The German Electricity Sector – Finally on the Move?

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Not only once but several times the media have maintained that the liberalisation of electricity could have a dangerous impact on the security of supply, grid investments, and the system, as well as on the price stability of this crucial and sensitive sector. In the summer of 2003, when the liberalisation and regulation of electricity had just entered a new round in the EU, several European countries suffered from power blackouts. Two years before it was California, which involuntarily gained negative publicity for its recently liberalised power sector.

Contrary to these cases blackouts have rarely been a serious issue in Germany so far. But in this country, which is supposed to form the centre of a common European electricity market, where the network usage costs are currently 70 percent above the EU average and electricity retail prices among the highest in the EU, a new energy law is on the verge of being enacted. The question that arises here is whether this law (which is overdue according to EU legislation) has the ability to perform the balancing act between the retention of a stable and sustainable system and the containment of excessive market power on the part of the incumbent players. At the moment it seems that the latter aspect is more urging – but nevertheless both problems should be solved simultaneously.

In this article we analyse the recent developments in the German electricity sector and relate them to experiences gained in the US. Initially we give a short overview to the special characteristics of this exceptional sector.

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Particularities of the electricity sector

The electricity sector exhibits several distinctive properties as compared to most other markets. Some of these properties are presented here in brief.

Natural monopoly

Traditionally the whole electricity sector was regarded as unsuitable for competition. In particular, high sunk capital costs predominated in all areas of the sector, creating economies of scale over the entire range of output. In this case the long-term cost minimising capacity and size of the firm is relatively large in comparison to market demand. There are also strong economies of scope between generation, transmission and distribution. With such economies of scale and scope it is optimal for one operator to serve the entire market. In this context publicly owned entities seemed to be a sensible way of securing the benefits of size – and the required large-scale financing – without suffering the drawbacks of monopoly pricing. At the same time, the vertical integration of generation and transmission, and often of generation, transmission and distribution would capture economies of scope. In countries (such as Germany) with traditionally multiple local private energy providers it was common for the government to license regionally protected monopolies, which in Germany were regulated only slightly.

Over the past two to three decades new technologies have significantly reduced the minimum efficient scale of generating plants, the investment costs of new units, and the time needed to plan and build new plants, while economies of scale for transmission and distribution networks persisted. Thus, competition between generators seemed feasible and efficiency improving, provided economies of scope between generation and transmission networks were not too great. The extent of those economies was not well known at the time electricity restructuring occurred in several countries, and we are still unsure about them.

One reason for the large economies of scale in transmission and distribution is due to the properties of electricity itself. In periods of low demand electric power can hardly be stored for peak load periods.[1] In an integrated network different regions are interconnected and the respective peak load periods, which rarely overlap completely, can be balanced

[1] In principle it is possible via pump storage power stations – but only at very high costs or energy losses.

against each other. In other words, without a supra-regional integrated network every region would need higher capacities in order to respond to the respective demand in peak periods. For the same reason reserve capacities (and some ancillary services, such as voltage control) can be of reduced size in a larger network.

Vertical separation

The feasibility and desirability of competition in generation, along with the continued persistence of natural monopoly in transmission and distribution networks calls for the establishment of independent generation companies and possibly independent marketers. These competing companies would either have access rights to transmission and distribution grids of vertically integrated electric utilities, or the grids themselves would be vertically separated. In any case, access of generators and other electricity suppliers to transmission and distribution grids is an essential facility without which competition among generators (and marketers) would not be feasible.

Transmission grids connect generating plants with consumption centres, using high-voltage networks that are typically meshed in countries with a large number of power stations and consumption centres. These grids are characterised by loop flows (Kirchhoff's Law), which means that their total capacity depends in a complicated way on the capacity of the individual links. Also, the networks have to be in equilibrium at any moment in time. Transmission grids therefore exhibit both economies and diseconomies of scope, and those can change by the hour. Their scheduling is simple only if no links are congested. In this case, the efficient electricity prices at all network nodes (both generation nodes and consumption nodes) have to be the same. In contrast, in a congested network the price differences between nodes should reflect the costs of congestion. They represent the scarcity value of transmission along all possible paths between nodes. These nodal price differences would, at the same time, be efficient real-time prices of network usage (Hogan 1992).

Distribution grids convert high-voltage power received from transmission grids into low-voltage power and deliver the electricity to end-users. Loop-flow problems in such grids are usually less pronounced than in transmission grids. In contrast to transmission grids, which are best managed on a regional basis covering the entirety of a country like Germany, distribution grids are typically many with each one forming a natural monopoly. Once vertical separation is chosen, it therefore makes sense to separate transmission and distribution companies vertically by management and ownership. Benchmark or yardstick regulation, which bases regulatory performance criteria and pricing on the performance of other regulated firms, would be ideal for the many distribution companies but hardly feasible for the single transmission companies.

