

Surrey Energy Economics Centre

**ELECTRICITY PRICING: CURRENT PRACTICE
AND FUTURE DEVELOPMENT**

by D Hawdon, E Marshall and R Orson

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The papers arose out of a seminar on Electricity Pricing: Current Practice and Future Development held at the University of Surrey in January 1992

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CONTENTS

	Page Nos
REGULATION AND THE POOL	1 - 6
Dr Eileen Marshall Office of Electricity Regulation	
CURRENT PRACTICE AND FUTURE DEVELOPMENTS	7 - 13
Professor Ray Orson Visiting Professor, University of Surrey	
CAN ELECTRICITY PRICING BE IMPROVED?	14 - 24
David Hawdon Surrey Energy Economics Centre, University of Surrey	

REGULATION AND THE POOL

Dr Eileen Marshall
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THE REGULATORY FRAMEWORK

The task of the Director General of Electricity Supply and the Office of Electricity Regulation which he heads, is to protect customers in terms of price and the quality of service they receive and to promote competition. These two aims are complementary in that the more effective choice customers have the greater their protection is likely to be.

In terms of industry structure and regulation the four activities of generation, transmission, distribution and supply have been essentially separated from each other. Transmission, distribution and supply are directly regulated but generation is not. The scope for encouraging competition in transmission and distribution may be limited, necessitating enduring regulation. But generation and supply are potentially more competitive and the Director has a primary duty to promote competition in generation and supply.

However, at Vesting, to secure an orderly transition to a fully competitive market in supply, the Secretary of State phased in competition by the introduction of a digressive franchise market for the Public Electricity Suppliers. That franchise is scheduled to decrease in 1994 and be removed completely by 1998. Hence with competitive supply only open to customers with over 1MW maximum demand, supply as well as transmission and distribution is a regulated activity.

Generation was not directly regulated at Vesting, because arguably it was unnecessary. In the short term electricity generated in France and Scotland as well as that produced by Nuclear Electric represented competition for output from National Power and PowerGen. And whilst National Power and PowerGen have substantial market share there is nevertheless the prospect of rivalry between them in bidding into the Pool, as each generator submits prices schedules to the National Grid Company (NGC) the day ahead of despatch and NGC then meets demand at the lowest cost. In the longer term new generators using new technology and constructing plant much more quickly than in the past, were expected to enter the market and hence increase competitive pressure.

REGULATION AND THE POOL

Subject to certain exemptions all generators capable of exporting more than 10MW of electricity are required to be licensed, as are all suppliers supplying more than 500KW of electricity. Licences were issued to CEGB successor companies at Vesting by the Secretary of State. All subsequent licences are issued by the Director General in accordance with a general authority given to him by the Secretary of State. This authority requires certain conditions to be included in licences. One such condition is that licensees both suppliers and generators must trade through the Pool. The Pool is thus a central feature of the restructured electricity industry, since virtually all the electricity in England and Wales is sold into and bought out of the Pool.

Pool members are required to trade electricity in accordance with the Pooling and Settlement Agreement (PSA), a long and complex document. The Pool rules, which set out the trading arrangements between Pool members, cover more than 250 pages of the Pooling and Settlement Agreement. An Initial Settlement Agreement is in place until March 1993 providing a relatively simple mechanism for introducing changes to the PSA during the early days of the market.

The Pool is an unincorporated association of its members. The Pool Executive Committee (PEC) has ten members, five generators and five suppliers. National Power, PowerGen and Nuclear Electric have seats and there are two seats for representatives of smaller generators (including the French and Scottish Generators). On the suppliers side, four seats are reserved for the twelve regional Electricity Companies and one seat for independent suppliers. The Director has observer status on the Pool Executive Committee and on the various sub-committees that report to the PEC.

The Director has several specific rights and duties in relation to the Initial Settlement Agreement and the Pooling and Settlement Agreement. Some of the most important of these are that the Director can require PEC to consider any proposal he wishes to make. The Director's consent is also required before any alteration is made to the Pool Rules. In addition individual pool members have a right of appeal to the Director in respect of any resolution passed or rejected by Pool members. There is no power to directly instigate changes to the terms of the Settlement agreements if this appeared necessary to safeguard the public interest. Nevertheless besides the scope afforded by his general competition powers, the Director does have the possibility of initiating change by proposing modifications to the licences of Pool members.

OFFER'S POOL PRICE INQUIRY

It is OFFER's task to protect the public interest in the Pool. To this end we have for example pressed for more information to be made available in the public domain, supported moves to simplify the Pool membership conditions thereby helping to facilitate new entry, and (with PowerGen) developed a works programme to enable companies with their own generation on-site to trade their electricity through the Pool on a net as opposed to a gross basis. Most significantly, in Autumn 1991 OFFER launched an enquiry into sudden price aberrations such as occurred in September 1991 and into recent trends in pool prices.

The Pool Price Inquiry Report¹ was published in December 1991. The main conclusions and recommendations were summarised in the Report as follows:

Spikes in Pool Prices

The spikes on 9 September 1991, when prices increased from 3p to 16p/KWh for three half-hours, was exceptional. Spikes have not constituted a serious and persistent phenomenon suggesting that the Pool is fundamentally flawed. NGC, in association with the Pool Executive Committee, is already reviewing the computer programs which schedule plant and set price. It is also examining how customer response can be better incorporated into its predictions of final demand used in setting Pool Prices.

