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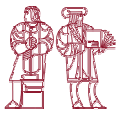

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Electricity Market Reform in the European Union: Review of Progress toward Liberalization & Integration[*]

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Abstract

The energy market liberalisation process in Europe is increasingly focused on electricity market integration and related cross border issues. This signals that the liberalisation of national electricity markets is now closer to the long-term objective of a single European energy market. The interface between the national electricity markets requires physical interconnections and technical arrangements. However, further progress towards this objective also raises important issues regarding the framework within which the integrated market is implemented. This paper reviews the progress towards a single European electricity market. We then discuss the emerging issues of market concentration, investments, and security of supply as well as some aspects of market design and regulation that are crucial for dynamic performance of a single European market.

Key words: Electricity, energy, liberalisation, regulation, integration, European Union

JEL Classification: L11, L22, L 52, Q48

1. INTRODUCTION

At present, European electricity market liberalisation represents the world's most extensive cross-jurisdiction reform of the electricity sector involving integration of distinct state-level or national electricity markets. In the US, in the aftermath of the California electricity crises in 2000-01, the restructuring process has slowed down significantly and many states have put their reform plans on hold. Apart from a small number of leading reform countries such as Australia, New Zealand, Chile and Argentina, many other countries around the world have made only limited progress towards comprehensive energy market deregulation along the lines now being pursued by the European Union (Jamasb et al., 2004). The Californian electricity crisis and the 2003 blackouts in New York and parts of Europe have clearly dampened political enthusiasm for reform.[1]

Against this background of a world-wide slow-down in the pace of electricity reform, the centrally driven effort by the European Commission has been the main force that keeping the program on course. Electricity sector liberalisation is part of the wider trend toward liberalisation and the withdrawal of the state from involvement in infrastructure industries (Schneider and Jäger, 2003). Given the strategic position of the electricity industry in national politics, in the absence of policy at the level of the European Union (EU), the pace of reform in many member states would have been considerably slower.[2]

However, relative progress in liberalisation is not the same as the achieving an integrated European electricity market. This paper reviews the development and the state of electricity sector liberalisation in the EU, and discusses the prospects for further progress towards an integrated European market in the light of the remaining challenges. While individual countries have made substantial progress toward liberalization, the EU's goal of a single European electricity market remains a long way off.[3]

2. ASSESSING LIBERALISATION AND INTEGRATION

Textbook microeconomic theory suggests that competition and the profit motive result in internal (production) and external (market) efficiency and that the benefits are passed on to customers and the economy in the form of lower prices and costs. The electricity supply industry (ESI) has important physical characteristics that shape its optimal regulatory design. It involves (i)

[1] This is in spite of the fact that there seems to be little formal evidence of a connection between electricity reform and blackouts (see for example, Bialek, 2004).

[2] Unless otherwise specified, with the EU electricity market we generally refer to the EU-15 countries plus Norway and Switzerland (EU-15+2) as the latter two are closely associated with the Union. Thus the 10 accession countries, mainly located in Central and Eastern Europe, are not included in the data we present here.

[3] The ideal of a single market within the EU is sometimes referred to as an 'internal' market, hence the titles of some of the relevant discussion documents.

large sunk costs which limit entry possibilities, (ii) vertical stages (generation, transmission, distribution and retailing) of production with different optimal scales, and (iii) a non-storable good delivered via a network which requires instantaneous physical balance of supply and demand at all nodes. Liberalisation of such an industry involves the creation of a combination of competitive energy and retail markets, and regulated transmission and distribution activities. Successful liberalisation requires well-organised energy, associated ancillary services and transmission capacity markets to achieve competition with physical balancing and appropriate regulation of monopoly power.

Experience from electricity liberalisation around the world has produced a measure of consensus over some generic measures for achieving a well functioning market-oriented industry. Liberalisation generally requires implementation of one or more of the following inter-related steps: sector restructuring, introduction of competition in wholesale generation and retail supply, incentive regulation of transmission and distribution networks, establishing an independent regulator, and privatisation (Jamasb, 2002; Joskow, 1998; Newbery, 2002a).

Table 1 outlines the measures for reforming a vertically integrated and publicly owned ESI into a competitive and privately owned industry. In practice, the actual measures need to take into account both the specific characteristics of the national (or supra-national region) electricity industry *and* the general features of the liberalisation model.

Table 1: Main Steps in Electricity Reform

Restructuring	- Vertical unbundling of generation, transmission, distribution, and supply activities
	- Horizontal splitting of generation and supply
Competition and Markets	- Wholesale market and retail competition - Allowing new entry into generation and supply
Regulation	- Establishing an independent regulator
	- Provision of third-party network access
	- Incentive regulation of transmission and distribution networks
Ownership	- Allowing new private actors
	- Privatising the existing publicly owned businesses

Liberalisation requires a suitable market structure within which effective competition can be fostered. Generally, this involves restructuring the sector by unbundling vertically integrated activities and reducing their horizontal concentration. The aim of vertical unbundling is to separate potentially competitive generation and supply from the natural monopoly activities of transmission and distribution networks. The aim of horizontal separation is to create enough effective competition in generation and retailing where economies of scale favour competition. In some circumstances

competition and/or efficiency may be promoted by increased horizontal concentration in retailing or distribution. This may be the case where large numbers of small distribution companies sell electricity (as was the case in the Netherlands until relatively recently).[4] Consolidation in this case may yield economies of scale and increased extra-territorial competition.

The effective separation of generation and transmission activities is crucial for achieving competition in the wholesale electricity markets (see Joskow, 2003b; Newbery, 1999) as this will help prevent anti-competitive behaviour by incumbent generators and ensure non-discriminatory network access to others. Failure to do so can prevent generators from participating in the market and will discourage new entry. Unbundling can take the form of functional, accounting, legal, or ownership separation, with the last being the most effective. Similarly, unbundling supply from distribution is important for effective retail competition. In Britain,[5] following legal separation of these activities, some distribution companies decided to leave the retail market altogether, thus indicating the importance of effective legal separation that eliminated the scope for cross subsidies between distribution and retail.[6]

Restructuring often involves horizontal splitting of incumbent generation firms or merging of retailing firms to change market concentration to theoretically and empirically competitive levels (usually thought to occur when the number of effective competitors in a market is at least five). In order to facilitate competition in generation in the short run and encourage new entry in the long-term, it is important to prevent high levels of concentration in the existing markets. Green and Newbery (1992) discuss the initial problems of high market power and concentration in England and Wales, which later led to regulatory-driven divestiture of significant amounts of assets.[7] They show that prices in liberalised markets (such as England and Wales) are closely related to the number of players and the 'tightness' of the market i.e. the supply and demand balance. The combination of low price elasticity of demand and a small

[4] See Arentsen et al. (2001).

[5] There are effectively three sub-markets in the UK- England and Wales, Scotland and Northern Ireland. The system of regulation is broadly similar for the whole of the UK but the nature of generation markets varies. In England and Wales there was a power pool until 2001 which was replaced by bilateral contracts and a balancing market. In Scotland there is considerable vertical integration between generation, transmission, distribution and supply, with separate nuclear plants supplying the two incumbents under contract. In Northern Ireland there has been a cost-based power procurement system based on the single buyer model which will not be replaced by full competition until 2007. In the text we use England and Wales, Britain (which further includes Scotland) and the UK where appropriate.

[6] For example, Western Power Distribution controls electricity distribution in two of the 15 UK regions formerly controlled by incumbent distribution and retailing companies and it has no interest in retailing in the UK. However, vertical and horizontal separation affects the organisation and size of the activities and entities concerned. Joskow (2002) discusses electricity reform in the light of some characteristics of the sector i.e. limited adaptability of existing assets, and economies of co-ordination in vertical integration structures and argues that while reforms have improved operating efficiency, their long-term benefits for resource allocation are yet to be determined. Joskow suggests that a transaction costs approach to design and evaluation of electricity reforms be adopted and determine whether benefits of reform offset the increased transaction costs from unbundling.

[7] Initially two companies set the energy price in the UK power pool for bulk electricity over 90% of the time.

number of competitors means that market prices can easily deviate from competitive levels.

Establishing wholesale and retail electricity markets is essential for liberalising the sector. Wholesale market design needs to take account of various technical, economic, and institutional issues associated with pricing, contracts, scheduling, balancing, and network congestion, taking account of the specific conditions of the sector (Hogan, 1998). Reforming countries have adopted different market models and these have evolved in stages, reflecting a learning process and a reminder that liberalisation remains a work in progress (Joskow, 2003b; Wolak, 2001).