Market clearance and market power in generation

As described above electricity supply and demand have to be in equilibrium at any time. Unfortunately power demand fluctuates quite substantially depending on time of day and season. Demand fluctuations cannot effectively be smoothed at this time, because intelligent metering and consumption scheduling devices – although technically feasible – are still lacking in Germany and elsewhere. In order to adjust the supply adequately to these demand fluctuations the power providers (or the generating companies) need to have several different types of power plants. Base load plants (hydro power, nuclear and lignite), which combine high fix and low variable costs, have to be mixed with shoulder plants (coal, natural gas and combined heat and power generation) and peaking plants (oil, gas, and pump storage power stations). The latter are only used for periods of high demand, as they combine low fixed and high variable costs.

But these complex capacity requirements are not easy to adjust to a higher (medium- or long-term) demand. The production of power plants is not only capital intensive but also characterised by substantial indivisibilities. Technological progress has indeed diminished the optimal firm size, but building a new power plant with an average economic life-time of 30 years is still associated with substantial cost and scheduling effort. Therefore those markets are not contestable – using the terms of Baumol, Panzar and Willig (1982) – and this favours inherently the high price-cost margins of the incumbent players. This phenomenon is amplified by the low price elasticity of demand for electricity. In fact, due to the lack of sophisticated metering, short-term demand is almost perfectly inelastic. Recurrent interaction of the market players also allows them to develop subtle strategies of communication and collusion and the short-term capacity constraints (as described above) prevent deviations from a strategy of collusion from being profitable.

Energy as an essential input for every economy

It is not only due to technical and market features that electricity takes on a special position among all bulk products. For every industry (and every household) it is also one of the most important input factors which are necessary for the functioning of almost every other activity. This is expressed by the low demand elasticity with respect to price and the almost unitary elasticity with respect to income. As we have seen in California, an electricity crisis certainly has the ability to disturb the economic processes substantially.

Under a private-sector environment the long term goal "security of supply" would be dominated by short-term profit orientation – and an inflexible price system cannot align these goals. It is therefore obvious that a stable and incentive-based regulatory framework is very important to avoid investment backlogs in generation, transmission and distribution of electricity. Whether such a framework is in place or will emerge in Europe's largest economy, namely Germany, will be discussed after including some lessons from the US.

Lessons from US electricity sector reforms

For a better understanding of the German legislative process it seems helpful to recall the problems that have hurt the US in their process of electricity restructuring. We will first give a brief description of the crisis in California in 2000/2001, which was the largest one of that kind in the US history, and then discuss some further features of the US electricity sector.

The California crisis

In the early 1990s it was in California where US electricity prices were highest. This situation was the result of failures in the existing system of vertically integrated monopolies. High investment costs for nuclear power plants, overcapacities and many expensive long-term contracts are some aspects that describe the situation at that time. In addition the interaction of the federal (FERC) and regional (CPUC) regulatory authority was inefficient and costly. It was somewhat obvious that the existing framework was inappropriate to solve the current problems and therefore California tried a new way and became precursor in the US electricity liberalisation. In 1998 the bill that combined complicated ingredients which have never been mixed together before (Vogelsang 2004, 15–16), became effective.

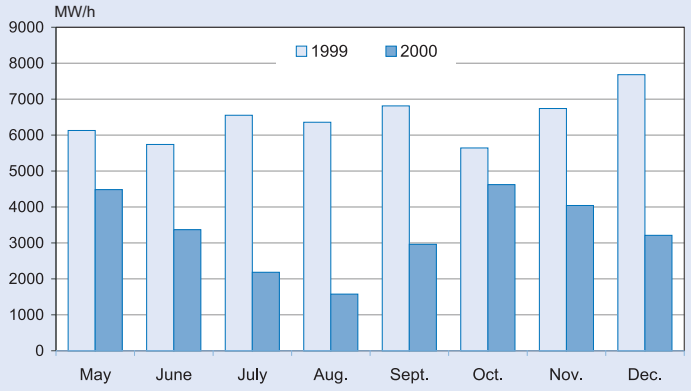
At the beginning of the reforms slightly more than 80 percent of the generation capacity in California was owned by three private electricity companies. In order to create a competitive wholesale market the distribution companies were forced to divest themselves of at least half of their generation facilities (Joskow 2001, 376). An independent system operator (ISO, in California: CAISO) was established to serve as a platform for wholesale and retail market trading and to supervise the transmission grid (which includes running various energy balancing, ancillary service, and congestion management markets). In addition the California Power Exchange (CALPX) was created to run day-ahead and hour-ahead hourly public wholesale markets for sales of energy. Both are non-profit corporations.

