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Addressing Market Power and Industry Restructuring

Lars Bergman *

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Industry Restructuring, Market Power and Workable Competition¹

Lars Bergman
Stockholm School of Economics
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1. Introduction

The basic rationale for European electricity market reform is the consumer benefits it can bring. These benefits may come in many forms. One is lower prices resulting from lower price-cost margins and more cost-efficient production and distribution of electricity². Another is a high degree of security of supply, in the short term as well as in the long term. A third type of benefit is environmental efficiency, i.e. an environmentally friendly electricity supply system. A fourth type is sustainability, i.e. an electricity supply system that in the long term does not critically depend on exhaustible natural resources. In this chapter we are primarily concerned with consumer benefits in the form of lower price-cost margins and a more efficient electricity supply industry.

The electricity supply industry can be organised and managed in several different ways. In the past vertical integration and central planning were the key features of the typical organisation of a European country's electricity supply industry. The EU electricity market directives, however, have induced fundamental reorganisation of the industry and major steps away from the central planning regime. Thus, in the emerging new era competition, made possible and facilitated by unbundling and market integration, is expected to be the main driver to attain efficiency in electricity supply³.

However, in a system where competition is expected to play such a significant role, competition clearly has to be at least "workable". By "workable competition", a term that will be extensively used in the following, is meant a market that is perhaps less perfect than the textbook vision of a competitive market but yet generally free from monopolistic pricing and various forms of collusion and manipulation. Unfortunately there are several threats to "workable" competition in European electricity markets.

One is market power, i.e. the power of a single generator or supplier to profitably raise the market price above the competitive level. Market power can be the result of a high degree of concentration on the seller side of the market⁴. But, as will be discussed in some detail below, an electricity market can suffer from market power problems even though the degree of concentration is low. One can say that a high

¹ The author is grateful to Eirik Amundsen and Chloé Le Coq for contributing WP 4 expert reports, and to David Newbery and Richard Green for comments on an earlier version of this chapter.

² Needless to say electricity prices also are affected by fuel prices and other factors not directly related to electricity market reform.

³ Another important driver, not covered in this report, is incentive regulation of the natural monopoly segments of the industry.

⁴ In principle a high degree of concentration on the buyer side of the market can also create market power problems. However, as electricity markets in general exhibit a very low degree of concentration on the buyer side this type of market power problems will not be further discussed.

degree of concentration is sufficient but not necessary for market power problems to emerge.

Another threat to workable competition is ill-designed environmental and other regulations. As is well known various “market failures”⁵ prevent regular market forces to deliver all the benefits of an “ideal” electricity supply system. Unless these market failures are efficiently dealt with the security of supply, environmental friendliness and sustainability aspects of electricity supply will suffer. But depending on the design of the regulations thus imposed the possibilities to exercise market power may be affected.

Market power can be mitigated by means of well designed policies. The purpose of this chapter is to identify cases of “best practice” in terms of dealing with market power problems in electricity markets. Both the generation and the retailing segments of the electricity market will be discussed. In the case of generation multi-country electricity market integration in the Nordic area is identified as a successful method of mitigating market power. In the case of retailing the design of the Norwegian retail market is identified as a successful method of implementing efficient retail competition. However, before discussing the selected cases the conceptual and empirical background of the analysis will be briefly discussed, and a few words will be said about the market power aspects of renewable electricity introduction.

2. The definition and effects of market power

As was mentioned above a firm has “market power” if it, by unilateral action, can increase its own profit by raising the market price above the competitive level. In order to raise the market price a firm must reduce its supply to the market. But a firm can benefit from unilateral reduction of supply only if the resulting profit margin increase on the remaining supply is big enough to more than compensate for the quantity reduction. This means that market power can be exercised only by firms that are big enough to be able to significantly raise the market price by reducing its own supply with a relatively small fraction. In other words the firm has to be a major supplier in the “relevant market”.

There is no precise definition of a “relevant market”, but in the context of competition policy such a market in general is delineated in terms of product range and geographical extent. In the case of electricity the lack of close substitutes makes the product dimension fairly unproblematic. In other words it makes sense to talk about a market for electricity and an electricity supply industry.

The geographical dimension, however, is more complicated. Electricity supply systems in Europe are interconnected, but the need for inter-connector capacity varies continuously as supply and demand conditions within different geographical areas

⁵ The market failures include the environmental impact of electricity generation and transmission and the public good aspects of sustainability and security of supply. The actual situation in many EU countries is that the environmental costs of electricity generation and transmission to a large extent are internalised by taxes. Moreover, it is possible to charge large customers for their desired level of security of supply, and to penalise them for not reducing demand when instructed to do so (in accordance with their contractual obligations). However, penalties can only be charged *ex post*, which means that the system operator has to make sure that the system is in balance in real time. This service can be seen as a public good.

change. Thus the geographical extent of the “relevant” market for electricity tends to vary considerably over time. As will be discussed below this feature of electricity markets is extremely important in the context of market power analysis and policy.

There is also a technological feature which is relevant in the context of market power in electricity markets. Thus, if a non-trivial share of generation is based on hydro power, and much of the water can be stored in reservoirs, it may be difficult to successfully exercise market power. This is because a reduction of output at a certain point in time will make a future increase of output necessary (unless the water is going to be spilled). Consequently the profit gain from currently reducing output and raising the market price has to exceed the loss of profit when future output is increased⁶.

However, to the extent that market power can be exercised it redistributes income from the consumers to the producers of electricity. It also leads to social costs as services that the consumers value more than they cost are not provided. Additional social costs are incurred if firms able to exercise market power are less eager to be cost-effective or to innovate for future efficiency increases. Thus the exercise of market power may lead to excessive costs rather than excessive profits, and may for that reason be difficult to detect and measure.

