Liberalisation and Regulation in Electricity Systems: How can we get the balance right?

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Abstract

This paper explores the issue of the balance between liberalisation and regulation in electricity systems, which is the essence of much of the detailed policies which are implemented in the sector. By *liberalisation* I take to mean the use of market or quasi-market mechanisms as part of a reform of the sector, by *regulation* I take to mean regulatory intervention to restrain the operation of market signals which would otherwise have operated in the absence of regulation. The paper takes an international perspective to look at the case for liberalisation, the case for regulation and the evidence on the effects of liberalisation. It concludes with an assessment on the future for electricity liberalisation. This paper forms the foreward to Sioshansi, F.P. (2008) (ed.), *Competitive Electricity Markets: Design, Implementation, Performance*, Oxford: Elsevier and makes reference to the papers in that volume.

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I am very grateful to Fereidoon (Perry) Sioshansi for asking me to write a foreword to this excellent volume. Perry has done scholars of electricity reform a great service by drawing together another excellent collection of chapters on various aspects of reform in electricity markets across the world. Electricity liberalisation continues to be one of the longest running and most interesting set of multi-country micro-economic experiments. While most of these national experiments are on-going, some are mature enough to no longer be considered experiments, and many have been running long enough to give rise to preliminary results. Economic analysis is well served by well-informed and detailed analyses of these experiments, such as appear in the pages of this book.

In this brief foreword, I want to explore the issue of the balance between liberalisation and regulation in electricity systems, which is the essence of much of the detailed policies which are implemented in the sector (Pfaffenberger also raises the issue of this balance in his preface to this volume). By *liberalisation* I take to mean the use of market or quasi-market mechanisms as part of a reform of the sector, by *regulation* I take to mean intervention to restrain the operation of market prices or to set standards (e.g. for quality or system security) at variance with those that would otherwise have operated in the absence of regulation. I use the word 'system' rather than 'market' to indicate the extent of the system covered by a single regulator or system operator, which may or may not involve a market. Thus national or regional electricity systems and ISO areas would be included in what I mean by an electricity system.

In looking at the issue of balance, let me say where I am coming from on this:

First, liberalisation of electricity systems typically happens within a context of regulation. There is no such thing as complete deregulation of electricity markets, at least for systems of any significant size. Even among the leaders in global electricity liberalisation - UK, Texas or Norway - what we observe is a liberalisation process which has gone further than in many other jurisdictions but what this means is that the balance between liberalisation and regulation has been shifted further in favour of

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liberalisation than elsewhere. Truly 'private' networks (e.g. in Woking in the UK (see London Energy Partnership, 2007)) or unregulated networks (e.g. in Mogadishu, within a failed state (see Nenova and Harford, 2004) can be observed but most systems are bigger than these.

Second, the extent of liberalisation of electricity systems is a choice variable, generally bounded by what might be possible. As has been amply demonstrated by the leading countries in electricity reform, there seems to be a lot of freedom to choose how much liberalisation to introduce. European countries in particular, at least initially, exhibited the full range of responses from virtually no change from a state vertically integrated monopoly to the creation of some of the most liberalised markets in the world. Among developing countries, Argentina and Chile exhibited substantial reform at an early stage while many more developed and developing countries have made less progress.

Third, while liberalisation is a choice variable it is a variable conditioned by national institutional factors. Correlje and De Vries discuss this more fully in their chapter. Institutional factors do appear to constrain jurisdictions in their reform schemes. In general, only jurisdictions with substantial pro-competitive histories have attempted the most extensive set of reform measures. Arguably only Latin America provides any examples of extensive electricity reform within a tradition of state intervention – with Argentina being the most interesting example of this. I will explore the extent to which reform choices may be constrained by wider institutional factors later in this chapter.

Fourth, it is difficult for me not to write from a UK perspective. Although I am familiar with the reform experience in several jurisdictions, I naturally judge what might be possible on the basis of the experience which I have observed most closely. The advantage of doing this is that that UK has an honourable tradition of leading in the area of energy market reform, the disadvantage is obvious. Increasingly I am interested in thinking about why it is that so few of the jurisdictions that have attempted to replicate the UK experience have been successful. The explanations that naturally suggest themselves include (1) that reforms have not been extensive enough or (2) that a reform package that might be effective in the UK gives rise to perverse results elsewhere. Several US markets would seem to be examples of the former, whereas developing countries might suffer from the latter problem. A final more general explanation (3) might be that institutional constraints – particularly with respect to the initial ownership structure of the industry - mean that while UK style reforms are technically possible, they would not be implemented because of the political economy of the interest groups that exist in the countries concerned. Several major European countries, such as France, Spain and Germany would seem to in this category. For example, in France the starting point is a powerful and well regarded state owned company, while in Germany the starting point involves economically powerful private companies.

I will continue by examining the case for liberalisation of electricity systems, then look at the case for regulation, offer a brief evaluation of what the evidence on where the balance might be drawn, before considering what the future might hold for electricity liberalisation.

The case for liberalisation

As Chao, Oren and Wilson remind us in their chapter, the past for most electricity systems involved a high degree of vertical integration – particularly between generation and transmission, but also between distribution and retail and frequently between all four stages of production. The economic arguments for large vertically integrated electricity companies, which were significant in size within political jurisdictions rested on a claim that vertical economies were significant. Many studies examined the nature of these vertical economies and most, if not all, concluded that vertical economies between generation and transmission were significant (e.g. Kaserman and Mayo, 1991). This provided arguments for the integration of what we now know to be potentially competitive generation and monopoly transmission networks. Papers which claim vertical economies continue to be written, e.g. on the regional Japanese electric power companies where a very high degree of vertical integration continues to be significant (see Nemoto and Goto, 2004).

