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ELECTRICITY PRICES FOR INDUSTRY

A Report by CPRS

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SUMMARY

1. In recent years industrialists have complained bitterly about United Kingdom electricity prices; and the NEDC Task Force in 1981 confirmed that some heavy users of electricity were paying more than some overseas competitors. The Government responded to the pressures in both the 1981 and 1982 Budgets with measures which are costing £100 million this year.

2. For most industrial consumers price differentials between the United Kingdom and overseas are not significant. Price comparisons are however generally less favourable than 5 years ago because of changes in the exchange rate and our general decline in competitiveness.

3. United Kingdom electricity intensive industries face a higher sterling electricity price than their main competitors in France, Germany and Italy. The reasons are primarily cost based, with pricing policies and industrial susbsidies playing a role.

4. For manufacturing industry as a whole electricity accounts for about 2½ per cent of costs. For the bulk of manufacturing firms electricity costs are not a major factor in their competitive position.

5. A few sectors of industry are seriously affected by electricity prices, notably -

i. aluminium, and integrated pulp and paper mills. These are so electricity-intensive that they have no long term future in the United Kingdom without large and permanent subsidies;

ii. chlorine and its derivatives. The United Kingdom could in time lose 4,000 jobs, possibly more;

iii. electric arc steel making - but electricity is only one of its many problems.

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6. There is no systematic bias against heavy industrial users in current electricity tariffs and the CPRS considers the marginal cost approach to pricing to be sound. The Coopers and Lybrand Study suggests that CEGB's prices are some 5-10 per cent too high. Most firms would profit from the changes they propose but ironically electricity intensive users on load management terms would not benefit much if at all.

7. Assuming that NCB coal prices remain broadly in line with the price of imported coal the propspects to 1990 are that current price disparities will persist with France, but narrow with Germany as most special contracts for electricity-intensive industries are renegotiated. There is room for improvement in the electricity industry's operational performance but this cannot have a very great impact on total system costs.

8. The CPRS sees no case for subsidising industry's electricity costs; such assistance would not be short lived, only part of the present price disparities reflect subsidies by foreign governments, there is no guarantee that state aid would do more than delay job losses, and there are more cost effective ways of reducing burdens on industry. Depending on the outcome of the current review of the Bulk Supply Tariff and developments abroad, the existing support for large users should be phased out in due course.

9. Maintaining competitive electricity prices in the longer term rests essentially on keeping NCB coal prices to CEGB aligned with the cost of imports to it and on establishing a successful nuclear programme with construction performance markedly better than has been achieved so far.

INTRODUCTION

1. This Government has been subjected to sustained lobbying from industrialists about high energy prices. The facts were carefully explored in a study by the NEDC Energy Task Force in February 1981 (updated in November 1981). As regards electricity, the Task Force concluded that prices in the UK were generally comparable with those in Belgium, Italy and the Netherlands. Prices in France were consistently and significantly lower than in the UK. In Germany most industrial consumers paid as much as or more than their UK equivalents, but those with high load factors* paid up to 16 per cent less than their UK counterparts and up to 30 per cent less in some cases where German utilities operated special contracts. Industrialists in the chemical and iron and steel sectors have been particularly active lobbyists, although not all their members are high load-factor users.

2. Ministers have already taken some action to alleviate the problem. In the 1981 Budget statement, the Chancellor of the Exchequer announced the introduction of an improved load management scheme (Category C) and a 3 per cent flexibility allowance for Area Boards to use in negotiating with large industrial consumers. In the forum of MISC 56 last summer, Ministers concentrated on industrial users of electricity (rather than energy in general), and considered what could be done, short of a subsidy, to mitigate the effect of the cheaper prices enjoyed by their competitors abroad. Considerable efforts were devoted to the design and development of schemes to help those industrial users who were most at a competitive disadvantage. The 1982 Budget included the contracted consumer load (CCL) scheme, which has a life of 3 years. The help given to electricity consumers in the 1981 Budget amounted to £45 million in 1981/82; and in the 1982 Budget to £100 million for 1982/83 (which includes the cost of continuing the 1981 Budget measures.)

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*This term is explained in Chapter 1, paragraph 4.

3. Since then the pressure on Government to do something about energy prices has eased somewhat. Complaints about electricity prices are less frequent, but as it is known that the Secretary of State for Energy is still considering the Bulk Supply Tariff (BST) Review submitted by the Electricity Council in January 1982, industrialists may simply be waiting to see what action he decides to take. The appointment of the consultants, Coopers and Lybrand, to advise on the BST Review has not been announced publicly, but pressure for some kind of Government statement on electricity prices is likely to build up towards the end of this year. In addition, the Government is committed to discuss electricity prices at NEDC before the end of the year. The forthcoming announcement of the electricity industry's EFL for 1983/4 is also likely to raise questions about prices. This is because the industry's financial target expires at the end of 1982/83, and the new one, which will clearly have to be compatible with the EFL, has not yet been announced.

4. In April 1982 it was agreed that the CPRS should undertake a study of the effect of electricity prices on UK industry and its competitors, and make recommendations. The terms of reference (attached to John Sparrow's letter of 7 April 1982 to the Chancellor of the Exchequer) were -

i. To examine the extent to which the price of electricity is more expensive for industrial customers in the UK than in other major industrial countries; and to advise on the reasons, considering in particular whether this is due to unavoidably high costs, such as efficiency, or to pricing policies.

ii. To examine how the cost of electricity in the UK is likely to move relative to costs in other major industrial countries; and to consider how we could react to lower prices in those countries.

iii. To examine the effects on industry of the continuation of the international price differentials foreseen under ii, assuming also continuation of present UK costs and tariff structures; to consider, in particular, which industries or processes may be adversely affected to a significant extent and to advise on the consequences for the economy as a whole.

iv. To advise on the costs, practicability and desirability of changes in the electricity pricing structure which would have the effect of reducing charges to the consumers identified in iii, including the possibility of legislative change; and on other possible forms of assistance.

v. To consider, in the light of i, ii, iii, and iv the case for reducing electricity prices to industry at the expense of other customers or the PSBR.

5. This paper follows the same logical thread as the terms of reference. Chapters 1 to 5 deal with sections i, ii and iii. Each of the first five chapters ends with a summary of the main conclusions that can be draw from the material in it. In Chapter 6 we discuss the results of the analysis and propose an approach to the problem.

6. In the preparation of this Report, we have discussed the issues involved with officials of the Departments of Energy and Industry and the Treasury and, as far as possible without revealing that we were involved in such a study, with the electricity supply industry, industrialists and industry federations. We have also conducted a series of off-the-record discussions in Germany.

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CHAPTER 1 - INTERNATIONAL COMPARISON OF PRICES

Electricity prices to large industrial users

1.1. Any attempts to compare industrial electricity prices for different countries are fraught with difficulties. Figures are available in many cases, but are not perfectly reliable - they are quite adequate to give an indication of how prices vary from one country to another but they do not always represent the exact price an industrialist would face in each place. In general, the figures are based on what the "average" user, with an average pattern of demand, would pay according to the published tariff. Large users, however, are often on special contracts whose details are kept secret for commercial reasons, and their load patterns may differ from the average; for example, a user may choose to concentrate his demand in the cheaper off-peak periods. In addition, exchange rate fluctuation can cause rapid changes in price relativities. The figures in this chapter should therefore be taken as indications only and used with care.

