g. taxes, environmental efforts, technologies used etc. Moreover prices changes are relative measures expressed as a percentage, therefore they do not account for an initial level. For instance, industry electricity prices[14] in the United Kingdom fell by 19 % between January 1999 and July 2001 while they fell by 4% in France. Nonetheless, it is hard to say, based on these measures, that competition was stronger in the UK than in France because prices were respectively 59 and 50 Euro/MWh in 1999 and were equal to 48 Euro/MWh in both countries in 2001.

One indicator used in these studies is the existence of wholesale organized markets, e.g. power exchanges. Though it is true that *"they contributes to the development of a transparent market price"* (EC, 2002), their existence provides

[13] See chapter 2, figure 2-1
[14] Eurostat category Ig: Consumption of 24000 MWh/year

little information on the extent of competition. For instance, if one player is able to determine the market-clearing price or if several players collude the fact that an exchange exists is meaningless. It is just a marketplace where competition is expected to occur, it does not necessary mean that competition is actually taking place.

It would be unfair to say that all indicators presented in the report commissioned by the Commission (EC, 2001f), defining "Energy liberalization indicators in Europe", provide little information on competition. Indeed, four interesting indicators with respect to competition analysis are mentioned. The first one, market concentration is based on installed capacity, and despite its shortcomings it represents an interesting starting point, but only a starting point (see 10-3-3). The three others indicators that are of particular interest are number of participants that can set the system marginal price on the organized market, volume traded by non-domestic members on the organized market, and volumes and prices on the bilateral market.

In a competitive market no single player should be able systematically to set the market price. Hence identifying which players are setting the price on the power exchange provides interesting information on the extent of competition by allowing differentiation between a low level of competition in markets where one or a few players set the prices and from competitive markets where a large number of players can set the price. Similarly the volumes of electricity traded by non-domestic members appears to be an important indicator on the real role of international competition. Finally, analyzing the volumes and prices, and ideally the market share of each participants, in the bilateral market allows us to gain a detailed understanding of the actual role of each market participant. Unfortunately, though mentioned, these indicators are not used because providing them requires data considered as commercially confidential and thus not available to the EC.

In conclusion, the actual form of monitoring carried out by the European Commission to supervise the development of the liberalization process is poorly suited for assessing competition in an integrated electricity market. Amongst the numerous indicators, regularly monitored by the EC, market concentration is the only one that provides some information about competition, and this is rather poor with respect to the stakes of the liberalization process and the creation of a competitive European-wide electricity market. Finally, although mentioned, the interesting competition indicators based on power exchanges have not been used due to the EC's lack of power to access relevant information.

10-2-4 The proposals: coordinate auctions/Strategy paper

Recent works by the ETSO and the European Commission have provided interesting insights into what will be the next important issues on the agenda of the European electricity liberalization process with respect to market design and the potential role of power exchanges. But these works also illustrate the lack of a clear perspective on what the European electricity market should look like. The ETSO proposals consider two approaches, the use of coordinated auctions and market splitting/market coupling for allocating interconnector capacity. The different reports and discussion papers put out by ETSO present interesting approaches because they share the objective of improving the use of actual interconnections by taking into account several technical problems, e.g. parallel flows in meshed networks. The EC strategy paper is interesting because it recognizes the difficulties of market integration and provides some guidelines for market design which rely strongly on power exchanges and a timetable for implementation. Finally it is worth noting that, while to different extent, these works recognize the potential role that power exchanges may play in facilitating the creation of a European market.

Since 2000, ETSO has published a set of documents aimed at promoting progress on the issue of congestion management. Two types of congestion management methods have been discussed both aimed at developing a

harmonized framework at the European level. One proposal aims to extend the bilateral auction, between two countries, e.g. A and B, to "multilateral" auctions that take into account the impact of transactions between more than two interconnected countries. For example in the case of four countries, the impact of a transaction between country A and country B on transactions between A and C, A and D, B and C, B and D, and C and D. This method is called "coordinate auctioning" (ETSO, 2001a; 2002b). The second approach considers the use of power exchanges for congestion management (ETSO, 2001b). This method is based on the market-splitting principles used in the Nordic area[15].

The starting point of the ETSO proposal on coordinated auctions is based on two relevant criticism of bilateral auctions, i.e. separate auctions increase complexity for market participants and do not reflect the impact of parallel flows in a meshed network because the definition of interconnector capacities cannot be calculated separately. The idea behind this mechanism is that coordinating the allocation procedures will allow a better use of the network by netting flows in opposite direction and reflecting the physical realities of loop flows. However, though such a mechanism would bring a large improvement over bilateral auctions, it retains several of the problems of the current methods used in Europe[16]. One, the principle of separation between energy and transport remains. Hence, market participants would still be required to enter into different transactions for energy, e.g. a power exchange, and transport, e.g. an auction. Two, the overall mechanism is based on the very restrictive assumption that zones can be defined[17]. Three, the major shortcoming of this approach is that the coordinate auction only uses the data of participants that are willing to use interconnection capacities and thus the impact of intra-zones production on interconnector capacities is not considered.

[15] See chapter 9
[16] Ibid.
[17] Ibid.

The second approach considered by ETSO is the use of power exchanges to deal with congestion. In the Nordic countries "market-splitting" is the expression used to defines this approach, where a single organized market is "split" when congestion occurs. However, since there is no single organized market in continental Europe but rather one organized market for each country, the use of this method for dealing with congestion is also called "market-coupling". Though it is largely recognized, even by ETSO that this method functions well in the Nordic countries, ETSO has regularly express reservations about this approach. Three problems have been presented as the main obstacles for the implementation of "market splitting". The first obstacle in ETSO's view is the presence of a highly meshed network in continental Europe which influences the location and the capacity of congested lines and make it difficult to define zones.

The second problem is related to the existence of bilateral contracts between congested areas which are hardly compatible with market splitting. Finally, ETSO argues that *"electricity markets in Continental Europe are at present far from being compatible enough to implement a common market splitting system"* (ETSO, 2001b). Hence, while the logical conclusion would have been to harmonize national market design, to get rid of bilateral contracts for cross-border trade[18], and to develop a more sophisticated version of market splitting that takes into account loops flows, e.g. nodal pricing, market splitting is at present considered to be unpractical. Thus, in the absence of a harmonized market design, ETSO has favored the coordinate auction approach because it has less institutional requirements and, according to ETSO is sufficiently flexible to function in a European market where market designs differ (ETSO, 2002a).