Despite the new possibilities of changing their energy provider, few customers took that option. At the same time retail prices of the incumbents were lowered by 10 percent and then fixed by law (until stranded assets were fully paid off or, at the latest, until 2002). All this happened under the assumption that wholesale power prices would always stay significantly below the regulated retail price. The three big providers were still serving about 88 percent of total demand, but they had divested the majority of their generating capacities before. They were thus obliged to buy a large fraction of the electricity, which was needed to serve all the customers, at CALPX and CAISO. This situation in comparison with fixed retail prices made them vulnerable for any price shock at the wholesale market. And this was exactly what was going to happen.

The slow process of licensing and completion of new power plants drove reserve capacities down by 1999. Then came the extremely hot summer of 2000. As a consequence, the electricity imports from the northern neighbouring states decreased dramatically (to a large extent the imports consisted of weather depending hydro power – see the Figure). At the same time, electricity demand rose due to the increased use of air condition as well as a booming economy.

As a consequence of rising demand and decreasing supply the electricity wholesale prices increased dramatically (from April to December 2000 about 1,300 percent) – and at the same time the providers had to serve the customers at lower and legally fixed retail

NET-ELECTRICITY-IMPORTS TO CALIFORNIA



Source: Joskow (2001) Table 4.

prices[2]. In addition the early onset of winter pushed the price for gas substantially and induced a further increase in electricity prices. A simultaneous increase in the price for emission certificates accelerated the whole process.

All these (mainly exogenous) adverse factors, emerging in combination, were certainly very problematic – nevertheless a well-developed regulatory framework probably would have been able to deal with these problems. In California this was not the case. The regulatory institutions were not able to mitigate the sector-intrinsic problems of market power (as described above) and this finally turned the balance. According to Borenstein et al. (2002) 59 percent of the electricity price increase between summer 1999 and summer 2000 was due to problems with market power. Wolak (2003) has calculated that market power (measured via the Lerner Index) of the five largest generators had quintupled between 1999 and 2000. Congestions in the grid had aggravated the "normal" market power problems.

As a result of all these factors the reserve capacities declined in summer 2000 below 5 percent, at the end of the year they were below 1.5 percent. This caused several emergencies of highest priority, but energy savings could still avert blackouts. Shortly thereafter the two largest providers went bankrupt and could not buy the necessary electricity to serve their customers. This finally triggered several huge blackouts in January 2001. Shortly thereafter CALPX went bankrupt as well and California was in the middle of its deepest electricity crisis, which has no analogy elsewhere – so far.

[2] For an illustration of the changing demand and the price developments, see Kuhlmann (2004), 59–60.

General features and institutions of the US electricity market

Although the California disaster was due to a combination of adverse weather, fuel markets and a booming economy, it is clear that it would not have happened without electricity restructuring. It is therefore worth looking at other US jurisdictions for better solutions. This particularly concerns the US federal level represented by the Federal Energy Regulatory Commission (FERC). The FERC was unable or unwilling to interfere in California to prevent the crisis. However, the FERC responded by constraining wholesale electricity prices through price caps and by trying to establish regional transmission organisations (RTOs) and a standard market design for highly centralised electricity markets[3]. The RTOs (which have not yet been established throughout the country) typically cover areas beyond single states and fulfil the same functions as ISOs including the function that used to be fulfilled by CALPX. RTOs and a skilful market design are particularly important in order to help avoid crises such as California as well as blackouts like in the north-eastern US in 2003. They require the adherence to consistent rules and an expansion of the transmission system. The latter has been particularly difficult in the US. Environmental concerns have been one reason. The other, however, is that additional transmission capacity can hurt areas with excess electricity supplies, which they would like to keep to themselves and thereby lower electricity prices in those areas. This has particularly hurt California, because it could not access eastern states for cheaper electricity.

The German electricity sector

Germany possesses a closely meshed electricity grid, where congestion or breakdowns are a rare exception and events like the ones in California (in 2001) or the north-eastern US and some European countries (in 2003) seem quite unlikely at the moment. The German market for electricity was opened for competition in 1998 – in theory even to 100 percent, which means that all (industry and private) customers can choose their individual provider. At that time

[3] The FERC only has jurisdiction over transmission networks and wholesale transactions so that distribution companies are regulated by state public utility commissions only.

this went far beyond the EU guidelines and Germany seemed to be a precursor as regards electricity liberalisation.