1.2. The NEDC Energy Task Force Study of February 1981, updated in November 1981, showed that the most important disparities faced by the UK in Europe were against France and Germany. For certain groups of consumers, prices in Italy also were very favourable. In this report we will concentrate mainly on these three countries, both because of the disparities and because between them they account for a quarter of our exports of manufactures and are therefore important in terms of the competition they provide.

1.3. A second group of countries (accounting for a further quarter of manufactured UK exports) is also considered, but in a little less detail, partly because less information on them is available on a comparable basis. It includes -

USA and Japan	-	these countries are important general trading competitors
Canada	-	important in the paper and board sector
Sweden	-	important in paper
Norway	-	important for chemicals and paper
Netherlands	-	important in chemicals and steel
Belgium	-	important for steel
Austria	-	important for special steels.

1.4. The Task Force work concluded that large high load factor* users - those who used large but fairly steady quantities of electricity for much of the time - were at a particular disadvantage in the UK. We give below some more up to date figures for users of 10 MW maximum demand. These are very large users; only 191 out of the total of 3125 industrial consumers considered in the NEDC report used 10 MW or more in 1980/1. Very few of these are at high load factors - there are only 29 at 70 per cent load factor or more.

Table 1A - Industrial Electricity Tariff Prices** - 10 MW users
(prices as at 30 July 1982, at current market exchange rates)

p/kWh

	Annual Load Factor		
	40%	60%	80%
UK (England and Wales)+	3.29	3.12	3.03
France	2.55	2.30	2.12
Germany (RWE++)	3.43	2.85	2.48
Italy	3.32	3.05	1.80

** Including all non-recoverable taxes, ie excluding VAT which is recoverable where electricity is an input to VAT rated goods.
+ Based on a load pattern representative of the chemical industry at 10 MW demand, and including Area Board flexibility allowance, but excluding load management. (However most consumers at these loads or above in the chemical industry are now on CCL.)
++ Germany has many electricity utilities each with different tariffs. RWE is the largest.

Source: The Electricity Council.

*The "load factor" relates the average electricity demand to the peak demand. For example, a consumer using roughly the same amount of electricity almost all the time would have a high load factor. A user whose demand fluctuates widely, very occasionally reaching a high peak, would have a low load factor.

1.5. Table 1A shows how, at low load factors, prices in the United Kingdom are competitive with those in Germany and Italy, but at high load factors they are well above the others. Prices in France are well below those in other countries except in Italy at 80 per cent load factor. There are, however, qualifications for each figure -

i. The United Kingdom prices can be reduced by around 20 per cent if the consumer is able to take advantage of load management terms. 107 consumers (mainly in the steel and chemical sectors) have elected to join the recently introduced Contracted Consumer Load Scheme. Users on CCL at 10 MW and 80 per cent load factor could get their price down from the 3.03 p/kWh shown in the table to 2.42 p/kWh. Other large consumers are on other forms of load management, giving smaller price reductions. The reductions in electricity costs from using load management terms may be partly offset by the higher costs incurred as a result of rescheduling production.

ii. The continued weakening of the French franc against the £ means that the gap between prices in France and the United Kingdom identified by NEDC has widened. French prices are now generally around 25 per cent lower than ours (not allowing for the effect of load management on United Kingdom prices).

iii. At 80 per cent load factor, the German (RWE) tariff price is 2.48 p/kWh -18 per cent cheaper than the British price (excluding load management). Germany has many electricity utilities each with different tariffs. RWE is the largest and offers prices and tariffs near the bottom of the range. The prices given here are based on RWE's published tariffs, but some industrial users pay significantly less than this under their special contracts.

iv. The Italian price at 80 per cent load factor is low, and much lower than at other load factors, because there is a specific price subsidy in Italy for users with load factors of 80 per cent or more.

1.6. Compared with the NEDC findings in November 1981 (showing differences of up to 28 per cent for France and 16 per cent for Germany), the discrepancies at higher load factors between the United Kingdom and France and Germany shown in Table 1A are up to 30 per cent and up to 18 per cent respectively. This is the net outcome of price increases in all three countries and movement in exchange rates. The disparity is of course reduced for many large consumers in the United Kingdom by load management terms.

1.7. Turning now to the second group of countries that were identified in paragraph 3 as of interest, Table 1B demonstrates that some of these countries enjoy electricity prices well below ours, especially at high load-factors (although figures as up to date as Table 1A are not available for this group).

Table 1B - Industrial Electricity Tariff Prices* - 10 MW users

(prices as at August 1981, at current market exchange rates)

p/kWh

	Annual Load Factor			
	20%	40%	60%	80%
UK				
England and Wales**	3.29-4.37	2.90-3.55	2.76-3.30	2.66-3.17
Scotland	3.73-3.97	3.05-3.21	2.80-2.91	2.64-2.75
N. Ireland	4.37	3.62	3.32	3.15
USA	3.43-10.51	2.69-7.38	2.40-6.23	1.99-5.57
Japan	5.48-5.92	4.20-4.74	3.77-4.34	3.56-4.15
Canada	2.23-2.44	1.46-1.78	1.17-1.20	1.00-1.05
Sweden	2.32-2.47	1.86-2.02	1.70-1.86	1.69-1.76
Netherlands	3.17-4.43	2.81-3.78	2.63-3.52	2.53-3.38
Belgium	n/a	n/a	2.68	2.52

* Including all non-recoverable taxes, ie excluding VAT which is recoverable where electricity is an input to VAT rated goods.
** Excluding load management.
Source: An International Comparison of Electricity Prices, The Electricity Council.

1.8. Within the UK, prices in England and Wales are broadly comparable with those in Scotland. Prices in N Ireland are subsidised down to the top end of the United Kingdom price range. Comparing the UK with the others, at 80 per cent load factor and taking the lower end of the price ranges, all the countries except the Netherlands and Japan have lower prices. Prices are particularly low in Sweden and Canada largely because much of their power is hydro-electric. Prices range widely in the US, but some utilities with large quantities of nuclear and hydro power are able to offer prices comparable to those in Sweden and Canada. Netherlands, Japan and some parts of the USA are more expensive than the UK because of their dependence on gas and oil for generation. The Netherlands are, however, introducing a scheme to help large users (over 6 MW and 50 per cent load factor). This is expected to reduce prices for 10 MW users to levels similar to those in the United Kingdom, but prices paid by very large users could fall below ours.

