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Öko-Institut e.V.
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Institute for Applied Ecology

Power Generation Market Concentration in Europe 1996-2000

An Empirical Analysis

Berlin, May 2002

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Abstract

The liberalisation of the European power market has significantly changed the framework of the electricity industry. The process of market opening and securing fair, transparent and sustainable third party access is still under way. But (incomplete) liberalisation can be thwarted by concentration trends in the electricity generation market.

The study analyses the market concentration trends on six regional markets in Europe from 1996 to 2000 based on different methodological approaches.

The analysis shows two very different development patterns. On the one hand, the market concentration in the United Kingdom decreased significantly in the last years and lead to electricity generation markets that can be called unconcentrated similar to the Scandinavian power production market. On the other hand, market concentration and its trends are occurring in all other regions. In markets which are characterized by former centralized state monopolies the concentration indicators remain very high. Furthermore, especially on the German market, which is historically characterized by a diversity of power generation, the recent and the upcoming mergers push the concentration indicators to levels which are more and more critically.

Given this background it is necessary to build more strict competition rules in the electricity markets as a necessary counterbalance to these developments. Key elements of this approach are a stricter unbundling, a more stringent regulatory basis for third party access, a premium for decentralised power generation taking into account long term avoided network costs and the elimination of other market distortions.

Acknowledgements

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1 Methodological Framework

There are different approaches to measure market concentration. In this study two different methodologies were combined.

Firstly, analysis was undertaken to identify the different market *Concentration Ratios* (CR) levels. The concept of concentration ratios is used extensively by the German Federal Cartel Office and other authorities.[1] The *Concentration Ratio* CR_n is defined as the market share of the n largest undertakings competing on the market.

$$CR_n = \sum_{i=1}^{n} x_i$$

CR_n *concentration ratio for n largest undertakings competing on a certain market*
x_i *market shares of the undertakings*

The concentration ratio is used by the German Federal Cartel Office following the guidelines given by the Act against Restraints of Competition (Section 19, No. 3)[2]:

"*An undertaking is presumed to be dominant if it has a market share of at least one third. A number of undertakings is presumed to be dominant if it*

1. *consists of three or fewer undertakings reaching a combined market share of 50 percent, or*
2. *consists of five or fewer undertakings reaching a combined market share of two thirds,*

unless the undertakings demonstrate that the conditions of competition may be expected to maintain substantial competition between them, or that the number of undertakings has no paramount market position in relation to the remaining competitors."

Secondly, the *Herfindahl-Hirschman Index* (HHI) is another widely accepted indicator for market concentration which takes into account the relative size and distribution of the companies in a market. It is calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers.

$$HHI = \sum_{i=1}^{m} x_i^{\,2}$$

HHI *Herfindahl-Hirschman Index*
x_i *market shares of the undertakings*
m *number of undertakings competing on a certain market*

[1] The indicator concentration ratio was used also in the USA until 1982, when Herfindahl-Hirschman Index (HHI) was introduced instead of CR4 (Market share of the four largest undertakings on a certain market).

[2] http://www.bundeskartellamt.de/GWB01-2002.pdf

The U.S. Department of Justice states[3]

"Markets in which the HHI is between 1000 and 1800 points are considered to be moderately concentrated, and those in which the HHI is in excess of 1800 points are considered to be concentrated. Transactions that increase the HHI by more than 100 points in concentrated markets presumptively raise antitrust concerns under the Horizontal Merger Guidelines issued by the U.S. Department of Justice and the Federal Trade Commission."

In Table 1 the specific levels which were derived from these definitions and used in this study for the different concentrations indicators are indicated.

Table 1 Critical Levels for Concentration Indicators

Concentration Ratio CR	Herfindahl-Hirschman Index HHI
Market dominance is presumed if CR1 > 33,3 % CR3 > 50 % CR5 > 66,7 %	Unconcentrated: HHI < 1,000 Moderately concentrated 1,000 < HHI < 1,800 Highly concentrated HHI > 1,800

A key issue for the analysis of market concentration is the definition of the relevant markets. However, there is no consensus in the scientific debate on relevant markets as some analysts insist on national markets as the relevant ones while others argue that a more regional view is the appropriate one.

In this study a mixed approach has been used. For some countries the analysis was done for the national market first but combined with other countries in a second step. The grouping of national markets followed the physical flows of electricity related to the volume of the national electricity markets according to the most recent data published by the Union for the Co-ordination of Transmission of Electricity (UCTE).

Based on this data the following regional markets for electricity generation were identified:

- United Kingdom
- Denmark, Sweden, Norway and Finland (Scandinavia)
- Spain and Portugal
- France, Belgium, the Netherlands and Luxembourg[4]

[3] http://www.usdoj.gov/atr/public/testimony/hhi.htm

- Germany (with a special focus to the national market), Austria and Switzerland
- Italy, Austria and Switzerland.

Subsequently an analysis was carried out for continental Europe considering France, Belgium, the Netherlands, Luxembourg, Germany, Austria and Switzerland. But it has to be pointed out that this approach is a more theoretical one given the background of today's reality.

