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Generating Profits? Can Liberalized Markets fit the Electricity Bill?

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For most of the last twenty years there has been a firm assumption that global electricity markets have embarked on an irreversible journey from highly regulated monopolistic structures to competitive markets. Yet since the California power crisis of 2000/01 questions have been raised as to whether competitive power markets can deliver secure, economic and environmentally acceptable power supplies. This paper looks at the evidence so far.

The dash for liberalization

> 'Liberalization of energy markets has brought great benefits to a lot of people. For consumers, it has brought greater choice of products, lower prices and a general improvement in the quality of service. For companies it has meant the freedom to develop new ideas, to build their business and to reap the rewards of success. The benefits of competitive energy markets are now widely accepted in the rest of the EU and there is widespread support for the creation of a policy framework to underpin the establishment of a functioning internal energy market.'
>
> (UK Energy Minister Peter Hain, March 2001)[1]

> 'Power is now a dirtier word in banking than telecoms. In the USA, UK and Latin America there are no investors, no banks and deregulation is losing credibility.'
>
> (Tony Marsh, EBRD Cofinanciers' meeting, March 2003)[2]

The following were factors leading to pressure for further market liberalization:

- the early gains in terms of reduced costs of electricity production (and therefore, to a greater or lesser extent, reduced prices for consumers) in several countries which have liberalized their power markets;
- ideological attraction to 'free' markets among many governments which exercised power in the 1980s and 1990s;
- useful capital receipts for the national exchequer.

Even so, liberalization of power markets is still at an experimental stage. Although in the 1970s and 1980s reforms were introduced in some countries (USA and Chile) to allow independent power producers to supply electricity to existing monopoly utilities, usually on the basis of inflexible long-term contracts, widespread liberalization only began with the introduction of competitive electricity markets in the UK in 1990, Norway in 1991 and New Zealand in 1994. In 2001 the International Energy Agency (IEA) summarized progress with liberalization in IEA countries (see Table 1).[3]

Table1: Summary of liberalization of retail electricity market in IEA countries by 2001

Country	Partial opening	Full opening
UK	1990	2000
Norway	1991	1991

[1] http://www.dti.gov.uk/ministers/archived/hain070301.html, Hain P. (7 March 2001), *Speech to* Electricity Association dinner.
[2] http://www.ebrd.com/oppor/syndi/meeting/pres/power.pdf, Marsh A., EBRD cofinanciers' meeting (11 March 2003), *Power and energy.*
[3] http://spider.iea.org/books/countries/2001/compendium.pdf, IEA, *Energy Policies of IEA Countries, 2001 Review.*

New Zealand	1994	1994
Australia	1994	
Finland	1995	1997
Sweden	1996	1996
Germany	1998	1998
Spain	1998	
USA	1998	
Austria	1999	
Denmark	1999	
Luxembourg	1999	
Netherlands	1999	
Portugal	1999	
Switzerland	1999	
Belgium	2000	
France	2000	
Ireland	2000	
Japan	2000	
Canada	2001	
Greece	2001	

The IEA predicted that by 2007 more than 500 million consumers in OECD countries (about half the total) would have a choice of supplier.[4]

However, in practice experience of 'liberalization', in its many and varied forms, has been mixed. In some regions, countries and states such as the UK, Germany, the Nordic region, Texas, New England, PJM (Pennsylvania/New Jersey/Maryland), Chile and New Zealand, experience has been largely positive, with lower power prices and no serious long-term disruption of supply for capacity reasons. In others – California, Alberta, Ontario, Italy – liberalization has been associated with problems in terms of higher power prices and disruptions in supplies. In 2001 the Center for Responsive Politics (USA) described the situation as follows:

> Advocates of deregulation say reducing government control of the industry will benefit consumers – lowering prices while expanding services and giving the public a say in who supplies the power that runs their computers, toasters, lamps, and more. But among the twenty-four States that have enacted electricity deregulation plans, results are mixed. Rising prices, skyrocketing demand, and limited supply in some areas have raised questions about the viability of deregulation.[5]

In a number of places – California, Arkansas, Arizona, Montana, Ontario, Queensland, Switzerland, Thailand – steps have been taken to delay, reject or reverse liberalization. In perhaps the most dramatic example, the Dominican Republic renationalized key elements of its power industry in 2003, just four years after they had been sold off.

Whether this pause is a sign of growing disillusionment with the concept of liberalization or a short-term response to a series of problems (very high price spikes in Scandinavia, the Netherlands, California, Alberta, Ontario, New Zealand, Argentina; blackouts in New York, Copenhagen, Italy, Victoria, Auckland, London, Birmingham (UK), Athens) is not yet clear. However, by early 2004 statements such as that of the President of the US National Energy Marketers Association, Craig Goodman, were becoming more frequent:

[4] http://www.iea.org/about/emr.pdf, IEA (2001), *Electricity market reform: California and after.*
[5] http://www.opensecrets.org/news/electricity.htm, Center for Responsive Politics (2001), *Electricity deregulation – what's the issue?*

> A utility that uses its scarce capital and credit rating to buy and sell a commodity as volatile as gas and electricity and all the risks associated therewith, that has zero upside potential, zero profit and a likelihood that they'll never recover the costs of that function, is not acting prudently on behalf of their shareholders.[6]

The peculiarities of competitive electricity markets

Electricity is a unique commodity. It cannot be stockpiled in large quantities and yet secure supplies on a moment-by-moment basis are enormously important. Recent blackouts in the developed world, as listed above, have both demonstrated that major outages are possible in developed countries and reminded us that the effects of such outages, in economic, social and health terms, can be significant.