Actually the market is still dominated by the originally dominant providers, who have merged from six to four since the liberalisation[4]. They have an aggregate market share of about 80 percent in electricity generation (without accounting for any cross-shareholding) – another 10 percent is produced by roughly 900 regional and municipal providers and the remaining 10 percent is produced by Deutsche Bahn AG and the manufacturing industry for their own electricity requirements. The same four dominant companies own the transmission grid. The regional providers and municipal utilities are very numerous, and one might think this should be enough to initiate competition[5], but in many cases the big four hold major shareholdings in these utilities. Between 2000 and 2002 RWE Energie and E.on acquired new stakes in about 40 utilities without causing an intervention of the Federal Cartel Office (Leprich 2002, 4).

The Energy Law of 1998

Whether competition in the electricity sector of an economy can emerge or not critically depends on the design of the market rules. This is particularly the case for the rules concerning network access. As described above in the section on natural monopoly,[6] the grid continues to represent an essential facility or monopolistic bottleneck. The access to this facility is crucial for potential and actual competitors and thus also for efficient competition.

The European electricity directive that was in force at that time (96/92/EG) gave member states the choice between negotiated[7] or regulated[8] third party access (TPA) and the single buyer[9] procedure. Germany was the only country choosing the negotiated TPA – which was actually implemented in several trade association agreements between energy producers and industrial consumers – where it was quite easy for the "old bulls" to make life hard for their competitors. Many of these competitors have vanished since then. These agreements were quite favourable to the incumbent network operators. This comes as no surprise, as not a single stakeholder of the potential competitors was involved in the proceedings. In the first *agreement* (concluded in May 1998) transmission was defined as point-to-point delivery and every electricity trader had to place a contract on the precise wheeling of power, which was obviously quite obstructive for effective competition. Therefore in December 1999 the associations approved a *second agreement*. This time the involved parties (in the meantime there were 6 instead of 3) assured simplified network access and created the preconditions for trades in a power exchange. This was aided by the so-called connection-point-model (*Anschlußpunktmodell*). In this scheme the end-customer paid an access fee to the distribution-network provider to whom he was immediately connected. He thereby obtained access to the entire German electricity network (at all voltage levels) and could then freely choose his provider. In other words, he had to sign two new contracts and bear some additional switching charges if he wanted to change his provider. Moreover there was no regulator in charge of monitoring whether the switching process was delayed deliberately by the respective incumbent. All these direct costs and indirect obstacles certainly played a decisive role in the decision of customers to change their provider. Less than four percent of the German households changed their energy provider after the liberalisation – an absurdly small number compared to 40 percent in the UK.

Finally in a *third attempt* (or rather an addendum to the second) in December 2001 the double-contract-model was abolished, but the pricing principles became more complicated than before. *Another supplement* was added in April 2002, where a cost-based real pre-tax return on equity was fixed at 6.5 percent, which has been widely criticised for its inflating effect on the net user fees.

The price development can serve as an indicator for the effectiveness of all these agreements. The electricity tariff fell initially (between 1998 and 2000) a little for households (1.8 percent per year) and quite considerably for the industry (13.7 percent per year), but in the following three years this process was in-

[4] VEBA and VIAG merged with E.on in 2000, and VEW was acquired by RWE. Apart from that there are Energie Baden-Württemberg (EnBW, which is mainly owned by Electricité de France) and Vattenfall – a Swedish state owned enterprise, which is also active in Finland and Poland.
[5] The regional providers mainly fulfil distributing and marketing services, but several of them also produce energy. Indeed some of these small municipal utilities meanwhile try to merge with others and start to counterbalance the big four. See for example Süddeutsche Zeitung (2005).
[6] See the paragraph on the Natural Monopoly properties in electricity.
[7] Under negotiated TPA producers and consumers of electricity will contract supplies directly with each other, but they will have to negotiate access to the network with its operator.
[8] In case of regulated TPA the price for the use of the transmission and distribution systems can, however, not be negotiated. It is regulated by a national regulatory agency (NRA).
[9] The single buyer has been defined in the directive as a legal person responsible for the unified management of the transmission system and/or for centralised electricity purchasing and selling. This means that the single buyer would normally, but not necessarily, also be the transmission system operator.

verted and the prices rose again (10.6 percent for the industry and 4.6 percent for households per year; BMWA 2005c). The Ecotax (introduced in 1999 and further increased in four steps) inflated this price increase, but this did not change the story.[10] In June 2003 the European Commission finally abolished the possibility of negotiated TPA and decided that in all member states a national regulator had to be established until July 2004 (Directive 2003/54/EC). From that moment the German "special way" was officially designated a dead-end street.