Until now, as presented during this work, the issue of market design has been a fundamentally missing part of the work of the European Commission. However, as this thesis was being written, at the beginning of 2003, the European Commission produced a "Strategy paper" aimed at presenting a medium term

[18] Against a fair compensation for market participants

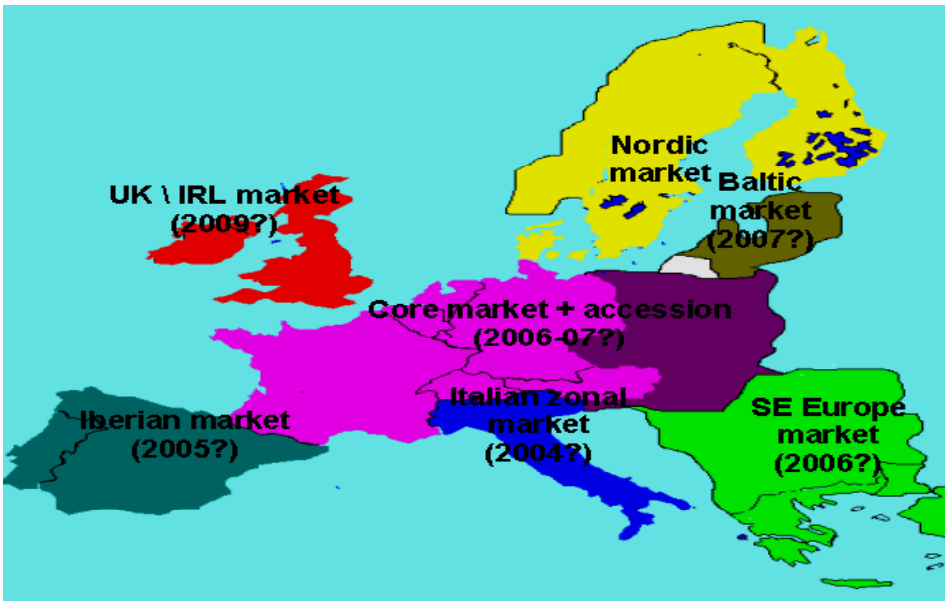
vision on what the internal electricity market should look like. This paper was not publicly available in June 2003, but it has been widely circulated between the different organizations (CEER, ETSO, national regulators), as the intention is for this document to become a public document by the end of 2003, and finally because this document is of particular interest for this work, we will now present a brief outline of the main points and limits of this document with respect to market design and market power. The document is of particular interest because it represents the first time the EC explicitly has addressed the issue of wholesale market design for the European electricity market. Though much less developed than the "standard market design" and "wholesale power market platform" of FERC[19], this document represents an interesting starting point for discussion on what the European electricity market should look like according to the EC. Further it gives an important role to power exchanges.

A first interesting aspect of this paper is that it recognizes that the creation of a single European electricity market might not be a realistic objective in the medium term and that the developments of different regional markets may be a necessary step. Hence the strategy paper defines seven possible regional markets according to transmission constraints and possible dates for the creation of these markets (figure 10-2). Second, the paper defines the creation of wholesale markets in each Member State as a medium term objective providing a single price area which can eventually cover more than one Member State. The use of market splitting is expressly favored in contrast to ETSO which favors of coordinate auctions. The "Strategy paper" addresses the problem of market power when it is difficult to increase interconnection capacity and recommends either divestments, capacity release program, or restriction to interconnector access for dominant generating companies, and monitoring by regulators for

[19] See 10-3-5, Box 10-1 for more on the "Standard market design". The Strategy paper address a very large number of issues in only 20 pages, i.e. market integration, implementation of the Directive, interconnection between Members States, choice by consumers, problems of market concentration, generation adequacy, renewable energy, tax/state aid, and relations with third countries.

possible market manipulation. Finally, this paper advocates strict control on further mergers.

Figure 10-2: Potential regional electricity markets in Europe



Source: De Jong (2003)

The content of this paper can be analyzed from two different point of views. On the one hand, it represents a step forward in the process of creating a competitive European electricity market by defining a concrete outline on the EC's view on some important aspects of market design. On the other hand, however, careful analysis of the draft document presents several serious inconsistencies. Some of these inconsistencies have already been point out in the ETSO comments on this document (ETSO, 2003). For instance, the "Strategy paper" recommends simultaneously creating single price areas and the using of "market-splitting", yet, in the presence of congestion, market splitting leads to the creation of several prices. Furthermore the "Strategy paper" states that in the case of serious congestion explicit auctions might be applied rather than market splitting mechanism. However what "serious" congestion means remains unclear and one may argue that because market splitting is a more efficient solution than

explicit auctions it should be especially favored when congestion is serious to optimize the use of scarce interconnector capacity. The paper also mention creating a power exchange in each Member State this antinomic with the market-splitting mechanism which requires that there is a single power exchange for the entire area.

Similar, the "Strategy paper" states that *"market structure based on obligatory pools […] should be avoided"*. It seems that an argument against mandatory pools is the incompatibility between a mandatory pool and bilateral contracts: *"Bilateral contracts for difference should always be possible to allow long term relationships between producers and suppliers".* This is particularly confusing because mandatory pools and bilateral contracts are not incompatible[20] as showed by the example of the British pool before NETA. Avoiding the obligatory feature of organized markets is not consistent with the stated preference for both market splitting and integration of balancing markets. Indeed, as noticed in the ETSO comments, market splitting as in Nordic countries implies the obligation for players to use the organized market for cross-border trading. Similar, balancing markets are always likely to be mandatory because close to the real time of delivery only the TSO know the transmission constraints.

Additionally, while defining the different regional markets appears to be a reasonable step, it faces several problems. One, it is may be interpreted as a step backwards because the initial objective was to create a single European electricity market. Two, it is unclear how these markets have been delimited. Three, the "Strategy paper" does not mention particular measures for Switzerland regardless to its central position geographically. Four, from a political point of view, it is unclear whether countries outside of the "core market" will oppose or promote this scheme which keeps them out of the major market.