The introduction of competition into electricity supply systems – variously referred to as 'liberalization' or 'deregulation', although such terms are something of a misnomer – has become the predominant trend in the markets of developed and, increasingly, developing countries since 1990. Many major organizations, such as the European Union, the Federal Energy Regulatory Commission (USA) and the IEA, have encouraged countries to increase the extent to which both generation and supply of energy are open to market forces, while recognizing that some elements of the process, notably transmission and distribution, are natural monopolies and must therefore continue to be regulated. The details of liberalization vary significantly from country to country, but broadly most models share some or all of the following features:

- unbundling of the natural monopolistic elements of electricity provision from those elements which are amenable to competition – generation and supply (i.e. sales directly to the consumer);
- to a greater or lesser extent barriers on vertical integration between generation and supply and also measures to prevent single players winning too large a share of either or both of these subsectors;
- introduction of a competitive market in generation, with a range of contracts available in the marketplace (e.g. 'long-term' contracts of up to a few years; futures markets; spot markets, often 'day ahead'; 'regulating' markets in which a plant is called up at very short notice to maintain voltage and frequency within acceptable limits, perhaps because there is a sudden surge or decline in demand or a major plant has broken down);
- bilateral 'over-the-counter' trading;
- an independent system operator responsible for managing the spot market and dispatching plant in real time;
- competition in the retail market, at least for consumers with large power demands;
- a regulator to oversee such issues as fair competition and mitigation of market power, monitoring of capacity margins etc.

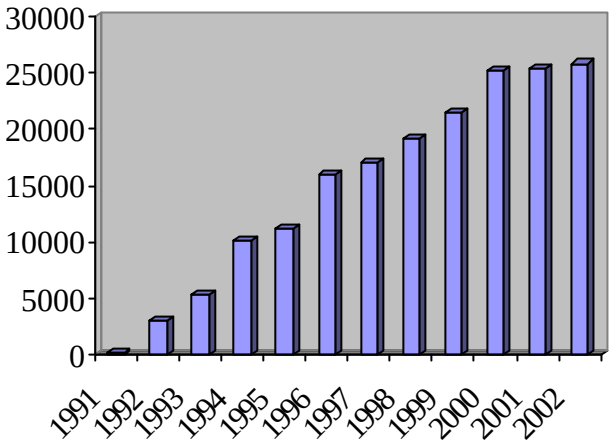
Despite the passage of nearly fifteen years since the advent of competition and in some cases privatization of the electricity supply industry in countries such as the UK, New Zealand and Norway – rather longer in the case of Chile – liberalization of power markets remains something of an experiment, the outcome of which is uncertain. In most cases, at least in the developed world, liberalization was initiated at a time of considerable overcapacity of generating plant – indeed, one of its main rationales was to improve the economic efficiency of investment in power capacity, since the previous arrangement of power markets as vertically integrated monopolies tended to result in the 'gold plating' of security measures and therefore significant higher capacity margins than were necessary to

[6] *Restructuring Today* (3 February 2004).

keep the lights on. The costs of this overcapacity had to be borne by taxpayers or electricity consumers: in either case this represented a drain on the economy as a whole.

It is only now that the capacity margin in some developed countries is reaching the point at which major new investment will be required in the near future. Even in the unusual case of the UK – where liberalization was accompanied by a major increase in investment in gas-fired generating capacity – investment slowed significantly at the turn of the century, though in that case not before considerable new reserves of capacity had been added (see Figure 1).[7]

Figure 1: New installed capacity since 1991, UK (MW, cumulative)



Source: http://www.nera.com/wwt/publications/5740.pdf, Shuttleworth G. and MacKerron G., NERA (2002), *Guidance and commitment: persuading the private sector to meet the aims of energy policy.*

Of course, reducing the costs of power cannot be the only aim of electricity policy. Modern economies require secure supplies for both business and residential purposes. Energy production and use have major environmental implications, notably for atmospheric challenges such as climate change and acid rain. Personal safety, public perceptions and political issues (especially the wide range of social issues associated with the availability and pricing of energy) also shape energy policy in important and sometimes unpredictable ways. The relative weight given to such issues will vary from country to country. While it is difficult to generalize, it is fair to say that in the developing world liberalization has been driven more by a recognition that the State is often incapable of providing the capital necessary to upgrade and maintain electricity supply systems against a background of rapidly increasing demand and a consequent desire to attract private capital and more efficient working practices into the marketplace.