The new Energy Law of 2005

Soon it became obvious that the deadline for the enactment of a new law would elapse without any new legislation being enacted. Finally, in July 2004, the federal cabinet agreed upon a first draft of the new energy bill. But it took another nine months of negotiating before a concrete law with all its prescriptions entered the final legislative process. On 15 April 2005 the Bundestag (German Parliament) finally passed a new energy law (which still has to pass the Federal Council, the German upper house, consisting of the Länder representatives[11]). Among the important alterations or improvements of the new law are the following.

First of all there is the legal and operational unbundling of generation and the networks. This measure should ensure that there are no incentives for the grid operator to discriminate against other network users in favour of its own subsidiaries. All vertically integrated electric power companies with more than 100,000 customers have to unbundle their network activities from generation and marketing – legally and operationally, but not in terms of ownership. For transmission companies (the big four) this rule will become effective immediately – the deadline for distribution companies is July 2007.

The German regulatory authority for telecommunication and postal services (RegTP) will inherit the supervision of the electricity and gas sector (as well as for the railway sector) and will be renamed "Federal Network Agency" ("*Bundesnetzagentur*"). A major task of this agency will be to set (or to specify the details of) the terms and conditions for network access, including price regulation, and to monitor compliance with these rules. It will further have some monitoring duties, a voice in the unification of contractual obligations and the task of settling disputes. Its discretionary power or ex-ante competencies, however, are quite limited. Some examples of the discretion it lacks are given below.

At any time the incumbent can – without previous notice – terminate the contract with the competitor who needs access to the grid. As explanatory statement such a measure should be "upon good cause", but this is a discretionary decision by the respective network operator, with no exertion of influence by the regulator. This gives the incumbent again a strong position.

Concerning the transaction costs associated with the network access it is intended that the incumbent network operators create standardised rules, but here again the regulator has no say in this matter. Its influence is also limited in the access to distribution networks, where the regulator can only affect the settlement procedure and the corresponding specification of a uniform price that has to be paid for deviations from predetermined load profiles.

Nevertheless, following several complaints of the energy-consuming industry and the Länder (Federal States) on the draft bill, the federal government, in the bill passed by the Bundestag, has somewhat enlarged the discretion of the regulator, in particular, with respect to the introduction of incentive regulation. After all the fierce criticism voiced in the course of the legislative process, the federal government has authorised the regulatory agency to further develop and to implement the concept for a price-cap or revenue-cap approach. Furthermore the regulator has a say in determining the conditions and notice periods, which are relevant for a change of the energy provider.

For the starting phase of the legislation, a rate-of-return provision will prevail with an allowed return on equity of 6.5 percent real pre tax. This will be replaced after one year by a new calculation provided by the regulator or by incentive regulation. The incentive regulation can come either in the form of price caps or revenue caps. The cap period has to be between two and five years. The scope of each cap is left open and can be restricted to certain voltage levels and networks. Adjustment factors include automatic pass-through of exogenous cost changes (e.g.,

[10] Even after tax deduction the average yearly price increase for households between 2000 and 2002 was three times higher than in the eight years preceding the liberalisation. In the industry, where price increases were even larger, 80 percent of the tax was initially remitted – for energy-intensive enterprises this is still the case.
[11] The current state of affairs is that the Länder representatives rejected the law (on April 29th) and remitted it to the mediation committee, which is supposed to agree on a compromise till June 15th. The law can then become effective on July 1st.

due to tax changes), inflation adjustments and incentive factors (known as "X"-factor in the literature on price caps). If price caps are chosen they should include some adjustment for quantity changes. The incentive factors for each cap period should be based on benchmarking relative to cost calculations for peer networks. The incentives can be set for each network individually or for groups of networks. Most of the details for the methods to be used in implementing the incentive provisions will be developed in bylaws enacted by the government, while the execution and decisions about individual networks or groups of networks will be made by the Federal Network Agency. At this point the new price regulation only refers to changes proposed by the grids for existing prices, but the political debate may form an ultimate compromise that would establish starting prices for all network access based on the new law.

Proposed bylaws to the Energy Law cover the pricing approach in detail. Network services are to be priced on the basis of maximum demand of a user during the relevant pricing period combined with a kWh price, which itself depends on annual load duration. This leads to a refined maximum demand tariff, where the total payment of a user is the sum of the maximum demand payment and the kWh used times the kWh fee, which itself depends on the relationship between peak and average use. As an alternative for users without maximum demand metering possibilities, grid access prices may be based on kWh usage alone.