Exchange Rates and Competitiveness

1.9. The picture presented above is materially different from that of 10 or even 5 years ago. Table 2 below shows that in 1973 UK industrial electricity prices were generally half those in Germany, by up to a third lower than in France, and by 12-25 per cent below Italian levels. In 1978 the UK's industrial electricity prices were generally about a third below German levels, very much the same as in France, and up to 15-20 per cent below Italian levels. The preceding paragraphs have shown that French industrial electricity consumers now enjoy a substantial advantage over their English counterparts; the same is true for industrial users in Germany and Italy if they maintain a high load factor. Why has the balance of advantage tilted so decisively against UK industrial consumers in recent years? We shall discuss in succeeding Chapters the main factors which affect electricity costs and prices. But there is one factor which deserves separate treatment - the effect of exchange rates on all international comparisons.

Table 2 - European Comparison of Industrial Electricity Tariffs*-2.5 MW users

	Load Factor			p**/kWh
	20%	40%	60%	80%
1 August 1973				
United Kingdom	0.92-1.25	0.72-0.90	0.61-0.77	0.56-0.70
France+	1.28	1.00	0.83	0.71
Germany	1.90-2.35	1.42-1.72	1.14-1.37	0.99-1.22
Italy	1.02	0.80	0.69	0.64
1 August 1978				
United Kingdom	2.42-2.97	2.07-2.41	1.82-2.16	1.69-2.04
France+	2.70-2.84	2.21-2.31	1.92-1.99	1.70-1.76
Germany	3.78-5.43	3.12-3.65	2.51-3.10	2.18-2.84
Italy	2.72-2.73	2.36-2.37	2.18-2.19	2.10-2.11

* Excluding VAT
** Converted at prevailing market exchange rates
\+ Cheapest zone
Source: A Comparison of Electricity Prices in the Countries of The European Community 1973-78. Electricity Council.

1.10. Table 3 below illuminates what happened in the 1970s. Column 1 shows that between 1975 and 1980 the rise in industrial electricity prices relative to the general domestic cost level in the UK was not very markedly out of line with that in other major countries. The real price of industrial electricity in the UK rose by roughly the same amount as in France, and considerably less than in Italy and the United States in this period. It rose more than in Germany, where in fact the real price of industrial electricity remained

virtually unchanged. But in general the UK's deterioration in relative sterling electricity prices does not reflect a deterioration in the real costs or productivity of the UK's electricity industry relative to those in our main competitors. (This is not to say that the absolute level of productivity and efficiency in our electricity supply industry (esi) is satisfactory, a subject to which we turn later.)

Table 3 - Increase in industrial electricity prices during the 1970s

	% increase in real price of electricity*	% increase in price expressed in Sterling**	
	1975-1980	1970-1975	1975-1980
United Kingdom	16	90	121
France	15	77	82
Germany	-1	94	26
Italy	27	97	136
United States	26	98	75

* Electricity price deflated by GDP deflator.

** Nominal prices converted into Sterling at prevailing market exchange rate.

Source: Energy Price Indices 1960-1980, Eurostat 1982.
1981 Annual Report to Congress, US Department of Energy.

1.11. Looking at price rises between 1975 and 1980 in sterling terms, however, (column 3 of Table 3) shows a very different picture. On that basis United Kingdom prices rose much more than in the other countries except Italy. This is in marked contrast with the experience between 1970 and 1975 (column 2 of Table 3). The deterioration in relative sterling industrial

electricity prices over recent years reflects movements in the exchange rate. Since the mid-70s the exchange rate and the general cost/price level in the United Kingdom have become de-coupled. In 1975 and 1980 sterling's effective ("trade weighted") exchange rate was much the same, yet the domestic cost level had virtually doubled. The divergence between the exchange rate and domestic costs since the mid 70s reflects the anti-inflationary stance of macro-economic policy, the impact of North Sea Oil production and higher world oil prices on the exchange rate, and the slowness (relative to the speed of adjustment in the exchange market) of the deceleration of domestic cost inflation, especially wages.

1.12. The disparities between United Kingdom and competitors' industrial electricity prices which have become apparent in recent years, do therefore, essentially reflect British industry's general loss of competitiveness. Whilst the NEDC Energy Task Force studies mentioned the exchange rate, they concentrated on snap-shot price comparisons in the 1980s and did not make clear its full importance and implications.

Conclusions

1.13. In summary, the main conclusions of this chapter are -

i. French prices are well below ours for all industrial consumers.

ii. German tariff prices are much the same as ours, except at very high load factors. At these load factors the German tariffs are considerably cheaper than ours, although a United Kingdom firm taking full advantage of the CCL scheme could get down to RWE's tariff prices. But German consumers enjoy yet lower prices through special contracts.

iii. Italian prices are comparable with ours except at 80 per cent load factor where they are subsidised and much cheaper.

iv. Some countries eg Sweden and Canada have large hydro-electric resources and enjoy much lower prices than ours.

v. Japan, Netherlands and parts of the USA have higher prices than ours.

vi. Exchange rate movements account for much of the changing disparities between United Kingdom and European electricity prices over recent years, reflecting the United Kingdom's general loss of competitiveness.

1.14. But why do utilities in different countries charge the prices they do? Undoubtedly among the most important factors governing electricity prices are the mix of generating plant and variations in feedstock prices. Another factor is of course pricing policies, and the extent to which Governments are prepared to require consumers to pay the full cost of generating the electricity they use and of investing for their future needs. Tariff structures can place more of the burden on some consumers than others and subsidies can switch it from the electricity consumer to the taxpayer. But countries with plenty of low cost nuclear and hydro-electric power have a head start. These are points we shall explore in Chapters 2 and 3.

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CHAPTER 2 - THE COSTS OF SUPPLYING ELECTRICITY

2.1. A utility's costs mainly depend on the proportions of different types of plant it uses; the prices it pays for the fuels it uses; and on the efficiency with which it both operates existing plant and builds new plant.

Plant Mix

2.2. The cheapest power is obtained from hydro-electric stations and from nuclear plant, provided that the stations are built efficiently and plant availability is kept at reasonable levels. Next, but much dearer, are large modern plants burning fossil fuels (with coal being cheaper than oil). Then come the smaller, less efficient coal and oil plants; and finally gas turbines (used in the United Kingdom only to meet peak demand). Costs depend on the mix of plant the utility runs to meet demand. The choice will depend on availability, fuel input price, response time and other factors. Some plant, particularly more efficient and lower cost base load plant, will be more intensively used than other types and will therefore have a larger influence on the price of electricity than the plant mix alone indicates.

2.3. Tables 4A and 4B below show the proportion of electricity actually generated by each type of plant in the UK and the countries chosen for comparison.

Table 4A - Electricity Generation in 1980

per cent

	Nuclear	Hydro and Other	Coal	Oil	Gas	Total*
UK	12.5	1.7	73.6	11.4	0.8	100
France	23	30	25	21	-	100
Germany	11.9	5.1	63.5	6.2	13.3	100
Italy	1.2	27.0	12.2	54.9	4.8	100

* Figures may not add to totals because of rounding.

Source: Energy Policies and Programmes of IEA Countries, IEA, 1982, and EdF figures for France.