The calculation of market shares in power generation was done in a way that direct control on power generation was taken into account. If detailed data were available, the power generation of undertakings which are owned partly by other firms was counted separately and *not* summarized to the shareholders. The power generation of single power plants owned by different utilities was however, differentiated according to the ownership structure. As a result of these assumptions the analysis can be characterized as a conservative one.

The data for power production of the different undertakings were derived from annual reports, sector statistics and other statistical materials which were compiled to Öko-Institut's power generation data base. The quantification of the different national power generation markets is based on data from Eurostat, UCTE, Nordel and national statistical offices (see Annex). All analysis is based on net power generation.

This study does not cover the accession countries. For an analysis of these countries a more complex approach is needed taking into account the liberalization and privatisation process which is still underway in some countries and the more complex ownership structures.

Last but not least the focus of the study is the power generation market. An analysis of the concentration trends in electricity distribution as well as the fast-growing integration of power and gas markets is increasingly important but exceeded the resources available for this analysis.

[4] The Netherland and Luxemburg could also be allocated to the regional market of Germany, Austria and Switzerland. But this different classification would not change the results of the analysis significantly.

2 Market Concentration in Different Regions

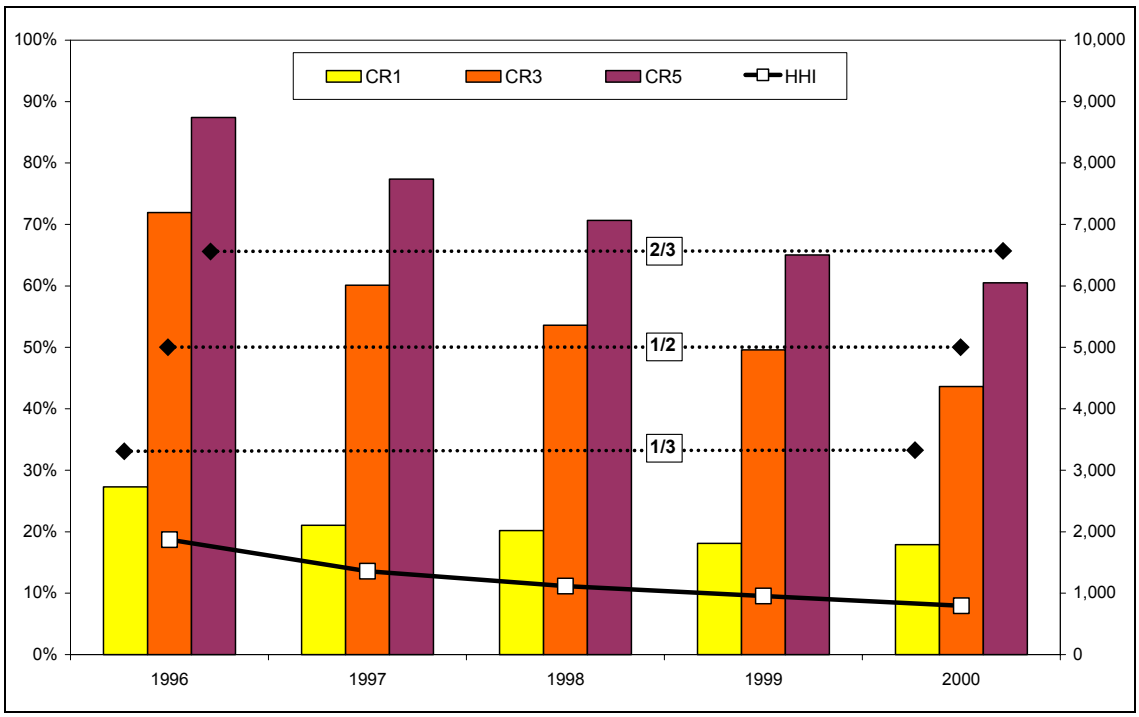
2.1 United Kingdom

Electricity generation increased significantly in the UK between 1990 and 2000 as well as from 1996 to 2000. In 2000 about 355 TWh were generated, which is 18.6 per cent more than in 1990 and 7.7 per cent higher than in 1996.

The electricity market in Great Britain was the first and most strictly liberalized market in Europe. Market liberalization was linked to privatisation which covered most of the non-nuclear generators. According to the Department of Industry the number of major electricity generators increased from 6 before privatisation to 11 in 1991 and 33 in mid 2001. The big generators were pushed for disinvestments and a number of new CCGT based generators now operate more than one power plant.

The dramatic changes in the electricity sector lead to drop in concentration indicators during the last years. Whereas CR3, CR5 and HHI exceeded the critical levels in 1996 the power generation market in the United Kingdom can be characterized as unconcentrated since the year 1999.