[20] See chapter 3

Beyond the fact that no reference is made to the coordinate auction proposal, which seems to show low consideration on behalf of the EC towards the preferred option of ETSO, ETSO's comments illustrate the reluctance toward detailed market design guidelines coming from the EC. This can be illustrated by the following *"The way the strategy paper is drafted gives the impression that TSOs' responsibilities are reduced to just implementing the decision of the EC, Members States and Regulators. ETSO considers necessary to address in much more detail in this paper the question of a suitable sharing of responsibilities in order to avoid unnecessary concentration of power, overregulation etc."* (ETSO, 2003). Similar, while the strategy paper recognizes the importance of market power and of market monitoring, it seems that this issue is not taken on board by ETSO as illustrated by the following: *"In our view, undue weight is put […] on market dominance or concentration and too little weight on high prices"(ETSO, 2003).*

In conclusion, recent work by ETSO and the EC illustrates a continuing lack of a clear perspective on, and consensus about, the future design of the European electricity market. One must first recognize the effort of the EC in that it has addressed, for the first time, the very complex issue of market design. Moreover the "Strategy paper" illustrates strong support from the EC for electricity power exchanges. Nevertheless the "Strategy paper" is far from providing a consistent framework. Fortunately, this paper is a draft and one may expect serious improvements on the first version after consultation with others parties. Unfortunately, this lack of consistency may also illustrate the absence of a clear perspective within the European Commission on what the European electricity market should look like, and more worryingly, a poor understanding of the different aspects of market design. If the final version does integrate major modifications it will raise concerns about the future ability and credibility of the EC to play a leading role in the "market" regulation process.

10-3 Toward European "market" regulation: the role of power exchanges

10-3-1 Introduction

The analysis of recent works by the European Commission has shown that monitoring to date has focused on the implementation of the Directive 96/92 and thus has not directly addressed the issue of market performance which is a necessary step for the improvement of market design. Monitoring of competition is mentioned in article 22 of the amended proposal for a Directive amending the Electricity and Gas Directives and amended proposal for regulation on cross-border exchanges in electricity: *"Member States shall designate one or more competent bodies as national regulatory authorities […] that shall at least be responsible for continuously monitoring the market […] in particular with respect to the level of competition"* (EC, 2003). It is unclear however, how this monitoring should take place.

In this section, since market accurate monitoring is seen as a fundamental step for market design, we suggest a practical approach for improving the actual functioning of the European electricity market based on effective monitoring of competition using power exchanges. We analyze how power exchanges can be useful for three important aspects of market monitoring, i.e. facilitating market definition, improving traditional market share analysis, and developing competition indicators. An important problem of any competition analysis is to define the relevant market, in this respect power exchanges provide interesting solutions (10-3-2). Subsequently, we discuss how classical market share analysis can be improved by using power exchanges (10-3-3). Additionally, we suggest which types of information should be combined with the information provided by power exchanges to create competition indicators (10-3-4). Finally based on this monitoring we provide several recommendations as to how power exchanges can be used to improve market design (10-3-5).

10-3-2 Power exchanges: a useful tool for defining the relevant market

The organizational complexity of the actual design of European electricity markets makes it difficult for competition authorities, regulators and governments to assess the efficiency of the functioning of their electricity market as a whole. It is necessary to define the relevant market before undertaking any further studies to estimate the level of competition and understand the reasons for the unsatisfactory output of these markets. Yet, the traditional approach, based on merger control procedure, appears to be ill suited while using power exchanges provides an interesting starting point.

Defining the relevant market provides the necessary framework for any analysis of competition. Market definition is not an end in itself but it represents the first step for any investigation where there are concerns regarding competition. The main objective of defining a market is to identify the competitors that might behave negatively with competition. The need to define markets has formed a fundamental basis of EU competition policy since its inception and has always been a pre-condition under articles 81 and 82 of the Treaty. The market definition notice provides guidance on the rules followed by the Commission to define the relevant market (EC, 1997). This notice gives three main elements that constrain the exercise of market power: demand substitutability, supply substitutability and potential competition. Demand substitutability represents the most important criteria. It refers to perfect or near perfect substitutes being readily available in a determined geographic area to which consumers can easily switch if prices increase. Supply substitutability represents the second criteria, and refers to producers who are able to switch to relevant production as a response to price increase. The potential competition criteria for market definition is not taken into account in this document. It appears as a later stage for identifying market power. In practice, the first step in market definition consists of defining the relevant product market and the relevant geographic market.

Under European regulation, the relevant product market comprises any products or services which are regarded by the buyers as interchangeable with respect to their characteristics, prices and intended use. The relevant geographic market is defined as the area in which *"the undertaking concerned are involved in the supply of relevant products or services in which the conditions of competition are sufficiently homogeneous and which can be distinguished from neighboring geographic areas because, in particular, conditions of competition are appreciably different in those areas".* In order to define these markets the commission put forward three basic sources of competitive constraint on a party: demand substitutability, supply substitutability and potential competition.

Demand substitution is estimated using the hypothetical monopolist test. This test is known as the "Small but Significant Non transitory Increase in Price" test (SSNIP). The objective of this test is to estimate the reaction of customers in response to a small (in the range of 5-10%) permanent relative price increase in the product market and areas considered. If the loss of sale resulting from substitution make the price increase unprofitable, additional substitutes and areas are included in the relevant market. The identification of a set of products and of relevant geographic area can be achieved based on this theoretical test.

Supply substitutability refers to the ability of producers or services providers to switch production to the relevant products as a response to a price increase. This substitutability capacity is only taken into account when suppliers can produce the good under consideration with respect to comparable standards in terms of effectiveness and immediacy. The notice states that supply side substitution should occur *"within a period that does imply a significant adjustment of existing assets"* which mean the very short term.

The traditional approach presents several limits for electricity because electricity markets differ widely from other product markets, e.g. non-storability, low demand elasticity, transmission constraints, complex market design. Using power

exchanges as a basis for defining the relevant market has several advantages that take into account these peculiarities.

Since electricity cannot be stored each single period represents a different market. Power exchanges allow this aspect of competition in electricity markets to be taken into consideration, by providing prices for each single hour, they reflect the dynamic aspects of competition. For instance, careful analysis of power exchange outcomes may reveal that a specific hour or combinations of a couple of hours represents particular markets that need to be isolated. Power exchanges can thus be use to narrow down market definition.