However, the possibility to gain market power and temporarily earn monopoly profits may stimulate innovation and thus help to increase power industry efficiency in the long run. Thus, to the extent that the exercise of market power induces entry of new firms that over time are able to compete away excessive profit margins, regulatory action against market power is not needed and may in fact be detrimental. But if entry is limited and market power is exercised over long periods of time market power mitigation measures are motivated and likely to benefit the consumers.

3. The measurement of market power in electricity markets

The degree of market power is commonly measured by the so called price-cost margin, i.e. the difference between price and marginal cost as a fraction of price ($[\text{price} - \text{marginal cost}] / \text{price}$). The price-cost margin is also called the Lerner index. This measure implicitly assumes that market power not only exists but is also exercised. If a firm could, but for the moment does not, exercise market power the Lerner index would indicate that there is no market power.

In theory the Lerner index is a straightforward measure, but in practice it may be difficult to apply. The reason for this is that information about the relevant marginal cost of supplying a good or a service in general is not readily available. However, in the case of the electricity supply industry quite a lot of relevant information about the cost of generating and supplying electricity is publicly available.

Thus a significant share of the variable cost of fossil and nuclear electricity is fuel cost, and there is plenty of information about fuel prices. In electricity supply systems based on hydro power, where the variable cost of generating power is the inter-temporal opportunity cost of stored water, a corresponding benchmark can be

⁶ There will be a net gain from this behaviour only if demand, at times when price is raised or lowered, is more sensitive to price reductions than to price increases.

calculated⁷. It is obvious that external estimates of the marginal costs of generating and supplying electricity may differ from the actual costs. Yet significant excessive price-cost margins in electricity generation and retailing are very likely to be detected without extraordinary monitoring efforts.

However, in spite of the possibilities to directly measure the degree of market power in electricity markets it is common and useful to apply various indirect measures⁸. More precisely, one looks for structural features of the market that are likely to give market power to one or several firms. Needless to say these indirect measures only indicate potential market power rather than actual exercise of market power.

A structural feature of particular interest in this context is concentration on the seller side of the market⁹. One problem with this approach is that measures of concentration do not capture two factors that are quite important from the market power point of view. The first is entry conditions. If new firms can easily enter the market, incumbents can not exercise market power over long periods. The second factor is the price-sensitivity of demand. If demand is very price-elastic it is unlikely that a firm could raise its profit by unilaterally reducing supply.

However, in the case of the electricity supply industry these problems are not overwhelmingly serious. This is partly because the demand for electricity is quite price-inelastic, particularly in the short term, and partly because entry barriers tend to be significant in electricity markets. Thus the industry structure is quite stable, and consumers to a large extent are unable to significantly reduce their consumption in response to price increases. Yet there are specific features of the electricity supply industry that call for other than industry concentration measures for identifying market power problems.

What is commonly called “the electricity market” in reality is a sequence of hourly, or even half-hourly, power markets. Thus the delivery of a certain amount of electricity during a specific hour may reflect a long-term bilateral agreement between a generator and a retailer, a settlement between two parties in the day-ahead market, a settlement between two parties in an “adjustment” market, or an intervention by the System Operator in the real time market in order to balance the system. Moreover, for physical reasons production and consumption, within each geographical area defined by physical transmission capacity or institutional constraints, must balance in real time.

Within this complex structure a generator may, more or less temporarily, be in a situation where he can profitably raise the market price, i.e. exercise market power. The reason for this may be that congestion in the transmission network, in conjunction with a suitable location of a not fully utilized generation unit, has given the generator

⁷ However, in order to do that quite sophisticated techniques have to be used, and the resulting estimates heavily depend on the assumptions about temperature and precipitation during a large number of future weeks.

⁸ A related approach is to use simulation models in order to detect whether a certain combination of market structure and firm behaviour makes it possible to exercise market power.

⁹ It should be noted that the degree of concentration depends on whether market power is exercised or not. Thus, a firm that decides to reduce output in order to exercise its potential market power will lose in terms of market share, and as a result concentration as usually measured will be reduced.

in question a monopoly position in a specific geographical area. A well located generator may under certain conditions even be able to create network congestion. And the generator in question does not have to be big in terms of annual production for these situations to emerge.

Temporary market power of this sort may lead to significant “price-spikes”, i.e. significant but temporary price increases. The impact of price-spikes on average electricity prices over a longer period may be quite small, even though the generator that caused the price-spike earned significant profit. However, there are also situations where “small” generators can exercise market power to such an extent that average electricity prices over longer periods are affected.

This may be the case if a generator controls a significant part of the “load-following” capacity, i.e. capacity that is used to supply the difference between the actual load and the output from base load nuclear and fossil fuelled units with a more or less constant rate of capacity utilisation. Hydro power, which is extremely flexible in terms of capacity utilisation, is “load-following capacity” (provided the water can be stored). A generator with a significant share of available load-following capacity does not have to be big in terms of total annual production. But by frequently being the only generator that is able to increase output enough to satisfy demand, i.e. by being “pivotal”, he has considerable market power.

Needless to say “big” generators may often be “pivotal”. But the fact that also small generators can be “pivotal” implies that the analysis of market power can not be limited to the measurement of firm size and industry concentration. For this reason several specific measures of market power in electricity markets focus on “pivotal” generators rather than market shares and other measures of concentration. Unfortunately, however, these measures are quite demanding in terms of the empirical data needed.

One of these measures is PSI, the Pivotal Supplier Index, which indicates the number of hours, or half-hours, during a specific period that a given supplier is “pivotal”. Thus PSI is a measure of potential market power. Another measure of potential market power is RSI, the Residual Supply Index. This index measures to what extent the competitors of a given generator, as a group, can meet the current demand. If the other generators can supply 100 percent or more of the demand, the generator in question does not have market power. But if demand can not be satisfied by the other generators producing at full capacity, the generator can influence the market price.