Quite similar to the former framework are the rules concerning benchmarking, system responsibility and network access in terms of a single-point market. This means that network companies will continue to be responsible for the system integrity and are therefore entitled to take measures in their own discretion against any malfunctioning of the grid. This function is aided by the duty of generators to form balancing units ("*Bilanzkreise*"), which guarantee balancing of generation and load for each generator or groups of generators at any point in time (on a fifteen-minute basis).[12] This simultaneously means that generators self-schedule, while the grid is responsible for back-up capacity, spinning reserves and generation to cover line losses. The purchase of such capacity has to occur in scheduled auctions.

The new law obliges transmission and distribution network owners to regularly report to the regulator about network capacity utilisation, physical condition and capacity expansion plans. They also have to report expected demands for network capacity in the future and plans for dealing with those demands and the expected capacity utilisation resulting from expansion plans.

Critique of the German approach

The proposed new German energy law is moving the electricity sector from the trade association agreements of network access to the regulation of electricity networks. In doing so, Germany complies with EU Directives without making a full break with the past. So far Germany has no experience with federal electricity regulation and it is thus appropriate to criticise it so that areas of possible improvements can be identified early on.

A feature distinguishing this law substantially from the American tradition is the limited amount of discretion given the regulator under the law. While American regulators are provided with fairly broad rules of law but constrained by tight rules of procedure (plus control by the courts), the new German energy law goes into the nitty-gritty of regulatory decision making by prescribing methods and outcomes in great detail. This is why an overhaul in the near future may become necessary. The overhaul would have to achieve what otherwise would have been done by an expert regulator. Because such an overhaul depends on the same legal process that has been so incumbency-friendly in the past, it could be a bad omen for future developments and may hinder the development of truly new competition which would depend on infrastructure investments that require stability in the regulatory environment and confidence in the pro-competitive nature of regulation. The lack of regulatory discretion has been justified with constitutional constraints on the actions of civil servants and administrations but the current bill and proposed bylaws clearly constrain the regulator more than the German Telecommunication Act of 2004 does with respect to telecommunications regulation.

Beyond the establishment of regulation by agency the most important break with the past is that the new energy law proposes separating the network parts of vertically integrated electric utilities from the generation and marketing parts. This separation is going to occur with respect to their legal status, their operation and informational links. It is, however, not a separation of ownership. It will take several

[12] They fulfil similar functions to the Balancing and Settlement Code in the UK. See ELEXON (2004).

years to gain sufficient experience to find out if the separation will lead to true independence such that the new network entities act neutrally towards outside generators and marketers. In particular, network expansion decisions may well continue to be influenced by the owners as generators who could favour their own generating plants. However, separation as planned may create enough distance from the former company so that the common interest subsides. For this to happen and in the interest of efficiency and innovation it would be important for the new network companies to develop into a viable and interesting business. For this to happen, the generation section would have to be unbundled from transmission and distribution in terms of ownership – which may raise further problems. In this kind of arrangement it is not so problematic that economies of scope are lost (this would already happen in operational unbundling), but legal questions of interference with private property rights may arise.

The sections of the proposed law and its bylaws on price regulation are highly detailed and certainly will keep economists and lawyers (and the Federal Network Agency) busy for a long time. They include very specific rules for rate-of-return regulation (including the allowed return on equity of 6.5 percent real pre tax), and two long sections each on incentive regulation and cost comparisons between companies. Thus, there is substantial room devoted to benchmarking as a means for incentive regulation, but it is not made clear how those rules will give the firms possibilities for developing innovative business strategies. In particular, by not distinguishing the rules for distribution companies from those for transmission companies the impression is given that both will be treated equally. However, there are about 900 distribution companies, which is an ample set for benchmarking, but only four transmission companies (which, in addition, should actually be run as a single entity). The last-minute inclusion of international benchmarking was therefore direly needed. A similar provision has proved to be very effective for the regulation of access and interconnection in telecommunications. Even if one does not like rate-of-return (or cost-plus) regulation because of its lack of efficiency properties, it may be appropriate to provide a starting point for tariffs that assures viability of the regulated firm and could lead to incentive regulation. Also, rate-of-return criteria could be called for, when incentive regulation needs to be adjusted after a number of years. The price caps or revenue caps allowed by the law as incentive devices are framed with sufficient flexibility so that they could become effective and efficient devices in the hands of a skilled regulator. This flexibility, however, could also lead to weak or distorted incentives, depending on the strength of the bylaws to be enacted by the government and on the expected interference of administrative courts with the regulator.