Market participation and efficiency requires sufficient liquidity. Standardised contracts help liquidity, stability and facilitate investment to deliver adequate generation capacity. Borenstein (2001) explains how long-term contract markets and price-responsive demand can help reduce the volatility of prices and risk. Although large consumers have benefited from competition, the benefits of extending retail competition to include residential customers have yet to be firmly established (Joskow and Tirole, 2004; Joskow, 2003a; Salies and Waddams Price, 2004). In the long run, new entry in generation and supply, and interconnections with other systems can also increase competition in the market. Slow growth and excess capacity in many European electricity markets limit profitable entry opportunities for newcomers, and continuing high levels of concentration in generation and retail markets limit competition (Pollitt, 1999).

Establishing an initially competitive market structure requires government initiative, and all examples of successful restructuring (England and Wales, Norway, Chile, Argentina and Australia) illustrate the importance of initial restructuring to facilitate competition. Where this did not occur, in Britain with the lack of competitors in generation, or in Chile with the continuing integration of some generation with transmission, ongoing problems were created for the regulatory system.[8] Regulation can be very good at policing a competitive system, but it is difficult for regulators to engineer changes in market structure following liberalisation (the process of introducing competition into England and Wales generation took nearly 10 years and the separation of transmission and generation took 18 years in Chile). Maintaining competitive markets requires that the incentives for new entry are correct. The regulator needs to establish clear rules for the wholesale market and to minimise regulatory uncertainty (Alesina, et al., 2003; Ishii and Yan 2004). Where competitive and monopoly stages remain integrated, the regulator must ensure that there is real and non-discriminatory access to transmission and distribution networks for generators and suppliers. Regulated third-party access has proven the most effective and widely used approach to the provision of network access. The one country in Europe which did not adopt such a system at the beginning of its reform process, Germany, was forced to adopt it following multiple

[8] See Pollitt (2004).

difficulties in competitive suppliers gaining access to incumbent company networks (Brunekreeft, 2002).

Moreover, distribution and transmission charges typically constitute around one third of final electricity prices and vary by at least a factor of two across Europe. In addition, there is significant potential for efficiency improvement and cost savings in European networks, both within and between countries (Jamasb and Pollitt, 2003, find average cost inefficiency to be of the order of 40%). Advances in incentive regulation theory, such as yardstick regulation, attempt to mimic market competition (Shleifer, 1985). In recent years, at least 10 European electricity regulators have adopted incentive models based on price cap regulation and utility benchmarking (Jamasb and Pollitt, 2001).

The main perceived effect of privatization is that the pursuit of profit by private owners will lead to efficiency improvement and cost saving (Vickers and Yarrow, 1988). Many reforming countries have sold off public enterprises or allowed new private entry. An increase in sector-wide ownership diversity can also facilitate direct competition in the generation and supply activities and yardstick regulation of networks by comparative performance. Privatization can also provide significant proceeds for the government and reduce its future liabilities (Newbery and Pollitt, 1997). However, privatization is not a prerequisite for liberalization. In theory, competition and incentive regulation can be applied to publicly owned enterprises (e.g. Norway). However, there is significant evidence that privatisation does deliver benefits, especially when combined with effective restructuring, competition, and regulation (Newbery, 1999; 2002a).

The generation fuel mix can affect the process of, and potential gains from, electricity liberalisation for two reasons. First, dominantly hydroelectric and nuclear based systems with adequate capacity (such as in Norway and France) typically have low short-run system marginal costs considerably below long-run marginal costs. This can be a problem if investment planning is excessively influenced by the current low prices, rather than by efficient long-run future prices, especially given the high capital costs and long lead times of nuclear and hydro investments. Second, liberalisation results in a market determination of new generation plant. This has tended to favour new gas-fired generation. Gas dependency raises security of supply issues, though this is initially mitigated by the inherited fuel mix within the generation portfolio. Drillisch and Riechmann's (1998) study of energy liberalisation in Europe finds a positive link between import independence and liberalisation, while the overall energy independence index is more significant than the independence index of the electricity sector alone. This probably reflects a relative unwillingness among the import dependent countries to let the market determine the structure of energy imports.

Liberalisation, through internal and cross-border competition, should lead to greater price convergence. The actual extent of convergence is, however, constrained by technological differences, interconnection capacity, the degree of

cost-reflective pricing, and variations in the efficiency and cost structure of transmission and distribution networks. Similarly, it is plausible that returns on investments will show signs of convergence. Also, capacity utilisation should improve while reserve margins will provide sufficient degree of security of supply.

3. THE LIBERALISATION PROCESS AND CONTEXT

Many of the liberalisation initiatives in Europe and elsewhere began in the early 1990s in an atmosphere of reduced political concern over energy supply security. The ending of the cold war made imports of gas from Russia less risky in an environment where liberalisation favoured the building of new gas-fired plants. An initial surplus of generation capacity supported the reforms, as there was no pressing need to ensure guaranteed returns to support new investment.

European reform was pursued at two parallel levels. First, under EU Electricity Market Directives, member countries were required to take at least a minimum set of steps by certain key dates toward the liberalisation of their national markets. Second, the European Commission promoted efforts to improve the interfaces between national markets by improving cross-border trading rules, and to expand cross-border transmission links. Trading rules are being developed with industry agreement and the EU has subsidised some cross-border transmission link upgrades (such as between Ireland and Great Britain). The underlying aim of both of these policies was to extend the principles of the European Single Market to the energy market by: the Directives would enable companies from across the EU to compete with national incumbents, while improved interconnection would reduce cross-border transport costs and increase competition.

The first and second EU Electricity Market Directives of 1996 and 2003 focused on unbundling the industry and on a gradual opening of national markets.[9] The second directive further promotes competition by toughening regulation of access to networks and requiring independent regulators. Regulation of cross-border trade aims to facilitate market integration (Table 2). The second directive aims to achieve, by July 2007 at the latest: (i) unbundling of transmission system operators (TSOs) and distribution system operators (DSOs) from the rest of the industry, (ii) free entry to generation, (iii) monitoring of supply competition, (iv) full market opening, (v) promotion of renewable sources, (vi) strengthening the role of the regulator, and (vii) a single European market.

In contrast to textbook models which regard an independent regulator to set the regulatory framework ex ante as a necessary first step, the EU focus on raising the standards of regulation came rather late, after the market structure and rules had been established. Thus in Italy and Spain, regulators are weak in

[9] The texts of the Directives can be found at http://europa.eu.int/comm/energy/electricity/legislation/index_en.htm.

the face of established incumbent company interests. In mid-2005, despite full liberalisation of the German electricity market, no central energy regulator had been yet established.[10] Also, privatising state-owned monopolies has not been part of the EU-wide drive toward liberalisation of the industry. While the political rationale for this is understandable, it is difficult to see how state ownership of large incumbent electricity companies (such as in France) can be conducive to competition.[11] These deviations from best practice reflect the need to avoid sovereign issues and reflect a pragmatic approach towards a collective agenda, rather than attempting to follow an optimum reform path.[12]

Table 2: EU Electricity Directives
Source: Vasconcelos (2004)

	Most common Form pre-1996	1996 Directive	2003 Directive
Generation	Monopoly →	Authorisation → Tendering	Authorisation
Transmission Distribution	Monopoly →	Regulated TPA Negotiated TPA Single Buyer	Regulated TPA
Supply	Monopoly →	Accounting separation	Legal separation from transmission and distribution
Customers	No Choice →	Choice for Eligible Customers (=1/3)	All non-household (2004) All (2007)
Unbundling T/D	None →	Accounts	Legal
Cross-Border Trade[13]	Monopoly →	Negotiated	Regulated
Regulation	Government → Department	Not specified	Regulatory Authority

3.1 The EU Generation Fuel Mix

Although electricity generation remains heavily dependent on fossil fuels, there has been a steady decline in the use of coal and oil. In turn, natural gas and nuclear power have met the demand growth. The increase in natural gas use can be attributed to the development of high efficiency combined-cycle gas turbines (CCGTs) whose short construction times and low cost makes them attractive to liberalised markets, notable in Britain, Spain and Italy. However,

[10] The current regulator for telecommunications and post will also assume responsibility for electricity and gas. The new regulatory authority (REGTP) is pending, waiting for the enactment of the new energy law (ENWG) in 2005. See Brunekreeft and Twelemann (2005).