Experience with liberalisation shows us that there were indeed costs to vertical separation, both in generation and transmission and between distribution and retail (see Newbery and Pollitt, 1997 and Domah and Pollitt, 2001). However these costs had to be incurred to achieve the benefits of more competition in generation and also more competition in retail. Studies showing vertical economies between the various stages of electricity supply are mostly not capable of modelling these benefits properly, and indeed in the case of studies where there are no non-integrated companies with whom performance of integrated utilities can be compared are seriously mis-specified.

The case for competition in generation rests on the benefits of competitive markets generally. More precisely, a central claim is that competition drives efficiency gains, which can be substantial given that generation can be as much as 65% of value added in the sector. Efficiency gains are of two main types: cost savings arising from the more efficient operation of existing assets and those arising from the choice of cheaper technologies for new generation. Both can be significant, even more so where initial operation has been in the hands of inefficient publicly owned utilities. Heavily regulated integrated utilities are subject to a potential gold plating problem if they are privately owned (following Averch and Johnson, 1962) and subject to the pressure to be instruments of government industrial policy which supports expensive home grown contractors and designs, rather than generic scalable technologies which are available off the shelf (see Henderson, 1977 and Green, 1995 on the highly expensive British nuclear programmes). Clearly the uptake of CCGT in competitive generation has been a great success in liberalised electricity markets, as has the cutting of support for expensive untried clean coal technologies (which would not have been as clean as CCGT) and the curtailing of the uneconomic roll out of nuclear power (Newbery and Pollitt, 1997). Competitive generation has clearly revealed the price of different technologies and caused clear choices to be made in line with market principles.

Electricity economists are keen to point out how different electricity is to other commodities and hence what some of the problems of letting the market operate might be. Indeed Chao, Oren and Wilson note that the regulatory compact in the US electricity sector was that monopoly operation of electricity networks was essentially the price that was paid by regulators in return for smoothing of retail electricity prices.

They suggest that electricity prices would be much more volatile in the absence of regulation and that this would be politically unacceptable. This is undoubtedly a powerful view of competition in retail electricity markets, which resonates today, even within the most fully liberalised markets. However it is a rather quaint given rising incomes and the increasing availability of sophisticated financial instruments. It may also be a view arising from US states where low power prices have been traditionally based on access to cheap coal (Joskow, 1997). Consumers in these states seem to have little to gain by deregulation and market extension to high price states. By contrast the enthusiastic advancement of market liberalisation in California was driven by high electricity prices in a state where demand was growing rapidly and there no cheap resources for power generation. Ambivalent views towards electricity reform are rather at odds with economists' normal enthusiasm for market-determined prices. What full retail competition (i.e. including households) in both the UK, Nordic countries, New Zealand and Texas reveals is that consumers can be content to pay 'volatile' electricity prices as long as there is a perceived benefit from retail competition. Undoubtedly the Chao et al. view does restrain regulators enthusiasm for proper retail competition in many US states and elsewhere. However it is based on the view that competition is ok in most markets, but somehow not ok in retail energy markets. This is rather odd, as economists (though not politicians) are happy to see volatile gasoline prices, but not volatile residential electricity (or natural gas?) prices. It is difficult to see how retail competition at the household level can make much progress in many jurisdictions unless this view faces serious challenge.

At this point it is important to be clear about what full retail competition looks like in electricity markets. This is because what passes for retail competition in many US states is such a pale version of competition as to invite ridicule. Retail competition should involve the ability to switch electricity supplier. Effective retail competition would involve the existence of, say, five or more energy companies offering retail tariffs. If a customer switches from the incumbent supplier they would receive a bill from a different company who would purchase monopoly transmission and distribution services from incumbents but be responsible for billing, contract terms, bundling of other services and the purchase of wholesale power.

In many US states this is not what is meant by 'retail choice'. Retail choice simply involves buying the wholesale power component of one's energy bill from a non-incumbent. This eliminates competition in billing, bundling of other services and contract terms. This is an unusual type of competition, which is not the same as we observe in genuinely competitive markets. Such an odd version of what is meant by competition may not be a big issue where the wholesale power component is the most significant part of the bill (and may indeed by billed separately) and absolutely large (i.e. for large industrial customers). However the anti-competitive (pro-incumbent) situation is worst at the household level where US retail choice often involves the offering of default regulated tariffs to retail consumers which restrict switching by being regulated at a low level or having the property that if one switches, one cannot return to the default service tariff. The lesson from deregulated markets where there has been significant customer switching is that the existence of a low regulated retail tariff discourages switching i.e., there should be a removal of price regulation of retail tariffs.

The benefits of household retail competition continue to be debated (Littlechild, 2002, expresses the arguments for full retail competition, while Green and McDaniel, 1998, present a sceptical view). Retail competition has now been revealed to be an important complement to competition in generation. A major observation of electricity reforms is that monopoly networks are different businesses from the competitive businesses – generation and retail. The former are, when regulated effectively, low risk infrastructure businesses, while the latter are higher risk businesses subject to the normal bankruptcy risk faced by companies in competitive markets. While the vertical economies between generation and transmission are not sufficient to offset the benefits of competition in wholesale power markets, they do appear to be significant between generation and retail. In particular the risk management advantages of generation and retail integration are very important, such that stand-alone retail electricity companies have struggled. Across the world large stand-alone start-up retail companies have, after some initial successes, have generally failed, as exemplified by the experience of the UK, Netherlands and New Zealand. A notable retail-only business model, which has succeeded is that of the former incumbent gas company in the UK (Centrica) which has very successfully diversified into electricity retailing in the UK and in the rest of Europe. However this company has been born of an unusually competitive and unbundled gas industry in the UK. The good news is that competition in retail markets is possible; the bad news is that it is only likely to be as extensive as competition in generation because non-integrated retail companies have little chance of success at any reasonable scale.

Economists are fond of pointing out the many other ways in which the detailed operation of the electricity market needs to be regulated. Thus there are issues to do with the efficient operation of the transmission system and the allocation of transmission capacity and the problems of incentivising enough generation capacity to be available to limit price spikes at peak times (see Singh, this volume). The liberalisation process has revealed that market and quasi-market mechanisms can address market and regulatory failures in these areas. PJM and some other jurisdictions, for example, have successfully implemented nodal pricing arrangements for the allocation of transmission capacity and many other markets have used price signals to make more efficient use of scarce transmission capacity.