General Level of Pool Prices

Average Pool Prices increased by 29% in the first half of financial year 1991/92 compared to the first half 1990/91; this was mainly accounted for by increases in System Marginal Price. However, in view of the significance of contracts, particularly those signed before Vesting, it is not possible to make an unambiguous judgement whether the Pool Prices have hitherto been too high or too low. There is no doubt that many customer, particularly in the first year of operation, have benefited from intense rivalry between generators which led to low prices both in the Pool and in direct sales contracts, and that Pool Prices alone would not cover the generators' total costs in the longer term. Equally, there is no doubt that the two major generators have recently been able to increase Pool Prices significantly. There has also been an element of artificiality about Pool Prices which is unsettling for customers and generators alike, and which gives misleading signals to both groups.

¹ Full Report available free of charge from OFFER Headquarters, Hagley House, Hagley Road, Birmingham B16 8QG, England UK.

Price controls on generators cannot be ruled out: however, the right approach is not to abandon competition but to make it work. The appropriate policy is to promote further competition in generation: to identify and eliminate any practices which distort or manipulate pricing in the Pool; and to identify and impose obligations on Pool members which prevent the exercise of monopoly power, make more transparent the working of the Pool and provide better information on which Pool members and others can make decisions.

Some have argued that the only way to achieve effective competition is to break up the major generating companies. These are early days yet, and the operation of the Pool has been much influenced by the arrangements put in place before it began operations. There is also encouraging evidence of rivalry between the various incumbent generators, and of entry by new independent power producers. At the same time, emerging experience in the Pool suggests that the dominant market position of the two major generators gives them the ability to influence and control Pool Prices. That is not likely to inspire confidence in the Pool, nor to be conducive to further new entry. If, in future, consumers and suppliers seem inadequately protected by the degree of competition obtaining in generation, I do not rule out the possibility of a reference to the Monopolies and Mergers Commission.

Capacity Payments

Capacity payments have been substantially higher than last year; they account for about 14% of the increase in Pool Prices. The increases arise from retirements of plant and lower declarations of plant availability.

During one period, PowerGen followed a policy of declaring some plant unavailable which was subsequently declared available. This policy increased Pool Prices, and introduced greater uncertainty into the market. I conclude that it represented an abuse of the company's dominant market position.

The interests of customers would be served, and confidence in the Pool increased, if the two major generators were not able to manipulate availability so as to exercise monopoly power. I therefore propose a new licence condition on National Power and PowerGen Explicitly to prohibit monopolistic or anti-competitive behaviour in relation to the availability of plant and the closure or mothballing of stations. It would oblige a licensee to publish information relating to these matters, and to establish arrangements under which it will seek to establish whether, and if so at what price, others would be willing to purchase any power stations which it intends to close or mothball.

The Pool is also modifying its procedures to limit the adverse effect of plant redeclarations on Pool Price.

Uplift

In the first six months of 1991/92, Uplift payments have been roughly double those in the previous year. Sixty per cent of this increase reflects higher payments for plant which is constrained on or off the system. The two major generators have increased their bid prices for constrained-on plant.

The increases in Uplift are a justifiable concern for customers and suppliers. At the same time, such prices may be necessary to keep such plant on the system and can send useful signals for future investment in plant and transmission. Appropriate price controls would not be easy to design and enforce.

I intend to monitor closely the prices of constrained-on plant, and to call on dominant companies to explain significant variations in their bidding patterns. I will need to satisfy myself that their availability and bidding are not anti-competitive. I am investigating further the appropriate arrangements for National Power's plant at Fawley. I have also undertaken to report to the Pool Executive Committee on gas turbine plant, and expect to report on both issues early in the new year.

Fundamental Pool Review

I recommend that Pool members, in their forthcoming Fundamental Review, give consideration to the issues raised in this Report, particularly:

- o the merits of alternatives to the present LOLP-VLL mechanism for determining capacity payments;
- o the basis of determining and charging out Uplift payments;
- o the possibility of demand-side bidding.

FOLLOW UP TO THE POOL PRICE INQUIRY REPORT

The measures proposed in the Pool Price Inquiry Report, should promote a more competitive market by providing more information on availability and facilitating the identification of any anti-competitive practices in the Pool. We have had fruitful discussions with the companies concerned on the detail of the new licence condition. It is also appropriate that there should be a comparable condition on Nuclear Electric as on the other two major generators,

requiring information to be provided about availability of plant. Nuclear Electric have indicated their willingness to discuss a licence modification to this end.

ELECTRICITY PRICING: CURRENT PRACTICE AND FUTURE DEVELOPMENTS

Professor Ray Orson
Visiting Professor, University of Surrey

The restructuring and privatisation of the Electricity Supply Industry has, I believe, already resulted in major achievements. It has:

- made clear, even apparently to those who should already have known, the real costs of nuclear power;
- substantially increased the pressure on British Coal to bring coal prices into line with market prices;
- made available, for the first time, substantial quantities of natural gas for power generation.

All these achievements could have been made, given the political will, without the need for restructuring and privatisation. This points to a fundamental deficiency of nationalisation.