2.4. France clearly has much more nuclear than the others, and like Italy enjoys a substantial amount of hydro-electric power. The UK and Germany, while having relatively little nuclear, depend most heavily on coal, which is cheaper than the oil on which Italy is so dependent. It should be noted that 45 per cent of the coal used in Germany is brown coal (lignite), which is cheaper than the steam coal which makes up the balance. However, German brown coal deposits are declining rapidly. France therefore has the advantage with so much nuclear and hydro, UK and Germany are broadly comparable and the cost to Italy of generating much of its electricity from costly oil is only partly offset by hydro-electric power.

2.5. The fuels used for electricity generation in the second group of countries demonstrate clearly why some of their prices are very low.

Table 4B - Electricity Generation in 1980

	Nuclear	Hydro and other	Coal	Oil	Gas	per cent Total*
UK	12.5	1.7	73.6	11.4	0.8	100
USA	10.9	11.7	52.6	10.4	14.4	100
Japan	16.1	18.4	11.7	41.1	12.7	100
Canada	9.7	68.3	16.5	3.5	2.0	100
Sweden	27.5	59.8	1.3	11.8	0	100
Norway	0	100	0	0	0	100
Netherlands	6.6	0	13.9	37.2	43.1	100
Belgium	23.1	1.5	35.4	30.0	10.0	100
Austria	0	70.8	8.3	15.6	5.2	100

* Figures may not add to totals because of rounding.

Source: Energy Policies and Programmes of IEA countries, IEA, 1982.

2.6. Canada, Sweden, Norway and Austria all produce over 70 per cent of their electricity from the cheapest sources, nuclear and hydro. By contrast, Japan and the Netherlands depend for over half of theirs on the more expensive sources, oil and gas. The national average figures for the USA mask significant differences between individual utilities, which account for their wide range of prices. Belgium lies between the two extremes, with a good proportion of nuclear generated electricity, but the benefits of this are offset by the need to depend for a substantial amount of the remainder on oil and gas.

2.7. Thus the United Kingdom does not enjoy the natural advantage which some countries have of large hydroelectric resources. Nor do we have a particularly large nuclear capacity: some of our competitors, most notably France, are now beginning to reap the benefits of a vigorous and successful nuclear programme. On the other hand things could be far worse: for example our proportion of oil fired plant is quite low.

The Cost of Fossil Fuels

2.8. For thermal power stations, fuel costs represent a very significant element in the overall cost structure.

2.9. The electricity supply industry (esi) in the United Kingdom has so much coal-fired plant that coal is by far the most important factor in the esi's costs. In 1981-82 it accounted for 46 per cent of the CEGB's total costs (on a CCA basis). For high load factor industrialists taking full advantage of load management, and not therefore paying any capacity charges, coal accounts for approaching 60 per cent of their electricity bills.

2.10. We have therefore considered whether the price paid by the esi for power station coal is at the right economic level. If it is too low, electricity prices are being subsidised below the economic price. But if it is too high, electricity consumers are carrying some of the burden of supporting NCB. The CPRS considers that, to the extent that the coal industry is to be supported at all, the cost of that support should be clearly defined (making it easier to control) and should be borne by the taxpayer through central Government.

2.11. So what is the right price? The CPRS considers that the volume of coal traded on the world market is adequate to establish a world traded price, and that the economic level of coal prices in the UK should be determined by reference to the world traded coal price. Our argument is that it is the world price for coal that represents the opportunity cost of coal to this country and indeed to other countries including our major competitors, and that given our future supply potential (small and invariable relative to the rest of the world's) we have little impact on the world's price. This argument is analogous to the reasoning underlying the pricing of UK produced crude oil.

2.12. At present the world (Rotterdam) price of coal is about £34/tonne. Trans-shipment to the United Kingdom involves additional costs of some £5/tonne, and transport to inland power stations - which account for four-fifths of the CEGB's coal burn - would add a further £5/tonne, giving a delivered cost at the CEGB's central power stations of £44/tonne. This is somewhat higher than the delivered price of NCB coal - £42/tonne. In the case of power stations on the Thames, the costs must be adjusted to allow for the higher transport cost of NCB coal and the lower transport costs of coal imports; the result is that at these Thames stations imports are substantially (about 15 per cent) cheaper than NCB coal. But overall the CEGB's total coal bill is aligned with the price to it of imported coal.

2.13. However these calculations assume existing import facilities which involve trans-shipment from the Continent. If efficient deepwater coal ports were developed in the UK there would be a net saving in import costs of £3/tonne. If imports are to be used as the competitive economic benchmark price, it is sensible to do the costing on the basis that imports are handled in the most efficient way. On this basis the delivered cost at inland power stations of imported coal could be about £41/tonne, slightly below the current NCB price. Taking into account also the prices at coastal stations, this would reduce the CEGB's total coal bill overall by about 5 per cent.

2.14. The NEDC's February and November 1981 Energy Task Force reports both concluded that UK coal prices were competitive with imports and prices being paid in Europe. Given current circumstances we agree that for the bulk of the CEGB's coal burn NCB coal prices are broadly in line with imports. This means that the costs of today's uneconomic level of coal output are borne not by the coal consumer, but by the taxpayer. However, developments in prospect may lead to a widening divergence. This November, under the terms of the NCB-CEGB agreement which runs until 1984, the NCB will raise their prices in line with inflation ie by about 6 to 7 per cent, and presumably they will increase them again in November 1983. Although the prospects for world coal prices over the same period are uncertain, dollar prices are unlikely to rise, and may even show some decline. Currently there are a number of distress sales by Poland and South Africa below the level of £34/tonne, and trans-Atlantic freight rates have tumbled. It is possible that these pressures may over the coming months tend to reduce the term price for new (long term) contracts.

2.15. The danger therefore exists that a gap between domestic and world coal prices will start to open up. In November 1982 NCB coal delivered to the CEGB's central power stations could cost about £45/tonne, a level some 10 per cent above the notional cost of imports (assuming, as in paragraph 13, the development of deepwater ports in the UK).

2.16. It is worth noting that the CEGB's case that coal is too expensive is only in part based on their lack of access to imports and the lower price of traded coal on the world market. Many of the CEGB's power stations are sited next to efficient inland pits with production costs below the price of imports. The CEGB has therefore suggested that NCB coal should be priced on a direct cost basis related to individual pits, which would significantly reduce its total coal bill. We cannot accept such a cost-based argument, which is one that the CEGB rejects in its own marginal cost pricing policy and which does not have the economic justification of a policy related to the world market in coal. Part of the reason why the CEGB feels aggrieved is that the NCB is known to

low prices to secure export orders. This is simply because NCB production is too high for the present level of demand, and the NCB has to slash prices in order to dispose at all of the last tonnage of coal. By contrast, electricity production is flexible and can be matched to demand.

2.17. As the United Kingdom is currently a net exporter of coal, it has been argued that, to reflect the opportunity cost, NCB coal prices should be related to the world market, less the costs of transport. This would give a very substantially lower price. But the United Kingdom is only an exporter because of its excessive level of uneconomic production. United Kingdom coal usage exceeds the level of production justified at or near current coal prices, and on an economic basis the United Kingdom would definitely be a net importer of coal. For this reason we consider that the relevant opportunity cost is based on the world market, plus the costs of transport.