In terms of the mitigation of price spikes, special mechanisms have been introduced to pay generators to make extra capacity available, either more generally via a capacity payment (e.g. in the North East US), or specifically at the system peak (e.g. in the UK). While the long-term incentive properties of some of these mechanisms are dubious, they can mitigate short-term capacity shortage problems (this seems to be the case in New England) and provide comfort to regulators and politicians that something is being done to prevent the lights from going out. This view is supported by Adib, Schubert and Oren, in their chapter, who suggest that ‘there is no evidence’ that capacity support mechanisms actually promote investment in the long term. Moran and Skinner’s chapter on Australia, further suggests that a market without capacity payments can work well, even though prices do occasionally spike. However as long as these spike reduction measures are not too expensive, they may be a price worth paying for the continuation of electricity reforms elsewhere in the system. Indeed, Bowring’s chapter on PJM’s capacity markets suggests that they may have a limited role to play in reassuring stakeholders that adequate capacity will be available.

Bowring concludes that capacity markets are 'not a panacea' but can play 'a critical *but circumscribed* role in wholesale power market design' [my italics].

Generation and retail electricity markets yield major market advantages over vertical integration. First, they allow the efficient handling of business risk. There are substantial uncertainties in the short, medium and long term in power markets. Markets are good at handling these types of risk. Indeed given the capacity of the oil market to handle much more significant risks, it would be odd if we did not leave these to the market in electricity.

Second, price has a significant role to play in ensuring security of electricity supply. The old vertical integrated system did provide security of supply – at a cost. Most markets allow a significant role for the price in ensuring security of supply. Around the market price insurance can be offered to those who want it, while those who want to self-insure can opt out. As the UK (2004-06), New Zealand (2001), Nordic countries (2002-03) and Chile (1998-99) have all demonstrated in recent years, retail electricity customers are willing to be exposed to significant price volatility and play a significant role in demand management.

Third, full retail competition offers a significant political advantage over vertical integration: the 'privatisation' of the final price of electricity. Where retail prices continue to be regulated, as they are in the absence of full retail competition or the continuation of a default service tariff, political or regulatory interference is much more likely. This is important at times of rising energy commodity prices, when the pressure will be to slow the translation of these into higher retail prices. Between 2004 and 2006, wholesale gas prices quadrupled in the UK and retail electricity and gas prices rose significantly. However the most common response to this sharp rise was for politicians to point out that most electricity and gas consumers could cut their energy bills by switching to a cheaper energy supplier. In the absence of retail competition the pressure for politicians' intervention would be much stronger than this. Continuation of regulation of the final price of electricity is usually a sign of insufficient competition in the wholesale power market. Removing such regulation focuses regulators attention on making the power market competitive. This is clearly demonstrated by the EU Energy Sector Inquiry, where advent of full retail competition at the household level has led the European Commission to focus on the removal of barriers to competition in wholesale power markets.

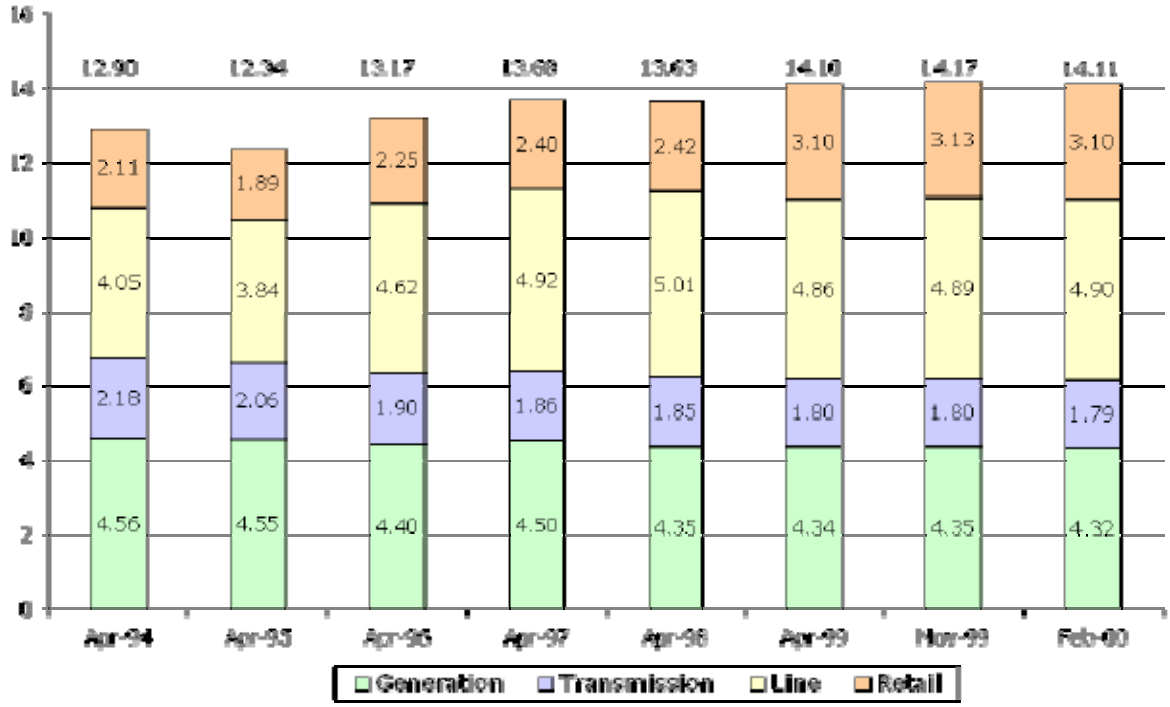
Fourth, competition promotes innovation, some of which may be unexpected. Retail competition in electricity markets has promoted joint marketing of electricity and gas where these were previously often provided by different local monopolies, the use of internet-based switching sites, payment by direct debit and the vertical integration of generation and retail (in jurisdictions where this did not previously exist). We have already noted the effect that competition in generation has had on the adoption of generation technologies. However it has also led to the refurbishment of assets, rather than their replacement (or originally scheduled closure). For example, the widespread life extension of the US nuclear fleet (where no plants have shut down since 1998 and where the majority seem set to be life-extended to 2035 and beyond) is something that is clearly incentivised by competition in generation (see Joskow, 2006a).