Though power exchanges only represent a small share of the total traded volumes, prices on power exchanges are well representative of the overall situation in bilateral markets[21]. Hence, power exchanges prices can be use as an indicator for the overall electricity market. Since substitution and arbitrage can be achieved across market potential large difference between power exchange prices and other bilateral market are unlikely to remain. For instance, one contract for 10 MWh baseload power for the following day contracted on the bilateral market can be considered to be a good substitute for 24 purchase contracts, i.e. one for each hour, on a power exchange.

Finally, using power exchanges markets helps us to take into account the fact that actual electricity markets are composed of more players than just national generators[22]. For instance pure traders and foreign generators without asset in the delivery area of the power exchange can play a very important role in the market. They can arbitrage between different types of OTC contracts, between OTC and power exchanges, or between power exchanges through the markets for interconnection capacities. Power exchanges are thus a good indicator of the

[21] See chapter 8
[22] See chapter 7

relevant geographical market because they allow the suppliers who are able to compete in the market to be identified.

10-3-3 Using power exchanges to improve traditional market share analysis

When a relevant market has been defined, a classical way to tackle market power is to estimate the level of concentration of this market. This approach is derived from the "Structure-Conduct-Performance" (SCP) paradigm[23], which states that market structure determines the behavior of participants and market outcome. From an intellectual point of view it appears logical that concentrated markets are more vulnerable to price manipulation and market power than less concentrated markets. Though traditional market share analysis present several shortcomings for electricity markets in general (Rosen and Williams, 1999), using this approach for power exchanges provides interesting insights into the extent of competition and is thus a useful step to start.

In their report issued in November 1997 on generator market power in England and Wales, the Brattle Group compares different values of the HHI[24] index of generator market power calculated by Littlechild, Newbery and Joskow (Brealey and Lapuerta, 1997). *"Professor Littlechild, has cited a figure of 1,750 as the divided line between a moderately concentrated and a highly concentrated market. Newbery and Green have estimated that an HHI of 2,000 could have eliminated most of the inefficiencies of a duopoly in generation. Finally, Joskow has argued that HHI figures above 2,500 indicate so severe risks of market power that regulatory intervention would be justified".* In Europe due to the dominant position of the incumbents a HHI index on the production side above 3.600, i.e. with a dominant player having more than 60% of installed capacity is common. This is a major concern for competition, since under European Union

[23] See chapter 1
[24] See chapter 7

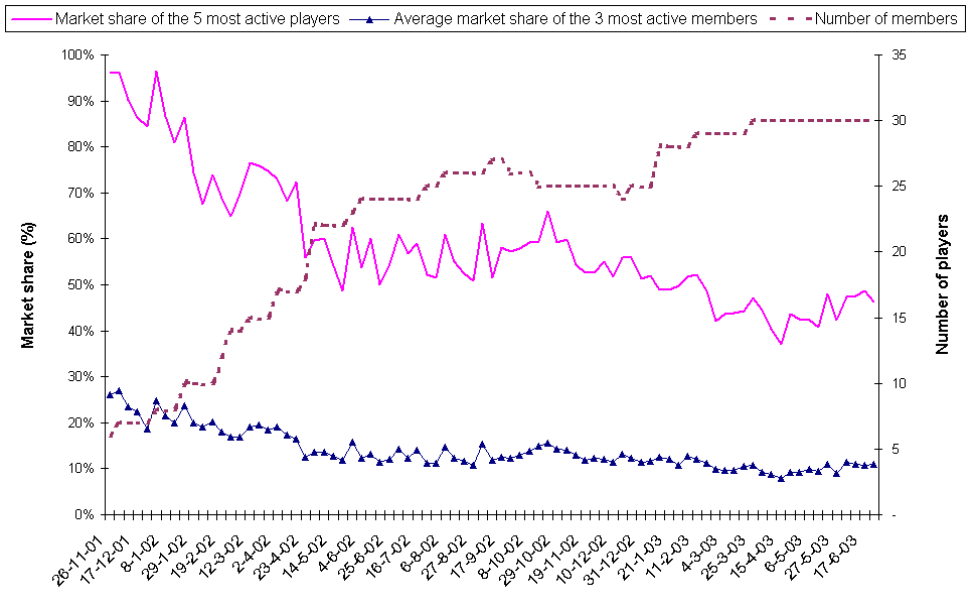
competition law, a market share above 40% is usually considered to be dominant.

In this example, and in general, market shares calculations in electricity markets have been realized from a production side point of view. Using installed capacity is the simplest methods. The greatest advantage of this approach is that it only consists of making an inventory of installed power in a defined area and calculating the market share of each player. This method is often used since it is easy to calculate, i.e. based on technical data, and reflects the basic conditions of the market. However this method can be criticize because it does not account for power plants that have been put out of production or that can not produce 100% of their theoretical capacity, and for power plants that have different levels of production over time. Ii also sometime hard to relate installed capacity with volumes sold. The main problem with concentration measure based on installed capacity is the fact that they are static measures that do not reflect the flexibility of production necessary to cope with the seasonal patterns of electricity demand.

Using power exchanges to calculate market shares provides some interesting solutions for these problems. First calculating market shares based on power exchange markets has the advantage of being able to take into consideration the fact that actual electricity markets are composed of more players than national generators. For instance, market share of pure traders and foreign generators without assets in the delivery area of the power exchange provide interesting information on the extent of the competition faced by national generators. Hence, if traded volumes of non-domestic members represent a significant share of the total, this would show a relatively good level of competition. In Europe, only the French power exchange publishes information about market share on the exchange (figure 10-3). Such information provides interesting information about the extent of competition on the exchange and the credibility of the price index. It can be seen that the role of EDF in the price determination process appears not to be significant which reinforce the credibility of Powernext. Yet the number of

participants has increased on a regular basis, the market share of the most active members has decreased strongly since Powernext started operation and is now relatively low

Figure 10-3: Weekly market share of the most active members



Source: Powernext

In practice, electricity players do not intervene in the market per power plant but per company. This portfolio approach makes it difficult to assess the relationship between physical flow and economical transactions. Hence using data from the transactions on the power exchange allows us to identify the actions of individual participants. Most generators have developed trading activities around their assets. Thus calculating market share on the power exchange on both sides, i.e. buyer and sellers, may allow us for instance to identify a generator that might be a buyer in a market when prices are lower than its production costs.