The bill leaves open if price caps or revenue caps should be used for incentive regulation. Revenue caps have been used elsewhere as a means to constrain total network output. The idea behind this is that electricity generation and electricity networks are environmentally detrimental so that output should be constrained. At the same time, electricity users should not have to pay too much for electricity services. This may be a laudable combination of values. However, it is well known that two rather divergent objectives cannot usually be achieved with a single instrument. Revenue caps, in particular, can lead to an inefficient reduction of output. Price caps are generally more efficient for electricity users, while environmental goals have to be achieved with other instruments than network pricing.

It is unclear at this time whether cross subsidization of generation companies by grid companies under common ownership remains a possible option under the new law. The regulated prices themselves are unlikely to allow for cross subsidies. However, siting and scheduling decisions may favour affiliated generation companies. Only full ownership separation can avoid such conflicts of interest.

The law will give the network companies system responsibility, meaning that they will actually have substantial regulatory functions for the electricity market. Whether this is preferable to the Independent System Operators (ISOs) in the US, remains to be determined empirically. US ISOs are nonprofit institutions run by experts and now supervised by independent bodies. From an economic efficiency perspective they may be influenced by professional engineering standards rather than by economic incentives. In contrast, the German network companies may be subject to overcapitalisation biases from the rate-of-return regulation aspects of the proposed law, although this danger should subside if the regulator moves quickly to incentive regulation.

The use of balancing units as a tool for achieving system-wide balance of generation and consumption at any time is an interesting compromise between individual self-scheduling of generating units and aggre-

gate scheduling by the network operator based on short-term bidding of all generation. Instead, the German system requires bidding only for backup generation, spinning reserves, line losses and ancillary services. Experiences with balancing units have been favourable in the past.

A very important and questionable feature of the German law is its insistence on viewing networks geographically as single-point markets. This is quite appropriate for distribution networks that are typically restricted in geographic size and for which customers requiring special access lines or additional capacities could be accommodated on an individual basis. High-voltage transmission networks, however, not only extend geographically, but also have a certain geographical structure. While there exists some consensus that, except for star-shaped transmission networks, distance is not an appropriate measure of transmission costs, the analysis of network costs suggests that network congestion is typically not evenly distributed geographically and neither are transmission losses. This means that it is either best to view transmission as occurring point-to-point or as using congestible transmission links based on Kirchhoff's law. In contrast, the single-point view of a transmission network would only be appropriate for short-term dispatch if there is no congestion at all in the network or if the nodal price differences are the same between all the relevant generation nodes and consumption nodes. Even if one of these two conditions is satisfied for some time the single-point view of the network gives no guidance for the efficient geographic distribution of transmission capacity expansion investments. While excess transmission network capacity may prevail in Germany at this time, such excess may vanish in the future, due to increased competition in generation or to environmental problems in siting new transmission lines. Whether excess capacity is efficient or not depends on the effect of transmission capacity on competition. In principle, excess capacity in transmission increases the market size for competing generators. However, the costs of excess capacity can be high, while the benefits of increased competition in generation are in the nature of Harberger triangles, which tend to be small.

Investment and usage decisions could also be adversely affected by the pricing approach for network services taken in the proposed legal prescriptions, based on maximum demand tariffs. Maximum demand tariffs have well-known efficiency problems if users are heterogeneous in the time profile of their demands. They are efficient only if peaks are coincident for all users. This is, however, quite unlikely. As a result, there will always be users whose peak demand falls outside the network peak. They would be induced by maximum demand tariffs to reduce consumption at off-peak periods and would face a zero price at the network peak. Refinements in the German maximum demand tariff may help avoid some of the peaking problems because the likelihood of coincident peaks increases in the ratio between average and peak load and because usage prices are not zero. However, the incentives to spread the load more evenly and move it away from the peak are definitely muted under the German system. Also, nonzero usage prices are inefficient at times of excess capacity.

Combining the potential inefficiencies from the single-point view of the network and the maximum demand tariffs can lead to inefficient investment decisions of generators in terms of location and peaking economies. This is something that the regulator may discover from the reports on capacity utilisation and expansion plans that the network owners have to deliver. If the utilisation figures are based on distorted prices this would bias expansion plans based on them. However, although the resulting capacities could be inefficient, this would not necessarily lead to major congestion problems.

Having criticised the German approach to pricing of transmission network services, it is worth conceding that the simplicity of having a single price schedule and a single service could save transactions costs and avoid price fluctuation and geographical price dispersion. This advantage, however, is paid for by potentially serious inefficiencies that are expressed in high costs of backup power and ancillary services needed to balance and stabilise the networks and in inefficient investment and usage decisions.

Eventually the enlarged influence of the regulator with regard to changing providers is definitely an important improvement. All the past delays and uncertainties were certainly an important reason for many customers to refrain from changing their providers and therefore an impediment for effective competition.