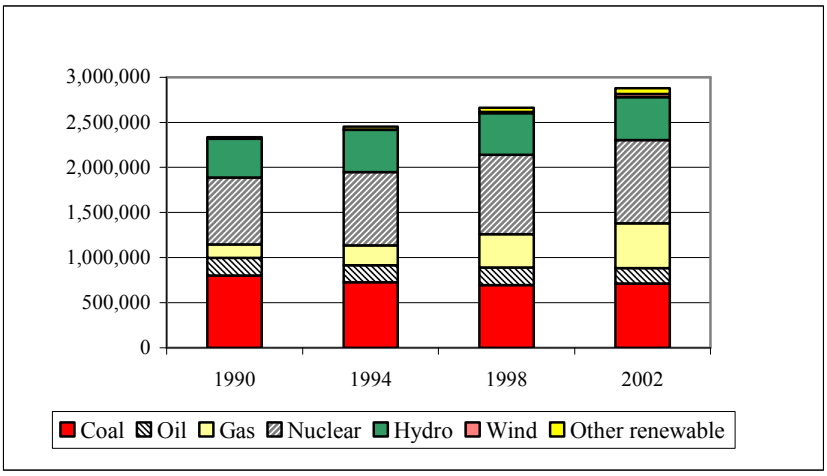
[11] But see Glachant and Finon (2005), who discusses the proposed partial privatisation of EdF. This problem is not just confined to state-owned incumbents. The introduction of competition into already privately owned sectors such as in the US and Japan has been as slow as in many state-owned sectors.

[12] This is most clearly illustrated in the case of France (see Glachant and Finon, 2005).

[13] Cross border trading rules are also covered by an additional regulation 1228/2003 on conditions for access to the network for cross-border exchanges in electricity.

the change in the overall fuel mix has been gradual; in particular non-hydro renewable energy remains low in percentage terms despite a rapid deployment in recent years (Figure 1). A simple Herfindahl-Hirshman Index as a measure of resource concentration or dependency shows some decline in reliance on specific sources in the EU (2,636 in 1990 to 2,253 in 2002).[14]

Figure 1: Electricity Fuel Mix - EU-15+2 in 2002 (GWh)
Source: Based on IEA (2004a)



Moreover, as shown in Figure 2, the distribution of generation sources across the EU is rather uneven. In principle, the resource diversity in the EU and across national markets implies a potential for improvement in capacity utilisation and efficiency through market integration and trade.

The extent of cross-border trade is largely a function of available interconnection capacity, generation capacity, cost structure, resource mix, and regulation. The actual level of cross-border trade among the EU countries varies considerably (Figure 3). The figure also shows that smaller member countries exhibit a relatively higher trade in relation to their market size (notably Denmark, Switzerland and Luxembourg). However, the current level of total trade in the EU remains relatively modest, largely a result of capacity constraints in the existing interconnections.

[14] Using data on the EU–15 +2 in seven generation fuel categories (coal, oil, gas, nuclear, hydro, wind, and others) from IEA (2004a).

Figure 2: Share of Electricity Supply Sources – EU-15+2 (2002)
Source: Based on IEA (2004a)

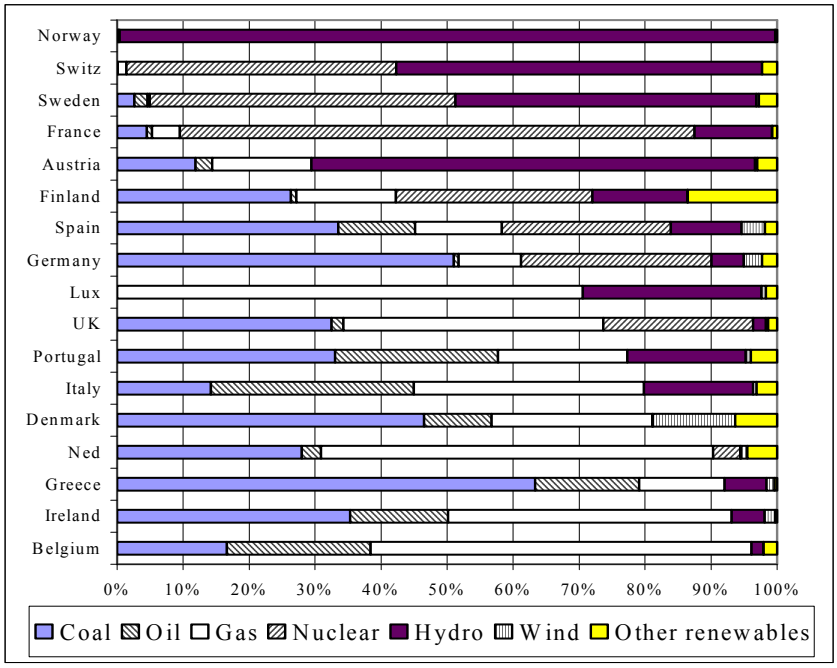
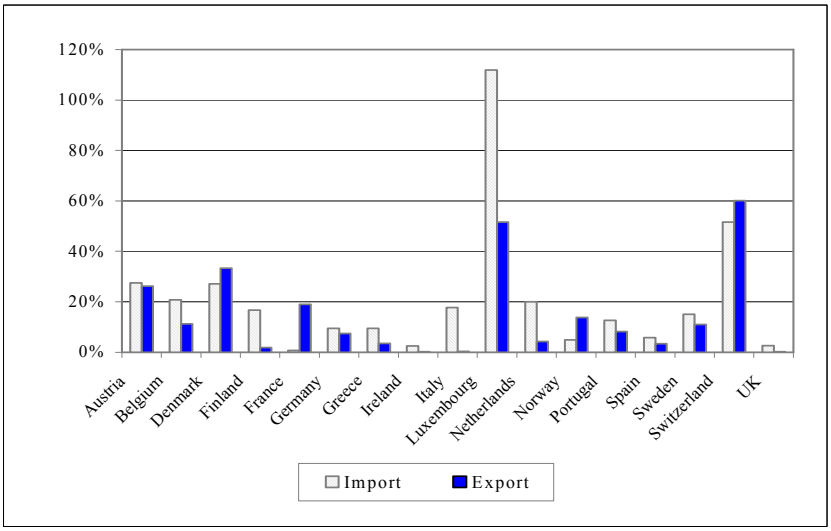


Figure 3: Imports/Exports as % of National Consumption (2002)
Source: Source: IEA (2003a)



3.2 Key Reform Steps in the EU

Restructuring

The aim of unbundling is to vertically separate the potentially competitive generation and supply functions from the natural monopoly distribution and transmission networks. Initial structural differences and the flexibility allowed by the first Electricity Directive have meant that member countries have adopted different approaches to separate these functions.

Effective separation of transmission system operators from generation is important for effective wholesale competition. In the US, where the pace of restructuring has generally been slow, the relative success of wholesale competition in the Pennsylvania-New Jersey-Maryland (PJM) system has been attributed mainly to effective separation of generation from other functions of the system (Joskow 2003b). Recognising this, the separation of transmission system operators has generally been more stringent than for distribution system operators, and more countries have applied ownership or at least legal separation rather than accounting or management separation (Table 3).

Table 3: Unbundling the Networks (from Both Generation and Retailing)
Source: European Commission (2005)

	Transmission System Operators	Distribution System Operators
Austria	Legal	Legal
Belgium	Legal	Legal
Denmark	Legal	Legal
Finland	Ownership	Accounting
France	Legal/	Management
Germany	Legal	Accounting
Greece	Legal	None
Ireland	Legal	Management
Italy	Own	Legal
Luxembourg	Management	Management
Netherlands	Ownership	Legal
Portugal	Ownership	Accounting
Spain	Ownership	Legal
Sweden	Ownership	Legal
UK	Ownership	Legal
Norway	Ownership	Legal/Accounting

The legal separation of distribution network operator from supply is important for retail competition. This prevents the cross subsidy of retail customers by the distribution business of integrated operators. In the UK, non-integrated businesses have successfully taken market share from incumbents. Centrica, the former gas incumbent, has a 25% market share of the residential

electricity market, while several other companies have built market share outside the geographic area of their distribution businesses.