2.18. Meanwhile the NCB exports 8 million tonnes or so of coal in order to clear its excess production at net realised prices far below those paid by the CEGB. If for a period the benefit of similar prices could be passed through to the final electricity prices payable by electricity-intensive UK industry this would make a substantial difference to their competitive position. This course is particularly attractive when considering a marginal case, such as an aluminium smelter, which will close without the benefit of such prices, thereby requiring more coal to be exported or stocked. However it is clear that selective price discounting to existing coal users would not materially increase the total demand for NCB coal. To remove the need to export NCB coal would require widespread and large cuts in UK coal prices at great cost to the Exchequer. Furthermore, since the Government's policy is that the NCB should achieve a demand/supply balance, price discounting in the UK would not be sustainable in the medium-term. It is therefore important that electricity-intensive industry continues to take its strategic decisions on the basis of the full price of coal. In short, the cash-flow advantages to particular industries would be paid for by substantial cash-flow disadvantages to Government, without materially affecting the long-run position.

Efficiency

2.19. The Monopolies and Mergers Commission (MMC) investigated the CEGB and reported last year. It gave the CEGB a comparatively clean bill of health as far as its operational efficiency was concerned, but was critical of power station construction costs and system development planning.

Operational Efficiency

2.20. The statistical problems of comparing operational efficiency between different utilities are severe. There are the usual problems of definition and measurement involved in international comparisons, and in addition, operational efficiency is affected by other factors that are not equal between countries eg the age and size of plant and the way the system is operated. Thermal efficiency, plant availability, system load factor, and labour productivity are all aspects of operational efficiency.

2.21. Thermal efficiency is a measure of the proportion of the energy content of the fuels used in electricity generation that is converted into electricity. The NEDC Task Force Report of February 1981 gave the following table. It covers all plant burning fossil fuels (but not nuclear or hydro plant for which a thermal efficiency comparison is not relevant).

Table 5 - Thermal Efficiency in 1977

	per cent
France	37.0
Italy	36.8
West Germany	35.1
United Kingdom	33.2
EEC Nine	35.2

Source: NEDC Energy Task Force Report, February 1981, based on Eurostat.

2.22. Not all plant in the system is, however, available for use at any particular time. Breakdowns and plant maintenance, for example, cause reductions in the amount of capacity available for use. Only the CEGB and EdF publish availability data regularly. The February 1981 NEDC report included the following comparison.

Table 6 - Availability of Large Conventional Units

	1970/1	1974/5	1978/9
UK (England and Wales)*	62.8	75.2	84.6
France**	66.5	83.0	73.1

* CEGB, 500-660 MW units
** EdF, 600 MW units

Source: NEDC Energy Task Force Report, February 1981.

2.23. The National Institute for Economic and Social Research have recently calculated estimates of labour productivity in the esi. Their estimates are shown in Table 7.

Table 7 - US and German Labour Productivity in the esi compared with the UK

UK = 1

	1968	1977 for US 1976 for Germany
US/UK	4.06	3.47
Germany/UK	1.93	2.25

Source: NIESR, 1982.

They suggest a significant shortfall of labour productivity in the UK esi and this shortfall is larger than that of the UK economy as a whole. As however labour accounts for only 9 per cent of CEGB costs and 16 per cent of all esi costs, improvements in productivity can make only a limited difference to total costs.

2.24. The efficiency of a system is related to the system load factor. In general the higher the system load factor, the higher the percentage of total electricity demand that is generated by base load plant and the higher is thermal efficiency and labour productivity. System load factors in the UK, France and Germany are 56 per cent, 67 per cent and 66 per cent respectively. The system load factor reflects the mix of electricity consumers and the pattern of their demands. The utility can influence it by tariff design only to a limited extent. The United Kingdom's lower system load factor weakens its comparative performance. Overall, however, the room for improvement in operational efficiency is not large enough to make an appreciable impact on the price disparities faced by high load factor industrialists.

Capacity cost efficiency

2.25. The poor performance of the British construction industry at large sites has caused concern for many years. The NEDO Report of 1976 "Engineering Construction Performance" looked at large sites, including power stations in the UK, USA, Germany and Italy. The report found that projects took longer to design and build in the UK than abroad, and involved more man hours and larger numbers employed on the site. Among the causes that were identified were the tendency to require more rigorous operating standards than foreign clients, an inability to catch up once time had been lost, less effective project planning and hard pressed industrial relations management. The recommendations included measures to improve morale and labour relations on site.

2.26. More recent experience corroborates these findings. Although comparable figures are not available, the problems encountered by the CEGB are well known. We shall not dwell on their disastrous experiences with, for example, most of the AGR programme and the Isle of Grain. But at best (eg Dinorwic and Drax), construction times have been about 8 years. Foreign

experience is variable. France's performance has been impressive, with construction times averaging under 6 years in its current nuclear programme. Germany too has constructed stations in about 6 years. America has suffered slippage in recent years with construction averaging about 8 years but this masks a wide range.

2.27. France also comes out well in the following comparison of the costs of building power stations in different countries.

Table 8 - Construction Cost

(Cost per kWh in constant prices, excluding taxes, discounted at 5 per cent)

	pence per kWh at 1.1.81	
	Nuclear Plant	Coal Fired Plant
UK	1.57	0.82
France	0.56	0.45
Germany	0.86	0.43
Italy	0.54	0.31

Source: Generating costs - assessment made in 1981 for plant to be commissioned in 1990, Unipede, 1982.

It is important to bear in mind that the figures in the table above reflect each country's views of the cost it would face in building a station to be commissioned in 1990, not necessarily the results it has already achieved. They are therefore far more likely to be optimistic than pessimistic. Nevertheless the main message is clear and stark - it is significantly more expensive to build either type of plant in the UK than elsewhere. The CEGB however strongly believes that the PWR will be substantially cheaper than the AGR which forms the basis for the UK nuclear figure in the above table.

2.28. A degree of reserve capacity, to ensure against the risk of normal plant breakdown, weather variability, and errors in demand forecasting, is required and is known as the planning margin. In the 1950s the CEGB's planning margin was 14 per cent. It was increased to 17 per cent, then 20 per cent in 1968 and 28 per cent in 1977. The rise reflects the increased uncertainty in forecasting demand, and the deterioration through time in plant reliability - a problem associated with the introduction of the large 500 and 660-MW sets. A recent report by the Electricity Consumers Council found that, although an international comparison of security of supply standards was difficult, the CEGB's standard appeared to be higher than those of other utilities. In addition, supply interruptions were rarely the result of generating failures - the main cause of failure had been the distribution system, because of factors like bad weather and strikes. The report concluded that a lower security standard could yield significant long term savings.