In addition to these benefits, substantial improvements in productivity and operating efficiency are being achieved in all parts of the new industry, often by managers who only four years ago would have sincerely denied that such improvements were possible. Again, it is wonderful how the cultural change from nationalised monopoly to competition can alter what are regarded as unchallengeable facts.

We are still at the beginning. The structures and commercial arrangement put in place so far have been substantial steps forward but a lot more needs to be done in the years ahead if the full benefits of a competitive market are to be captured.

This applies particularly to the Pooling and Settlements Agreement. The Department of Energy describes this Agreement as lying "at the core of the industry structure". It is interesting to observe, however, that nowhere in the 1988 White Paper is there any reference to the Pool. Clearly, the Secretary of State and his advisers had much to learn about the Industry in the two years or so between the White Paper and the Vesting of the new companies.

The Pooling and Settlement Agreement defines the Pool Selling Price as:

$$\text{MEP} + \text{LOLP (VLL - MEP)} + \text{Uplift}$$

where Uplift includes payments for ancillary services, reserve, availability, transmission constraints and changes in availability. It takes, I understand, nearly 1,000 pages to define these terms and specify how they are to be calculated.

Somehow, this does not look like the definition of a competitive market price, even after allowing for the fact that some of these terms would be regarded with other commodities as akin to delivery charges. In addition and as is well-known, any trade agreement like the Pooling and Settlement Agreement encourages the participants in the market to play according to the rules and not according to the real needs of the Market.

The Government was committed in the privatisation of electricity to the introduction of competition in electricity generation and electricity supply. Why, then, did it accept a Pooling and Settlement Agreement to lie "at the core of the industry structure" in spite of the danger that the Pool would become, in the dictionary definition, "an arrangement for eliminating competition".

The main burden of responsibility for this can be put upon those who, 150-200 years ago, had the genius to discover electricity but who unfortunately did not also discover a means by which electricity could be stored. If only electricity could be stored, all the complexities of the calculation of Pool prices could be eliminated and we would be left simply with MEP, which is the equivalent of the competitive market price for other commodities.

This unfortunate technical characteristic means that electricity has to be produced at the moment of consumption, that it is impossible to identify any customer's consumption of electricity with any producer's production and that some sort of pool is an essential adjunct to an electricity market. It is more rewarding to consider how the Pooling and Settlement Agreement can be improved than it is to consider how it can be abolished.

The first thing that needs to be said in this respect is that any changes in Pool rules should have the aim of encouraging competition and not of giving an advantage to one or other of the vested interests involved. It is pleasing that in his recent Report on Pool prices, the Director General said that the right approach is to make completion work.

I would suggest two necessary conditions for achieving this objective. There are, no doubt, more.

The first relates to the pricing of electricity to final customers. Pool prices have been as high as about 35p per kWh. They can go as high as £2.00 per kWh. Suppose I were to tell you that the Pool price is now, at this moment, 40p per kWh. What would you do about it? Some of you may be very large industrial customers and you might have been told yesterday that a price like this was expected. You might well have instructed your factory to reduce its demand for electricity at around this time today. What you would not do, and no-one in this room would do it either, would be to telephone home now and make sure that

all unessential uses of electricity were switched off. Why? Because at home you are being charged something like 7p per kWh for electricity and not the assumed Pool price of 40p.

Here lies one essential problem with an electricity market. While generators and electricity suppliers happily (or unhappily!) watch the real time half-hourly fluctuations in the market price, the vast majority of customers who create the demands they have to meet are totally indifferent. In other words, we have a supply curve for electricity but we do not have a demand curve.

One can say that the Pooling and Settlement Agreement provides the answer to the question, "What is the sound of one hand clapping?".

My first necessary condition for making competition work is, then, that electricity customers should be exposed to real time pricing, so as to create a demand curve for electricity. The DGES clearly appreciates this point because, with his eye on the time, not too distant, when the RECs' franchises will be abolished, he has asked that steps be taken to introduce more sophisticated metering. You cannot have an electricity supply from a supplier other than your REC without real time metering.

The absence, at present, of real time pricing for customers is the reason why it is necessary to have the LOLP x VLL term in the Pool price. With real time pricing, this term would be unnecessary.

Some may argue that it is unreasonable and undesirable to expose millions of electricity customers to the rigours of real time half-hourly pricing. If this is so, then it will be necessary to accept some limitations on the extent to which a competitive market for electricity is feasible.

In this case, the situation would be one in which larger electricity customers accept real time pricing whereas smaller customers do not. This would give rise to an interesting problem, which must already exist to some extent: is it right to expose customers who accept real time pricing to the higher pool prices created by the price-unresponsive demands of customers who do not accept real time pricing?

I will now move on to my second necessary condition for making competition work.

The Pool price, like the Bulk Supply Tariff before it, is the same throughout the whole of England and Wales. Given the different geographical distributions of generation and demand, this is clearly wrong. In fact, the cost of providing electricity to customers in the southern half of the country is higher than the cost of providing electricity to customers in the northern half. Similarly, the worth of electricity generated in the south is greater than the worth of electricity generated in the north. The differences are not trivial: there could

be increases of as much as 10 per cent in parts of the south and reductions of as much as 10 per cent in parts of the north in the prices paid by customers and received by generators located there.