While the evidence from countries with successful liberalisation is that vertical separation of networks and competitive activities can yield significant benefits, vertical integration between retailing and generation appears to have a strong commercial rationale. This is because the supply risks inherent in the generation segment can be insured against by integrating into retailing. The benefits of such integration can be clearly seen in England and Wales where a recent collapse in the wholesale price of electricity drove a number of non-integrated generators into bankruptcy while integrated utilities were able to maintain profitability and survive.

Table 4 shows the extent to which countries have separated networks from competitive activities using four indicative criteria. The table uses five criteria reflecting ownership, accounting, regulatory, legal, and physical aspects important for effective separation. The table also shows that the extent of unbundling of the transmission system is generally higher than for distribution networks.

Table 4: Extent of Network Unbundling
Source: Based on European Commission (2005)

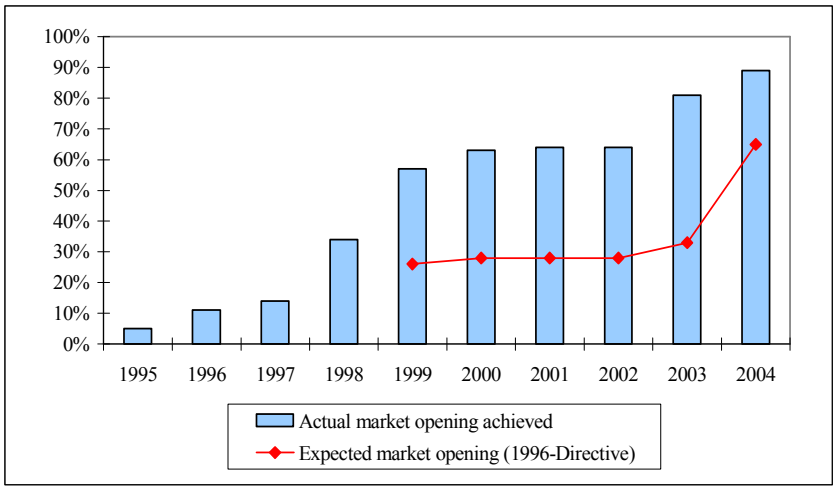
	Transmission System Operator Score/5	Distribution System Operator Score/5
Austria	4	3
Belgium	4	3.5*
Denmark	4	3
Finland	5	1.5
France	4	1
Germany	4	1.5
Greece	1	0
Ireland	3	3
Italy	5	3
Luxembourg	1	1
Netherlands	5	3
Portugal	5	3
Spain	5	4
Sweden	5	4
UK	5	4.5
Norway	5	1.5
• TSO: Ownership unbundling, Yes=1, No=0; DSO: Legal unbundling, Yes=1, No=0 • *Published accounts*, Yes=1, No=0 • *Compliance officer*, Yes=1, No=0 • *Separate corporate* identity, Yes=1, No=0, Often=0.5 • *Separate locations*, Yes=1, No=0, Partly=0.5		
* Brussels region not yet legally unbundled and no compliance officer in Flanders region.		

Effective competition may also require horizontal unbundling of companies in generation and retailing in order to reduce market concentration. Thus in England and Wales the largest generators were obliged to divest part of their plant portfolio to other firms, and later traded horizontal divestitures for the right to integrate into supply. The EU Directives have not required horizontal separation to control market concentration at the national or EU level. However, in order to meet market opening rules, ENEL of Italy (65 percent state-owned) has been required to sell off 15,000 MW generation capacity and EdF of France has auctioned some 6,000 MW generation capacity (42 TWh energy) per year. This strongly supports the view that a competitive market cannot operate without further changes in horizontal market structure in several of the most significant European electricity markets.

Competition

Despite a mixed ownership structure, wholesale competition is now complete in all member countries, and all large users and many small consumers can freely choose their electricity suppliers. The 2003 Electricity Directive has raised the standards for competition by ruling out the single-buyer model for distribution utilities (adopted by Northern Ireland, Portugal and Italy) and requiring regulated third-party access to distribution networks.

Figure 4: Actual and Expected Levels of Market Opening (by units sold)
Source: European Commission (2004b, 2005) and own Calculations



Most of the EU electricity market is, at least in principle, now open to competition. Although not yet required by the Directives, some countries have already extended market opening to households and have, thus, exceeded the required levels, as Figure 4 shows. Even in France, where liberalisation has been relatively slow and which is often regarded as a closed market, non-EDF suppliers serve about 15 percent of the eligible market (Glachant and Finon, 2005). The 2003 Directive requires that all non-household customers can freely choose their electricity supplier by 1 July 2004, followed by full market opening

to include all household customers by 1 July 2007 (after a review to assess obstacles to the single market in 2006).

Declared market opening does not necessarily imply effective competition and competitive prices. Achieving competitive prices depends on the number of players and the nature of consumer demand. The combination of low price responsiveness and a small number of competitors means that market prices can easily deviate from competitive levels. Currently, national electricity markets in many of the EU countries are dominated by relatively few companies and smaller consumers are resistant to switching.

However, the benefits of extending retail competition to small customers such as residential users remains subject to debate (Joskow, 2003a). An active demand side can help to reduce the effect of periodic supply fluctuations. Von der Fehr et al. (2005) discuss the example of Norway, where during the winter of 2002-2003, residential users (most of whom had variable price contracts) responded to the sharp price increases in the spot market caused by low water levels in hydroelectric reservoirs by reducing their demand, thus avoiding blackouts.

Regulation

Although market structure is important in promoting competition, appropriate regulation, in particular, implementing regulated third-party access to networks, is important for effective competition. Recognising the importance of this, the 2003 Electricity Directive required member countries to establish independent regulatory agencies.

Genoud and Finger (2002) observe a degree of convergence in European electricity regulation with the European Commission as an influential factor. Gilardi (2003), in a comparative analysis of independent regulatory agencies in the EU, observes that although there are variations in the degree of independence among the electricity regulators, they tend to be more independent than regulators in other infrastructure industries and comparable to those in the leading reform sector: telecommunications.

In addition, incentive-based regulation of networks can promote efficiency and cost savings in the natural monopoly segments of the sector. In Germany, where there has been no independent regulator in place and, hence an absence of incentive-based schemes, the network charges have largely remained unchanged and are among the highest in Europe (see Figure 6).

Privatization

As mentioned, the EU Electricity Directives are silent on the need for private ownership. In Germany and Belgium, the industry was largely privately-owned before reform. The most extensive privatisation programs have taken place in the UK and Portugal. Some countries have undertaken partial privatisation (e.g. Italy) while others envisage this as a possibility for the future (e.g. France). In these countries, private participation has been through entry by new firms. This approach avoids political sensitivities that could delay

liberalisation. In the Netherlands the transmission and distribution utilities remain in public ownership (van Damme, 2005).

Splitting large companies to increase competition is easier at the time of privatization. In some countries, this has sometimes been resisted to avoid the possibility of national companies falling into the hands of large foreign companies (e.g. The Netherlands and Norway). Norway demonstrates that liberalisation does not require privatisation, as competition was introduced with predominantly state and local ownership, although this took some time to emerge (Magnus and Midttun, 2000).

4. EFFECTS OF REFORM

Ideally we should be able to quantify the performance and effects of electricity reforms. However, it is too early to measure the outcomes of most European reforms, and it is in any case difficult to construct satisfactory or plausible counterfactual scenarios.[15] The impacts on market structure are quicker to emerge and easier to measure.

4.1 Market Structure - Mergers and Acquisitions and Market Concentration

Not surprisingly the financial integration of electricity markets in Europe has taken place more rapidly than the physical integration of electricity power flows and networks. In the absence of proactive regulation and control of Mergers and Acquisitions (M&As), European electricity companies have shown a marked tendency towards increased market concentration (Newbery, 2002b; Codognet et al, 2002). Increased market concentration or consolidation has occurred at both national and EU levels, and this may limit the effectiveness of competition.