Herein lies perhaps the central tension within the liberalization of electricity supply systems. If private investment is to be attracted into the industry there must be a reasonable prospect of companies being allowed to profit from good decisions without the impression that governments and regulators are forever poised to intervene in the marketplace in unpredictable ways. However, governments have a responsibility to ensure that the wider implications of electricity supply (industrial, environmental and social) are taken into account and so will always feel an urge to regulate in order to 'guide' the market towards acceptable outcomes.

[7] http://www.ofgem.gov.uk/temp/ofgem/cache/cmsattach/5078_JESS_report_12nov03.pdf, Ofgem (2003), *Joint Energy Security of Supply Working Group (Jess) third report*. (In November 2003 Ofgem reported a drop in gas- and coal-fired projects described as 'planned' from 10,300 MW to 6,500 MW over the previous year. Only 800 MW was actually under construction, plus 760 MW of Combined Heat and Power and 90 MW of windpower.

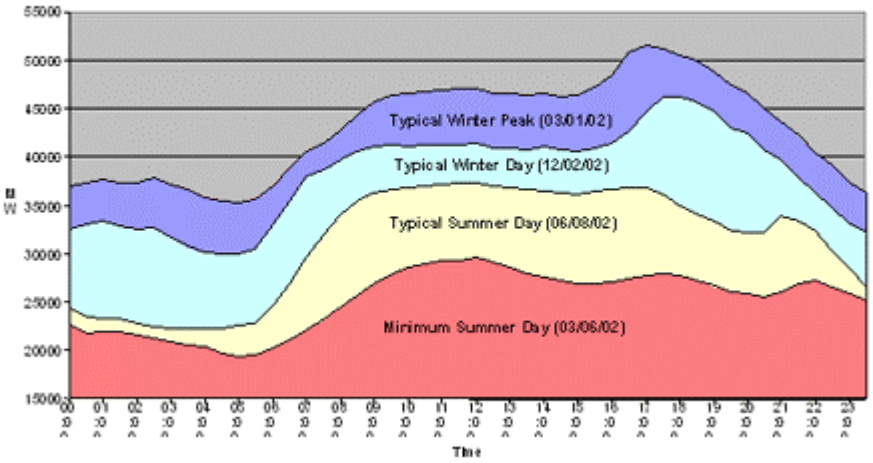
Emerging themes in liberalized power markets

There is so far little empirical evidence of how liberalized markets will develop when the initial circumstances in which they were instituted have changed. Nonetheless, a number of themes are emerging, particularly within developed countries, which require careful consideration and which may point the way towards energy policies of the future. These involve a number of issues.

(1) *The adequacy of signals for new investment within liberalized power markets* – what will happen when capacity margins become sufficiently tight to threaten chronic power cuts?

Since electricity cannot be stockpiled, there tend to be long periods, when demand is relatively low, in which prices (especially for power traded through spot markets) fall towards the avoidable costs of the marginal generator. Figure 2 shows an example of demand forecasting.

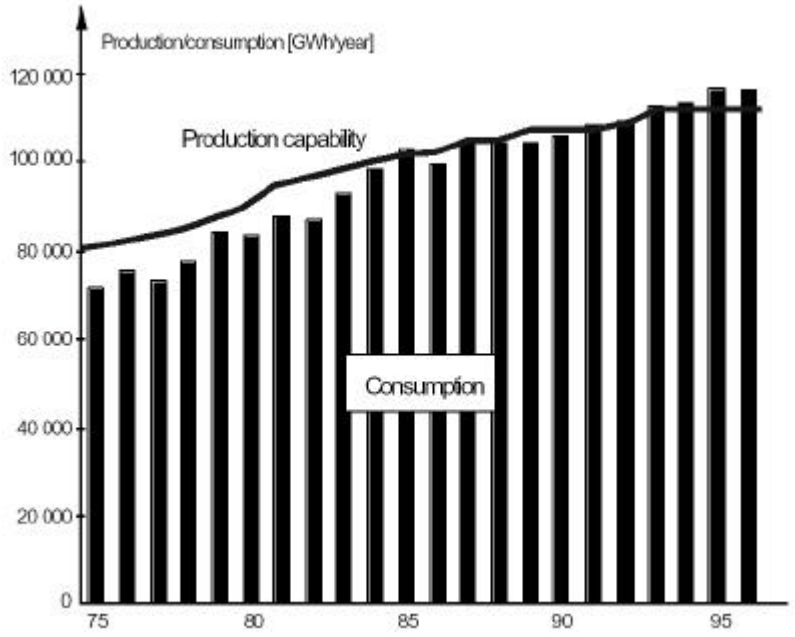
Figure 2: UK summer and winter demands, 2002



Source: http://www.nationalgrid.com/uk/activities/mn_demand.html, National Grid Transco (2003), *Demand forecasting.*

To compensate, in order to provide a reasonable return on capital employed, there will need to be periods in which prices are significantly above avoidable costs. However, periods of very high prices bring political risk and loud cries for an end to the 'profiteering' of the power companies. There is evidence from a range of countries that when the political temperature rises in this way governments, either directly or via regulatory bodies, do indeed intervene to cap price rises or otherwise 'guide' the market. In California, since 2000, there have been price caps at seven different values, ranging from $55 to $750 per MWh. For someone considering making the sizeable investments involved in power generation, the extra risk associated with second-guessing the actions of regulators will inevitably delay, or perhaps even drive out, necessary investment, or (which is in effect the same thing) increase the required rate of return.