For the reasons just discussed it is obvious that an electricity market may suffer from market power problems even though the degree of concentration is low. However, if the degree of concentration is high it is quite likely that the one or two biggest generators, from time to time, are pivotal and that the PSI and RSI values are relatively high. This means that measures of size and concentration, after all, are relevant from the point of view of market power analysis also in electricity markets. Not in their own right, but because they are correlated with the relevant but empirically demanding measures of potential market power. As stated in the introductory section a high degree of concentration is sufficient but not necessary for market power problems to emerge.

Thus an analysis of market power problems in the European electricity markets should include an analysis of the structural development of the European electricity supply industry, using the standard measures of industry concentration. One of these is CX, the sum of the market shares of the X largest firms. Commonly used special cases are C1 and C3, i.e. the market shares of the single biggest and the three biggest firms, respectively¹⁰. Another commonly used measure of concentration is the Herfindahl-Hirschman index (HHI) which is defined as the sum of the squares of the market shares, in percent, of all firms in the market¹¹. Under certain assumptions about firm behaviour the Lerner index, i.e. the measure of the degree of market power, is proportional to the value of HHI.

However, before turning to the application of these measures it should be noted that the “electricity market specific” measures of market power provide an important insight, namely that capacity constraints create possibilities to exercise market power in electricity markets. Thus the probability that a generator will be pivotal increases dramatically when total generating capacity becomes scarce in relation to demand. In the same way the probability that a generator will be pivotal in a sub-market created by network constraints increases if network capacity does not keep pace with the demand for transmission services.

In the context of electricity market liberalisation policy these observations point at a specific problem. Part of the efficiency gains that liberalisation and integration of the European electricity markets are expected to bring stem from elimination of excessive generation capacity. But if increasingly scarce generation capacity, possibly being the result of deliberate action by major generators, is allowed to create market power problems the potential efficiency gains of increased competition may not be realized.

Thus the competitiveness of the electricity markets is a kind of public good that has to be provided by means of vigilant competition policy and possibly other types of regulation. Moreover, the benefits of efficient competition should be taken into account when TSO:s decide about the timing, location and size of transmission and inter-connector capacity additions.

4. Concentration and structural change in the European power industry

If the entire EU-25 was one single market for electricity the degree of concentration would be quite low. This is illustrated by the fact that the annual consumption of electricity in EU-25 is around 3 000 TWh, while the annual production by EdF, by far the biggest generator, is only around 480 TWh or 16 percent of total consumption. The concentration measures C3 and HHI are well below the critical levels, i.e. 0.50 and 1 800, respectively.

¹⁰ According to the *EU Merger Regulation* (Regulation No. 4064/89) and later revisions a C1 value at or above 50 percent is considered as evidence of a dominant position.

¹¹ According to the *Merger Guidelines* issued by the US Federal Trade Commission in 1992 there are no concerns about competition in conjunction with a merger if the post-merger value of HHI is below 1 000. If, on the other hand, the value is above 1 800 there are serious concerns. Under certain conditions values between 1 000 and 1 800 may, according to these guidelines, give rise to concerns about the competition effects of a merger. The HHI equal to 1 800 limit corresponds to a situation where there are 5-6 equally sized firms in a market.

However, in reality there are significant barriers to cross-border electricity trade in Europe. One type of impediment is institutional barriers such as different degrees of market opening and transmission tariffs leading to “pan-caking” of transmission charges when electricity is traded over long distances. Another type of barrier to trade is insufficient inter-connector capacities between, and in some cases within, countries. It should be noted that what is “sufficient” in terms of inter-connector capacity is an economic rather than a physical issue¹². The key point is whether the inter-connector capacity is large enough to allow cross-border trade to equalise prices in adjacent countries or regions.

Using the price equalisation criterion the inter-connector capacities within EU-25 are currently clearly insufficient, and EU-25 is divided into a number of “electrical islands”, i.e. areas between which inter-connector capacities are too limited to allow cross-border trade to equalise prices. The number of such “islands” is of course a matter of definition¹³ (see Table 1 for an example), but the basic observation is clear: The European electricity market is a set of regional electricity markets. Moreover, some of these regional markets exhibit a relatively high degree of concentration.

Needless to say there are also inter-connector capacity limitations within the “islands”, creating even more concentrated sub-regional and national markets. In several of the national markets the combined market share of the three biggest generators exceeds 70 percent or more. Thus quite significant inter-connector capacity expansion is needed before the regional markets can be fully integrated into something resembling a single EU-25 electricity market. Before that process is completed concentration levels in some regions and countries suggest that non-trivial market power exists and can distort prices and the allocation of resources in the economy.

Table 1. Regional electricity markets in EU-25

Region	Population (Millions)	Electricity consumption TWh	C1 (%)*	C3 (%)*
Iberian Region	50	257	35	64
Western Europe	169	1 208	36	64
Eastern Europe	59	236	16	34
Nordic Region	24	380	20	43
Adriatic Region	73	425	34	51
United Kingdom	60	373	18	41

* By C1 and C3, respectively, is meant the market share of the single biggest and the three biggest generators in the market in question.

Source: Vattenfall

¹² From an economic point of view inter-connector capacity should be “efficient” in the sense that, on the margin, the cost of capacity expansion should be equal to the cost of the congestion caused by limited inter-connector capacity.

¹³ If the requirement is that prices within an “electrical island” should be equalised all the time the number of “electrical islands” would be very large. However, if temporary price differences are accepted the number immediately becomes much smaller.

The EU electricity market directives have opened up for fundamental changes in the structure of the European electricity supply industry. The first of the two directives imposed unbundling of generation and transmission, while the second prescribed unbundling of distribution and retailing. As a result the potentially competitive segments of the industry (generation and retailing) are (or will soon be) separated from the natural monopoly segments (transmission and distribution). Together with rules and regulations about third party access to the networks and market opening this has laid the ground for competition in generation and retailing within countries and facilitated cross-border trade and market integration.