Conclusions

2.29. The main conclusions of this chapter are -

i. Only France, with a large amount of nuclear power, and Canada, Sweden, Norway and Austria, with a dominant share of hydro-electric power, have generating mixes with significantly lower cost structures than the UK. Germany is broadly comparable with the UK and the cost to Italy of a large share of oil-fired thermal plant is only partly offset by hydro-electric power.

ii. Fuel costs are a major cost component for electricity generation. In the UK we conclude that although the current coal bill paid by the CEGB to the NCB is about right, the immediate prospect is that NCB prices will rise above import related prices.

iii. In terms of operational efficiency, the UK is at a disadvantage compared with France and Germany. Partly this results from a different pattern of demand which the utilities can only influence to a limited extent. There is certainly room for the esi to improve its operational efficiency but the impact on its overall cost structure would be small.

iv. Construction costs are significantly higher for both coal and nuclear plant in the UK than elsewhere.

CHAPTER 3 - PRICING POLICIES

3.1. The price of electricity to consumers is dependent not only on cost but on the financial regime within which the utility operates and the way in which, via the tariffs, it shares out the costs between consumers.

UK pricing policy

3.2. In the United Kingdom the esi is required to meet a financial target set by Government. The Government's general policy is that consumers should pay economic prices for energy, as established by the international market. For electricity, in which there is no international market, pricing policies have been based on long run marginal costs in order to give the correct economic signals to users and the supply industry. The financial target for the electricity supply industry for the three years from 1980/81 to 1982/83 was based on estimates of marginal costs made by the CEGB in 1979. These suggested that in 1979 the CEGB's Bulk Supply Tariff was on average some 5 to 10 per cent below marginal costs. The financial target was set on the basis that this under-pricing would be progressively phased out. It was expressed as an average 1.8 per cent (subsequently reduced to 1.7 per cent) return on net assets over the three years.

3.3. In England and Wales the electricity produced by the CEGB is sold wholesale at a price determined by a published Bulk Supply Tariff (BST) to Area Boards, who then distribute electricity to consumers. The CEGB accounts for approximately 4/5ths of the electricity supply industry's costs, but for large industrial consumers Area Board distribution costs are low, and their prices are very largely determined by the BST alone.

3.4. The 1967 White Paper on the Nationalised Industries (Cmnd 3437) argued that if national resources were to be allocated efficiently, nationalised industry prices should be reasonably related to costs at the margin. Although it was acknowledged that when there was spare capacity, short run marginal costs (variable costs) would be relevant, it gave more emphasis to the need to cover long run marginal costs (including the capacity element). In the 1978 White Paper (Cmnd 7131) Government re-affirmed that for industries where

there was sufficient scope for setting prices, these should take account of the need to cover costs, including the opportunity costs of capital. It further said that these costs should be reflected in the industry's medium term financial target. Of course, appropriate pricing principles do not of themselves ensure efficiency.

3.5. Marginal cost pricing in the electricity industry has two main components -

i. the variable costs of producing electricity. These are mainly fuel, but also associated fuel handling and labour costs. Because of the varied range of power stations (using different fuels - coal, oil, nuclear, gas turbines - and of different ages), a merit order exists and power stations are brought onto the system in order of increasing cost to meet increases in demand. Electricity demand varies significantly both during each day and on a seasonal basis. As a consequence marginal costs vary; different power stations are being brought on to meet increments of demand at different times. This is why the BST has different energy charges over the 8 hour night, 14½ hour day and 1½ hour peak periods.

ii. The element that gives marginal cost its longer term dimension is the cost of adding capacity to the system. Given the variation in demand just referred to, capacity costs essentially arise from extra peak demand. The BST therefore levies capacity charges at times of peak demand in the winter. The net cost of adding to capacity is the capital cost of plant, plus, through its impact on the merit order, its effect on generating costs. New capacity will have lower generating costs, be used as intensively as possible, and therefore displace more costly plant at the margin. If the electricity supply system is in balance - in the sense that demand and cost assessments turn out to be broadly correct and the plant mix is such as to minimise costs - the net cost of each type of capacity, whether new nuclear or fossil plant or the costs of delaying the retirement of existing plant, will be the same. If this were not so, costs could be lowered by rearranging the plant mix.

3.6. As mentioned above, the esi's financial target for 1980/81 to 1982/83 was set so as to phase out underpricing. Some spare capacity was expected but it was assumed that by the middle 1980s demand and capacity would be in broad balance. The marginal cost estimates therefore included the full net cost of adding new capacity to the system. But since then the environment facing the industry has changed significantly. Two elements stand out -

i. the recession has been more severe than expected and expectations of growth in the United Kingdom have fallen. In addition higher energy prices have led to greater reductions in energy use than was thought likely during the 1970s. As a consequence estimates of future demands for electricity have been revised downwards substantially on a number of occasions, so that the period of excess capacity is likely to be prolonged until well into the 1990s.

ii. oil prices rose sharply in 1979 and 1980, although they have since fallen back somewhat. The prospect is of very much higher prices for fossil fuels than was thought likely in the late 1970s. The result is that the economic case for investment in nuclear electricity is now based on cost saving and the advantages of diversifying sources of supply, rather than on expansion of capacity.

3.7. Indeed since the electricity supply industry has excess capacity extending well into the 1990s, there is no present case on grounds of capacity for building new plant. A substantial amount of new investment in nuclear plant would apparently be justifiable on the grounds of cost saving and diversification of supply but this would effectively prolong the period of excess capacity even further. This makes it even harder to pursue the nuclear programme in the face of public and political opposition. The existence of excess capacity also has important implications for marginal costs. Because of the comparatively low fixed costs of retaining relatively modern and efficient existing plant on the system and the absence of any need to build new plant to meet additional demand in the next decade, the marginal capacity cost of meeting additional demands is low.

The Bulk Supply Tariff

3.8. Earlier this year the Secretary of State for Energy commissioned Coopers and Lybrand Associates to report on the Review of the BST which the Electricity Council had carried out. In their report Coopers have investigated the BST's structure thoroughly, including the implications of the current imbalance in capacity for prices. We do not propose to adjudicate on the many detailed and important points raised by Coopers' investigation. However their conclusions do have implications for this current CPRS study.

3.9. The thrust of Coopers' work is, first, that the BST's capacity charges (which account for one fifth of CEGB's revenues) are too high. This is partly because inadequate weight is given to excess capacity (which lowers the cost of meeting additional demand), but also for more detailed methodological reasons. Secondly, the BST's structure may not adequately reflect the variation in costs during the day or over the year. The questions and problems posed by Coopers' investigation require further follow-up work by the Department of Energy with the CEGB. Assessments of the quantitative impact of Coopers' conclusions are therefore inevitably very uncertain at this stage. Nonetheless, it appears reasonable to suppose that too high a level of capacity charges results in the overall BST average selling price being at least 5 per cent and perhaps as much as 10 per cent too high. However the BST incorporates various load management schemes, arrangements under which large users reduce their demands for electricity at times of likely system peak, in return for reductions in capacity charges. By virtue of these load management schemes many of the larger intensive users already pay reduced capacity charges or are able to escape paying them entirely, so avoiding any element of overcharging contained in them. But industrialists would be affected by the introduction of a more sophisticated reflection of costs in the BST as Coopers recommended. Some, by concentrating their demand in the cheaper time periods, would benefit. For others it may not be practicable or worthwhile to re-schedule their demands and they might end up worse off than they are now.