Finally, since power exchange spot markets provide 24 markets per day, i.e. one for each hour, they also provide the possibility to calculate concentration measure for each key time period and thus provide a dynamic estimation of competition in contrast to the static HHI which is based on installed capacity.

While calculating 24 HHI indexes per day might hamper the possibility to reach a robust conclusion, analysts should be able to weight these HHI to define aggregate HHI indexes, e.g. peak-off peak/weekdays-weekends, or to focus on specific hours, e.g. super peak hour and compare them over time. Thus, defining a set of HHI based on traded volumes on the power exchanges will allow market monitoring units to identify if any individual players has market power in any given time period.

10-3-4 Power exchanges: competition indicators for effective market monitoring

Due to their complexity, as illustrated in California by the Enron's memos[25], concentration measures do no suffice for analyzing competition in electricity markets. Amongst the most important issues that HHI does not account for, are aggressive bidding, withholding capacity, tacit collusion and complex rules manipulations. For these reasons, though HHI based on volume traded on power exchange provide a good starting point they need to be completed to recognize important problems related to market power analysis in electricity markets. The existence of an organized market such as an official power exchange facilitates the task of market monitoring units (MMU) because it can provide a large amount of information, in contrast to bilateral markets, that can be use to analyze competition. The question is then how can we use power exchange data to perform an adequate analysis.

A practical way to perform an analysis is to compare actual data with what would be expected in a well functioning market. A significant amount of analysis can be done based on power exchanges and others type of public information. For instance, a simple indicator is an estimation of the relationship between system load and prices on the power exchange. Indeed, one would expect that prices are higher during points of high demand than during periods of low demand.

[25] See chapter 6 and appendix 1

Systematically monitoring this relationship across time appears to be a good way to test whether market outcomes reflect markets conditions.

Analyzing resilience on power exchanges, i.e. the sensitivity of the market-clearing price to incremental demand, provides interesting insights into the level of liquidity on a market. Indeed, estimating the impact of different values of additional demand on market prices is a good indicator of the sensitivity of a market to potential market manipulation. For instance, if a small additional demand of 5 MW dramatically increase prices, this reflects a low level of competition where almost any player can influence prices. In contrast, if a large additional demand order has a low impact on prices this indicates that no player can individually influence prices.

The price-cost markup index is a more sophisticated indicator of competition. The goal of the markup index is to estimate the difference between the observed market price and what might be expected in a competitive market. The price-cost markup index is defined here as the difference between market price (MP) and marginal cost (MC), divided by market price (=MP–MC)/MP). The central assumption behind this reasoning is that in theory market price should be determined by the marginal cost of the marginal. This method has been widely used in California for estimating market power[26] and is regularly used by the MMU of PJM (PJM, 2003). Such indicators provide a fundamental benchmark, i.e. relationship price/cost, and should be considered for this reason.

As the publicly available information is mainly aggregated, it does not suffice for effective monitoring by the MMU, which needs more detailed information to ensure effective monitoring. The information produced by power exchanges is particularly interesting because it allows the MMU to assess the behavior of individual participants, in particular, the data on individual bids and individually traded volumes allow it to construct several interesting indicators.

[26] See appendix 1

To be effective the MMU should have access to individual bids on the organized markets which would allow it to determine which players can set the system marginal price. On wholesale short term markets, such as power exchanges, market power depends on a firm's capacity to modify the short run marginal costs of generation in each hour of the day and the ability to withhold part of its production capacity. Then estimating market power in generation requires an analysis of a firm's plant production costs and especially its capacity to meet demand during peak hours when the market is tight. Since, the last accepted bids fixes the price on power exchanges, the price offered by the last bidder is a relevant indicator of the existence of a dominant position. Thus, the systematic identification of the players that set the market-clearing price on power exchanges provides information about the level of competition because a real indicator of market power is not just a firm's market share it is also its ability to control the clearing price. For example if one player sets the price on the power exchange 90% of the time, this would indicate a lack of competition and strongly suggest the existence of market power.

Power exchanges can also be used to analyze the problem of withholding capacity. Withholding capacity is certainly the most well known strategic behaviour in electricity markets to abuse market power. The traditional form of withholding capacity consists of decreasing supply and profiting from the high prices for other production. The profitability of such a strategy can be tested using power exchanges. To test this the MMU needs to run several simulations based on actual bids and add or withdraw supply bids, such simulations will allow the MMU to estimate how changes in supply influence the profits of the different players and thus facilitate the detection of market power. Another simulation approach consists of removing the bids of one player and estimating the impact on prices and volumes. If the changes are significant, this would not show automatically that the player is abusing market power but it would show that the player has potential market power and thus specific attention should be paid to its behaviour.

In periods of high demand, suppliers that are aware of the tightness of the market may use excessively high bids on the power exchange to increase market price. Such behavior is known as aggressive bidding or economic withholding. For buyers who are short in the OTC market the power exchange represents the last place to buy electricity before going to the expensive (and risky) balancing market. Hence, an analysis, by the MMU over time, of bids is a practical way to identify such behavior. If such behavior is detected, the MMU can undertake further investigations and determine whether the higher bids where justified or whether they were an abuse of market power.

Due to the confidential nature of the data used, the details of the work of market monitoring units should remain restricted because revealing information on players at the level of individuals participants would be commercially sensitive and might favor collusion. For instance, the purpose monitoring is not to publish which participant is setting the price for any particular hour, but rather to get insights into the real extent of competition. Hence, an MMU could publish anonymously the number of participants that were able to set up the price on the power exchange for a defined period and the number of occurrence. As a rule, an MMU should publish the results of its findings in a format that does not allow individuals participants to be identified.

Finally, one of the most difficult aspects of monitoring electricity markets is defining the boundaries of the market[27]. Indeed, once an electricity market has been defined, it is extremely difficult to take import and export with neighboring countries into account. Although the net amount of electricity entering or leaving a pre-defined market can be measured, it is almost impossible to identify the exact origin and the cost of that power. This problem is of particular relevance in Europe where the development of cross-border trade is significant. Thus, although a significant part of market monitoring can be done at national level, it is also necessary to monitor the electricity markets at a supra-national level.

[27] See 10-3-2

Indeed, purely national monitoring make little sense in the presence of international players competing simultaneously in several markets. Hence, focusing only on one power exchange is unlikely to capture all the subtleties of market participant' strategies[28].