However, the European power industry does not passively wait for the market integration process to be completed. Thus, parallel to the gradual elimination of barriers to cross-border electricity trade in Europe there is also a horizontal integration process, in the form of mergers and acquisitions, within the European power industry. A key feature of this process is that the major power companies expand beyond their traditional national markets. Thus, during the last few years the growth of major European power companies, such as EDF, RWE Energie, ENEL, E.ON and several more large power companies, have significantly exceeded the growth of electricity consumption in their respective home market.

From the market concentration point of view the impact of the horizontal integration process is mixed. In an EU-25 perspective concentration is clearly increasing. But as the level of concentration remains low this is not a real threat to workable competition in the single EU-25 market that eventually may emerge. In an “electrical island” perspective, however, the impact on concentration of additional horizontal integration may be detrimental. Yet there is reason to distinguish between two types of concentration increases.

“Type 1” is a merger or an acquisition that involves a generator that already has a dominating position in the “electrical island” where the merger or acquisition takes place. There is no exact definition of “dominating position”, but in order to be dominating a generator should have at least 40 percent of the market. In this case the concentration measures C3 and HHI will both increase. More importantly, the dominating position of the generator in question will be strengthened, and the risk that market power will be exercised increases. In other words this is a kind of concentration increase that may threaten workable competition. One recent example of a “Type 1” merger is the creation of E.ON, Germany’s second largest generator, by merging VEBA and VIAB.

A “Type 2” concentration increase is a merger or an acquisition that does not involve one of the dominating generators in the “electrical island” where the merger or acquisition takes place, and does not give the enlarged generator a dominating position in that “electrical island”. A recent example is Vattenfall’s expansion in Germany, based on acquisitions and mergers of existing relatively small generating companies. Other major power companies also have acquired a single relatively small generating company in “another” region, and may continue with other acquisitions and mergers and thus affect the power industry structure in the region in question.

In the case of “Type 2” concentration increases the C3 index is not affected at all, while there is a small increase in the HHI index. Moreover, the risk that market power

will be exercised does not increase. On the contrary competition may be more intensive if small generators merge and become more able to compete with the large generators even though the market has become more concentrated. This view is supported by the fact that competition authorities do what they can to prevent “Type 1” horizontal integration, but generally have no complaints about “Type 2” horizontal integration.

5. Market power mitigation in wholesale electricity market

As indicated by the discussion above market power mitigation in wholesale electricity markets includes measures to reduce concentration in regional and national markets. In doing this there are basically two, not mutually exclusive, options. One is to split the dominating generator or generators and/or to facilitate entry of new generators. This option was successfully adopted in England and Wales, where the initial division of the single power producer CEGB into three generating companies was followed by further divestiture of incumbent generating capacity and entry of new generators. As a result concentration was significantly reduced¹⁴.

The other basic option is to integrate two or more national or regional markets and thus increase the geographical extent of the relevant market. As will be discussed in the *Best Practice* sub-section below the market integration alternative has been successfully adopted by the Nordic countries. In addition to the trivial fact that a single European market for electricity can not be established unless national and regional markets are integrated there are several economic arguments in favour of this option.

The basic argument is that integration of previously separated markets allows gains from trade and economies of scale to be fully exploited. Gains from trade arise since the marginal cost of generating power differs between the countries. This is because factors such as availability of hydro power, availability of suitable sites for wind power, access to natural gas and availability of bio-fuels differ between countries. Moreover, in small countries the splitting option could prevent economies of scale in generation or in the provision of reserve capacity to be fully exploited.

However, there is also a third, complementary, option to mitigate wholesale market power, namely the establishment of a market for forward contracts. Thus, instead of increasing the number of competitors in a given market, a given number of generators are given the possibility to compete both in the spot market and in a forward market. According to economic theory oligopolistic firms will have incentives to enter forward contracts. Moreover, this will lead to an increase of aggregate output and a decrease of the market price¹⁵ as if the number of competitors had increased. An

¹⁴ The “coal HHI”, i.e. the Herfindahl-Hirschman Index for the coal fired segment of generation, went down from above 5 000 in 1990 to below 1 800 in 2004 (See Newbery, D. (2005), “Electricity Liberalisation in Britain: The Quest for a Satisfactory Market Design”, *The Energy Journal*, Special Issue on European Electricity Liberalisation). As coal fired plants were in effect setting prices most of the time during this period the “coal HHI” is a suitable measure of concentration in the context of market power analysis.

¹⁵ The result is due to Allaz and Vila [“Cournot Competition, Forward Markets and Efficiency”, *Journal of Economic Theory* 59, 1-16] and their analysis of a duopoly case. They found that the introduction of a forward market created a kind of prisoner’s dilemma situation in which both duopolists, by trying to increase profit by obtaining a Stackelberg leader position, ended up producing more and selling at a lower price main than if none of them had entered the forward market. In an

important consequence of forward contracting is that generators have less incentive to reduce output in order to raise the spot market price. Note that this “benefit” of forward markets is additional to their role of offering hedges against spot market price risk.

A crucial part of electricity market reform in the Nordic countries was the establishment of Nord Pool, i.e. the company that operates both a common power exchange (a spot market) and forward markets for electricity. Around 30 percent of total electricity consumption in the Nordic area is traded at the Nord Pool spot market, while the total forward market turnover is around five times the spot market trade. Thus forward contracting is quite extensive.

As mentioned above the “splitting and entry option” was successfully used in England and Wales. One of the important lessons from England and Wales is that vigilant and suitably designed competition policy can significantly reduce concentration in a short time, and thus pave the way for efficient competition. In the Nordic countries the “market integration and forward contracting option” has been the key instrument to mitigate market power. In the ensuing sub-section the Nordic example is described as “best practice” in the context of market power mitigation.

Best Practice Case 1: Nordic market integration and forward contracting

A market integration strategy has two components. The first is to implement third party inter-connector access and proper pricing of inter-connector services. The second is to create a common set of rules and regulations that is conducive to trade across the national borders. However, the market integration strategy is feasible only if physical inter-connector capacity is sufficient and is expanded as load and cross-border trade grow.