It is well-known that competition and uniform prices are not compatible. Maintaining a national pool price for electricity must restrict the development of competition. I am, incidentally, a little surprised that customers in the north of the country, particularly the larger ones, and generators in the south of the country do not appear already to have complained about this situation.

Taking my two necessary condition together, what I am saying is that for competition to develop properly it will be necessary to move towards what is called real time nodal pricing for generators, electricity suppliers and final customers. This is not yet a practical possibility: it is well beyond the present abilities of computers and meters. But if competition is the objective this will eventually be necessary to reach the objective.

Some, perhaps many, will say that it is bad enough having 17,520 different prices in the year; 17,520 x 300 different prices would be an impossibility. I am merely pointing to the directions in which the Pool rules need to be changed in order to achieve the declared objective of electricity privatisation.

My second necessary condition regarding geographically differentiated electricity prices leads me neatly into a brief discussion of transmission pricing.

Transmission pricing is both a highly complex subject and, until recently, a largely unstudied one. I do not pretend to know all the questions, let alone the answers. One thing is clear to me: there are important electrical laws affecting costs and prices in transmission and it is not possible to reach correct economic solutions without taking full account of these laws.

There is a decided oddity about the structure the Government created for the Industry. While the costs of owning and maintaining the transmission network are vested in the National Grid Company, so that their Use of System charges are designed to recover these costs, the costs of using the transmission network are included in Pool prices. These "user" costs include transmission losses (included in the Pool Purchase Price) and the costs of transmission constraints and reactive compensation, included in Pool Uplift. Part of the oddity is that NGC, in its role as provider of transmission services, is not even a member of the Pool (NGC is a member in respect of its ownership of the pumped storage power stations).

This dichotomy makes it difficult, if not impossible, to get transmission pricing "right" because part of the problem is the interaction between investment costs and user costs: changes in Pool rules could affect the principles upon which NGC should be charging and vice versa.

The economic *raison d'être* of a transmission network is twofold:

- a) to reduce the costs of providing a secure electricity supply;
- b) to transport electricity from areas where it is cheap to produce to areas where it is expensive.

The first of these reasons merits further explanation. To take an extreme illustration, suppose that there are a number of unconnected nodes, each with a demand of 200 MW and generation set sizes also of 200 MW. If each set has an availability of 90 per cent, it would be necessary to have 3 sets (i.e. 600 MW) at each node to provide 99.9 per cent reliability. By interconnecting these nodes with a transmission system, the total number of sets required can be reduced dramatically and if the number of nodes is sufficiently high a generation "plant margin" of around 20 per cent could be sufficient.

Thus, investment in transmission is justified where the reduction in investment in generation is greater. This was, in fact, the main reason for the construction of the original transmission system in this country, the investment costs of which were far more than offset by a reduction in generation investment. It may well be that in today's circumstances, the size of the existing transmission system could not be justified by this reason alone.

As regards the transport justification for transmission, suppose that there is one part of the country where the cost of electricity is 2p per kWh and another part of the country where the cost is 6p per kWh. Provided that the cost of transmitting electricity is less than 4p per kWh, it will be worth constructing a transmission line between these two points.

Once this transmission line is in place, however, the price of electricity in the formerly high price area reduces to 2p per kWh plus the cost of the electrical losses involved in transporting electricity from the cheap area.

A fundamental point emerges from both these over-simplified illustrations: while the transmission company bears the investment costs, all the benefits of the investment accrue to others and ultimately, in a fully competitive market, to final customers for electricity. Part of the problem of transmission pricing, therefore, is how is the transmission company to be given incentives to invest where this would in overall terms be economic and how is it to recover its investment costs and obtain a return on its investment?

Similar questions arise concerning the costs of transmission losses and constraints. These costs are influenced by a number of factors: the configuration of the transmission network, transmission line outages, e.g. for maintenance purposes, the location of generators (which includes decisions on the retirement of old plant as well as the location of new plant), generator availability and the location of demand, including the extent of demand management.

For example, suppose that there were a transmission constraint which resulted in the price of electricity at one node being 6p per kWh whereas everywhere else it were 2p per kWh. The problem could be solved either by reinforcing the transmission system or by building a 2p per kWh generator at the expensive node - or even in some cases by customers at the expensive node adopting demand management techniques.

It should be noted that any of these actions would have the effect of reducing prices at the expensive node towards 2p per kWh. In consequence, a new generator could not rely on keeping for himself the difference between the *ex ante* 6p per kWh price and his 2p per kWh generation.

The way the Pool rules deal with these issues is not helpful. For example, they compensate generators who are unable to generate because of a constraint. While it may be thought that this is equitable in so far as long established generators are concerned, it does not seem to me to be helpful in reaching the right locational decisions if generators are to be compensated for being in the wrong place.

In addition, constraint costs are very much locational specific but the Pool averages these costs over the whole country so that, for example customers in the North help pay for constraint costs which arise in the South.

What emerges from all this is that sound solutions to the problem of transmission pricing cannot be found independently of a reconsideration of Pool rules. I do not pretend to know all the answers, but I believe that among the ingredients of a theoretically sound solution will be found the following:

- a) because the need for transmission is created by geographical differences in electricity prices, real time nodal pricing must figure in the solution to transmission pricing problems, as it does in the solution to some Pool pricing problems;
- b) a mechanism is needed whereby the differences in real time nodal prices accrue to NGC as part of NGC's income;
- c) NGC's incentive, in the interest of reducing electricity prices, should be to minimise these differences where it is economic to do so.