Table 10-1: Competition indicators and power exchanges

Indicators based on public information	Indicators based on information available to MMU
•PX prices Vs system load •PX prices/volumes developments •Comparison OTC/Power exchange/Balancing prices •Difference actual prices/theoretical prices •Deepness of the market (based on aggregate bids curves) •Level of integration with neighbouring markets •PX prices Vs costs •Resilience •Impact of scheduled/unplanned outage/ maintenance on interconnector on PX prices •Evolution of congestion Vs price of congestion	•Individual market share on PX traded volumes •Who set the price on the PX •Marginal unit ownership Vs who set the price on PX •Market share of non-domestic producers on PX •Level of liquidity •Volume traded Vs Load per player •Who use interconnection capacity •Reserve margin Vs PX prices •Profitability of withholding capacity on PX •Impact of change of design •Level of demand response on the PX

Since power exchanges are now in place in most European countries, combining the analysis of different exchanges would provide interesting information about participants behaviors. For instance, studying the behavior of players on two exchanges would help indicate the extent of arbitrage between two exchanges. In the case where there is low arbitrage, despite a price difference, a European market monitoring unit that combines the work of the different national MMU might investigate the reasons for such inefficiency. This could reveal incompatible marketplace design, e.g. different products or incompatible trading periods.

In conclusion, the existence of organized markets, such as an official power exchange, facilitates the task of MMU because they provide a large amount of information that a monitor can then use to analyze competition on a market.

[28] To this respect, the strategies "export of California power" and "Death Star" described in the Enron's memos are good illustrations of how players can take advantage of a system if monitoring is limited to national markets (see chapter 6).

Access to relevant information is crucial for both the development of competition and effective market monitoring. With regards to monitoring, it appears suitable for more information to become publicly available while still maintaining confidentiality with regards to any detailed information that the MMU may access. Power exchanges are very interesting for monitors because they help MMU to obtain the information necessary to develop indicators of competition (table 10-1). Such indicators are vital for assessing market performance. Market monitoring, in that it helps to identify market design flaws and anti-competitive behavior, plays an important role in terms of preventing market power abuse by players. Close monitoring discourage players from acting anti-competitively since players know monitoring units are "watching" them. Such monitoring also reinforces confidence in the fairness of the market because market participants know that unfair practices will be detected and sanctions taken against abusive players.

10-3-5 Recommendations: power exchanges as a basis for a market regulation framework

Based on the economic theory of electricity markets and successful international experiences one might be tempted to make just one recommendation to create a single European electricity market. This recommendation would be to merge the different national system operators and power exchanges to create a single European system operator that would implement nodal pricing at a European level. Yet, although such a system appears likely to be the only one able to take into consideration technical aspects and ensure economic efficiency, such a recommendation will be of little use. This is because it will be seen as such a dramatic change with respect to the approach followed to date that it will be considered to be "practically" unfeasible, which would be true in the short term at short notice, and thus rejected by the different parties. Hence, we suggest a step by step approach to an integrated European market based on power exchanges.

Since wholesale marketplace/market design was overlooked in the liberalization process for the European electricity market, the initial step that needs to be considered is a detail assessment of the actual situation. To do this we need to make a detail analysis of the different national market designs, i.e. trading arrangements, grid codes, functioning of bilateral market/power exchange/balancing mechanisms/allocation methods for interconnector capacity. We need to estimate the level of market integration based on power exchanges and extend the work presented in this thesis. Such an analysis would shed light on the diversity of national market designs and provide the European Commission with solid empirical evidences for further reforms of the electricity market and a first benchmark for evaluating progress.

Recommendation 1: *The European Commission should realize a detail analysis of the actual European wholesale electricity market design and the level of market integration using power exchanges*

Subsequently the European Commission should consider the different alternative for market designs. Ideally, the choice between market designs should be made in favor of the model that delivers the best performance. A comparison of the costs and benefits of each model with respect to market structure, i.e. number of players, barrier to entry, excess capacity, interconnections etc; market design, i.e. mandatory pool, voluntary exchange, nodal pricing, zonal pricing, auction mechanisms etc; and institutional features, i.e. ownership, regulation, market governance, environmental constraint etc, appears to be the best approach. However, in practice a cost benefit analysis would face a major difficulty as noted by Newbery (2000): *"Given the large number of possible factors that might explain differences in performance of different trading arrangements, and the short time period over which most have been tested and adjusted, the empirical evidence is far from decisive as to which design suits which set of circumstances. The debate has therefore been largely driven by a priori arguments, analogies or the expectations of different special interest groups who see opportunities for gain from changes of the existing system".* One way of comparing the differences

in performance of different market design would be to identify clearly the different alternatives by comparing, for instance, the different theoretical models and the international experiences. Many models of market design already exist and many variations are possible. It is important to recognize that no model is perfect because electricity markets are imperfect and complex (Ruff, 1999). Though it is unlikely that such a comparison would end with the identification of a perfect model, it would allow us to define some critical principles of successful models that need to be followed and should sort out and allow us to dismiss fallacious approaches. In this respect, determining the role of power exchanges in the successful examples of Nord pool and PJM and their role in the failure of the California market should allow to identify several fundamental success factors.

Recommendation 2: *The European Commission and the different interested parties (ETSO, CEER…) should consider the different alternatives for market design to identify the critical principles of well-functioning markets with respect to the role of power exchanges*

Despite the variety of market designs, one important characteristic of most well functioning electricity markets is that a single institution combines system operation (TSOs) and market operation (power exchange). Such integration or at least a high level of collaboration is fundamental because it allows the marketplace to take into consideration transmission constraints which represent a key aspect of market design in electricity markets. Moreover, since in Europe the balancing markets are managed by system operators and day-ahead markets by power exchanges, a high level of coordination between the two entities is necessary to avoid incompatible rules between the two markets that may distort competition. Such collaboration is necessary to coordinate congestion management and synchronize the functioning of day-ahead market with balancing markets.