Figure 1 Power Generation Market Concentration in the United Kingdom, 1996-2000



Source Öko-Institut calculations

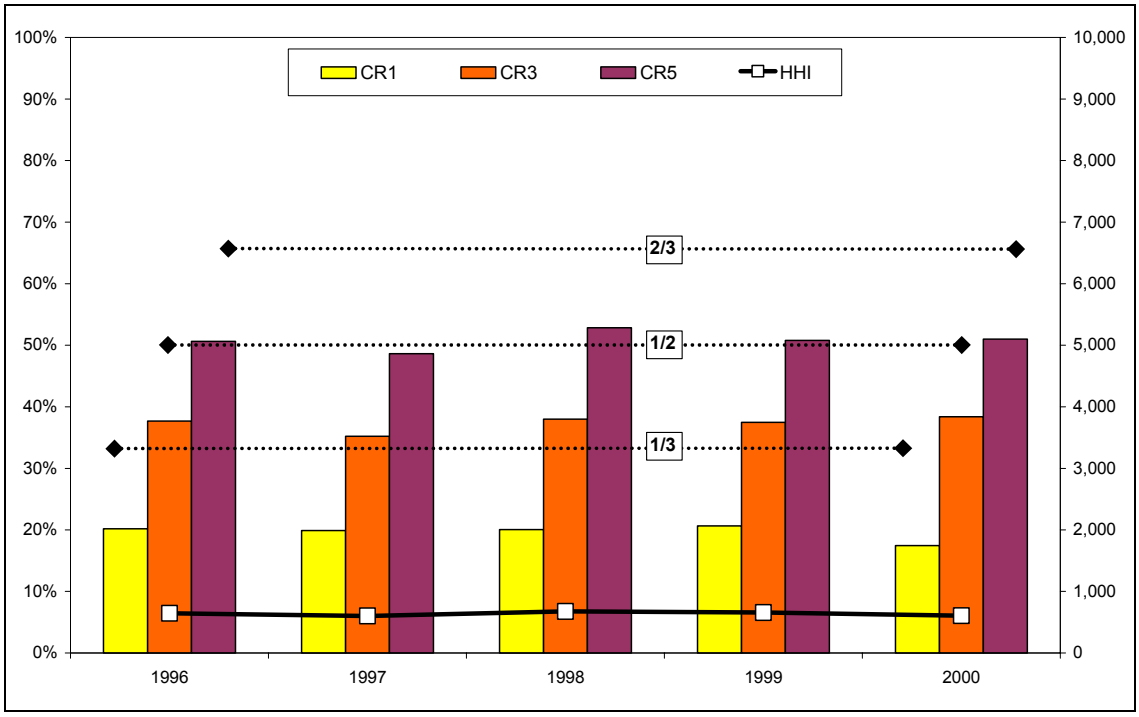
Major players on the power generation market of UK in 2000 were British Energy (63 TWh), National Power (48 TWh, which was demerged into Innogy and International Power in October 2000), PowerGen (43 TWh), Scottish Power (29 TWh), BNFL Magnox (24 TWh) and TXU Europe (20 TWh).

2.2 Scandinavia

Electricity generation in Scandinavia in 2000 was about 386 TWh. Compared with 1990 this is an increase of about 14.7 per cent. Since 1996 the power generation has been expanded by 8 per cent.

The Scandinavian power market is characterized by diversified structures and a high level of competition. Neither the CR indicators nor the HHI exceeded the critical levels.

Figure 2 Power Generation Market Concentration in Scandinavia, 1996-2000



Source Öko-Institut calculations

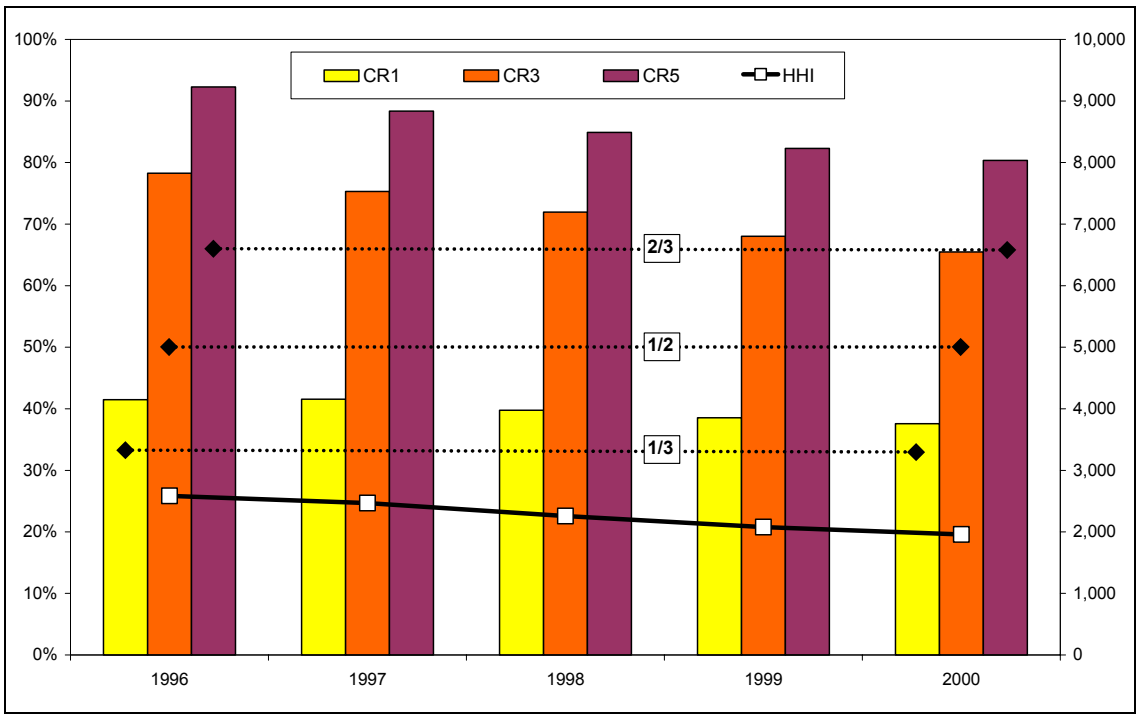
The major players on the Scandinavian power generation markets are the Swedish Vattenfall (70 TWh), the Norwegian Statkraft (40 TWh), Fortum from Finland (40 TWh), Sydkraft (28 TWh) and Birka Energi (21 TWh) from Sweden and Eltra (21 TWh) from Denmark.