Figure 3: Production and consumption of electricity in Norway, 1975–96



Source: http://www.elkraft.ntnu.no/~sie1065/kap%206.pdf, Aam S. and Wangensteen I. (1998), *Restructuring/deregulation of the electricity supply industry.*

One model for attracting investment is one in which future customers provide the initial investment and then buy power, in proportion to that initial investment, at or near avoidable cost. TVO's new nuclear plant in Finland is being financed on such a basis, as is Intergen's Rijnmond CCGT in Rotterdam. However, investment in 'merchant' power plants, selling electricity on an open market, may be more problematic. Long-term power contracts between generators and consumers also bring potential problems, as illustrated for example in the market in England and Wales in 2001 and 2002.

(2) *Inherent tensions between the needs of investors, the needs of consumers and the wider needs of society* – how can these be accommodated within liberalized power markets?

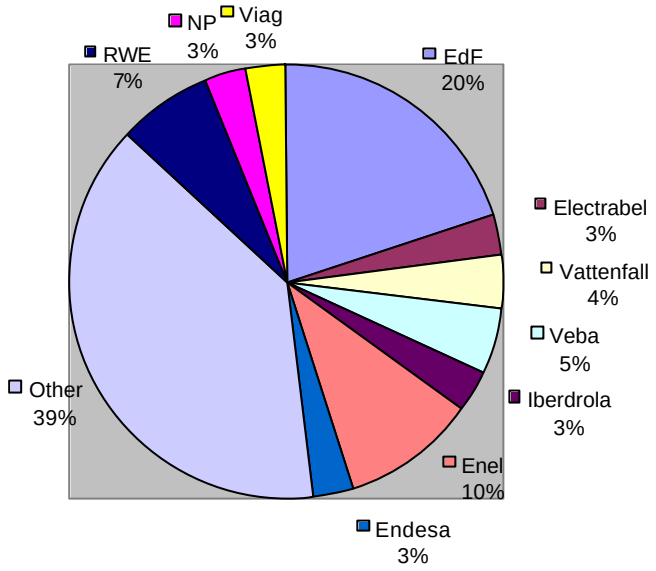
Different communities require different things from the energy system. Governments, for example, will wish to intervene in order to 'guide' electricity markets to fulfil political requirements such as secure supplies and low prices. Potential investors, by contrast, require a stable investment environment in which governments have credibly divested themselves of powers to intervene in such fashion. It is not clear that these inherent tensions are easily managed within a competitive electricity supply system.

(3) *The implications of growing vertical integration and of increasing concentration at both generation and supply levels* – is competition possible (or desirable) in a commodity with the unique characteristics of electricity, without determined regulatory effort?

Except where regulators have made major efforts to prevent it, mature liberalized power markets are increasingly characterized by growing concentration, both through consolidation at generation and retail levels and through growing vertical integration across generation and supply, in many cases involving local distribution networks as well. There has also been a growing trend towards integration of gas and electricity industries. Larger companies have greater market power which can be used to erect barriers to new entrants as well as to manipulate prices to higher levels than they might have been in a more competitive environment.

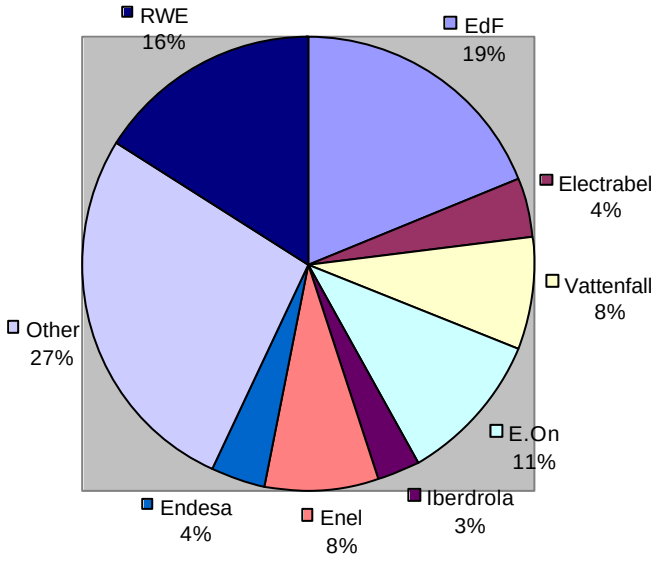
As shown in Figures 4 and 5, in 1998 the five biggest generators in Europe commanded 46% of the market, but by 2002 this had increased to 62%.