Recommendation 3: C*ollaboration between the different power exchanges (PX-PX) and the different transmission system operators (TSO-TSO) but also between the PX and TSO (PX-TSO) needs to be encouraged and developed*

Market-based mechanisms have been recognized in the Florence process since 2000 as the most efficient way to allocate interconnection capacities. Although bilateral auctions for the allocation of physical transmission right are not an optimal solution, they nevertheless represent a real step forward compared to first-in first-served and prorata methods. Indeed, non-market-based approaches which give away valuable transmission rights, should be eliminated. Once the amended EU electricity Directive of 2003 and Regulation No 1228/2003 (See box 10-1) come into force, the allocation of all interconnector capacities based on auction will signal the beginning of the standardization of market design. Moreover it is necessary that these auctions are managed by independent system operators, in contrast to vertically integrated utilities, to ensure the neutrality of the mechanism. Once such mechanisms are in place netting should be encouraged to maximize available capacity.

Recommendation 4: *In the short-term market-based mechanisms for congestion management managed by independent system operators should be implemented, netting should be encouraged, and compatibility with power exchanges should be respected*

In the medium term, the integration of transport and energy must be considered to maximize the utilization of interconnector capacity and locational pricing (nodal or at least zonal) should be encouraged. Ex-ante determination of interconnector capacity results in inefficient allocation of the available capacity because the real capacity available can only be determined once physical flows are known. Hence the separation of transport and energy does not maximize the utilization of the network because the available capacity defined by the TSO, and auctioned, is lower than the real available capacity which force the TSO to take into account a substantial safety margin. Although most national networks are very dense, which has allowed most European Members States to ignore transmission constraints at the national level, locational pricing based on power exchanges at a national level should be considered. The main reasons for this are to optimize

the utilization of congested interconnectors and to provide a signal for new investment in generation and networks.

Recommendation 5: *In the medium term improvement of the efficiency of transmission pricing by integrating transport and energy and moving towards locational pricing through better collaboration between power exchanges and system operator needs to be considered*

One practical way to improve the functioning of the actual European electricity market(s) is to increase the level of information available. The "Open Access Same Time Information System" (OASIS) required by FERC provides a good example. Such a system covers a large range of operational information, e.g. day ahead scheduled outages, transmission line real time scheduled outages, transmission line real time actual outages, scheduled flows, real time events, real time actual load, demand forecast etc. The two key benefits of increasing market transparency are one, it removes asymmetries between players which is fundamental for the creation of a one level playing field, and two, it facilitates market monitoring.

Recommendation 6: *The level of transparency of electricity markets should be improved by system operators and power exchanges by publishing relevant information*

In markets characterised by short-term inelasticity of demand, a concentrated structure and a design in transitional phases, opportunities for abuse of market power represent a major threat for the development of competition. Above all, it is worth noting that the first necessary condition for competition is the presence of a competitive market structure. Though market design plays an important role in the creation of a competitive market it does not solve the problem of concentration that exist in most European markets. Until now, the European Commission has been powerless to block large mergers and acquisitions. Across Europe, electricity markets are already very concentrated with a growing trend towards further concentrations. For instance, despite the fact that EDF was already the largest player in Europe, the European Commission was unable to

prevent this company gaining shares in Austrian, Italian, British and German companies. Even worse, EDF has been able to increase its market share in France by buying a French co-generation company (Dalkia). Similarly, the impotence of national competition authorities has been recently illustrated with the German merger between E.on and Rurhrgas. The EU Commission was relatively silent on this 'mega-fusion' simply because this merger did not fall under the current EU competition law. At a national level, competition authorities are often reluctant to challenge such mergers because the concept of a "national champion" able to compete on the European market appears appealing – regardless of the threat it represents for a well functioning (national) market. Competition needs players and therefore further concentration should be carefully evaluated.

Though market design cannot solve problems of market structure, poorly designed markets may facilitate the abuse of market power by, for instance, restricting entry or limiting demand response. Since electricity markets are very complex and highly dynamic, classical indicators, e.g. HHI based on installed capacity, and traditional competition laws are poorly suited to address this issue (See 10-3-2). Careful market design can help to mitigate market power by improving transparency, facilitating competition and optimizing the use of network. Hence the different aspects of market structure need to be carefully considered and new indicators of competition determined, e.g. system load VS prices, price-cost markup index, the number of participants that are able to set up the price etc.

Recommendation 7: *Pursue initiatives to address the issue of market power by considering the impact of market design on market power and developing "competition indicators" using power exchanges*

A continuing challenge in electricity market regulation is how to design the market and analyze the level of competition. Continuous monitoring by specialized entities, i.e. Market Monitoring Units (MMU) at the national level is suitable for this purpose. Using power exchanges, MMU should perform analysis

of the development of competition and provide recommendations regarding how to improve market performance, for instance by recommending changes in market design. Additionally, a European Market Monitoring Unit should be created to combine the different national analysis and to address the issues that involve more than one national market.

Recommendation 8: *Create a European Market Monitoring Unit and national MMU for effective monitoring of competition and market design*

Market monitoring is of little use if it only identifies problems and is not backed up by regulatory authorities that can implement and enforce recommendations to fix the problems. This is especially important because it is difficult to get everything right at the outset. Hence procedures to fix electricity market design and market performance problems are suitable. Unfortunately, the EU Directive(s) and traditional competition laws are currently inadequate for this purpose.

Concretely, the different regulatory authorities need to define what the European market should look like. Political, economic and governmental differences make it impossible to replicate at a European level the approaches used at national levels and elsewhere around the world. Nevertheless some critical principles of successful processes can be identified and need to be followed. Clear principles with respect to market design should be defined and measures should be adopted to facilitate competition in electricity markets at a European level. For this purpose, a uniform policy approach is necessary which will define a precise market regulation framework, i.e. market design and market monitoring. This is the purpose of the "Strategy paper" but, as we have seen, this remains a very incomplete draft, and it appears unlikely that in it present state it will suffice to create an integrated market[29].

If the level of integration remains low, which is likely to occur due to the lack of a harmonized market design, the European Commission should, in the medium

[29] See 10-2-4

term, present a market regulation framework. Such a framework would define the main features of the design of the European electricity market not just for cross-border trade but also for the detailed principles of market design in each Member State.