2.3 Portugal and Spain

Power generation on the Iberian Peninsula is a rapid growing market. The electricity generation in 2000 (about 256 TWh) was 49.1 per cent higher than in 1990 and has increased by about 27.5 per cent since 1996.

Although the concentration indicators show a slightly declining trend all indicators remain above the critical levels. The sensitivity analysis clearly shows that this situation would not change even if increased electricity imports would be assumed. Given the background of the large increase of power generation the downward trend is a result of the overall growth of electricity production being somewhat higher than the generation growth of the major power producers.

Figure 3 Power Generation Market Concentration in Portugal and Spain, 1996-2000



Source Öko-Institut calculations

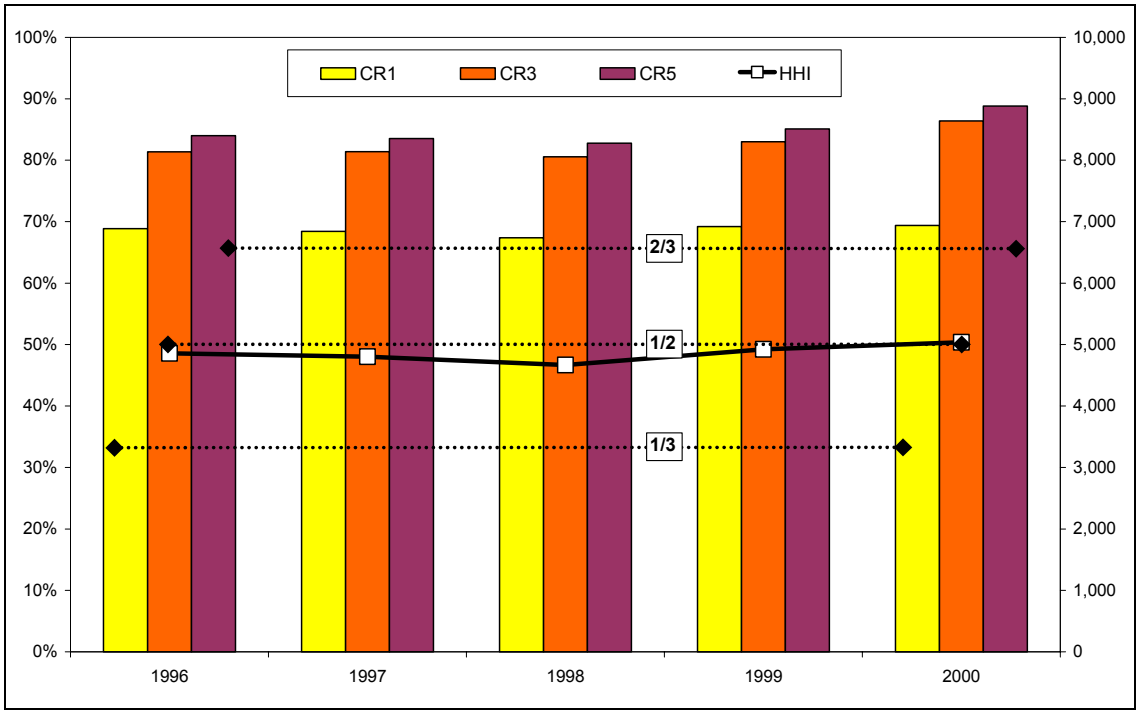
The power generation market in Spain and Portugal is dominated by Endesa and Iberdrola from Spain (96 TWh and 48 TWh) which generate more than half of the total electricity. The other large generators are Union-Fenesa, Hidrocantábrico (24 and 14 TWh, both from Spain) and Electricidade de Portugal (24 TWh).

2.4 France, Belgium, the Netherlands and Luxembourg

The power generation market of France and the Benelux countries is largely dominated by developments in France. In 2000 the power production in the four countries amounted to 670 TWh an increase of 24.7 per cent from 1990 levels and 3.8 per cent 1996 levels. Three quarters of the power generation in 2000 came from France.