However, no commercial enterprise can be expected to undertake investment which would reduce its income. A further mechanism is needed to give NGC a satisfactory return on investment it undertakes for the benefit of users of the system. It will be necessary in this to find ways of identifying the benefits for which NGC was responsible as compared with the benefits which arise from the actions of users, e.g. from the locational and availability decisions of generators.

To do these things would at best take a great deal of time. There would be formidable computing and metering problems to be overcome and it would send the Pooling and Settlements Agreement very largely back to the drawing board. Because the changes would have differential effects on the profitability of Pool members and on the geographic pattern of electricity prices to final customers, agreements would be difficult to reach. In the final analysis, the resulting system may not be manageable.

All these are imponderables. At this stage, it may only be possible to approach the issues piecemeal, trying to find what will be second-best solutions for each of them. But if this collection of second-best solutions are to be mutually consistent and point in the right direction, an overall strategy is needed. In the circumstances of the new industry, it would seem that only the DGES can provide this.

CAN ELECTRICITY PRICING BE IMPROVED?

David Hawdon, University of Surrey

1. CAUSE FOR CONCERN ABOUT ELECTRICITY PRICES

Grounds for concern about and public policy intervention in electricity prices have frequently been expressed¹. I will concentrate on fears of excessive pricing articulated by consumer bodies. The principal concerns are as follows.

- 1.1 Most consumers deal with a local monopoly in the form of a regional electricity company. They are therefore in a weak position in negotiating terms of supply. Although alternative sources are available for certain uses of electricity such as for cooking and heating, electricity retains a monopoly in lighting and power applications. Even in regard to uses for which alternatives are available the consumer faces substantial investment costs in transferring from one fuel to another. This is a barrier to competition which is often perceived as being exploited by the supplier.
- 1.2 Electricity is particularly important for vulnerable categories of consumers - the so-called 'fuel poor' of low income households², households with high laundry bills due to disabilities, and older people who require additional heating. This latter category is likely to become increasingly important in electoral terms over time.
- 1.3 The pricing procedures of the electricity industry are complex with different price formulae governing different aspects of electricity industry activity. The regulatory formulae as well as allowing for changes in RPI, purchase costs, transmission and distribution charges, also include a fossil fuel levy and adjustments because of inaccurate inflation forecasting. This compounding of cost, policy and random elements makes it difficult for customers to understand changes in prices and make appropriate responses. Allowing for inflation estimates in the price mechanism introduces the possibility that customers are overcharged when low inflation is not correctly anticipated. The Regulator has had to warn 7 of the electricity companies that they are likely to have overcharged customers because of incorrect inflation forecasts in 1991/92. Where customers may be recompensed for such errors a further

¹ For a recent example see National Consumer Council (1991)

² See Neighbourhood Energy Action (1991)

forecasts in 1991/92. Where customers may be recompensed for such errors a further anomaly is introduced because customers in different parts of the country will receive different price signals.

- 1.4 The regional electricity companies have the power to increase prices beyond the rate of inflation if unexpected changes would materially affect their profits or losses. Although this power does not appear to have been used its existence adds to the difficulty of disentangling the causes of price movements and responding appropriately.
- 1.5 The distribution price formula linking price with $RPI + X$ where X is an efficiency factor is a cause for concern. Criticism has been directed at the setting of positive values of X which seem to vary directly with the regional electricity companies' industrial load. This is seen by customers as a rather arbitrary method of price discrimination.
- 1.6 The actual tariffs charged since privatisation have been criticised for:
 - a. Leading to price increases for the average domestic consumer of substantially more than inflation.
 - b. Perpetuating regional price differences. National Consumers Council (1991) quotes December 1990 prices in Cardiff as being over 17% higher than in Aberdeen based on standard tariffs including standing charges.
- 1.7 The RPI may be an inappropriate base for price changes because company costs contain high fixed cost elements and therefore do not vary with the RPI. In addition fuel prices are components of RPI and consumers perceive an element of circularity in price setting.
- 1.8 There are fears that in forthcoming price reviews attempts might be made to link customer prices to the cost of electricity as determined in the pool. At the moment there is no pass-through of pool prices into tariffs. This means that customers are cushioned against underlying cost increases but the reverse is also true - they do not benefit from low pool prices. To the extent that this link does not exist customers are not paying true marginal costs and allocation decisions are distorted.
- 1.9 So far as large industrial consumers are concerned there are two major criticisms
 - a. Use of market power by the generators to manipulating pool prices (the wholesale market for electricity) has greatly increased the uncertainty attached to prices and made price forecasting more difficult and hence rational substitution of other fuels at peak times more expensive.

- b. An argument on equity grounds that steady load industrial consumers should not have to contribute to high peak charges which are mainly due to domestic consumers.

2. DEVELOPMENT OF PRICE POLICY

- 2.1 Prior to privatisation electricity prices were subject to frequent intervention by government.

In 1983/84 government imposed a price rise on the industry in spite of excess generating capacity availability. This arose out of a disagreement between the electricity supply industry and the Treasury about long run marginal costs.