Horizontal concentration

The legacy of pre-reform public ownership and centralised control through national companies (e.g. in France, Portugal, Italy, Greece and Ireland) has ensured that horizontal concentration remains high in many countries. While some reforms have led to significant reductions in concentration in generation and retailing (e.g. England and Wales, and the Nordic market), these remain exceptions rather than the norm. Among the EU-15, concentration in generation for the largest three generation firms remains above 60% in 10 markets (by installed capacity). In retailing there is a similar picture with the three-firm concentration ratio remaining above 60% in 12 markets (by number of customers).[16]

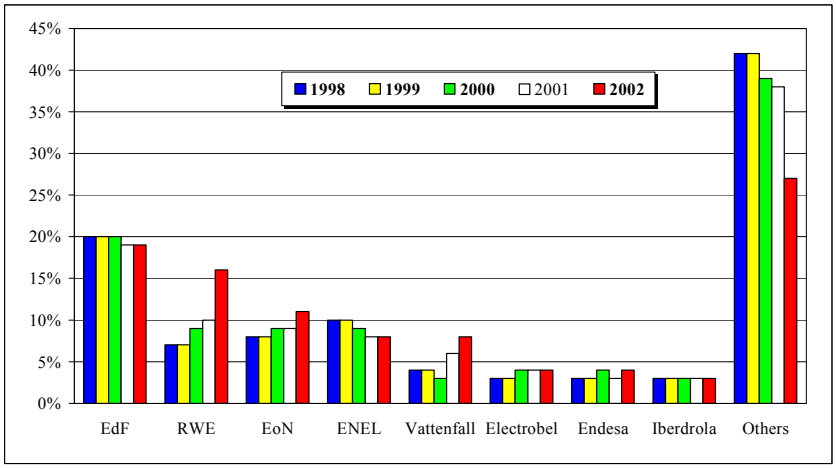
[15] Newbery and Pollitt (1997) and Domah and Pollitt (2001) quantify reform effects in the England and Wales market on the basis of a careful reconciliation of the pre and post reform companies and the identification of a plausible counterfactual for what might have happened to costs and prices in the absence of reform.

[16] Concentration figures are from European Commission (2005).

In principle, with progress towards larger regional markets or the single European market, national concentration may cease to be relevant, given adequate interconnect capacity. However, horizontal cross-border M&As can offset much of the deconcentration effect of market enlargement. In the short run markets will continue to be primarily national (especially in the larger markets in the UK, France, Germany, Italy and Spain) where transmission links are not strong enough to reduce the market power of domestic incumbents.

European utilities have been keen to position themselves in the new market and have moved more quickly that national and European decision-makers. Some acquisitions have involved considerable premiums which reflects the acquiring firms' expectations. As shown in Figure 5, more than two-thirds of the European market is now concentrated in the hands of eight large companies, with the Europe-wide four-firm concentration ratio at 50%. The current ownership structure in Europe constitutes a complex web including many partial shareholdings, which makes an analysis of their effect on the operation and further development of the European market rather difficult.

Figure 5: Generation Market Shares in Western Europe
Source: Codognet et al. (2002), Energia Klub (2002), and Own Calculations



Vertical integration

In pre-liberalisation electricity sectors, vertically integrated structures had apparent economic and technical advantages and were a convenient organisational arrangement for state-owned sectors.[17] Initial restructuring often attempted to reduce this. However, profit-oriented and privatised utilities have exhibited strong tendencies toward vertical (re)integration through domestic and cross-border mergers and acquisitions (M&As). Codognet et al (2002) show that vertically integrated electricity utilities have been among the most active in European M&As and have tended to acquire other vertically integrated

[17] We discuss M&As in this section due to their structural implications for the national and EU market while recognising that M&A is an aspect of firm behaviour and a distinct component of the market structure-firm behaviour-performance of the industrial organisation paradigm.

companies. Bortolotti and Siniscalco (2004) find that vertical integration has had a negative and significant impact on the number of privatizations and the proceeds from privatisation.

There is also a possible indirect link between M&As and investment. Allowing for some degree of vertical integration, for example between generation and retail supply, may lead to higher investment due to the risk-reducing properties of such mergers. However, this poses regulators with a trade-off in the form of possible negative effects on competition. For example, in Great Britain, the retail supply margin appears to have increased with higher concentration resulting from M&As as the number of national competitors in supply falls and the degree of integration between generators and suppliers has increased.[18]

Despite the obvious problems associated with increased market concentration, national and supranational regulators have been relatively inactive in tackling the issue (Thatcher, 2002). In some cases, the desire to create national champions that match their European counterparts may have constrained intervention to create a diversified ownership structure.

M&A decisions are usually the responsibility of national competition agencies. As with the E.oN – Ruhrgas merger in Germany, which was deemed to have large anti-competitive effects (Brunekreeft, 2004), it is not clear that these agencies are sufficiently aware of the dynamics of competition within complex electricity markets. What is needed is a competent energy regulator to provide clear advice on such cases (Newbery, 2004). It is interesting to note that there was no national energy sector regulator to advise on the E.oN – Ruhrgas case which was first rejected by German Federal Cartel Office, only to be overruled later by the government. The European Commission did not intervene on the grounds that over two-thirds of E.oN's combined European turnover was in Germany.[19]

4.2 Sector Performance

Electricity prices

The performance of liberalisation can be measured in a number ways. The effect on electricity prices is, perhaps, the single most important performance indicator. A desirable outcome of the single European market is to achieve a lower average EU price and a degree of price convergence through wholesale and retail competition. However, this outcome is also dependent on: (i) fuel markets and, in particular, access to natural gas, (ii) competition and resulting price convergence in national gas markets, (iii) sufficient interconnection capacity, and (iv) EU-wide emissions trading creating

[18] Since 1999 there have been several mergers of the supply companies of the former 15 regional electricity companies in the UK reducing the supply companies to 6 independent groups.

[19] Though an earlier notification or completion of the subsequent acquisition of Powergen shortly after would have made this a case for the Commission as the cross-border merger size thresholds would have triggered an investigation.

uniformity in emissions prices. In addition, incentive regulation can lead to minimisation and convergence of network charges.

A price decline (or more accurately, a decline in the price-cost margin) may suggest that efficiency gains have been achieved and that the gains have been passed on to customers. Liberalisation may also involve rebalancing of tariffs for different customer groups as a result of cost-reflective pricing so that not all consumers will experience the same price changes. These trends are further complicated by changes in prices for gas, oil and coal.

As shown in Figure 6, there is a significant variation in end-user prices in member countries, although this differential can be associated with different components of the final price. The figure shows convergence of generation price in the Nordic markets. Italy and Ireland exhibit notably high generation prices and retail margins.[20] At the same time, Norway and UK as the countries with longest incentive-based regulation of networks, have among the lowest transmission and distribution charges. The UK also exhibits the lowest retail supply cost and margin.

Figure 6: Estimated Breakdown of Expected Electricity Prices 2004 (50 MWh/year Customer (euro/MWh, before Taxes)
Source: European Commission (2004b)

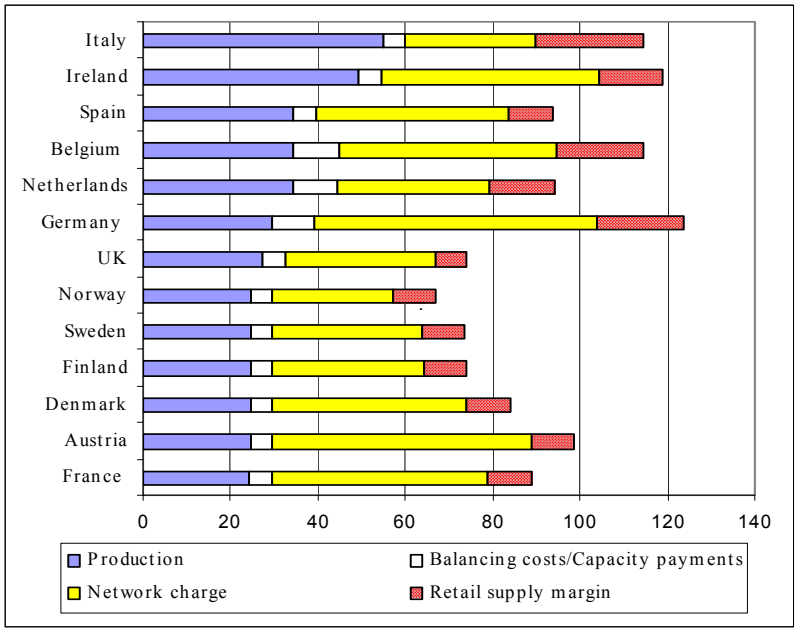


Figure 7 indicates a general decline in EU average electricity prices for major customer categories between 1997 and 2003. The reduction in average prices for households, small industrial customers, and large industrial users have been 6, 20, and 9.5 percent respectively. Also, the figure shows that the order and magnitude of the prices for these customer groups seem to have come more

[20] It should be noted that generation fuel taxes vary across the countries (see IEA, 2004b).

in line with the underlying costs of supply, which would suggest that residential prices should be higher than small industrial prices. This appears to have come against a background of flat or rising prices for fossil fuels for electricity generation over the period.[21] It also comes at a time when operating costs seem to have been falling in the electricity supply industry, combined with sharp declines in employment in recent years. Labour productivity in the utilities (including electricity) sectors has increased with about 30 percent between 1996 and 2001 (European Commission, 2004a). While the overall trend price decline may have been due to exogenous technological changes, it is not inconsistent with the anticipated benefits of the implementation of the Electricity Directives.