In the Nordic area there is a long tradition of cross-border power exchanges between the major power companies. The reason for this is that the share of hydro power differs significantly between the countries, being 100 percent in Norway, 50 percent in Sweden, 15 percent in Finland and zero in Denmark. As the supply of hydro power varies considerably between different years the gains from cross-border trade have been large and investments in inter-connector capacity profitable. Consequently the existing inter-connector capacities are quite significant, particularly between Norway and Sweden¹⁶.

The creation of the Nordic market started in 1996 when the border tariffs between Norway and Sweden were abolished and the common power exchange (Nord Pool) was established. Finland joined the market in 1998 and the process was completed in 2000 when Denmark was fully integrated into the Nord Pool system. In all the four Nordic countries the national electricity market exhibited a high degree of

experimental study, designed to test Allaz’ and Vila’s result Le Coq and Orzen [in Le Coq (2003), Quantity Choices and Market Power in Electricity Markets”, PhD dissertation, Stockholm School of Economics], the authors could confirm the competition enhancing effect of forward trading. However the experimental results suggest that this effect is not as strong as indicated by the theoretical analysis.

¹⁶ The existing inter-connector capacities between Norway and Sweden is around 4 000 MW, which corresponds to around 15 percent of peak load in Sweden and more than 20 percent of peak load in Norway.

concentration, with a publicly owned power company having a dominating position¹⁷. This was particularly the case in Sweden where Vattenfall, with just above 50 percent of the generation market, was conceived to have considerable potential market power.

The key market institutions of the Nordic electricity market are the common power exchange and the forward markets operated by Nord Pool. The rules and regulations of transmission pricing and inter-connector congestion management support the efficient functioning of the market. Thus the prices of transmission services are independent of the location of, and distance between, buyers and sellers, and inter-connector congestion fees are positive only when net demand exceeds capacity. There are still four national TSO:s, but from the point of view of the functioning of the common market there is a very close cooperation between the TSO:s. There is also an efficient flow of relevant information about expected load and inter-connector capacity utilisation between the TSO:s and Nord Pool.

When evaluating the market integration strategy in the Nordic countries two issues are particularly important. The first is whether the measures implemented have been sufficient in terms of creating an integrated Nordic electricity market, i.e. to equalise wholesale electricity prices across national borders. The second is whether market power of any significant degree is or can be exercised in the integrated market. In the following both issues will be briefly discussed, beginning with the price equalisation issue.

From time to time the physical inter-connector constraints are binding so that the Nordic market becomes two or several regional markets with different prices. With the exception of 2000, when inter-connectors from Norway were congested most of the time, there has been complete price equalisation between 30 and 60 percent¹⁸ of the time and only small price differences during most of the remaining time. For two-country sub-regions the degree of complete price equalisation is, of course, even higher.

Thus, after 1998 when Finland joined the Nord Pool system, the Swedish and Finnish markets have been fully integrated between 75 and 100 percent of the time. The corresponding interval for the Norwegian and Swedish markets 1996-2003 is 60-85 percent. Moreover, the share of the time when Sweden has been an isolated “price island” is in the range 0-5 percent. The corresponding interval for Finland is in general equally low, but reached around 16 percent in 2000 and 30 percent in 2003. West Denmark is also fully integrated with at least one other area most of the time, while the different parts of Norway¹⁹ and East Denmark are isolated price areas more often (typically 20-30 percent of the time).

Needless to say price equalisation within the Nordic area is not complete. Yet, in view of the significant degree of price equalisation the best approximation of reality is to consider the Nordic market a single integrated market. In other words it seems that, given the physical inter-connector capacities, the measures implemented have been

¹⁷ However, from an electricity market point of view Denmark is effectively divided into two regions, East and West, with a dominating power company in each region.

¹⁸ The figures refer to the outcomes in individual years.

¹⁹ As a result of the Norwegian congestion management system Norway from time to time is divided into several regional price areas.

sufficient to create an integrated Nordic market for electricity. The next issue, then, is whether the creation of the integrated market also has solved the market power problems that the national markets were expected to suffer from if they had remained essentially isolated.

On the basis of the standard concentration measures the integration has managed to eliminate potential market power. For instance, by geographically extending the market Vattenfall's share of the relevant market has been reduced from around 50 percent to around 20 percent, and the C3 and HHI measures have developed in a similar way. However, as was discussed above, a high degree of concentration is not necessary for market power problems to emerge. Unfortunately, however, systematic estimates of PSI and RSI²⁰ are not available, and the same applies to detailed estimates of the Lerner index.

Yet several studies have used the evidence that is available in order to identify signs that market power is being exercised²¹. The common conclusion of these studies is that, with the exception of some temporary "price-spikes", the development of spot market prices essentially reflects the development of the relevant marginal costs. Moreover on the average price-cost margins are small enough to be compatible with reasonably efficient competition. In other words, available evidence suggests that competition in the Nordic electricity market is "workable".

Without internal ranking it seems that the following factors have been instrumental in preventing market power to be established, maintained and exercised in the Nordic electricity market:

- Low degree of concentration. As a result of market integration the degree of concentration is low. It is likely, but so far not empirically confirmed, that the reduction of concentration also meant a reduction of the pivotal supplier problem.
- Competition policy. Signals from the Competition Authority, together with the strategic objectives of the company, have induced Vattenfall, the biggest generator, to grow outside rather than within the Nordic area. Thus, in spite of increasing cross-ownership the growth strategies of the companies have not to any significant degree restored the pre-integration level of concentration.
- Forward contracting. Even though the quantitative importance of forward contracting in terms of market power mitigation is difficult to estimate, there is a significant degree of forward contracting.
- Market rules. The trading rules adopted by Nord Pool are very stringent with respect to dissemination of information to all market participants. Thus information about available hydro stocks and the operation plans for power nuclear plants can not be kept as company secrets.
- Significant share of hydro power in the generation mix. As was mentioned above the fact that current reductions of hydro power production will lead to

²⁰ That is the Pivotal Supplier Index and the Residual Supplier Index discussed in Section 3 above.