The case for regulation

Even in the leading utility reform sector – telecoms - regulators have been slow to remove regulated retail and access tariffs to networks for competitive telecom service providers. Thus we might expect there to continue to be a strong pressure for continued regulation in the electricity sector.

Demsetz (1968) asked the question: why regulate utilities? He pointed out that while natural monopoly might still exist, it could be restrained by franchising or competition for the field in utility sectors, such as electricity. In New Zealand, as Bertram (2006) discussed in this book's predecessor volume, the government conducted a rather interesting economic experiment. They left the regulation of the operation of the electricity distribution businesses to general competition policy. This resulted in the lines businesses significantly increasing their charges relative to costs and absorbing all of the benefits of competition in generation and retail (see Figure 1). This experiment graphically demonstrates the fact that electricity networks do have significant market power and need to be formally price regulated. It also provides a good argument for an effective sector specific regulator formally charged with implementing a price review process in networks, even in jurisdictions with competent general competition authorities.

Figure 1
New Zealand Residential Electricity Price c/kWh (2000 NZ$)
Source: Ministry of Economic Development (2000).



Regulation of the average prices or revenue of natural monopoly networks is not enough to ensure that network owners do not abuse their monopoly power in situations where there continues to be vertical integration of electricity networks with either generation or retail businesses. As the experience with telecoms deregulation shows, there is a need for the regulation of access to monopoly networks for

generators trying to reach customers and retailers trying to source power (see Bergman et al., 1998 on telecoms). Such access pricing needs to ensure that the incumbent network asset owners can secure a return to their investment *and* that switching to non-incumbents occurs simply on the basis of differences in costs, prices and service offerings in the competitive parts of the supply chain.

In the case of telecoms, the efficient component pricing rule (Baumol et al., 1997) attempted to limit inefficient bypass of the incumbent's assets in the competitive segment in conditions where the final price was regulated. In electricity, the problem of access pricing involves clear non-discrimination in the allocation of network access and the regulation of tariffs to reflect the true costs of the monopoly network. In general, energy regulators have been able to do this where their powers have been sufficient, though in some continental European countries, such as Germany, there have been substantial problems reported by non-incumbent generators trying to get access terms in the early years of restructuring (see Bergman et al., 1999).

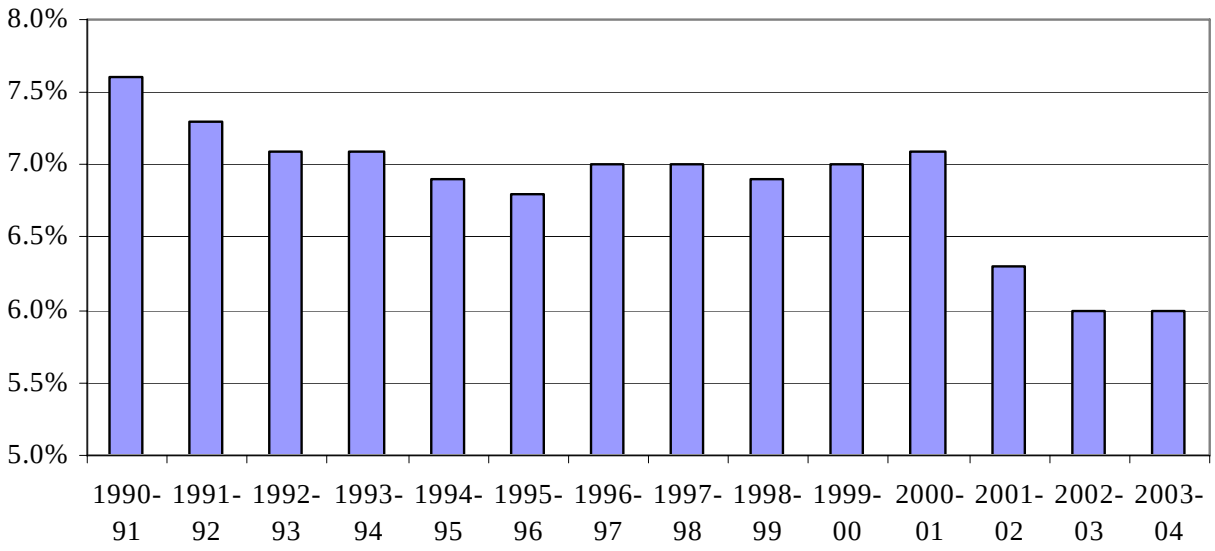
In retail, there have been examples of incumbent retailers integrated with distribution wires attempting to allocate an overly generous part of the initially shared assets to the monopoly distribution wires business and hence raising access charges for non-incumbent retailers. This effectively means that the retail customers who switch to non-incumbents subsidise the retail part of an incumbent's business. The potential size of this cost allocation problem is substantial. The UK electricity regulator, Ofgem, reallocated an amount equivalent to around 18% (of which a third was metering costs) of the controllable cost of regulated distribution from distribution wires to retail in 2000 (see Ofgem, 1999, p.17). This reflected the misallocation of assets and costs within incumbent integrated distribution and retail companies at the time the market was opened to full retail competition.