Figure 4: Electricity market shares in Western Europe, 1998



Source: http://www.epoc.uni-bremen.de/publications/pup2003/files/Berlin_Hall_Privatisation.PDF, Hall D., University of Greenwich (2003), *Privatisation, corruption, oligopoly.*

Figure 5: Electricity market shares in Western Europe, 2002



Source: http://www.epoc.uni-bremen.de/publications/pup2003/files/Berlin_Hall_Privatisation.PDF, Hall D., University of Greenwich (2003), *Privatisation, corruption, oligopoly*.

Yet it can be argued that, with its associated risks, the nature of investment in electricity generation is such that it can only be funded by large, probably cross-border, operators such as those that are emerging within western Europe. It is not yet clear what is the appropriate level of competition (or the appropriate number of competitors) to fulfil the dual goals of creating downward competitive pressure on prices while also retaining entities large enough to contemplate timely investment in new plants.

(4) Potential consumer responses to price spikes.

Although the price elasticity of electricity demand is notoriously low – many of electricity's uses are essential and no substitute fuel is available – when capacity margins are very tight a small increase in demand or reduction in available capacity can have a major upward effect of prices. If prices could be transmitted to major consumers in real time it is likely that demand reductions could be found which would serve to control price rises. There is indirect evidence for this in the major demand reductions that followed price crises in California, Norway and Brazil. By contrast, price caps and long-term contracts serve to protect the consumer from price spikes and so dampen potential demand-side responses. Real-time metering is expensive, requiring both the installation of equipment at the point of use and more sophisticated demand measurement centrally, but may be a more effective approach to managing supply security than attempting to retain high reserve capacity margins.

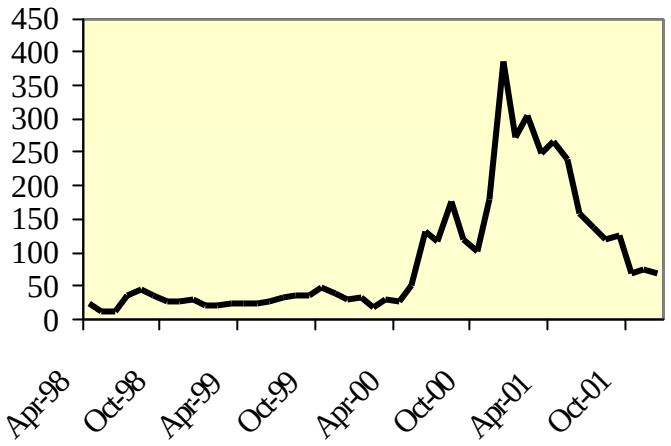
(5) The influence of different fuel mixes on price spiking – are some combinations of generating fuels more susceptible than others to price spiking and/or outages?

Any power plant can come off line, either predictably or unpredictably, for a variety of reasons – maintenance needs, labour strikes, unavailability of cooling water (especially for thermal/nuclear plants) etc. The need to maintain significant 'spinning reserves' (i.e. reserves in a state of readiness to take over instantaneously if a plant should fail) is one of the arguments that some commentators use against the concept of large-scale centralized generating plant as opposed to smaller-scale generation more embedded in the demand network.[8]

However, there is tentative evidence that two power fuels – renewables (hydropower) and imported gas – have been particularly associated with problems. Periods of low rainfall have led to reductions in the reliability of output from hydro plants, for instance in New Zealand, Chile, Norway and Sweden and the western USA. The volatility of gas prices led to severe problems in areas such as California and Alberta in 2000 and 2001, as Figure 6 demonstrates. Texas, with significant gas reserves of its own, was much less affected by the crisis which beset the western USA at the turn of the century.

Figure 6: Average monthly wholesale power price in California ($/MWh)

[8] See Patterson W. (1999), *Transforming electricity*, Chatham House, and subsequent work such as *http://www.riia.org/viewdocument.php?documentid=4689*, '*Networking change: keeping the lights on', Working Paper 3* (2004).