²¹ See for instance Bergman, L. (2002) "The Nordic electricity market – continued success or emerging problems", *Swedish Economic Policy Review*, 9, 51-88, and N.M von der Fehr, E.S. Amundsen and L. Bergman (2005) "The Nordic Market: Sign of Stress", *The Energy Journal*, Special Issue on European Electricity Liberalisation, 71-98.

future production increases makes it difficult to successfully exercise market power for generators with a high share of hydro power.

It is not easy to distinguish the relative importance of these factors. Yet it is unlikely that the last factor, i.e. the availability of hydro power, is the main reason for the lack of apparent market power problems in the Nordic electricity market. Thus the strategy for mitigating market power adopted by the governments in the Nordic countries appears to be “best practice”.

6. Market power mitigation in retail electricity markets

If electricity market reform in Europe is to benefit the consumers the efficiency gains in the generation, transmission and distribution segments of the industry have to be reflected in retail prices. Thus the margin between retail and wholesale prices should only reflect the relevant costs of distribution, metering, billing and general services to retail customers. This suggests that retailing is an important segment of the electricity supply industry, and that efficient retail competition, from the point of view of the final consumers, is the key to the success of electricity market reform.

However, this is only partly true. In an electricity market with a well-functioning spot market the consumers could buy electricity directly in the spot market and pay the local distributor for transportation, metering and billing services. In other words, from the point of view of supplying electricity to the consumers at spot market price the retailers are not needed.

The reason for this is, of course, that all consumers are directly connected to the electricity network, and that the retailers essentially provide financial services. More precisely, the retailers carry the price and quantity risks²² associated with the fact that standard retail contracts allow customers to consume whatever quantities they want (within certain capacity limits) at whatever time they prefer. In addition retailers manage billing and may offer credit and services such as electricity conservation advice²³. In a static sense the benefits that retail competition can bring thus are hedges against the price and quantity risks, billing, and a set of services such as credit and advice²⁴.

There are two major types of costs of retail competition. The first is the cost of managing the information flows associated with keeping track of the consumption of the customers of each retailer. The second is the cost of marketing that is associated with competition between retailers. The alternative to retail competition is retail prices directly linked to spot market prices, combined with regulated charges for metering, billing and other services (in addition to distribution). The case for full retail competition thus depends on whether the benefits exceed the costs.

²² There are quantity risks in the sense that the “good” traded in wholesale markets is a certain number of MW:s per hour (or half-hour), while the final customers basically have an option to consume electricity at a given price. Thus the suppliers face uncertainty about the amount of electricity that their customers will choose to consume a specific hour (or half-hour).

²³ In electricity markets without a well-functioning spot market the retailers procure electricity on behalf of their customers by entering long-term contracts with generators.

²⁴ In addition retailers add liquidity to the financial markets, i.e. the markets for electricity forwards and futures, and thus positively contribute to the efficiency of these markets.

However, there is also an important “dynamic” argument for retail competition. Thus, new retailers competing with incumbents for customers and profit have strong incentives to keep their costs at a minimum and to offer attractive prices and services to the customers. As a result of competition between entrants and incumbents the margin between wholesale and retail prices is squeezed to the benefit of consumers. There is a case for retail competition if this process can bring the benefits of wholesale competition to the end users more effectively than direct regulation of costs and trade margins. For this to be the case, however, retail markets have to be reasonably competitive.

In wholesale electricity markets incumbents tend to be protected from competition by significant entry barriers and transmission capacity constraints. In retail markets there are no entry barriers in the form of capital intensive infrastructure, although licensing and approval requirements may make it costly for new firms to enter the market. Instead customer immobility, resulting from high actual and perceived switching and information costs, may be the most important entry barrier in electricity retail markets. To the extent that final customers refrain from switching to more efficient suppliers the incumbent suppliers can charge excessive prices and prevent the customers to benefit from increased power industry efficiency.

From these points of view the design and functioning of the Norwegian electricity retail market appears to be “best practice”. In the ensuing sub-section the Norwegian case is discussed in some detail.

Best Practice Case 2: Retail competition in Norway²⁵

Norway was one of the first countries to reorganize its electricity sector and this sector has now attained a mature stage, also with respect to retailing. By now it seems to be a generally held view that the Norwegian retailing market functions quite well. Conducive for this development are some characteristic features of the Norwegian retailing market. These features may be said to reflect good practices for a well functioning retailing market. In particular, they comprise:

- Free entry on the supplier side
- Low degree of supplier concentration
- Transparent prices and conditions for electricity offered
- Free choice of supplier and contracts
- No charge for switching supplier

In the following each of these specific features are briefly commented.

Free entry on the supplier side

Any prospective company is free to start trading electricity in Norway. In accordance with the Norwegian Energy Act of 1990, any entity that engages in trade of electricity must hold a trading licence²⁶. However, the system of licences is not a hindrance for

²⁵ This section is written by Eirik Amundsen.

²⁶ Thus a trader who buy and sell electricity in their own name and bear the financial risk for any losses must obtain a licence, while power brokers, who do not take any responsibility for the financial aspects of a contract, do not need to hold a licence.

free entry, but rather is intended to safeguard customers' interests by helping to ensure economically sound electricity trading. The Norwegian retailing market is also open to foreign companies. The Finnish company Fortum Markets AS, for instance, is a sizable supplier in Norway).

Low degree of supplier concentration

Partly due to the conditions of free entry and partly due to an historical diverse structure of companies supplying electricity to the residential sector the concentration of suppliers in Norway is rather low²⁷. In 2004 as many as 226 companies were engaged in trading, and 80 of them were not involved in any other activities. Approximately 30 of the 130 companies that supply electricity to the residential sector are considered to compete on a nationwide basis.