The appropriate regulation of access charges and terms continues to drive the debate over unbundling of network assets in Europe. Successive European electricity directives in 1996 and 2003 have mandated increasingly tough unbundling requirements between the network and competitive businesses within integrated companies. The recent EU Energy Sector Enquiry highlighted access problems as a major barrier to the advancement of competition in European electricity and gas markets (European Commission, 2007). In mid-2007, the European Commission is pressing for full ownership unbundling of gas and electricity transmission networks from the rest of the system. This has been proposed to finally remove the incentive on transmission owners to favour their own generation or to not propose transmission investments, which would bring system benefits at the expense of corporate profits in generation. It remains to be seen whether the Commission will eventually force ownership unbundling of just system operation along an ISO model (such as PJM) or will also require the ownership unbundling of transmission assets to create independent TSOs (such as in the UK or under the stalled RTO model in the US). The weaker ISO model option may prevail as a compromise with countries for whom ownership unbundling of transmission assets is politically unacceptable. ISOs without transmission assets may do well on non-discrimination but do not solve the problem of under-investment in transmission by companies with market power in generation. Singh discusses the problems in US transmission in his chapter, putting emphasis on the need to improve transmission investment incentives and the fact that the debate in

the US has begun to focus on the case for independent transmission companies as opposed to ISOs.

Regulation is also important in a number of non-price areas: for example, standards for quality of service, reliability and network losses. Unless regulators enforce some sort of penalty price for the non-delivery of minimum standards, there may be incentives for services to deteriorate or not optimally improve the quality of the operation of the network. A good example of this follows. Distribution losses are paid for by retail customers who must buy extra power to cover network losses. Network losses are assumed, for charging purposes, to be uniform and constant in most distribution networks. Hence there is little advantage for competitive suppliers seeking to minimise these, resulting in market failure. In the UK, network losses in distribution did not change much over the first ten years following liberalisation, until the regulator introduced a tougher financial penalty for distribution losses payable by network owners (see Jamasb and Pollitt, 2007). This led to a sharp and immediate cut in distribution losses as shown in Figure 2.

Figure 2
Distribution losses in the UK as percentage of energy delivered
Source: Jamasb and Pollitt (2007).



The creation of competitive wholesale markets has been associated with the need to create appropriate transmission access regimes. However the rise of distributed generation (embedded within the distribution network), in response to technological change and climate change concerns, has necessitated a more considered regulatory approach to the regulation of distribution access. This is pressurising regulators to develop more flexible access terms for distributed generation within the distribution network, which reflect its true value to the system. The regulatory issues raised by distributed generation are discussed in the chapter by Bauknecht and Brunekreeft.

It is important to note that there has been a significant improvement in the sophistication of regulation of natural monopolies since electricity reform began. The Averch-Johnson effect, the theory of regulatory capture (Stigler, 1971) and distortions of regulated price differentials (Peltzman, 1976), not to mention the rather unimpressive early attempts at limited (and hence distortionary) incentive regulation (Berg and Jeong, 1991) are lessons that now seem to be well learned by the *best* regulatory agencies operating in competitive markets. Indeed there does seem to be a rather clear positive correlation between the degree of development of liberalisation and the quality of the regulatory agency (see Green et al, 2005). Particular progress has been made in the incentive regulation of electricity networks, where sophisticated analysis has been combined with the use of fixed term price controls, which incentivise cost reduction (Jamasb and Pollitt, 2001 and Joskow, 2005). Indeed an obvious potential gain from unbundling electricity networks from the rest of the supply chain is the facilitation of superior regulation of network businesses. This can lead to significant cuts in regulated tariffs and / or increases in investment, as exemplified by the experience of the UK, Nordic countries, Chile and New South Wales. Effective regulation not only brings direct benefits through more efficient networks but also through the facilitation of wholesale and retail competition across these networks.

While the regulation of electricity networks is clearly necessary, electricity market liberalisation has thrown up a strong case for market monitoring (as detailed in the chapter by Adib, Hurlbut and Jaussaud) of the operation of the competition within generation and retail markets. Market monitoring requires vigilance and quick action to correct market rules if societal welfare is to be maximised (or not significantly reduced). Specialist energy regulators seem best able to analyse market data and to propose remedies, with detailed market rule changes sometimes delegated to system operators or wholesale market governance mechanisms if sufficient regulatory threat is in place. The need for regulatory oversight of this type would seem to be more necessary in the early stages of market redesign due to the complexity and scope for gaming which exists in electricity markets. However over time regulatory oversight may be reduced as market operators become more able to self-regulate. A parallel might be drawn with financial markets in this respect where effective self-regulation may be generally desirable within a context of appropriate legal protection and the operation of the general competition authority.

Electricity markets may need to be redesigned from time to time with significant regulatory involvement (in assessing the relative merits of different designs) as new analysis on optimal market design comes to light. An example of such a design question is raised in the chapter by Sioshansi, Oren and O'Neill who examine the relative merits of central versus self-commitment of generation units. They come down in favour of central commitment rather than self-commitment. Self-commitment was a significant element of the New Electricity Trading Arrangements for wholesale power which replaced the Pool (begun in 1990) in England and Wales in 2001. In their chapter O'Neill and Hobbs consider the lessons from different auction markets in the US for wholesale energy and ancillary services. All such significant redesigns need careful assessment in order to avoid imposing additional costs on electricity customers.

Particular problems have been noted with the utilisation of interconnectors between jurisdictions, price signalling within power pools, withholding of capacity and mergers between energy companies. Interconnectors are a particular issue within the transmission system because they can be closely monitored. What seems to be the case, is that these can be often congested, flowing in a perverse direction and not subject to appropriate capacity upgrading. In Europe, international electricity and gas interconnectors are the subject of scrutiny of regulators (see European Commission, 2007) to detect the operation of market power by integrated incumbents. Gas interconnector utilisation (or the lack of it) and non-responsiveness to large international price differentials have been particularly noted. Power pools and organised power markets can be subject to price manipulation. This is because of the repeated game nature of such interaction and the ability of firms to signal to one another within the power pool. Such accusations were regularly made of firms in the early days of power pool in the UK. Indeed when the regulator imposed a price cap on the incumbents in this market, they managed to hit it exactly (see Newbery, 2006).