In 1987/88 prices were forced to rise in spite of falling oil costs. The then Secretary of State for Energy, Cecil Parkinson, in November 1987 announced a 9% rise in average area board prices to take effect from April 1988 which was subsequently translated into a 15% rise for the period 87/88 to 1988/89 taken together. Both these rises were justified on two grounds - the need to raise the industry's financial return prior to privatisation and the need to encourage private sector investment in new power station construction.

- 2.2 Since privatisation a further price rise was announced on 23/3/90 by John Wakeham. Prices were to rise on average by less than 6%. However, the increase for customers of less than 1 MW was to be 9%, although this was accompanied by the assurance that no further real price increases would occur before April 1993. Again the decision was justified in terms of investment promotion in the industry.

- 2.3 Price comparisons

The general trend in quarterly UK electricity prices is displayed in Figure 1. Using data from the IEA publication, Energy Prices and Taxes, I have calculated the growth of electricity prices to domestic and industrial consumers between 1978 and 1991. The results are as follows:

FIGURE 1 - UK ELECTRICITY PRICES IN DOMESTIC AND INDUSTRY MARKETS

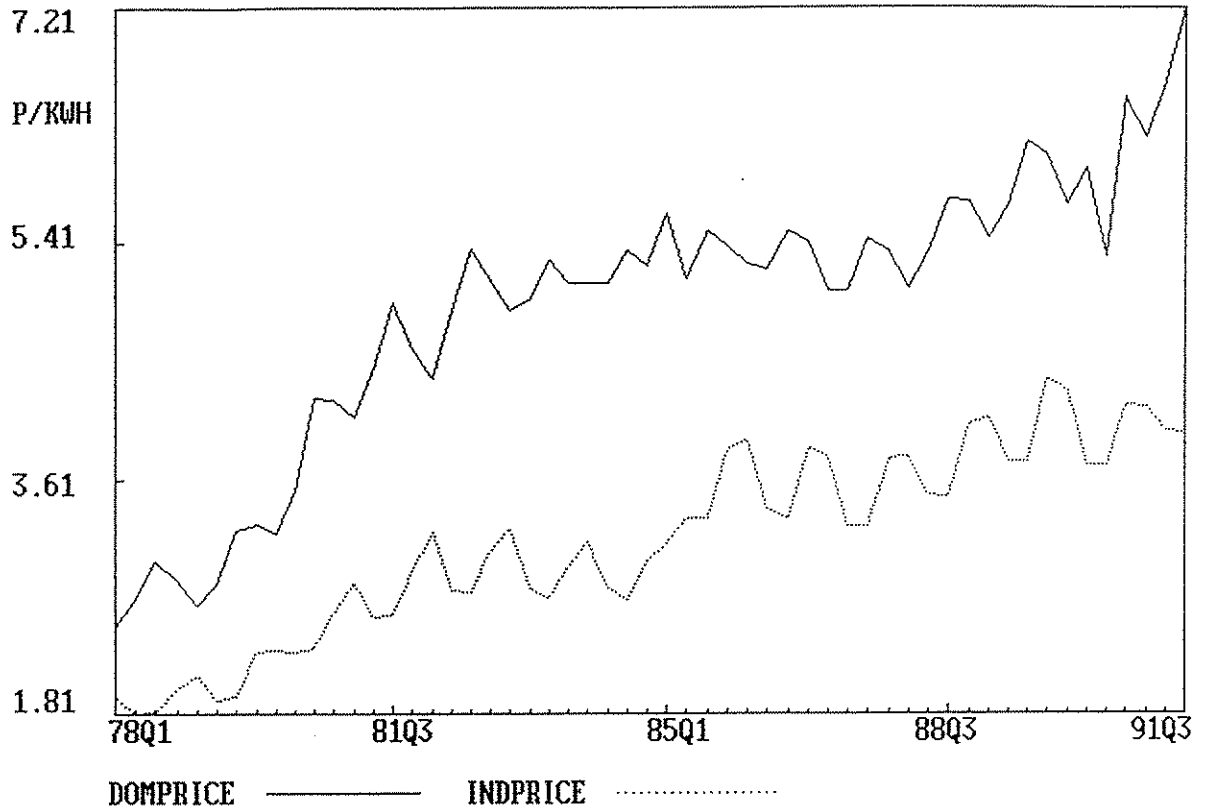


TABLE 1 ELECTRICITY PRICE CHANGES

	Industrial Market (Percentage increase 91Q3 over 78Q1)	Domestic Market
UK	+107.9	+191.9
GER	+52.7	+ 54.3
USA	+83.2	+ 95.8

The price of electricity has risen faster in the UK than in some of our major competitors and more rapidly for domestic consumers than for industrial. Although much of the change took place between 1978 and 1980, significant further increases following privatisation have kept the UK ahead.

3. EXPLANATION

In accounting for these differences I will examine the role of relative rates of domestic inflation and lack of market competitiveness. The impact of inflation is likely to be substantial due to the RPI element in UK electricity formulae. In regard to competitiveness the three major economies differ substantially. The UK had for most of the period a monopoly generator supplying local distribution monopolies. These were in public ownership with price control exercised by Secretaries of State for Energy from time to time. In Germany, prices have a substantial tax component and policy was designed largely in support the domestic coal industry. In the US utilities are privately owned but subject to regulatory constraint.