The French power generation market dominants the concentration indicators. All indicators significantly exceed the critical levels and no trends of substantial changes can be observed. However, some indicators (CR3, CR5, HHI) show a slight increase.

Figure 4 Power Generation Market Concentration in France, Belgium, the Netherlands and Luxembourg, 1996-2000



Source Öko-Institut calculations

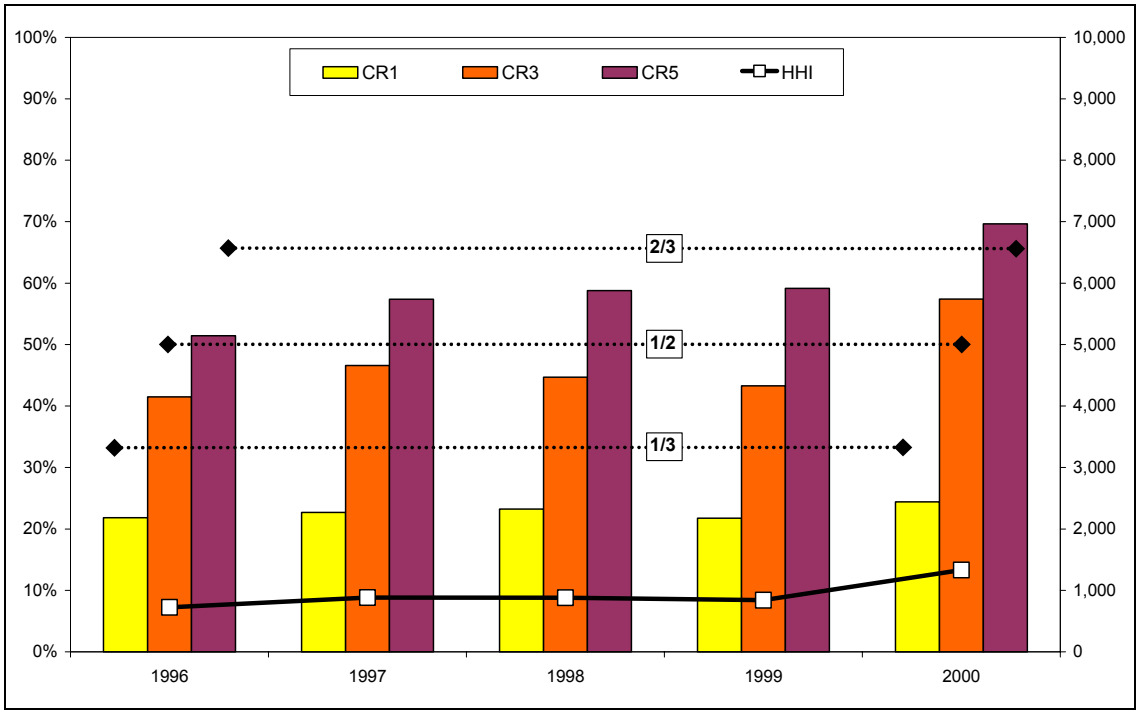
The main players on the power generation market in France and Benelux countries are Electricité de France (465 TWh) and Electrabel (97 TWh). Although some other undertakings generate significant amounts of electricity (the French CNR - Compagnie Nationale du Rhône and Charbonnage de France, Delta and Essent in the Netherlands) they only play a minor role in the market. This can be seen very clearly from the small differences between the indicators CR3 and CR5. Not surprisingly generators from Luxembourg (Société Electric de l'Our and CEGEDEL) play only a minor role on the regional market.

2.5 Germany, Austria and Switzerland

The 659 TWh power generation market in the region is clearly dominated by Germany. In 2000 the German 533 TWh electricity production was about 4.3 per cent larger than in 1990. The increase from 1996 to 2000 amounted to 3.3 per cent.

Whereas the concentration indicators were below the critical levels as a result of the mega mergers CR3 and CR5 in between exceed the critical levels. This trend will continue if the recently announced mergers between Hamburg's HEW, Berlin's BEWAG and the East German VEAG to Vattenfall Europe will take place. Afterwards the HHI will account for more than 1,400 which is in the upper range of a moderately concentrated market.