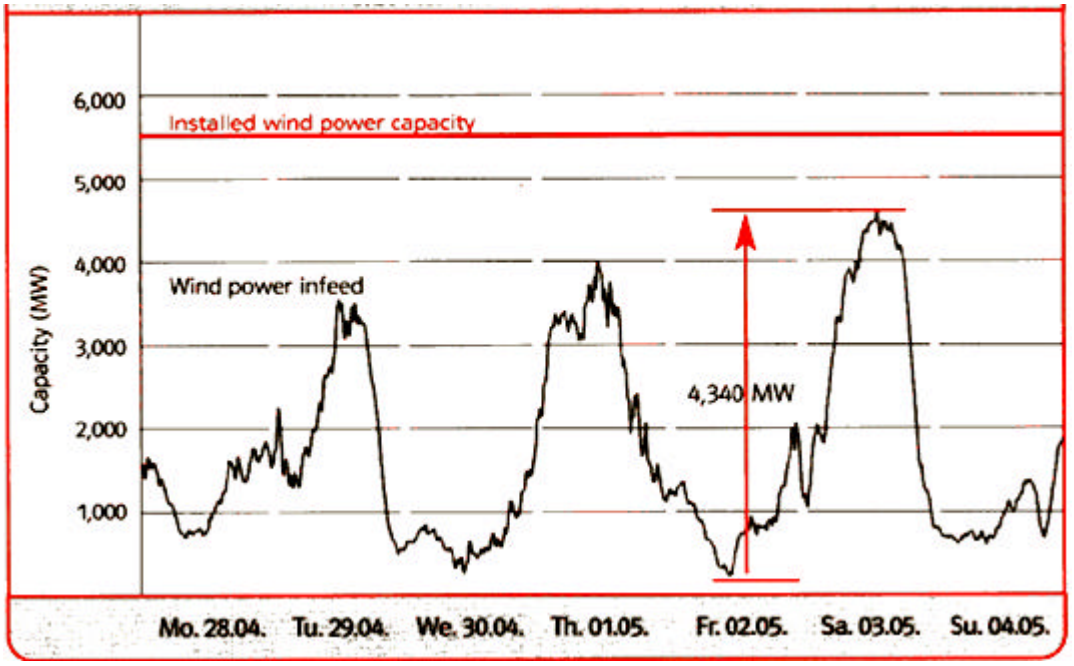


Source: http://www.econ.jhu.edu/People/Harrington/Joskow01.pdf, Joskow, P., *Oxford Review of Economic Policy* (Autumn 2001), 'California's electricity crisis': http://www.cpuc.ca.gov/static/industry/electric/electric+markets/histyroical+information/average+energy+costs+2000+thro+2001.xls, CPUC (2002), *Average energy costs 2000 thro' 2001*.

By contrast, systems more reliant on domestically mined coal and nuclear power appear to be much less prone to price spiking with its associated political and economic effects. This may be of particular importance in Europe, which is likely to become more dependent on gas imported from the former Soviet Union, and new renewables which, like hydropower, tend to be intermittent in their output.

Although new renewables such as windpower will not suffer chronic problems such as prolonged droughts, and so will not be unavailable for the long periods that have been typical of hydropower in many countries, in the short term they can be considerably more intermittent. In some cases, such as tidal power, output is likely to be predictable but not constant. In the case of wind, output is not only intermittent but also unpredictable beyond a few days' notice. For example, in 2003 E.On Netz was taking output from over 5,500 MW of wind capacity in Germany, spread over a large geographical area. The output could fluctuate widely within relatively short periods of time.

Figure 7: Fluctuations in wind power feed in E.On Netz control area, April/May 2003



Source: http://www.eon-netz.com/frameset_reloader_homepage.phtml?top=Ressources/frame_head_eng.jsp&bottom=frameset_english/energy_eng/ene_windenergy_eng/ene_win_windreport_eng/ene_win_windreport_eng.jsp, E.On Netz, *Wind Report 2004*.

On 19 November 2003 output dropped by 3,640 MW (from approximately 4,200 MW to approximately 600 MW) in just six hours, at an average rate of 10 MW per minute.

Managing this intermittency in the absence of a large-scale method of storing electricity represents a challenge, especially at times of high windspeeds when wind generators may need to be immobilized rapidly to prevent damage and alternative capacity must be brought on line very quickly. During times when the renewables are not available, expensive peaking plants using fossil fuels will have to be dispatched, with potentially large effects on system marginal prices (and also potentially on emissions). Some of this capacity must be kept spinning, using fuel and emitting greenhouse gases even when the wind is blowing. E.On estimates that spinning reserve capacity of some 50–60% of installed wind power capacity, and total 'shadow capacity' of some 80% of wind capacity, must be maintained.

The potential problems associated with overdependence on unreliable electricity sources were illustrated in during the hot spell in June 2003. Increased demand for air conditioning etc. was coupled with drought and a significant reduction in availability of power from other sources, notably large windfarms (and also from inland conventional power stations including French and German nuclear plants). This led not only to very high prices but also to a major reduction in exports from France and Germany, resulting in blackouts in Italy, which was highly dependent on such imports. Although on this occasion the contribution of the shortage of wind was not the crucial factor, it would have been more important had there been considerably more reliance on windpower in the area.