Figure 7: EU Average Real Price (2004 Euro per MWh)
Source: Own Calculations Based on EU Data and Inflation Rate (Unweighted)

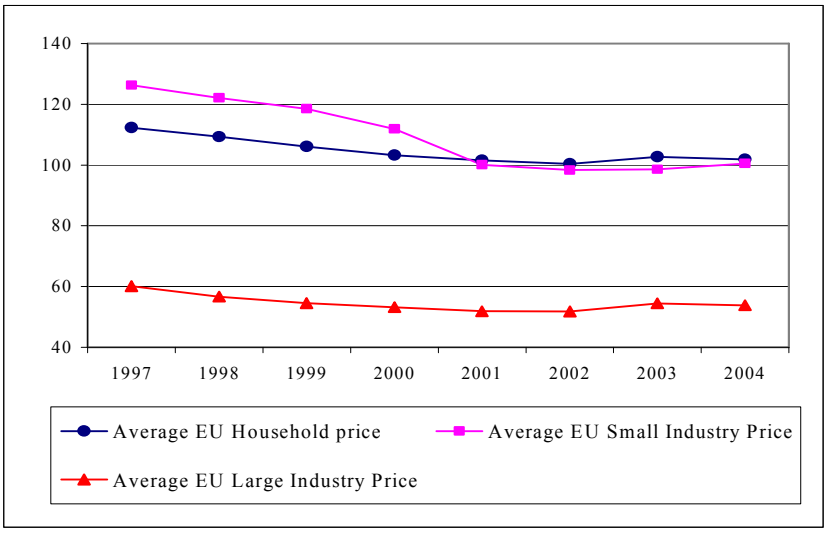


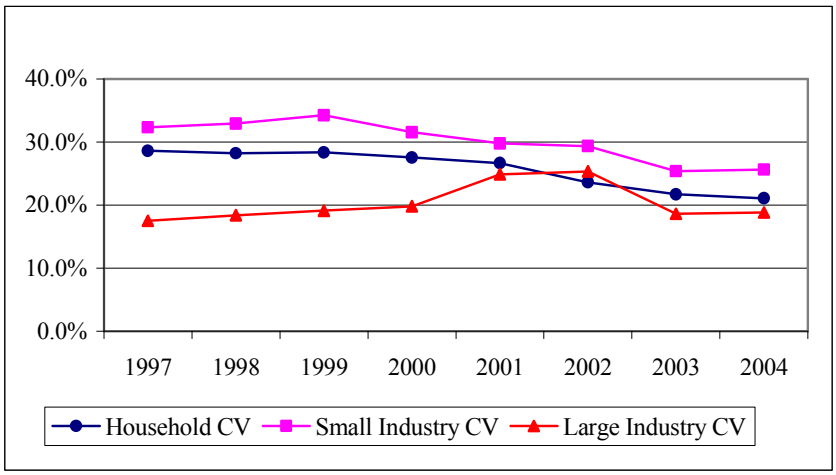
Figure 8 shows that during this period, the variabilities of national average prices for households and small industries have declined while the picture for large industries has, despite a general price decrease, been somewhat mixed.[22] Active customer choice of electricity supplier is crucial for effective competition and for consumers to benefit from efficiency gains.

Another indication of price convergence is the degree of price integration in the wholesale markets. The highly integrated Nordic market also exhibits high degree of price convergence. The level of price integration between other European markets is, however, generally low and reflects low interconnection capacity (Boisseleau, 2004: Bower, 2002).

[21] There is only patchy data available on fossil fuel prices on a consistent basis (see IEA, 2004b). Coal for electricity generation rose in Euro terms in most OECD Europe countries between 1997 and 2002. Heavy oil for electricity generation and industrial natural gas prices have fluctuated over the period but are generally higher (in Euro terms) in 2003 than in 1997 for most OECD Europe countries.

[22] Price variability is measured by the coefficient of variation, defined as the standard deviation divided by the mean.

Figure 8: Price Convergence - Coefficient of Variation (CV)
Source: Based on European Commission (2004b, 2005)



The number of customers that have switched suppliers or have renegotiated their contracts show considerable variation across member countries. As expected, large industrial users have been more active than other groups and have taken advantage of the market opening. However, with the arrival of full market opening from July 2007, an increasing number of smaller customers will be eligible to switch to a new supplier or to enter contract renegotiations (Table 5).

Table 5: Customer Switching - % Switched / Renegotiated in 2003 & 2002*
Source: European Commission (2004b, 2005)

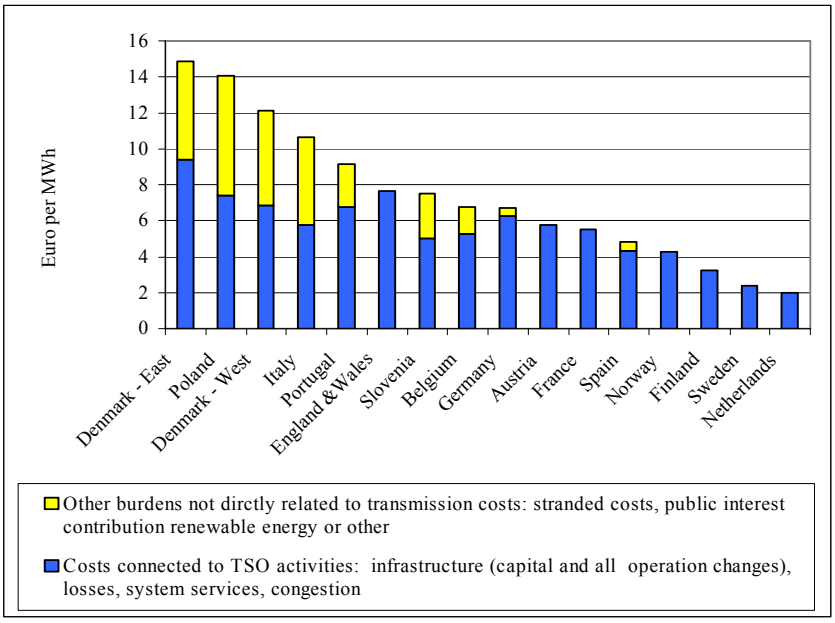
	Large Eligible Industrial Users[a]	Small Commercial / Domestic
Austria	(15%) 7%	(5%) 1%
Belgium	(5%[b]) 8%	19%
Denmark	(45%) 22%	5%
Finland	([c]) 16%	(10%) 4%
France	(15%) n.k.	
Germany	(20%) n.k.	(5%) n.k.
Greece	(0%) 0%	
Ireland	(20%) 6%	(2%) 1%
Italy	(15%) n.k.	
Luxembourg	(10%[d]) n.k.	
Netherlands	(20%) n.k.	n.k.
Portugal	(10%) 7%	1%
Spain	(20%) 5%	0%
Sweden	([a]) 5%	(10%[e]) 10%
UK	(15%) n.k.	(12%) 22%
Norway	(12%) 15%	(14%) 19%

* 2002 figures in parenthesis.
[a] In general refers to clients consuming more than 1GWh/year.
[b] 40% have renegotiated their contract.
[c] Most large users in Finland and Sweden tender every year for a new supplier.
[d] 15% have renegotiated their contract.
[e] Cumulative 40% since 1998.

Distribution and transmission tariffs constitute a significant share of final electricity prices and are not subject to competitive pressure. Efficiency improvements and tariff reductions require appropriate regulation. Figure 9 shows that there is considerable variation in transmission tariffs across member countries. Although average transmission tariffs fell by 9 percent in real terms between 2002 and 2003, the spread between the tariffs scarcely changed (ETSO, 2003 and 2004).