Figure 5 Power Generation Market Concentration in Germany, 1996-2000

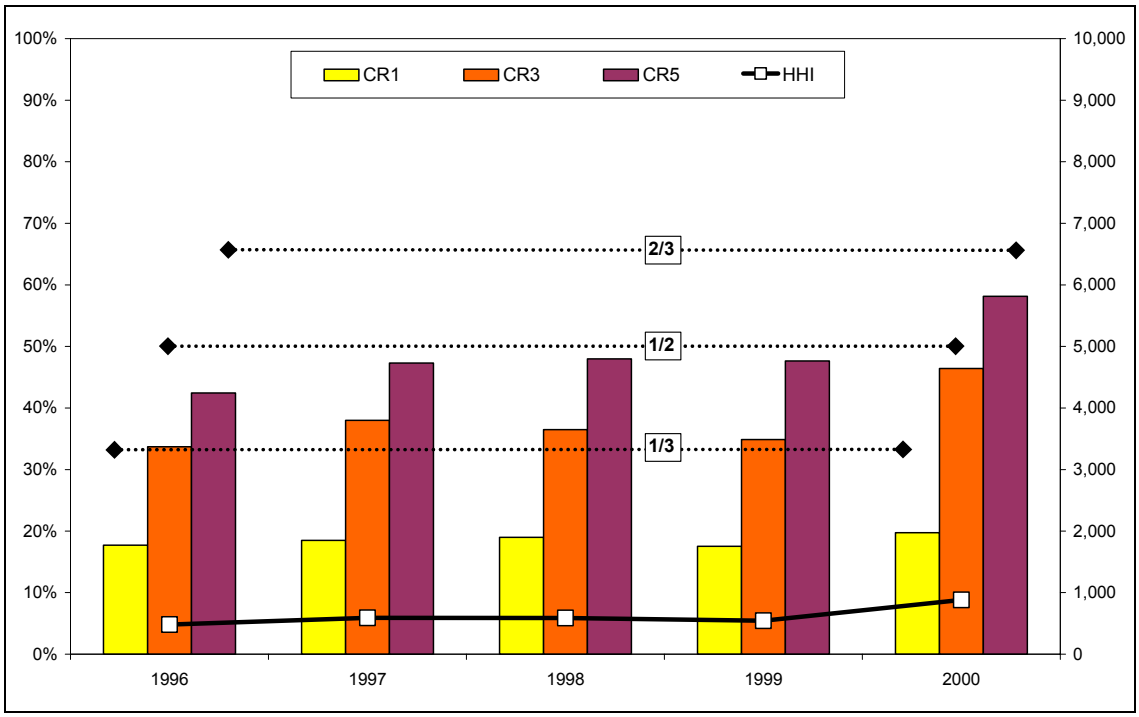


Source Öko-Institut calculations

The major German electricity generators are RWE (about 130 TWh in Germany), E.ON (125 TWh), VEAG (51 TWh) as well as HEW, BEWAG and VEAG which will form Vattenfall Europe with a German power generation of about 78 TWh.

If a wider view on the relevant markets is chosen the concentration indicators today do not reach the critical levels on the one hand but show the some growth trend. If the Vattenfall Europe merger is taken into account the CR3 indicator exceeds the critical level and the CR5 indicator is quite close to 66 per cent. HHI will doubled to about 1,000 in this case.

Figure 6 Power Generation Market Concentration in Germany, Austria and Switzerland, 1996-2000



Source Öko-Institut calculations

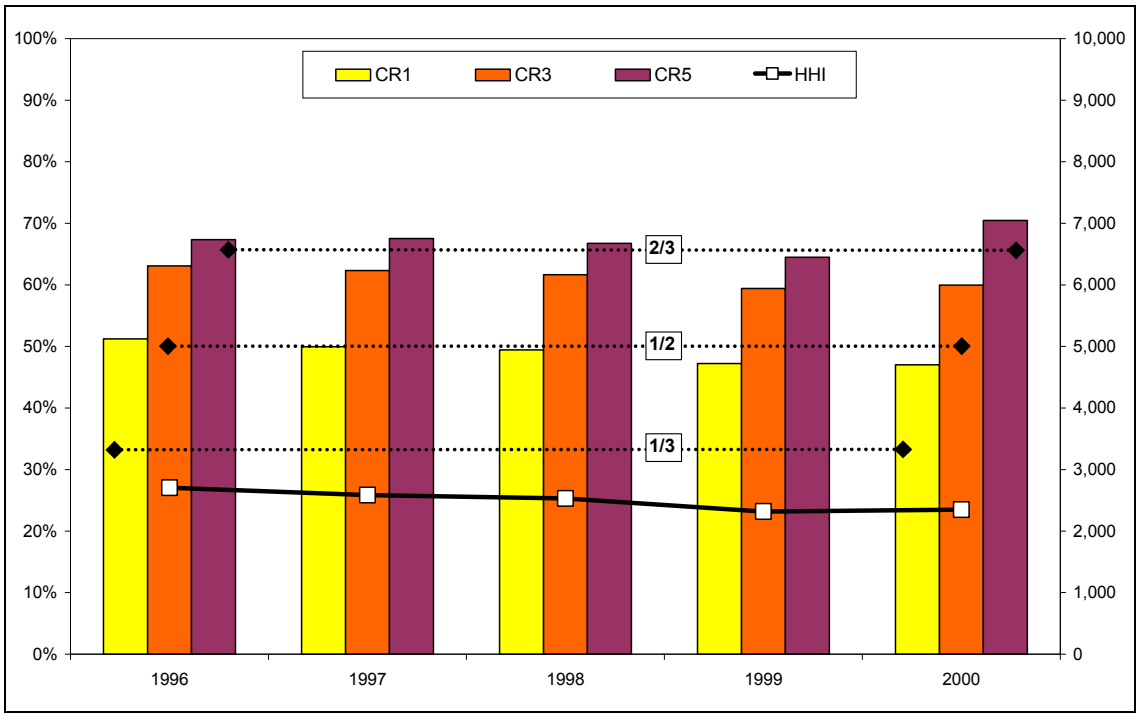
Besides the large German generators only the Austrian Verbundgesellschaft (28 TWh), AXPO (22 TWh) and NOK (20 TWh), both from Switzerland play an important role among the major power producers in the region.