An important aspect of retail competition is to what extent incumbent suppliers in an area are subject to competition. In Norway as a whole there are around 15 suppliers who constitute the group of main competitors to the incumbent suppliers. This number is sufficient to maintain efficient competition.

Transparent prices and conditions of power supply

The Norwegian Competition Authority regularly posts prices and conditions for electricity contracts for end users on the internet²⁸. Companies are listed according to price (relative to average consumption) and contract type with an easy access to information on the companies supplying the contracts. As not all suppliers are active in all local areas, the customer has the option of inspecting prices and conditions for the specific area where he or she resides.

Free choice of supplier and contracts

Customers may freely choose a contract from a new supplier directly on the internet and the engaged company will take care of the necessary changes (i.e. cancellation of old contracts, notifying the distribution company as to where to send the metering information and so on). Customers may choose among three broad categories of contracts reflecting various degrees of price risk: *fixed price contracts*, *spot price contracts* and *standard variable tariff contracts*.

The fixed price contracts may be of various lengths (e.g. one year or three years). Currently²⁹ some 20 percent of the electricity sold to households is sold on this kind of contracts. The spot price contracts are typically based on the average monthly spot price with the addition of a mark up and possibly also including optional caps on the maximum price payable at any time. About 16 percent of the electricity to households is sold on spot price contracts.

The standard variable tariff contract is typically provided by the incumbent in a consumption area. Hence, customers that have not changed supplier or contract type will get this kind of contract. The tariff of the contract may be changed at short notice (14 days). Some 64 percent of the electricity to households is sold on this type of

²⁷ One may observe that the largest electricity companies of Norway, Statkraft and Norsk Hydro Produksjon do not sell power to the residential sector. These companies, thus supply power to the industrial sector, notably the power intensive industry (e.g. aluminum smelting).

²⁸ See <http://www.konkurransetilsynet.no/>

²⁹ First quarter of 2005.

contract. While the standard variable tariff contracts used to have rather stable prices with only a few seasonal corrections over the year, they have in recent years become subject to competition among the retailers and thus more volatile with frequent price changes.

The percentage of households with a supplier other than their local supplier has been steadily increasing from 5 percent in 1999 to 24 percent in the first quarter of 2005. The rate of switching of supplier per quarter has been fluctuating but has showed an increasing trend until shortly after the turbulent winter season of 2002/2003. After that the rate has fallen back somewhat.

No charge for switching supplier

In the aftermath of the introduction of the Norwegian Energy Act suppliers of electricity started to introduce large fees and long quit periods for changing supplier, thus effectively preventing households from buying electricity from other suppliers. This practise was, however, halted as of 1 January 1997 and customers may now change supplier at no charge with a switching time of a couple of weeks. At the same time the non-pecuniary costs of switching (searching costs etc.) have also been reduced along with the efficient provision of information as provided by the *Norwegian Competition Authority*.

Concluding remarks on retail competition in Norway

The specific organization of the Norwegian retail market as discussed above has since the mid 90'ies contributed to distinct improvements and benefits for the Norwegian residential electricity consumers. First of all there are clear indications of a shrinking margin between the average residential end user price and the spot market price. Furthermore, there has been a reduction of the variation in contract prices offered to consumers, thus indicating increasing competition between suppliers.

However, along with this development there has also been more volatility of average residential end user prices, reflecting the monthly, seasonal and annual variation of spot prices. While this may be seen as exposing consumers to increased price risk it also implies that consumers are faced with electricity prices that are more in line with the real opportunity costs of providing electricity for society. Hence, exposure to varying prices may trigger demand responses from the consumers' side which are economically beneficial to society. Consumers that find price risk to be excessive still have the opportunity of signing fixed price contracts.

7. Environmental regulation, renewable electricity and market power

Environmental regulation affects power industry and electricity market development in many ways. Performance standards, constraints on technology and fuel choice as well as environmentally motivated taxes and charges affect generation and transmission costs. More stringent performance standards for new than for existing generation units affect entry conditions and thus competition in the electricity market. During the next couple of decades, and parallel to the implementation of the rules and regulations aimed at creating a European market for electricity, two environmental policy objectives and related sets of regulations are likely to affect the power industry.

The first is the objective to reduce emissions of greenhouse gases in accordance with the Kyoto agreement. In order to attain the agreed upon emission reduction target the

European Emission Trading System (ETS), in which the power industry is included, has recently been implemented. The other is large scale introduction of electricity from renewable energy sources in accordance with the EU renewable electricity directive (2001/77/EC). In order to comply with the renewable electricity target some countries have introduced, or plan to introduce, so called “Tradable Green Certificates” (TGC) systems.

An emission trading system has two basic elements. The first is a specified limit on the total emissions of a given pollutant from a given set of sources, such as plants in certain industries in certain areas. In order to impose the specified limit tradable emission permits are issued. Each permit allows the holder to emit a given amount of the pollutant, and the allowance per permit times the number of permits is equal to the specified limit on total emissions. The second element is a specific allocation of the permits across the different sources and possibly other agents in the economy. Once the permit trading begins and a market price has been established all sources in effect will face a financial cost for each unit of emission. Moreover, the permits will become financial assets and part of the financial wealth of the holders³⁰.

Ceteris paribus the level of wholesale electricity prices will increase as a result of carbon dioxide emission trading. This is because the cost of fossil electricity will increase in absolute terms. It will also increase in relation to non-fossil electricity such as nuclear, hydro, biomass and wind power. Among the fossil electricity alternatives the cost of coal-based electricity will increase in relation to electricity based on natural gas or oil.

As the conditions for using the different power generating alternatives differ between countries and regions the change in relative costs will affect the pattern of cross-border electricity trade. In the long term the location of power generation may be affected as well. From the market power point of view the key effect of carbon emission trading is that entry of generators using non-fossil technology is facilitated. However, as the ETS has been in place such a short time the impact of the system on entry and cross-border trade still remains to be seen and no examples of “best practice” is available.