In addition, distribution tariffs vary significantly across member countries, although these differences appear to be less than for transmission tariffs. There are also significant variations in distribution tariffs within individual countries (as can be seen in Figure 6 where the distribution charges in Germany are twice those in the UK and explain more than half of the differential in the final prices between the two countries). These variations might reflect legitimate cost variations or the use of distribution charges as local taxes by municipal owners.

Figure 9: Comparison of Transmission Invoices (2003): Producers and Consumers Connected at EHV (Utilisation Time 5,000 hrs/y)[23]
Source: ETSO (2004)



High charges may also reflect unwarranted joint cost allocations within vertically integrated businesses cross-subsidising competitive segments such as retailing from monopoly segments. Independent incentive regulation promotes cost saving, and efficiency improvement in the networks and should prevent

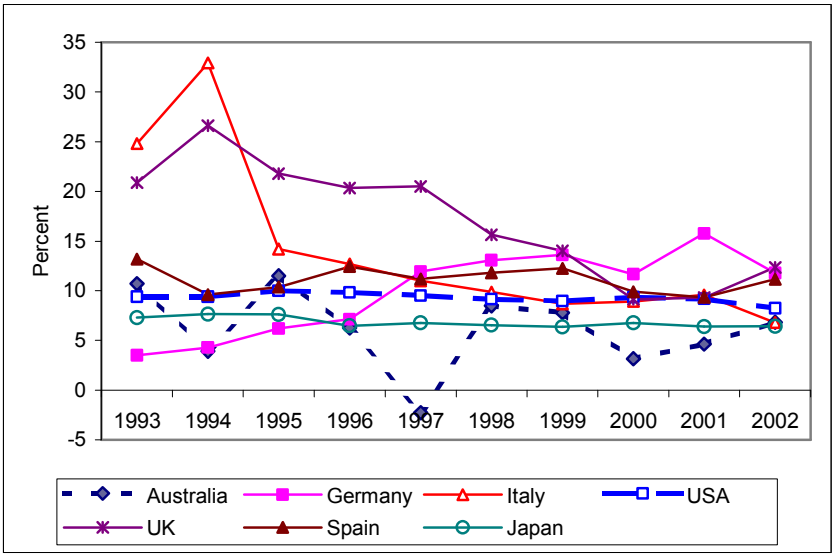
[23] Note that these figures are for large customers connected to the transmission system. The network charge figure in Figure 6 is for small industrial and commercial customers and includes both transmission and distribution charges. Hence the discrepancies for some countries between the two figures (e.g. Germany).

such anti-competitive cross-subsidies. Incentive network regulation has led to concerns about the effect on the quality of service, which exhibits variations both across and within countries (CEER, 2003). However, there appears to be no evidence of quality of service declining under incentive regulation. This is not surprising as quality of service is usually explicitly incentivised.

Investment adequacy

In the absence of central planning, the market is required to deliver sufficient and timely investments if liberalisation is to be sustainable. Insufficient investment is arguably the biggest concern raised by liberalised electricity markets. Assessing the incentives for future investment adequacy is difficult due to existing over-capacity. However, over time, as demand and supply move more into balance, new investment will be needed and will require an adequate return. Figure 10 shows that returns on investment in some of the companies in the largest member countries have been declining and converging.[24]

Figure 10: Return on total capital OECD electricity companies
Source: Standard and Poor's (2003) in IEA (2003b)



It is expected that financial and physical integration would cause profitability to converge. It is more difficult to determine whether the return is at an efficient level and whether it will lead to sufficient new investment. In Norway in recent years, for example, the return on capital for electricity utilities has been lower than that of the manufacturing industries (von der Fehr et al., this issue). One question is whether electricity is less risky than other industries, justifying lower returns.

[24] The rate of return is measured as operating income relative to total invested capital (long-term financing sources including equity and long-term debt) and refer to the company performance and include investments outside the home country.

The existing excess capacity in Europe and in important markets such as Germany and France, is expected to narrow in coming years (UCTE, 2003). Although some accession countries may also have some excess capacity, inevitably, much of the future investments in the enlarged European electricity will take place in liberalised markets. A period of high demand growth and sustained under-investment can eradicate the existing reserve capacity and threaten the stability of the system, especially where this is combined with a lack of political will to allow prices to rise.

Security of supply

Security of supply is important for maintaining a reliable and stable power system. In addition, security of supply has an important political and public opinion dimension. Significant supply interruptions and large price spikes can undermine support for liberalisation and integration. Current levels of reserve capacity in most member countries are not a cause for immediate concern (UCTE, 2003), though there are some exceptions. For example, Italy remains very dependent on imports because of limited available capacity and a lack of siting approvals for new power plants.

Figure 11 shows changes in remaining capacity in the UCTE system between 1999 and 2003.[25] Overall, reserve capacity in the post-liberalisation year appears to have been relatively stable. A closer examination shows that reserve capacity for the period between May and July 2003 is somewhat lower than previous years. At the same time, with the exception of February, the reserve capacity for the colder months of the year has generally improved. We note that this data is rather crude (it does not include intra-month peaks or reflect variations in the likelihood of an outage at the same measured reserve margin for example). A better measure would be given by the loss of load probability, but this figure is not readily available.

Security of supply must be addressed at both national and at the EU level as it represents a common resource within an EU single market and, hence, is liable to exploitation. If every country relies on imports to meet peaks in demand, and peaks are correlated, such reliance involves a fallacy of composition. In the face of problems with siting of new plants and environmental concerns, easy access to imported electricity may be the path of least resistance. At the same time, visual impact (and associated NIMBY attitudes) may limit the expansion of interconnection capacity. Figure 12 shows the import and export flows of electricity as a percentage of national consumption for some key transit countries and for the EU-15+2 countries. As shown in the figure there has been a modest increase in cross-border trade as a share of consumption at the EU level, though a much greater increase for some of the selected countries.

[25] Member countries in the Union for the Co-ordination of Transmission of Electricity (UCTE) are: Austria, Belgium, Bulgaria, Bosnia–Herzegovina, Croatia, Czech Republic, Denmark, France, Serbia and Montenegro, FYROM, Germany, Greece, Hungary, Italy, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovak Republic, Spain, Switzerland.

Figure 11: Remaining Capacity without Exchanges as Percentage of Total Generating Capacity in UCTE
Source: UCTE (1999, 2000, 2003)

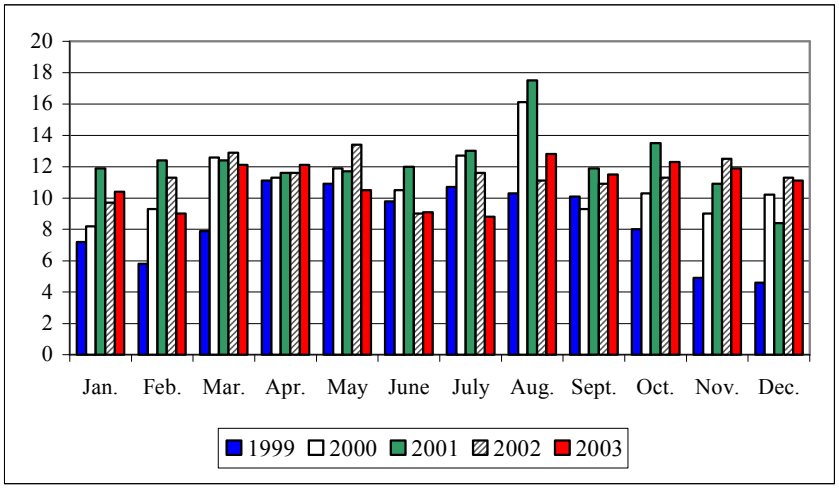
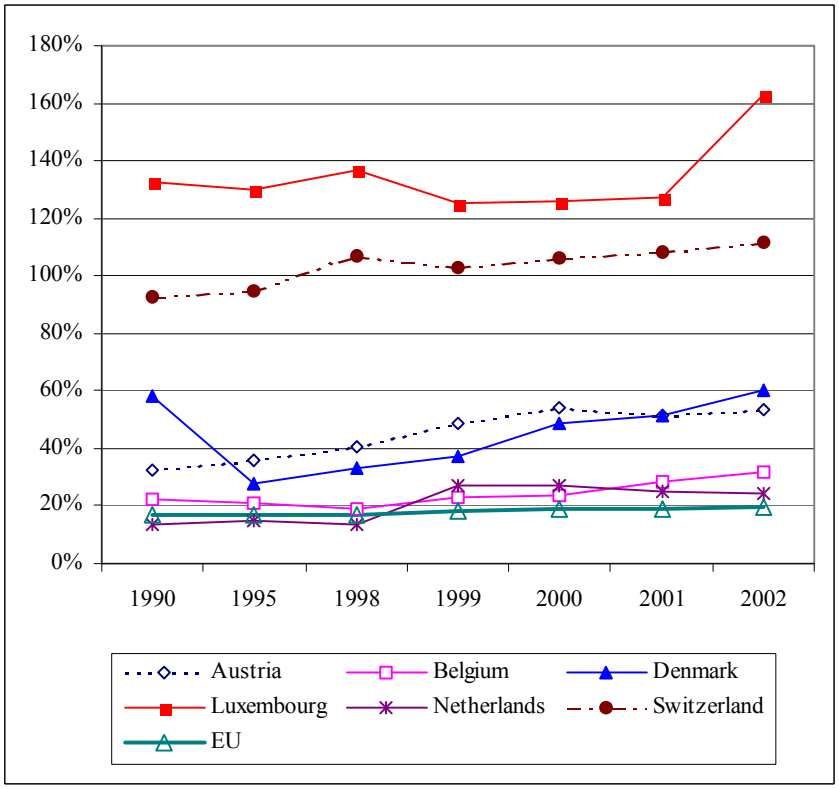