Theoretically, the responsiveness of price to cost changes should vary with the degree of competition, or potential competition. A proposition from elementary microeconomics states that the price cost margin should vary inversely with the elasticity of demand for a product. This gives the relationship between price (p) and marginal cost (mc) as

$$p = -e/(1-e).mc$$

where e is the price elasticity. ($e \neq 1$)

In other words, the lower the price elasticity the greater the markup of price over mc. Further, in dynamic terms the lower the elasticity the greater should be the expected speed of pass-through of given cost changes. Thus we would expect that the link between cost changes and price changes should be stronger in countries like the UK and Germany but weaker (numerically) in the more competitive situation in the US.

A full price model for a product like electricity for which storage is not practicable would be a reduced form including elements from both demand and supply sides of the market except during periods when price changes were imposed from outside. Generally price changes have not been imposed directly but indirectly through toughening the regulatory regime. We might expect a relationship like:

$$p = (\text{supply factors, demand factors, regulatory factors})$$

In the simplest model this reduced form would be as follows:

$$p = f(\text{industry costs, income/activity variable, regulation dummies})$$

Industry costs include price of power inputs (mainly coal - (pcoal)), general price movements (rpi). Income (gdp) is measured by real GDP and industrial activity by production indices (i). We will test the pass through rate by examining the coefficients on coal input costs and the time lags involved.

The two price models used were:

Domestic sector:

$$p_j = f(\text{pcoal}, \text{rpi}, \text{gdp}, \text{seasonals}) \text{ for } j = \text{uk, us and ger}$$

Industrial sector:

$$p_k = h(\text{pcoal}, \text{rpi}, \text{i}, \text{seasonals}) \text{ for } k = \text{uk, us and ger}$$

4. THE RESULTS

4.1 United Kingdom

- (a) Domestic Electricity Prices (Equation A1 in the Appendix). Simply including coal prices explains 85% of the variance of domestic prices. The best fitting equation includes pcoal, and rpi. The income variable, gdp, was not significant suggesting that it is safe to ignore the potential bias arising from the relationship between size and average revenue. The simple test for privatisation effects is to include a dummy variable which takes the value of 1 from 1990. It adds significantly and positively to the explanatory power of the equation and this result suggests that the effects of privatisation are to raise price above what might have been expected.

The rate of pass-through is tested by incorporating lagged values of pcoal in the equation. There is no evidence of significant lags in price formation which suggests a rapid rate of pass through, consistent with the exercise of monopoly power by distributors.

- (b) In the industrial sector (Equation A2), pcoal, rpi and industrial activity all affect prices positively. Coal and inflation are more important than industrial activity and pass-through is immediate in this sector. Does privatisation have any effect? In this sector, the impact of privatisation seems to have been negative. This may reflect the generally more competitive nature of the industrial market where prices are more responsive to movements in world oil prices.

4.2 US Electricity Prices

- (a) Domestic Prices.(Equation A3) Unlike the UK market, prices in the US domestic sector respond positively to changes in gdp as well as pcoal and rpi. Again unlike the UK market there is a delay in the pass-through of prices. Here the delay is between 1 and 2 periods. The data estimates support the conclusion that the US domestic market responds in a more competitive manner to changes in income than the UK. The delay in pass-through is probably due to the effectiveness of price regulation.
- (b) In the US industrial market (Equation A4), the activity variable emerges with the wrong sign. Excluding activity, prices are seen to be responsive to pcoal and inflation. As with the domestic sector, prices respond to changes in costs with a lag - in the industrial sector case a two-period lag is best in terms of goodness of fit.

4.3 German Electricity Prices

- (a) Domestic Prices (Equation A5). Initially the results looked very unpromising. The German market is more regulated than that of the UK. The coefficient on pcoal was negative and rpi performed poorly. However investigating the lag effect showed that replacing pcoal by pcoal(-1) produced the required positive impact. The model does not perform at all well in connection with this market but the evidence of lagged pass through suggests some delaying effects of regulation.
- (b) In the industrial market (Equation A6), both pcoal and industrial activity have negative effects on the price of electricity. Dropping the activity variable and lagging pcoal heavily back 4 quarters improved the performance of the model. The evidence is consistent either with the existence of strong competitive pressures or an effective regulatory system or both.

5. PUTTING UK PRICES ONTO A SOUNDER FOOTING

We have seen that the history of UK prices has been characterised by monopolistic behaviour of which quick pass-through has been an important feature. In these circumstances, two steps might be taken to introduce a more competitive climate. The first is to introduce an accelerated timetable for the removal of monopoly control over smaller domestic and commercial customers. Competitive pressures would discourage the rapid pass-through of cost increases to the consumer. Alternatively, but less attractively, the abandonment of the present cost-plus type of regulatory mechanism in favour of a rate of return regulation with suitable

safeguards to prevent over expansion of capital input would moderate pass-through rates. The second step would be to improve the flow of information and incentives to consumers by extending time of day and real time tariffs to both domestic and commercial sector consumers. Table 2 provides some information on current tariff arrangements. Existing off-peak tariffs such as the Economy Seven provide only a general incentive to shift from day to night usage but do nothing specifically to moderate costly system peak demand. It is desirable to provide stronger incentives to consumers to shift out of these high cost periods and to forge a stronger link between price and marginal cost.