2.6 Italy, Switzerland and Austria

The total electricity generation in the regional market of Italy, Switzerland and Austria was 388 TWh in 2000, of which 262 TWh was produced in Italy. The regional market expanded from 1990 to 2000 about 26 per cent, from 1996 to 2000 about 14.1 per cent. Power production in Italy accounts for two thirds of the regional market. The increase of power generation in Italy between 1990 and 2000 was slightly above the regional trend but slightly lower from 1996 to 2000.

The concentration indicators show a slightly decrease between 1996 and 2000 for CR1, CR3 and HHI. In contrast to this CR5 is characterized by a trend of growth. Nevertheless, all indicators exceed the critical levels significantly.

Figure 7 Power Generation Market Concentration in Italy, Switzerland and Austria, 1996-2000



Source Öko-Institut calculations

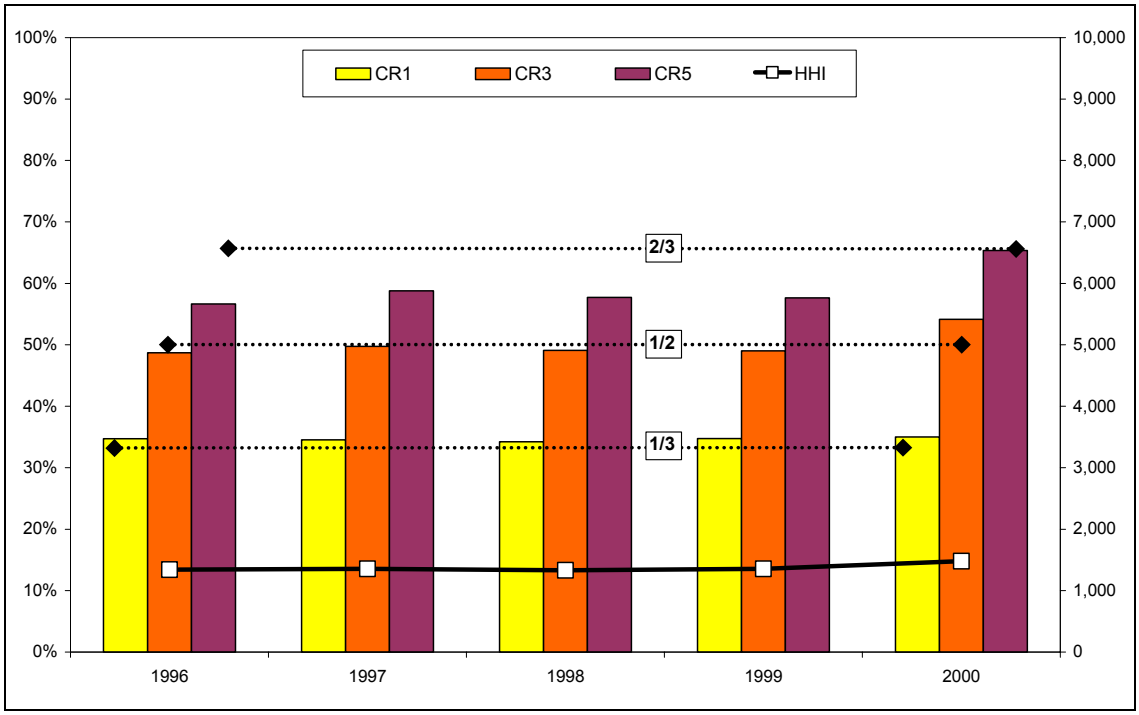
The regional market is dominated by Italy's ENEL with a generation of 183 TWh in 2000. The only other large generator in Italy is Edison with a 21 TWh production which is similar to the major generators from Austria and Switzerland (see chapter 2.5).

2.7 A Theoretical Approach: France, Belgium, the Netherlands, Luxembourg, Germany, Switzerland and Austria

More a theoretical approach than market reality is the continental power generation market of France, Benelux, Germany, Austria and Switzerland. The generated power in these eight countries amounted to 1,329 TWh in 2000 which is equivalent to an 15.4 per cent increase from 1990 to 2000 and a 4.6 per cent growth between 1996 and 2000. About 80 per cent of the total generated power come from France and Germany.

The concentration indicator CR1 illustrates the dominant role of EdF in the continental power exceeding the critical level of 33 per cent. In the real market Edf's power should be even larger because German EnBW is partly owned by EdF what will increase CR1.

Figure 8 *Power Generation Market Concentration in France, Belgium, the Netherlands, Luxembourg, Germany, Switzerland and Austria, 1996-2000*



Source *Öko-Institut calculations*

The increase of CR3 and CR5 points out the significant influence of the recent mergers in Germany. As a result of the upcoming Vattenfall Europe merger CR3 and CR5 will continue to rise. As a consequence the critical levels of CR3 and CR5 will be exceeded during the next years if no other changes will take place.