Considerations of this nature were behind the decision taken in December 2003 by the Irish energy regulator to halt connections of windpower to the Irish grid. Kieran O'Brien, Managing Director of ESB National Grid, said that wind connections 'pose an increased risk to the security and stability of the power system which exceed the level normally likely to be acceptable by a prudent system operator'.[9]

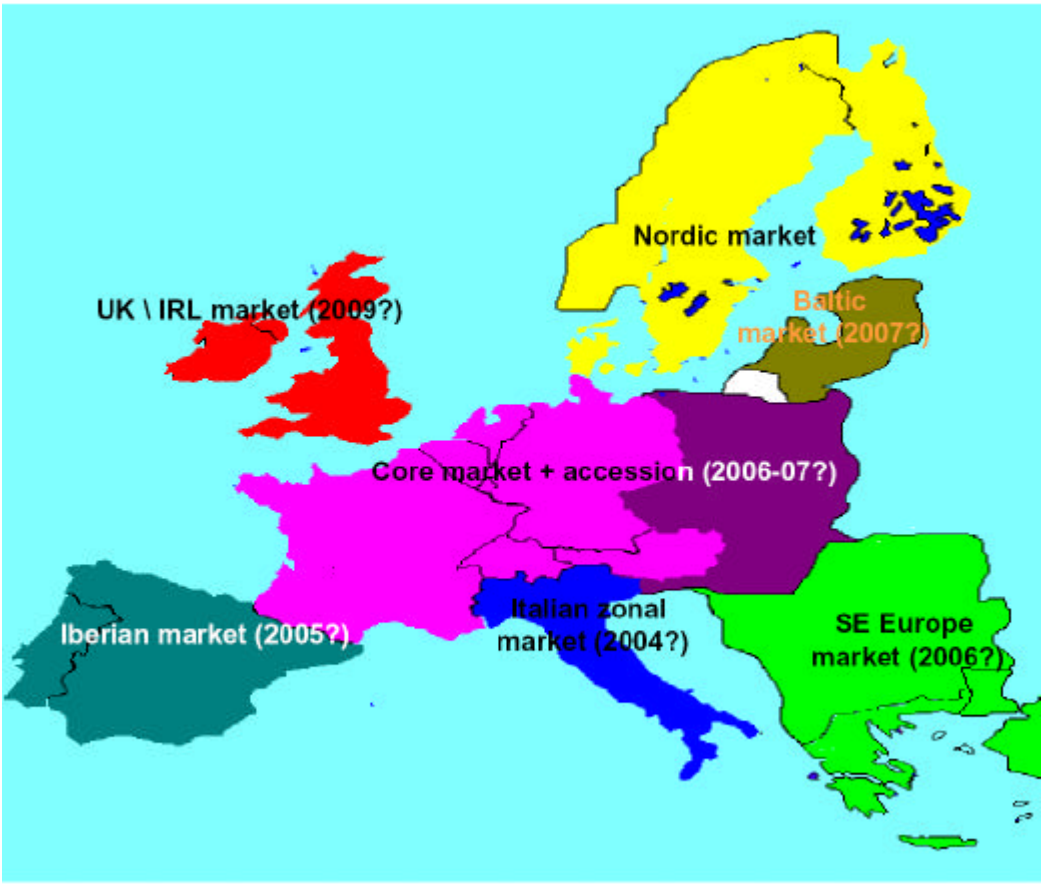
[9] *EnergyOnline News,* 4 December 2003.

Of course, any attempt on the part of governments to manage the fuel mix, to encourage greater use of indigenous energy supplies to reduce dependence on imports, will potentially conflict with the rationale of liberalizing the market in the first place.

(6) *The growth of cross-border trading in electricity and the development of regional market* – what are the implications of using cross-border interconnectors, generally created to enable well-coordinated bilateral electricity trading between neighbouring countries, as major components in international power markets in which large numbers of relatively uncoordinated trades take place on a continual basis?

The growth of regional markets has been one of the most notable developments of the liberalized era (see Figure 8). Regional markets offer a number of advantages, not least in creating a larger market which may stimulate more effective competition and also in reducing the demand for each participating nation to retain such a large capacity margin. For example, unscheduled plant breakdown might be compensated by imports while in geographical areas which are extended over several longitudes the time of peak demand will be different in different parts of the regional market, allowing net east-west or west-east flows at different times to replace reserve capacity.

Figure 8: Regional markets in Europe



Source: http://www.clingendael.nl/ciep/activities/seminars/pdf/040227%20CIEP%20market%20integration.pdf, Giesbertz P. and Tönjes C. (2004), *Integration of markets: benefits, preconditions and impediments.*

However, with rare exceptions, although the interconnectors and national wires involved are in effect playing the part of a grid serving a single market, there is no single regional transmission operator to ensure smooth running. In August and September 2003 transmission system failures underlay major power outages in the northeast of North America, in England (London and Birmingham), in Copenhagen and south Sweden and in Italy, while a reduction in the availability of imports (coupled in some cases with anomalous

pressure to increase exports despite shortages of power at home) were important factors in crises in Italy in June 2003, in California in 2000 and 2001 and in Victoria in 2000.

As a result a number of questions are arising. Will the cost requirements needed to strengthen cross-border interconnectors and national grids outweigh the savings in generating capacity? Who should bear the cost of such strengthening and how will it be financed? Is there a danger that growing reliance on interconnection will further undermine investment in generating capacity, resulting in a very efficient grid but insufficient power to drive it? How can differences in national markets within a regional interconnection be managed (a major issue for example during the power crises in California and Victoria in 2000 and 2001)?

(7) The consensus that liberalization is both inevitable and desirable.