Such a problem is also a central issue in the United States where in the absence of a clear consensus on what markets should look like the initial approach of the FERC for electricity restructuring was to let each market develop its own design. This thinking was capture by the phrase: *"let a thousand flowers bloom"*. This process resulted in the creation of several flawed designs. Hence, in testimony before the US Senate committee on energy and natural resources, Pat Wood, Chairman of FERC stated that wholesale power markets in the US have *"many of the worst features of both regulated and competitive markets, and few of the benefits of either"*. Having faced the failure of the *"let a thousand flowers bloom"* approach, FERC issued its proposed rule for a Standard Market Design (box 10-2) which has recently been replaced by the Wholesale Power Market Platform.

Using input from the different MMU, a European framework would recognize that the creation of a single market needs not only harmonization of cross-border mechanisms but also to create compatible national market designs. Power exchanges are important tools in this case since they represent an important part of each national market design. An extension of the European Commission authority might be opposed by many Member States but makes sense because international transactions are crucial for the creation of a single electricity market, and market design flaws in one country are likely to have adverse effects on other countries. Although, it appears to be difficult to standardize market design in each State at short notice, it appears to be necessary to standardize at least wholesale pricing and transmission rules at the European level. In the absence, to date, of recognition for the importance of market design, it is unlikely that such framework would be perceived as necessary by the different parties. On the contrary it would be seen as overregulation and to be incompatible with the

principle of subsiduarity. However, if in a couple of years facts shows that a real integrated market has failed to emerge, one may expect support for more draconian measures using such a framework.

Recommendation 9: *In the medium term, the European Commission needs to define a market design framework clarifying the role of power exchanges for the European electricity market: a market design Directive?*

Box 10-2: Market Regulation: the approach of FERC

In 2002, the Federal Energy Regulatory Commission's (FERC) Order No. 2000 set in motion the voluntary formation of regional transmission organizations (RTOs). Unhappy with the progress to date on RTO formation and in an effort to foster seamless transmission and wholesale energy markets, FERC issued its proposed rule on Standard Market Design (SMD) in the Notice of proposed Rulemaking (NOPR). The proposed SMD rule would require the mandatory formation of Independent Transmission Providers (ITPs) that will implement and administer the new SMD. The aim of this proposal was to create: genuine wholesale competition, an efficient transmission system, proper pricing signals for investment in transmission, generation facilities and demand reductions and more customer options. Moreover market monitoring and market power mitigation are also key features.

Some key elements of the SMD proposal are presented below:

- **Transmission constraints → Locational Marginal Pricing (LMP)**

LMP (nodal pricing) should be used to manage transmission congestion

- **Volatility → Bilateral contracts**

The SMD includes reliance on financial bilateral contracts that limit the effect of potential volatility

- **Short term trading → An independent Transmission Provider (ITP)**

The ITP will establish short-term and ancillary services markets.

- **Security of supply → A resource adequacy requirement**

Requirement on load-serving entities to ensure that they have adequate capacity to serve their load plus a minimum reserve margin

- **Market power → Monitoring and mitigation procedures**

Special attention should be given to market power through monitoring of bids (when relevant), possible withholding of capacity, and implementation of a safety-net cap.

The SMD proposal represents a significant step forward to enhance competition in American's electricity markets. While some details are missing and need to be further discussed (Hogan, 2002), this proposal provides a consistent starting-point-framework taking into account both market design and market monitoring that appeared necessary to support a competitive electricity market. However after consultation with different parties several modifications were made to take into consideration the concerns of opponents in the Southeast and Northwest. The SMD became the Wholesale Power market Platform (WPMP) in April 2003. In recasting the SMD proposal as the WPMP, FERC allowed some flexibility in the implementation. The open questions now are : How long will it take to implement the WPMP? Will States regulators accept it? To what extent will the different implementation be compatible?

10-4 Conclusion

A continuing challenge in electricity market regulation is how to design the market and analyze the level of competition. The short-term inelasticity of demand, the concentrated structure of most electricity markets and the relatively poor design of electricity markets in transitional phases represent important concerns with respect to competition. For this reason market monitoring is necessary. To date the European Commission has focused its monitoring on the implementation of the Directive and not paid due attention to wholesale market design and wholesale market performance. Moreover, recent work by the EC and ETSO seems to show a lack of a clear perspective on what the European electricity market should look like.

In order to move forward we have suggested a practical approach for improving the actual functioning of the European electricity markets using power exchanges. We have showed how power exchanges can be used to facilitate the problem of market definition and improve traditional market share analysis. We have then suggest how power exchanges can facilitate the construction of competition indicators to ensure effective market monitoring and identify potential market design improvements. In this respect the existence of power exchanges, in contrast to purely bilateral markets, facilitates the work of monitoring units by aggregating a large amount of information about participant behavior and providing details data on the evolution of supply and demand.

This work shows that only opening access to interconnection capacities is not sufficient to create an integrated market, it also requires designing the market that facilitate competition. In the absence of specific guidelines for market design, this has been carried out at a national level which has resulted in different arrangements. However, one important feature of actual market design is the existence of power exchanges in most Members States. These marketplaces have been able to develop good indicators of their respective national markets and thus can be used as a starting point for the development of an integrated

market. Concretely, additional measures need to be taken to favor the creation of a European electricity market such as the creation of a consistent framework for market regulation. Market design and market monitoring need to be recognized as two essential elements for the well functioning of electricity markets. In Europe the liberalization process has overlooked these two issues. The focus has been on the legal aspects (liberalization) rather than economic aspects (competition).

The Directive 96/92 represents a significant step toward the creation of competitive markets, i.e. it has induced dramatic changes in the electricity industry, but it has not provide guidance on the question of what the market should look like. Liberalization is only one step in the process, alone it cannot deliver the expected benefits of a single integrated European-wide electricity market. The peculiarities of electricity markets need to be recognized. This involves designing the market at a European level rather than at a national level, and installing committees that are well equipped to perform effective monitoring. Since power exchanges are an important part of the actual market design they represent an interesting tool for this market monitoring process, and because it is hard to get everything right at the outset, this monitoring will allow monitoring committees to make recommendations for further improvements of the market design.

In conclusion, the definition of a clear and consistent market regulation framework by the EC appears to be a fundamental step in the sense that it will provide the necessary basis for negotiation with all interested parties to move from the actual situation, characterized by a low level of integration, to the creation of a real European wide market. The definition of such a framework is a complex task because no model is perfect. However, a detail analysis by monitoring committees using power exchanges can be utilized to provide solid empirical evidences that can be used to help regulatory bodies in the definition of such a framework.