TABLE 2. OFF PEAK TARIFFS IN THE UK

REGIONAL ELECTRICITY COMPANY	OFF PEAK TARIFFS		INDUSTRIAL MD TARIFFS				ECONOMY 7	
	1990	1991	MD CHARGE £/KW(KV a)	LOW RATE p/kwh	HIGH RATE p/kwh	SEAS ONA L	LOW RATE p/kwh	HIGH RATE p/kwh
LONDON	7	7	8.00	2.14	4.88	Y	2.43	7.15
SEEBOARD	3	3	7.84	2.22	4.76	Y	2.42	6.62
SOUTHERN	11	11	8.4	2.1	4.88	Y	2.4	7.05
S.WESTERN	7	7	7.5	2.05	5.62	Y	2.22	7.65
EASTERN	5	7	7.13	2.19	4.86	Y	2.43	6.5
E. MIDLAND	6	6	6.68	2.14	5.14	Y	2.38	6.62
MIDLANDS	4	4	5.64	2.15	4.75	Y	2.4	7.23
S. WALES	6	6	6.8	2.10	5.45	Y	2.44	7.83
MANWEB	7	8	41.5	2.13	6.09	Y	2.41	7.55
YORKSHIRE	7	7	7.1	2.06	4.93	Y	2.22	6.69
NORTERN	5	8	9.5	1.85	4.35	Y	2.07	7.23
NORWEB	7	8	7.41	1.9	5.17	Y	2.4	7.04
SC. POWER	11	11	23.4	2.44	5.49	Y	2.55	6.71
SC HYDRO	5	5	6.68	2.2	4.43	Y	2.24	6.48

Source: Electricity Supply Handbook 1990,1991, The Electrical Times, London.

APPENDIX

VARIABLE DEFINITIONS:

UK/US/GPDOM	Domestic sector electricity prices (UK, US and Germany).
UK/US/GPCOAL	Price of coal in UK, US and Germany. Source IEA
UK/US/GERRPI	Retail price index of UK, US and Germany. EEC
UK/US/GERI	Index of industrial production. EEC
UK/US/GERGDP	Gross domestic product in 1985 prices. EEC
Q1, Q2, Q3	Quarterly dummies.
PR	Privatisation dummy from 1990 Q1.

RESULTS FOR MAJOR PRICE EQUATIONS

UK DOMESTIC PRICE MODEL - EQUATION A1

$$\text{UKPDOM} = 0.13 + 0.88\text{UKPCOAL} + 0.12\text{UKRPI} + .43\text{PR} - .27\text{Q1} - .18\text{Q2} + .65\text{Q3} \quad \text{RBS}=0.94$$

(0.61) (6.46) (2.54) (1.92) (-2.63) (-1.72) (.62) DW =1.32

UK INDUSTRIAL PRICE MODEL - EQUATION A2

$$\text{UKPIND} = 0.55 + 0.60\text{UKPCOAL} + .36\text{UKI} + 0.28\text{UKRPI} - .32\text{PR} + .679\text{Q1} - .31\text{Q2} - .35\text{Q3} \quad \text{RBS}=0.95$$

(.11) (.64) (.64) (6.49) (-2.14) (1.1) (-5.08) (-5.73) DW=.0.85

US DOMESTIC PRICE MODEL - EQUATION A3

$$\text{USPDOM} = -3.18 + 0.14\text{USPCOAL}(-3) + 0.29\text{USRPI} + .007\text{USGDP} - .59\text{Q1} - .66\text{Q2} + .30\text{Q3} \quad \text{RBS}=0.97$$

(-5.23) (13.39) (4.76) (3.06) (-7.45) (-0.83) (3.82) DW =1.71

US INDUSTRIAL PRICE MODEL - EQUATION A4

$$\text{USPIND} = -1.13 + 0.13\text{USPCOAL}(-3) + 0.13\text{USRPI} - .10\text{Q1} - .31\text{Q2} - .27\text{Q3} \quad \text{RBS}=0.96$$

(-6.23) (22.01) (8.99) (-1.81) (-.54) (4.71) DW =1.53

GERMANY DOMESTIC PRICE MODEL - EQUATION A5

$$\text{GPDOM} = -1.31 + 0.61\text{GPCOAL}2(-2) - .50\text{GERGDP} - .69\text{Q1} - .15\text{Q2} + .82\text{Q3} \quad \text{RBS}=0.93$$

(-7.73) (11.53) (12.13) (-.19) (-.40) (0.23) DW =0.47

GERMANY INDUSTRIAL PRICE MODEL - EQUATION A6

$$\text{GPIND} = -4.53 + 0.11\text{GPCOAL}(-4) + 0.16\text{GERRPI} - .29\text{Q1} - .10\text{Q2} + .84\text{Q3} \quad \text{RBS}=0.90$$

(-4.81) (2.24) (9.23) (-.13) (-.48) (.38) DW =0.17

REFERENCES

National Consumer Council (1991). The Results of Electricity Privatisation. Memorandum by the NCC to the Select Committee on Energy December 1991. CP120/91

Neighbourhood Energy Action (1991). Ten Years Cold: Report on a Decade of Fuel Poverty in Britain. November 1991.