HHI would show moderately concentrated markets in the upper range of concentration (about 1,500 points) even in this more theoretical case of a large integrated market for power generation in continental Europe.

3 Conclusions

The analysis leads to a clear picture of market concentration in the liberalized power generation markets in Europe. Electricity production in the United Kingdom and in Scandinavia can be characterized as unconcentrated because of the developments of the last years, however, in all other regions market concentration and its trends are critical. In the markets characterized by former centralized state monopolies the concentration indicators remain very high. The situation in Spain, Portugal and Italy where a slightly decrease of market concentration can be observed does not lead to a significantly different situation than in France and Belgium where nearly no changes can be measured. Furthermore, especially on the German market which is historically characterized by a certain diversity of power generation the recent and the upcoming mergers push the concentration indicators to levels which are more and more critically.

Taking into account the challenge of developing fair, transparent and sustainable energy markets in Europe several conclusions can be drawn:

- the remaining and the upcoming market concentration in the field of power generation has to be seen as endangering fair, competitive and sustainable energy markets,
- breaking old monopolies and avoiding new concentration trends in the generation sector must be a central issue for competition policy in the energy sector,
- of the high levels of market concentration in the generation sector this must be compensated for by extremely fair, transparent and coherent rules for third party access.

Regarding the last issue the following subjects should be addressed

- Strict unbundling of generation, transmission and distribution is a key issue. Ownership unbundling should be seen as the medium term target, legal unbundling should be established immediately.
- The common rules for terms and conditions as well as charges for the use of networks should developed in a way that the rules and charges for third party access are fair, transparent and of binding nature as well as coherent in the European context.
- Decentral power generation should receive a premium for long term avoided network costs.
- Additional market distortions (availability of decommissioning funds for activities in the market, fuel cycle cost obligations, liability issues, etc.) between electricity generators should be removed.

Last but not least, the further in-depth evaluation of market concentration in the electricity sector on a regular basis should be seen as a key issue for the future improvement of the internal market for energy.

Annex

Net Electricity Production in European Countries, 1990-2000

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	TWh										
United Kingdom	299.4	302.7	299.2	304.0	307.9	316.6	329.7	329.1	342.8	347.9	355.2
Denmark	24.1	34.3	29.1	31.9	37.8	34.5	50.7	41.9	39.2	37.0	34.2
Sweden	142.9	143.5	142.8	142.4	139.4	144.2	136.6	143.2	153.8	150.5	141.9
Norway	120.8	110.1	116.5	119.3	112.5	122.5	104.1	111.1	116.1	122.9	142.8
Finland	48.8	59.2	55.0	58.0	62.2	60.6	66.4	66.2	67.3	66.8	67.2
Spain	144.3	148.4	150.9	149.4	154.5	159.5	167.4	182.2	188.0	200.1	214.1
Portugal	27.3	28.7	28.7	29.9	30.2	31.9	33.2	32.9	37.5	41.2	41.8
France	399.7	433.5	441.7	450.3	454.7	471.6	490.5	481.4	487.5	495.1	513.4
Belgium	67.2	68.1	68.2	67.2	68.6	70.6	72.4	75.1	79.5	80.8	80.1
Netherlands	69.5	71.8	74.5	74.0	76.7	77.7	81.8	83.1	87.4	74.6	75.6
Luxembourg	1.3	1.3	1.2	1.0	1.2	1.2	1.3	1.2	1.3	1.0	1.3
Germany	510.7	500.5	498.7	488.2	489.3	497.8	515.9	512.8	517.9	520.5	532.7
Austria	48.8	49.8	49.6	52.4	53.2	55.0	53.2	55.2	55.9	58.9	60.5
Switzerland	54.0	55.8	57.1	59.7	64.8	61.6	55.0	60.9	60.9	66.7	65.4
Italia	205.2	210.5	214.4	211.4	219.9	228.9	232.0	238.6	246.3	253.1	262.4

Sources: Eurostat, UCTE, NORDEL, DTI, AG Energiebilanzen, Öko-Institut calculations

About Öko-Institut

Öko-Institut (Institut für angewandte Ökologie – Institute for Applied Ecology, a registered non-profit association) was founded in 1977. The objective of the Institute is environmental research independent of government and industry, for the benefit of society. Our mission is to analyse and evaluate current and future environmental problems, to point out risks, and to develop and implement problem-solving strategies and measures. In doing so, we follow the guiding principle of sustainable development.

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Systems analysis: development and evaluation of planning and analysis tools (e.g. emission and material-flow analyses), development of scenarios and identification of macroeconomic effects.

Implementation: development, improvement and implementation of environmental policy and management instruments (laws, levies, financing models, management guidelines, participation in planning processes, etc.).

Action planning: development of sectoral action plans for environmental impact abatement, especially for climate protection, transportation systems and waste management, encompassing both environmental and economic aspects.

Environmental communication: providing scientific support for mediation processes, chairing Round Tables and Agenda 21 processes, organizing congresses and workshops, lecturing, publishing.

Committee and consultant work and expert opinions: UN and EU working groups, national commissions, standardization committees, assessment of permit applications, political advice.

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