“Tradable Green certificates” (TGC system) is an alternative to direct financial support to renewable electricity such as wind, biomass and hydro power. The basic design of a TGC system is that generators receive one TGC per unit of “green” electricity generated, while consumers are required to buy a certain number of TGC:s per unit of electricity consumed. The fraction of consumption that has to be “green” electricity is called the “percentage requirement”. The design of the system implies that the demand for TGC:s is directly derived from the demand for electricity, and that generators have to be active both in the electricity market and in the market for TGC:s. As a generator of “green” electricity gets revenue from both markets for each unit of electricity generated the competitiveness of renewable electricity is strengthened.

Given that ETS is in place and the power industry is included in the system it is not obvious why TGC systems are needed. Positive prices on carbon dioxide emission

³⁰ For this reason the rules and practices for initial distribution of emission permits are controversial. However, from the resource allocation and market price point of view this aspect of an emission trading system is less important.

permits strengthen the competitiveness of non-fossil power production. As there are severe constraints on the expansion of both nuclear and large scale hydro power in most European countries positive prices on carbon dioxide emission permits in effect is a subsidy to wind, biomass and small scale hydro power, i.e. the technologies that TGC systems are designed to support. However, the quantitative goals for renewable electricity introduction, i.e. more than 20 percent of total electricity generation after 2010, will not necessarily be reached by means of the emission trading system.

Thus the reasons for introducing TGC systems should be something else than the climate policy objectives that the ETS system is supposed to handle. There are particularly two alternative reasons that have been proposed. The first is that TGC systems, by supporting the introduction of renewable electricity, in effect provides a public good, namely diversity in the generation mix of the European power industry. The second is related to the first but emphasises the need to further develop renewable power generation technology and reduce the cost of “green” electricity. Thus it is basically an “infant industry” argument. Although both arguments make sense, a thorough analysis of the costs and benefits of large scale support to renewable electricity, and evaluation of alternative policies to foster diversity in power generation, should be done before TGC systems are introduced.

In the present context, however, the key aspect of TGC systems is that they may open up new possibilities to exercise market power in the electricity market. This is because the “percentage requirement” creates a direct link between the TGC market and the electricity market³¹. Thus a generator that is able to exercise market power in the TGC market can, in effect, exercise market power in the electricity market. Moreover, in many cases it is easier to gain a dominating position in the TGC market than in the electricity market. For instance, suitable locations for wind power plants, i.e. locations with suitable wind conditions and a reasonably short distance to the transmission network, may be a scarce resource. This means that unless a TGC system is carefully designed it may become a vehicle for exercising market power in the electricity market.

In Sweden a TGC trading system has been in operation since May 2003. For the final customer the price of TGC:s has been around €0.3 or 8-10 percent of the price of electricity (excluding network charges and taxes). Although it is much too early to evaluate the Swedish TGC system there are some apparent problems, and the system is far from “*Best Practice*”. The most important problem is that there is considerable uncertainty about the rules and regulations of the system in the long term. Thus the initial rules were scheduled to be valid until 2010, but will be replaced with a revised set of rules already in 2007 when a common Norwegian-Swedish TGC market is scheduled to be opened. The uncertainty about the rules, and long term existence, of the system deters investments in renewable electricity.

8. Summary and conclusions

European electricity market reform will benefit consumers only if workable competition, in wholesale and retail markets, can be established. Market power, i.e. the power of a single generator or supplier to profitably raise the market price above

³¹ If the percentage requirement is g and the total capacity of producing “green” electricity is G , then the total consumption of electricity in effect is capped to be less than or equal to G/g .

the competitive level, is a potential threat to workable competition. However, the factors behind market power problems differ significantly between wholesale and retail markets.

Thus, in wholesale markets it is entry barriers and transmission capacity constraints that create potential market power and facilitate the exercise of market power. A key problem, emerging from the need to continuously balance generation and load in electricity supply systems, is that a generator may be “pivotal” and thus have quite significant potential market power. As dominating generators are likely to be “pivotal” more often than small generators market power problems in wholesale markets are positively correlated with concentration on the seller side.

In retail markets, however, entry barriers in general are insignificant. Instead incumbents tend to be protected from competition, and thus be able to exercise market power, by the immobility of the retail customers. This immobility is to a large extent caused by the actual and perceived information and switching costs of the customers. As a result the benefits of increased wholesale competition may lead to wider margins between retail and wholesale prices rather than lower retail prices.

In the present study two cases of successful market power mitigation have been identified. The first is the integration of the four national electricity markets in the Nordic area, and the parallel establishment of a common power exchange and liquid forward markets. The integration of the national markets has significantly extended the “relevant market” and thus reduced concentration. Available evidence about price-cost margins suggests that competition indeed is “workable” in the Nordic electricity market, i.e. that market power is not being exercised to any significant degree. To some extent this is due to the significant share of hydro power in the generation mix. Yet the Nordic case is a strong indication that market integration and forward trading is an efficient set of measures to mitigate market power in wholesale markets.

The second case of successful market power mitigation is the design and functioning of the Norwegian retail market. Free entry, low degree of concentration, transparent prices, a wide set of alternative contracts between retailers and customers, and low switching costs are all factors that have contributed to well functioning retail competition in Norway. As a result consumers have benefited from lower margins between retail and wholesale prices as well as lower retail prices, particularly in periods when hydro power supply has been high.

But consumers have also been exposed to higher prices in periods when hydro power supply has been unusually low. However, from a social point of view this means that retail prices better than before reflect the relevant marginal cost of producing and distributing electricity in Norway. It also means that consumers have been exposed to the price risk that is an intrinsic feature of electricity supply systems dominated by hydro power, and consequently have been given incentives to hedge that price risk in accordance with their own preferences by choosing a suitable contract.