California's ill-fated power markets are still under investigation for the alleged withholding of capacity to drive up prices (see Sweeney, 2006). Measures of the residual market power index clearly show that in many power markets incumbents have the ability to withhold enough capacity to drive up the price significantly.

Finally, power company mergers require careful assessment. This is because the sheer volume of transactions among energy companies brought about by liberalisation has the capacity to rapidly change the shape of the power sector (see Codognet et al., 2002). The increase in effective market size brought about by liberalisation in many US and European markets, requires mergers to be evaluated more carefully than would have been the case in the past. In Europe, the concentration of ownership at the European level has been the price paid to reduce concentration within individual national markets (see Jamasb and Pollitt, 2005). Meanwhile mergers between electricity and gas companies have created the potential for the sophisticated exercise of market power in the interrelation between gas and electricity markets. The highly controversial merger between EON and Ruhrgas in 2003 integrated the major supplier of wholesale gas and one of the major energy companies in Germany, eliminating a major potential competitor in the electricity market. This merger was opposed by the German competition authority but approved by the government. A similar merger between Endesa and Gas Natural in Spain in 2006 was initially approved but failed to occur.

It is important to stress that while liberalisation has involved some reduction in regulation in wholesale and retail electricity, it is not necessarily the case that liberalisation and regulation are substitutes. Wholesale and retail competition may require *more* regulation (in terms of cost and complexity) to ensure their success. A state owned vertically integrated national monopoly may require minimal regulation, but is not consistent with a liberalised market.

Evaluating the experience with electricity market reform

Globally, the evidence on the success of electricity reform is surprisingly mixed. One would have expected to find clear evidence of reform success showing up by now in the econometric evidence. This is however difficult to demonstrate as Jamasb et al.

(2004) show. There are only two econometric studies of the price effects of electricity reform in the OECD (Steiner, 2001 and Hattori and Tsutsui, 2004). Both show some weak evidence of lower prices in the period to 1999, but it is difficult to distinguish which reform steps may be contributing to this. The evidence for developing countries is even more difficult. There is support for the view that incentive regulation, with privatisation and wholesale competition does raise investment, reduce losses and lower prices. However the precise interaction between reform steps is somewhat complex. The picture is complicated somewhat because pre-reform prices may have been artificially low relative to economic levels. Successful reform in these cases involves raising the price or simply holding prices constant while efficiency is increased.

Part of the problem is that the success of electricity liberalisation might be measured on several dimensions, for example, price, quality of service, losses and investment, and may need several years of observation before a trend improvement is apparent (given 'normal' year to year volatility). In recent years high commodity prices for gas further cloud the picture. Another problem is a lack of careful cost benefit analyses of reforms in particular jurisdictions where the counterfactual has been clearly worked out and is defensible. The basic assumption that variables of interest would have been same as before in the absence of liberalisation may not be the right one. Indeed in many cases, the liberalisation may have resulted in some variables (e.g. price) rising less rapidly or indeed falling less rapidly, than would otherwise have been case.

A promising way forward is to make a list of where one might think there has been a successful electricity reform. A good start would be to look at the chapters of Sioshansi and Pfaffenberger (2006). Among developing and transition countries Argentina and Chile stand out as successful poster cases. After this, the list becomes quite thin with perhaps, Peru and Columbia as additional cases. In many others there have been significant problems (e.g. Brazil: as discussed by Araujo, Correia, Costa and Melo in their chapter in this volume), and yet others not a lot has yet been tried (e.g. Middle East, Africa, parts of India). Among developed countries, there has been a lot of reform impetus. The EU has attempted a major organised reform programme but only the UK, Norway, Sweden, Finland and the Netherlands can really be said to be making significant progress from the pre-reform model. In most other European countries demonstrating a positive impact from electricity reforms and indeed much real enthusiasm beyond that generated by wishing to be good European citizens in complying with the Directives is difficult.

In North America, Texas, PJM, New England and New York demonstrate good progress in wholesale competition, but only Texas and some odd bits of Maine, Pennsylvania and Ohio have retail choice, while many states exhibit no progress from the traditional vertically integrated model. In Maine, Pennsylvania and Ohio regulated retail tariffs continue to limit competition and 'choice' is simply in the generation part of the retail bill. In Ohio one incumbent company discourages switching by highlighting consumer's right to choose not to release data to alternative energy suppliers (on privacy grounds). Australia and New Zealand have shown enthusiasm for reform but significant problems remain in several Australian states (e.g. Queensland, Tasmania and Western Australia where only partial liberalisation has occurred), though good retail competition is developing in Victoria and South Australia (see Moran and Skinner, this volume, on Australia). In New Zealand there

have been a number of legislative attempts to progress reform in the face of setbacks. In Japan progress with electricity reform continues to move very slowly.

Overall the picture is one of significant progress towards the maximum possible electricity reform being made in only a handful of jurisdictions, while reform progress has stalled at some intermediate stage in many more jurisdictions. Even some of the places where we think of the most progress as being made: parts of PJM, as well as Chile and Argentina have not got full retail competition.

Correlje and De Vries suggest that, it is difficult to come up with clear lessons from electricity reforms which translate globally because of what they call physical, economic and institutional factors. However there are some lessons:

First, ownership unbundling of electricity transmission from the rest of the electricity network has produced clear benefits in the markets where it has been tried in terms of improving access conditions for competitive generation and removing incentives to under-invest in transmission. ISOs with continued integration of transmission and generation are largely effective in improving access conditions and the operation of the transmission system but suffer significantly from continuing under investment; Chile being an excellent example of this, among others (see Pollitt, 2004).

Second, getting market structure right in electricity generation is crucial for the success of electricity reform. This involves sufficient divestiture to, say, five players by incumbents. Relying on new entry alone will not be enough to ensure the reduction in the market power of incumbents. Where regulators have been unable to introduce low concentration at the opening of new power markets, they have faced an uphill battle to reduce concentration. Really successful wholesale power markets either introduced competition right at the start e.g., in Argentina, PJM, Texas or undertook significant regulatory intervention subsequently, e.g., in UK.