Liberalization is still very much the dominant direction in global electricity markets. However, following the California crisis there have been varying degrees of reversal of competition measures in countries and states such as Arizona, Arkansas, Montana, Ontario, Queensland and Switzerland. Should there be no California-style experiences in the near future, confidence in liberalization may well be restored; but should there be another similar event it is an open question as to whether more countries would retreat from liberalization and return to some degree of central planning.

In some less developed countries liberalization faces a number of challenges that are different from those in developed countries, the starting point often having been a need to attract extra investment into the sector and reform a tariff regime, characterized by heavy subsidies and (in many cases) frequent non-payment of bills. The desire to spread electrification for social reasons is often a strong driving force in such countries. In a number of countries taxes on the private sector to fund either expansion or subsidy are being introduced, but there are complaints that insufficient measures were implemented initially to spread the benefits of investment. Part of the problem appears to be an attempt to graft models of liberalization which emerged in developed countries onto markets in less developed nations where the needs are very different, often under pressure from international institutions such as the World Bank and the International Monetary Fund. Public perception of inequity in the reforms has had a major effect on the rate of liberalization in Latin America in particular: privatizations have been overturned as the result of public pressure and unrest (in Ariquipa, Peru, for example) while public acceptance of privatization is running at 20% in that country.[10] In countries such as the Dominican Republic and Thailand liberalization has stalled or has even been reversed.

It can be argued, then, that liberalization attempts in some developing countries have largely failed for three reasons:[11]

- reform of a power sector is a highly complex technical activity; it arouses very high political interest and strong public antagonism and involves the transformation of bureaucratic agencies with long histories of political interference;
- reform has often been directed by parties that are not technicians or specialists and that have agendas that go well beyond reform of the sector and only limited interest in economic efficiency or improving sector performance;

[10] Preston F. (2004), private communication.

[11] *http://www.nera.com/image/Electricity%20Journal%20Rosensweig%20Voll%20%20Agudelo.article%20Nov%202004.pdf*, Rosenzweig M., Voll S. and Pabon-Aguledo C. (2004), 'Power sector reform: experiences from the road', *The Electricity Journal* (15 November 2004).

- reform is often pursued by governments that lack a clear understanding of the models, their requirements, and the implications for the necessary and proper role of government.

Conclusions and implications for policy-makers

The implications for investment in the major restructuring of electricity markets have been profound. Although liberalization in most countries is still in its early days (when judged against the lifetimes of investments in the electricity industry) a number of themes are emerging – a reduction in the capacity margins which tended to be preserved within command-and-control electricity supply systems (caused at least in part by a shift in emphasis from the importance of preserving secure supplies to a desire to reduce costs and increase profits), a major shift from investment in sources with high capital/low operational cost profiles (notably nuclear power) to the CCGT (with low initial investment but high operating costs, especially at times of high fuel prices), growth in integration (both vertical and horizontal) where market rules allow it, increased cross-border trading of electricity and periods of extreme volatility in wholesale power prices often accompanied by government intervention in the marketplace.

If the next few years bring experiences which suggest that highly fragmented power markets are incompatible with early investment to prevent power cuts then the most basic current assumptions about competitive market structures and the associated implications for investment in new generating capacity may prove to be invalid. A return to command-and-control power markets is not the only option, and indeed at present looks highly unlikely. However, a European electricity market dominated by the 'seven brothers' (EdF, RWE, E.On, Enel, Vattenfall, Endesa and Electrabel), each with considerable market power and each with significant involvement in supply as well as generation, could well create an environment in which longer-term investment is attractive. A sensible approach to future electricity production might well involve planning for this scenario, for example by ensuring that technical options are ready to be deployed if and when required, rather than leaving everything to the short-term forces which now predominate.

For policy-makers, then, the following steps would seem to be important.

- Make a firm statement that secure power supplies are not merely a matter for the marketplace and that government must play a role in shaping market rules to encourage maintenance of appropriate capacity margins, e.g. by considering the option of capacity markets or capacity payments.
- Recognize that a perception that government or regulators may intervene capriciously in markets may damage the confidence of investors to commit to funding new generating capacity at the appropriate time. This involves a recognition that very high power prices may not be reflective of abuse of market power but may be necessary to send the signals for new investment. Regulators should avoid price caps and should develop a scheme of compensation for power generators which lose income because of regulatory action.
- Monitor more closely the mix of different types of capacity, recognizing that some capacity mixes are more susceptible to interruptions in supply or long-term price spiking than others.
- Encourage installation of real-time metering for major electricity consumers in order to maximize demand-side responses to high wholesale and balancing electricity prices.
- Work towards developing cross-border system operators and system rules to respond to the (at present largely uncoordinated) growth of international trading in electricity.
- Recognize that no single generic model of liberalization will be appropriate for all circumstances and that schemes should be designed with the particular

requirements of the country or region in question in mind – for example, different measures will be needed in countries with developed electricity systems and reasonable capacity margins to those needed in countries with rapidly growing demand and heavy social pressure to provide electricity services at affordable cost to people who do not presently have access to them.