Conclusions

While we have provided a highly critical view of the German electricity sector reforms, they clearly mark a distinct progress over the status quo. Furthermore,

Germany is unlikely to fall into the same traps as California. Neither is there constraining end-user price regulation nor are network bottlenecks likely any time soon. However, in spite of the progress Germany and California share market power problems in generation. In California (and the US in general) market power persists in spite of small market shares of individual generators. It is the result of short-term transactions in very open markets that facilitate strategic decisions. The US response has been largely price caps for short-term wholesale transactions. In Germany, market power in generation is associated with high market shares and – until now – with vertical integration of generation, transmission and (partially) distribution. The latter cause of market power is likely to vanish if the new law is applied vigorously. However, market concentration can only be reduced either by rigorous application of competition policy or by increasing the electricity markets beyond the German borders. None of the German generating companies is big enough to warrant divestiture. Thus, competition policy can only prevent further increases in concentration via mergers. Increasing the geographic scope of electricity markets requires sufficient transnational transmission capacity in neutral hands. It also requires sufficient generation capacity in neighbouring countries.

One reason for market power among generating companies in California has been the lack of long-term contracts for electricity. The availability of such contracts in Germany should therefore reduce market power. However, long-term contracts signed under unfavourable terms by German communities with E.on very recently show that long-term contracts do not always have this property.[13] They also make one pessimistic about the view of those communities about the market power reducing effects of the new legislation.

The potential benefits of electricity sector reforms include cost savings and demand responsiveness in generation, a better mix of generating facilities and a reduction in mark-ups for final users. In the U.S., cost savings and a better mix in generation facilities have been realised. Market power was not preventing those because of fairly easy entry into generation. Whether high market concentration in Germany prevents such entry remains to be seen. High mark-ups over costs seem to prevail in Germany for transmission and distribution as well as for generation. The newly established regulation may reduce the former mark-ups but only increased competition can reduce the latter.

[13] For these contracts, see Hummel (2005).

References

Baumol, W. J, J. C. Panzar and R.D. Willig (1982), "Contestable Markets and the Theory of Industry Structure", Harcourt Brace Jovanovich, San Diego.

Bauchmüller, M. (2005), "Die Kraft der Kommunen", *Süddeutsche Zeitung*, March 5/6, 32.

BMWA (Bundesministerium für Wirtschaft und Arbeit – German Federal Ministry for Labour and Economics 2005a), Strom Netzzugangsverordnung, NZV, 14 April 2005.

BMWA (2005b), Strom Netzentgeltverordnung, NEV, 14 April 2005.

BMWA (2005c), "Energiedaten, Nationale und Internationale Entwicklung" (Energy-Data, National and International Developments), http://www.bmwi.bund.de/Navigation/Service/Bestellservice/publikationen-energiepolitik,did=51884.html

BMWA (2005d), "Zweites Gesetz zur Neuregelung des Energiewirtschaftsrechts", 15 April 2005.

Borenstein, S., J. B. Bushnell and F. A. Wolak (2002), "Measuring Market Inefficiencies in California's Restructured Wholesale Electricity Market", *American Economic Review* 92 (5), 1376-1405.

ELEXON (2004), "ELEXON – The Balancing and Settlement Company", available at http://www.elexon.co.uk/documents/Publications/Publications_-_Publication/BSC_Company_final.pdf.

Hogan, W. W. (1992), "Contract Networks for Electric Power Transmission", *Journal of Regulatory Economics* (4), 211–42.

Hummel, M. (2005), "Das Preisdiktat des Energie-Riesen", *Süddeutsche Zeitung*, 2 April 2005.

Joskow, P.L. (2001), "California's Electricity Crisis", *Oxford Review of Economic Policy* 17(3), 365–88.

Kuhlmann, A. (2004), "Die Elektrizitätskrise in Kalifornien – oder: Wie riskant ist die Liberalisierung von Netzsektoren?", *List Forum für Wirtschafts- und Finanzpolitik* 30(1), 49–68.

Leprich, U. (2002), "Stromwettbewerb durch Regulierung", Institut für ZukunftsEnergie-Systeme, http://www.izes.de/downloads/stromwettbewerb.pdf (accessed 2 May 2005).

Süddeutsche Zeitung (2005), "Die Kraft der Kommunen", March 5th/6th, 32.

Vogelsang, I. (2004), "Network Utilities in the U.S. – Sector Reform without Privatization", *CESifo Working Paper* no. 1142.

Wolak, F. A. (2003), "Measuring Unilateral Market Power in Wholesale Electricity Markets: The California Market, 1998–2000", *American Economic Review* 93(2), 425–30.