3.10. The Coopers report indicates that there is a large degree of averaging within the existing BST, which averages the cost of generation into four time of day rates. This is taken even further by Area Boards in their taiffs and the types of contracts and special arrangements they make with industrialists. Coopers' report suggests that weekend rates and perhaps a sub-division of the standard day rate may be appropriate. This, combined with explicit charging by Area Boards for the existing 1½ hour peak period surcharge, could for some industrialists lower their electricity bills - but it would not be enough to remove more than a small part of the price disparities with France and Germany. Steel producers are among the more vociferous lobbyists, and many of them would be in a position to make use of more sophisticated day rates in particular, because their process is interruptible. Not only would a more sophisticated tariff be justified in its own right, but industrialists have shown through the various load management schemes that they can respond to appropriate price signals.

3.11. The CPRS draws the following conclusions from Coopers' report and its implications.

i. There is no systematic bias in the present BST against large high load factor industrialists. Indeed, the Contracted Consumer Load scheme, by going beyond what can strictly be justified on cost grounds, may be unduly generous. (This is because the number of hours in which users might be asked to reduce demand is less than the actual number of peak hours.) Additionally, under a scheme announced in the 1981 Budget, the Area Boards have 3 per cent flexibility in dealing with large industrial consumers. In effect this has allowed a reduction in electricity prices for large industrialists; again this has no rigorous cost basis to justify it. These two concessions cost £100 million in 1982/83, a figure which was specifically allowed for in setting the electricity industry's EFL. In principle these factors should be corrected when a more cost reflective BST is introduced.

ii. The great majority of industrial consumers would benefit from lower BST capacity charges if these were to be introduced as a result of further work following Coopers' recommendations.

iii. But, ironically, these same changes would give less benefit - in some cases, none - to high load factor industrialists who are already on load management terms; and this is the very group which contains most of the industrialists who are most affected by - and disaffected about - electricity prices.

iv. If a more sophisticated cost reflective tariff were introduced, some industrialists, by re-scheduling demand, would have the option of lowering their electricity bills by concentrating demand in the cheaper time periods offered.

v. The implementation of Coopers' proposals, which were inspired purely by resource allocation considerations, would have substantial costs in terms of additional public expenditure - perhaps of the order of £½ billion a year. Such a figure is of course not without wider macro-economic significance, but the balancing of these wider considerations is beyond our terms of reference.

3.12. Coopers' report suggested that coal prices are too high. They came to this conclusion because the NCB offers substantial discounts in order to sell additional tonnages in some markets (including to the CEGB for a coal take above 75 million tonnes a year), so as to keep stock levels under control. And, because of the effect on overall NCB costs of the loss making portion of the industry, and because of the comparatively low cost (relative to current prices) of developing some new reserves, Coopers presume that the excess costs come through in NCB prices. But as explained in Chapter 2, the CPRS considers a world related price to be the most appropriate economic yardstick. On this basis present coal prices are not too high; the costs of the uneconomic portion of the NCB's activities are borne by the taxpayer rather than by coal consumers.

Industry's arguments

3.13. The CPRS has considered the main complaints expressed by industrialists about electricity prices and contracts. These are discussed in more detail below, but they are in many cases based on misunderstandings. However the esi for their part have not made much effort to dispel these misunderstandings.

3.14. Underlying many of these arguments is industry's understandable fear that because of its monopoly position the esi is operating in an inefficient and non-market oriented manner and is able to pass on the cost consequences to its customers. The CPRS is considering the wider issues raised by this complaint in a forthcoming report on state monopolies. Inefficiency is very difficult to prove in a monopoly, but as discussed in Chapter 2, improvements in operational efficiency would not have a very significant impact on prices. Overcapacity and planning limitations are not confined to state monopolies. As far as the charge of non-market oriented behaviour is concerned, it is generally accepted that the current structure of the esi is unsatisfactory and that the separation of a centralised generation authority from regional distribution and supply boards does distance the consumer from the dominant sector of the esi, the CEGB. Our discussions in Germany have also indicated that a regionalised system, largely made up of separate power-boards, appears to allow a greater degree of market response and the potential for limited competition. Although we consider that these areas should be studied further, such structural changes would complement rather than replace the long run marginal cost pricing policy. It should be noted that German utilities stress the need to give correct cost-reflective price signals and reject the argument that they should phase price movements in sympathy with the economic cycle. We return to some of these points in Chapter 6 and concentrate below on some of the more technical criticisms raised by industry.

3.15. It is often alleged that the CEGB has got its marginal cost methodology badly wrong, especially with regard to the balance between energy and capacity charges. In part this can be attributed to a lack of clear and consistent public explanation and presentation of its methodology. Coopers, in considering this criticism, conclude 'although we have several reservations concerning the calculation of capacity and energy charges we are satisfied that the CEGB's approach is, in broad principle, consistent.' And we pointed out in paragraph 3.9 that although the BST is too high because of too high capacity charges, many large industrial users pay reduced capacity charges or avoid them altogether through load management.

3.16. Two additional arguments often raised are that electricity pricing should be on the basis of an optimal (rather than existing) system, and that base load plant (ie the more efficient and low cost plant) should be dedicated or allocated to high load factor industrialists. Pricing on the basis of an optimal plant mix could not be justified, given the size and speed of the United Kingdom's prospective nuclear programme (see chapter 4). EdF is, it is true, anticipating the benefits of low nuclear costs in its tariffs, but France's large scale successful nuclear programme is well on the way to fruition. In the United Kingdom the argument for pricing on the basis of optimal plant mix cannot be an economic argument based on the need to give consumers the right signals, since the timescale is too protracted for the signals to be relevant.

3.17. Industrialists have argued that efficient coal fired plant should be dedicated to meet their demands, so justifying cheaper prices. This argument is in fact misconceived as the BST does charge base load users the costs of marginal base load coal plant. Furthermore, for industrialists on load management terms, current prices are lower than would flow from the full costs of allocated coal plant. The same conclusion would not apply for dedicated nuclear plant. In the longer term, in a fully balanced system, nuclear would become the marginal base load plant and industrialists would receive no economic advantage from dedication. At present with an unbalanced system, dedicated nuclear stations already in operation would provide electricity at lower prices than those flowing from the BST.

3.18. Plant dedication can however prove to be very risky for the user. As the esi knows to its cost, expectations about such crucial factors as construction costs and fuel prices can be falsified; for example ten years ago industrialists might well have argued for dedicated oil-fired plant. Relying on the total system spreads the risk. And lowering electricity prices for some consumers now by giving them the benefit of what is at present the cheapest plant would result in higher prices for other consumers. We can see no economic justification for such a cross-subsidy.