Figure 12: Import Plus Export Flows as Percentage of Consumption
Source: IEA Electricity Information Database



Individual countries should maintain a degree of domestic energy security based on their degree of energy import dependency. In the short run, increased trade and interconnection capacity can lead to better utilisation of existing capacity. Recent problems between Chile and Argentina, where Argentina interrupted gas exports to Chile following a shortage of gas for domestic consumption, remind us that trade in energy is vulnerable (Pollitt, 2004). The best insurance policies against interruptions in energy policy are effective crisis management at the EU level to allow optimal sharing of EU reserves and responsible national reserve policies.

Environmental impact

Nuclear plants currently do much to restrain carbon emissions from the power sector, and important decisions on their replacement will have to be made as they reach the end of their economic life or are phased out. Whether renewable energy sources can provide a substantial share of future electricity requirements is unclear. For example, maintaining the rapid growth of wind power will depend on the extent to which government support translates into suitable market instruments and institutions (including planning permission) to make development projects feasible and commercially viable (Wolsink, 2000). Competition and market risk can lead to a preference for less capital-intensive generation technologies with shorter construction time (Llamas and Stéphane, 2000). The long-term effects of liberalisation on the choice of low-carbon technologies will depend on the level and predictability of the subsidy they receive. Many new technologies remain expensive per kWh (wind, tidal and solar PV) and have poor security of supply characteristics that require larger reserve margins and expensive system reinforcement.

Member countries' record of electricity generation from renewable sources is mixed. Between 1992 and 2001, the share of renewables as a percentage of targets for 2010 in seven member countries declined or remained the same. For the whole of the EU during the same period, the share of renewables increased to about 10 percent (European Commission, 2004a). However, progress towards target levels can be regarded as uneven (Johansson and Turkenburg, 2004). It is clear that liberalisation across Europe does not stand in the way of differences of national emphasis on renewables policy.

Social impact

Between 1996 and 2001, EU electricity prices have consistently increased at a lower rate than the consumer price index. During this period, the affordability index for electricity improved for all income groups in most member countries. In addition, consumers appear to be generally satisfied with service quality (European Commission, 2004a). Recent increases in fuel prices may end this benign period of declining real prices. The ability of regulators to pass efficiency gains from liberalisation to customers will be increasingly important for continued public acceptability of the liberalisation program and for further integration of European markets.

5. CONCLUSION AND POLICY LESSONS

The efforts by the European Commission to move towards a single electricity market have focused on sector restructuring and competition in the wholesale market. The focus has increasingly been on regulation, access to transmission and distribution networks, and competition in wholesale markets and in retail supply. Overall, the centralised approach to market liberalisation through the Electricity Directives, based on stepwise progress and minimum compliance, has succeeded in maintaining the pace of reform in the original EU-15 and in a number of associated and accession countries.

Given the initial diversity across EU electricity sectors, the Directives have achieved a degree of standardisation of structures, institutions, and rules in national markets. Market opening has proceeded rapidly and in many cases, beyond the minimum requirements. Most consumers, and particularly large users, are seeing lower and converging prices. The productivity of electricity companies has increased, while their profits in the more competitive markets (such as in England and Wales), appear to have declined, reflecting continued excess capacity.

The European electricity market is now approaching challenges where, in contrast to the consensus-based minimum requirements of the Directives, more specific and technical issues need to be addressed. Whereas general guidelines could be devised to achieve political consensus in the Directives, this is less desirable or feasible for the more technical aspects of market design. The case of California, where the failed market design was a product of political compromise to satisfy different interests, rather than an embodiment of technical and functional good practice, is a good example of this (Sweeney, 2002).

The most plausible route to a single European market is through regional markets as an intermediate stage. There are several recognisable regional markets in the EU: the Nordic, UK-Ireland, Baltic, east European, west European, southeast European, Iberian, and Italian zonal markets. However, these markets vary in their degree of internal integration. The Nordic market is the most advanced in terms of effective international integration (with formal and common market rules and price convergence), while the Iberian market is still taking shape. The west European market (including France, Germany, Switzerland, Netherlands and Belgium) is the largest regional market, and its central geographic position implies that further progress toward an integrated electricity market in the EU will be dependent on the development of this market.

Existing interconnection capacities are not sufficient to reduce the effect of concentration in national markets (European Commission, 2004b). There remain important investment and environmental issues that need to be resolved if capacity is to be increased. Individual transmission system enhancements require careful cost-benefit analysis. To have a real effect, the development of regional day-ahead and balancing markets also depends on adequate interconnection capacity.

Security of supply does not appear to be a fundamental problem at the moment. However, emerging regional electricity markets need to develop appropriate rules to ensure security of supply at the level of the region if the benefits of trade are to be realised, and free riding on the provision of joint security is to be managed. Thus measures such as capacity charges and interventions by national TSO's in times of stress need to be agreed and harmonised at the regional market level if these markets are to develop satisfactorily.

Mergers and acquisitions have resulted in increased and high concentration in the European electricity market, where some companies have strong ownership interests in neighbouring markets. The process of referring merger cases to competition authorities has been ineffective in preventing an unhealthy growth in market concentration. What is needed is better informed analysis of such markets by competent energy regulators, perhaps coupled with greater Commission pressure on national governments.

The existing divergence of transmission and distribution network tariffs limits the convergence of end-user prices. It may also represent hidden cross-subsidies being paid by monopoly network businesses to competitive generation and retail businesses, deterring competitive entry. Incentive-based regulation regimes have exhibited the potential to achieved efficiency improvement, cost savings, and the avoidance of such cross subsidies. However, these regimes are still being developed in many European countries.

Finally, implementing and monitoring the progress of liberalisation and integration requires access to good data. In the post-liberalisation era, some types of data have been deemed commercially sensitive and are not made available even to regulators. There is a need for adequate disclosure to regulators, more transparency, and the collection and publication of new types of data. There is, for example, a shortage of data on ownership interests of companies, cost information, subsidies, and measures of security of supply. This is particularly true of data aggregated at the EU level and at the level of the emerging regional markets. Data collection requires continuity and commitment to achieve long-term benefits. Improving the quality of data requires joint effort and agreement on types of data needed, collection methods, and standard reporting formats. In some cases, commercial sensitivity and national confidentiality rules limit exchange of data between regulators and here the barriers for co-operation may need to be lowered through agreements and legislation.

Liberalisation and integration of the European market is a continuing process and remains a work in progress. Gradual market evolution can create market uncertainty due to its slow progress to an uncertain end point. Increased uncertainty leads to strategic behaviour and raises the cost of capital, and reducing investment and entry in the short term, and lower innovation in the long term. While market concentration remains high and interconnection capacity inadequate to overcome this concentration such uncertainty is likely to continue.

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