Third, incentive regulation based on RPI-X price control of monopoly networks can deliver significant incentives to reduce costs and can facilitate efficient operation with the provision of stable cash flow for new investment. Regulators that have not made best use of incentive regulation have missed out on a substantial part of the gains from ending of the vertical monopoly in electricity. This is clear from a glance at the division of the final price of electricity between generation, transmission, distribution and retail elements in European countries. The countries with tougher incentive regulation of networks have significantly lower network costs than those who do not (Jamasb and Pollitt, 2005).

Fourth, regulation can address market failures in electricity markets such as those associated with quality of supply. The problem with regulatory incentives to meet non-price objectives is that they may interact with one another and create perverse incentives. Regulators need to understand the power of incentives both to solve perceived problems in electricity systems and to inadvertently incentivise welfare reducing activity. Indeed part of the problem of electricity liberalisation is that it requires more sophisticated regulation to be successful.

Overall the potential benefits of electricity reform seem to be positive. Newbery and Pollitt (1997) conservatively estimated that generation and transmission reform in the

UK reduced costs permanently by 5%. Fabrizio et al. (2006) come up with a similar figure for the reduction in generation costs due to reforms in the US. Looking at final electricity prices in the US, Joskow (2006b) finds that competitive wholesale markets and retail competition have reduced prices (relative to their absence) significantly, with retail competition reducing prices by 5-10% for residential customers and 5% for industrial customers. Focussing on just the New England wholesale power market, Barmack et al. (2007) find a net gain of 2% of costs due to reforms. In distribution and retail, the benefits are similar in order of magnitude. Domah and Pollitt (2001) identified gains of around 10% of costs for the UK. For developing countries, Toba (2003) estimated that the liberalisation of Philippine electricity generation produced a one-off gain equivalent to around 10% of GDP, while Mota (2003) estimated that the privatisation (and incentive regulation) of Brazilian electricity distribution produced a one-off gain of more than 2% of GDP.

Stephen Littlechild (2000) helpfully breaks down the benefit of the early years of the UK reforms in Table 1.

Table 1: Sources of price reduction to domestic users 1991/92-1998/9
(Source: Littlechild, 2000)

Source	%
Lower generation costs	10
Lower distribution and transmission charges	9
Lower supply business margin	1
Lower fossil fuel levy (mainly to fund nuclear liabilities)	9
Total	29

Littlechild's analysis helpfully focuses on residential customers and provides a point estimate of the impact of reform (in contrast to the NPV calculations of the Newbery and Pollitt (1997) and Domah and Pollitt (2001) studies). This indicates that the reduction in residential prices is split almost equally between lower generation costs (operating efficiency and fuel switching), lower distribution and transmission charges (transferred to consumers via RPI-X) and a lower fossil fuel levy, which was the subsidy to the nuclear sector to cover un-financed decommissioning liabilities (the ending of an industrial subsidy). Thus one might say that gains were coming from competition, improved economic regulation and the elimination of inefficient industrial subsidies to energy production. This highlights the fact that in many countries a clear benefit of liberalisation is likely to be the end of expensive industrial policies towards the energy sector or at the very least increase the transparency of the cost of these.

The future of electricity liberalisation

Electricity reform around the world has been driven by a combination of the success of the early reformers (who inspired many followers) and the extensive reform programs at the federal level in the US and at the level of the European Commission in Europe. As the difficulty of replicating the success of the early reformers has become more apparent, particularly in developing countries, and as the US federal

program has stalled, many jurisdictions have failed to pursue electricity liberalisation to its logical conclusion. Only in the EU has the sustained commitment of the European Commission within a wider single market agenda (which encompasses all industrial sectors) and a political system where energy reforms can become part of the international bargaining process has the pressure for further electricity market reforms been sustained. However, Cornwall's chapter highlights just how far there is to go to establish regional electricity markets (covering groups of neighbouring countries) in Europe, let alone to the Commission's goal of a single electricity market in Europe.

What is becoming increasingly clear is that electricity reform has failed to convince many of its merits (e.g. Thomas, 2006). On the basis of the evidence of the delivery of clear benefits being somewhat mixed, this is hardly surprising. What seems to be the case is that the pursuit of electricity reform through to its logical conclusion is only likely to happen in jurisdictions where there is a strong ideological commitment to competition in energy markets. This will partly be driven by resource conditions – the presence of initially high costs with scope for efficiency gains is conducive to reform – but significantly by whether there is a fundamental belief that electricity prices should be left to the market. This belief is partly a belief in the market itself and partly a belief in the market for energy per se.

Some who believe in the market still think energy markets sufficiently different from others to warrant the sort of intervention that prevents the emergence of effective competition in generation and / or in retail. Often this reflects (or is supported by) concerns about security of supply and increasingly concerns about pollution from electricity production. What is absolutely clear is that successful through-going electricity liberalisation requires both a belief in competition and effective institutions of competition policy. Countries, such as France and Germany, will struggle to make serious progress with electricity reform unless they can change their attitude to competition in the electricity sector. This is not beyond the bounds of possibility but it will require the sort of reluctant change in attitude, which globalisation and technological change has brought about in other sectors (such as telecoms).

A new and important challenge to electricity reform is posed by climate change. As Ford discusses in his chapter, climate change is a serious issue which the power sector will be expected to address. Economically sensible policies for the internalisation of the external costs of CO2 emissions have been enacted in the EU (as the EU Emissions Trading System) and proposed in the US (various state and regional trading initiatives are progressing, with a bill for a national scheme being put before the Senate in 2003). However, with regard to the balance of liberalisation and regulation in electricity systems, climate change is a potential vehicle for the return of old-style intervention in electricity generation and in retail competition. The argument will be that the market will not invest in low carbon generation without long-term contracts for low carbon electricity generation. Such contracts would effectively eliminate competition in the wholesale power market. On the retail side, the argument will be that consumers who switch, fail to provide long-term incentives for micro-power and demand side management (DSM) investments. Regulators face a significant challenge if they are to introduce subsidies to low carbon electricity generation which do not effectively end competition. Clearly environmental externalities should be priced properly as a first step. Competition should be viewed as part of solution, not the problem. Encouraging price sensitivity and consumer selection between own

generation, DSM measures and energy supplier would be a more effective way of mobilising extra resources (from customers) and cheaper market led responses for tackling climate change than potentially highly expensive centrally imposed investments. The potential for DSM in liberalised market environments is taken up in the chapter by Zarnikau.

In the context of rising political concern about climate change, we need to heed the lessons of history on the poor track record of government backed technologies in energy. Cohen and Noll (1991) highlight the 'technology pork barrel' in the US and the difficulty of ceasing government funding of energy technologies which fail to deliver. Fri (2003) suggests that although the theoretical case for public funding (or consumer subsidy) of energy R&D is compelling, the track record suggests that the situations where intervention is likely to have positive net present value are rather limited. He also makes the interesting observation that subsidies for strategic deployment to exploit learning economies have been of dubious economic value as learning has been just as rapid in non-subsidised 'mature' technologies. Most successful innovation in electricity systems is incremental (Fri, 2003) and best left to the forces of the competition, attempts to force the pace by subsidy are likely to be expensive mistakes (especially in aggregate across the portfolio range of technological interventions). By contrast the introduction of market based incentives to abate environmental pollution in electricity have an excellent track record. The US SO2 cap and trade programme being the most notably successful of these (see Ellerman and Dubroeucq, 2004). In this context it is vital that we properly evaluate the success of the various renewable electricity support schemes implemented around the world (as for example in the chapter by Haas et al.), while continuing to press for the establishment of a sensibly high trading price for CO2. Once this price established the requirement for large and potentially wasteful subsides to support the roll out of renewable capacity will be substantially reduced.

Liberalised electricity markets have had a good run where they have been implemented. The US, UK, New Zealand, Australia and Scandinavia initially had very favourable generation capacity reserve margins, well developed transmission and distribution networks and a favourable fuel price environment. This facilitated electricity reform by allowing for a significant period of uncertainty and learning where little net new investment was necessary. (Though in many of the early reformers *there was* significant new investment – Chile and Argentina being the most striking examples in terms of demand growth). However the investment demands, even on mature networks are now increasing as networks require replacement (or refurbishment) and significant new generation investments are required given the investment cycle. This will test the investment incentive structure in these markets (and will test government commitment to leaving investments to the market). In networks, new mechanisms need to be developed for incentivising least cost investments rather than simply incentivising efficient operation (as under RPI-X). Innovative new schemes for the selection of new investments have been successfully tried out – such as the public contest method for new transmission investments in Argentina which involved users voting for whether they wanted new lines (Littlechild and Skerk, 2004). Competitive tendering, even for investments within meshed networks, could be extended with the tender price being incorporated in the regulatory asset base.

Correlje and De Vries bring us back to the consistency of electricity reforms with underlying institutional determinants as well as physical and economic factors. This is in line with recent work being done on the determinants of economic growth by La Porta et al. (1999) and the strength of financial systems by Bordo (2006). It seems clear that the detailed electricity system reform needs to be consistent with the institutional framework within which the reforms take place. Starting points are important: significant public ownership and prices which more than cover efficient economic cost greatly facilitate a structural reform which will yield positive social welfare. These starting points were present in Chile, Argentina, UK, Australia and New Zealand. Initial private ownership (e.g. in the US, Japan and Germany) and prices below economic cost (e.g. in India) make reform much more difficult. Electricity reforms are complex and require a commitment to competition and efficient regulation. Significantly they also need to show flexibility to emerging information and allow scope for mid-course adjustments. It seems clear that a jurisdiction like the UK is very well suited to delivering a successful electricity reform at both the generation, network and retail levels. This is because the UK has a strong central state capable of encouraging private sector compliance under threat of legislation, a deep commitment to competition and liberalised final prices, a tradition of independent regulation and a significant capacity for institutional learning. Part of the problem faced by other jurisdictions is that some of the elements of the required institutional capability are not present and hence severely limit the capacity of the society to deliver a successful electricity reform. Another way of putting this, is to say that what we might call the Standard Reform Design as followed by the UK, Texas etc is a model with an institutional 'fit' appropriate to those jurisdictions. Of course this is not to say that for a given jurisdiction an alternative and potentially equally successful model, more in keeping with the institutional environment, does not exist. It is merely to say that Standard Reform Design to which the EU and the other reforming states are implicitly working will not be appropriate in many, if not most, jurisdictions. It is however worth pointing out that the UK's (and one suspects, that of most other reforming states) institutional capabilities in the area of recent electricity reforms have been recently acquired and have not always been present. That said, it is true that a striking conclusion from a comprehensive survey of the electricity deregulation process in the UK is how impressive the British civil service was in designing and implementing a comprehensive reform, from scratch, in less than two years (Henney, 1994).

To come full circle: I think there *is* an appropriate balancing of liberalisation and appropriate regulation in a given electricity system. However I think that the leading jurisdictions in electricity reform challenge everyone else to justify why reform ought not to be extended into areas previously thought to be unsuited to competition. This challenge seems particularly appropriate in the US where the contrast between leaders and laggards in reform seems marked and without much *institutional* logic (in the La Porta et al. and Bordo sense), though one can undoubtedly come up with theories to explain them (the Joskow, 1997, discussion of reform attitude and pre-reform price being the most economically satisfying). In other countries however the argument for the balance to be set in different places becomes easier to justify on the basis of differences in institutional capability. The challenge posed by this is then to improve institutional capability in order to exploit the possible gains from electricity liberalisation. The real prize for proceeding with this is an electricity system capable of fully harnessing the power of competitive forces to respond to an uncertain future

for the world's energy markets in the face of environmental, technological and geopolitical challenges.

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