3.19. Nevertheless large industrial electricity users have much to gain from more nuclear power stations within the esi. Efforts by industry to draw attention to the link between industrial competitiveness and nuclear power could play a significant part in persuading public opinion of the need for a more vigorous nuclear programme. It should also be noted that, with the proposed new legislation on private generation, there will be nothing in principle to prevent private industry from developing nuclear power within the private sector - perhaps in consortia using the national grid as a common carrier.

Communication between the esi and industry

3.20. It is however clear that much more could and should be done to explain and justify to industry the methodology of electricity pricing. The esi will have to make a major effort on this once changes in the tariff structure flowing from Coopers' Report have been agreed. Industry should be given a clear statement of the Area Boards' criteria and rules for contracts and special agreements. The Electricity Council have informed us that currently there is nothing stopping an industrialist being given BST terms. This should be made clear.

3.21. Industrialists have also complained that they should be able to deal direct with the CEGB. They say that Area Boards do not necessarily understand, or have any financial incentive to find out about, the underlying cost intricacies of the BST. Even if it does prove possible in future to revise the BST so as to give more sophisticated cost messages, there could still be cases where negotiation between large industrial users and the CEGB could lead to special tariffs which were more advantageous to both sides. Discussions with the CEGB could also help to dispel some of the misunderstandings which industrialists have about electricity tariffs and the costs of the esi, and might relieve some of their sense of frustration. We therefore recommend that large industrial users should be given a real opportunity to deal directly with the CEGB.

3.22. These recommendations will not result in markedly cheaper electricity for industrialists. But they should help to remove much of the misunderstanding, and allow industrialists to negotiate more effectively with the electricity industry, so that they can both arrange their affairs so as to minimise their costs.

International Comparisons

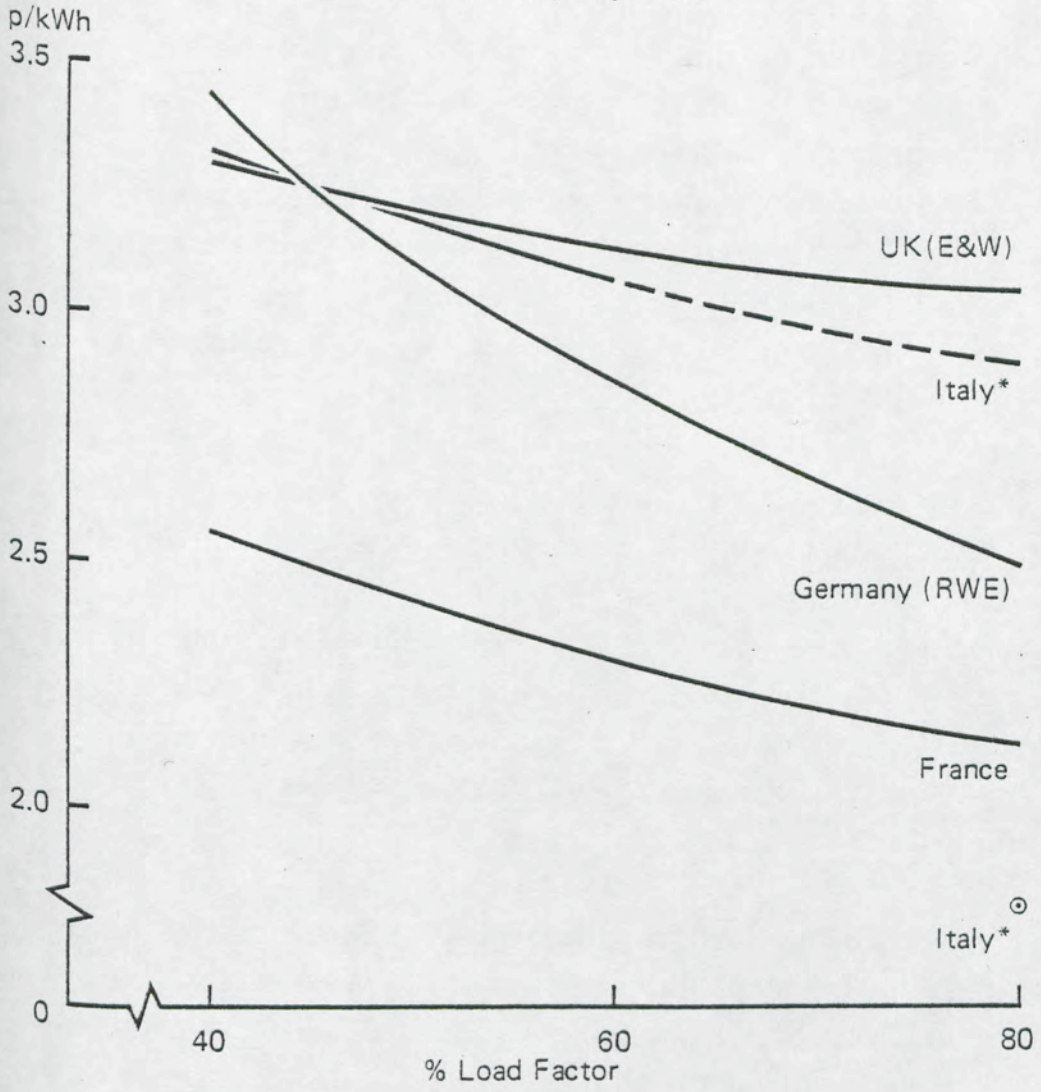
3.23. But, it can be argued, even if we accept the conclusion that the BST does not systematically discriminate against the heavy industrial user of electricity, it remains true that firms in France, and some of them in Germany and Italy, pay less than their counterparts here. What part does pricing policy play in those differences?

3.24. In general low load factor users in all countries pay more for each unit of electricity than high load factor users. Such tariffs are described as "degressive". The wider the difference between what high and low load factor users pay, the more degressive the tariff is. Clearly if the costs of producing electricity in two countries are the same, high load factor users will be better off in the country with the more degressive tariff, and low load factor users in the other. It is generally the case that tariffs in Germany are more degressive than elsewhere.

3.25. The graph in Figure 2 below compares, for large industrial consumers, tariff shapes in the United Kingdom with those elsewhere. The graph is based on Table 1A in Chapter 1 and the same qualifications apply.

3.26. The graph shows that, broadly speaking, in France and the United Kingdom costs are shared out in similar ways between low load factor and high load factor users. But the different levels indicate that costs overall are lowest in France. On the other hand, Germany's prices, as indicated by RWE, are more degressive, and high load factor users in RWE do very well compared with their competitors in other countries. The Italian curve is quite comparable to the United Kingdom's, until 80 per cent load factor is reached.

FIGURE 1 Industrial Tariff Prices per Unit
(10 MW load, July 1982)



* Users at load factors of 80 per cent or more in Italy enjoy a substantial price concession. The tariff curve between 60 per cent and 80 per cent load factor has been estimated.

France

3.27. In France, most electricity is produced by the nationalised utility Electricite de France (EdF) which has a monopoly of the transmission and distribution of electricity. The French Government's intention is that industry should receive electricity at a competitive, but not subsidised, price, and the cost of supply to each category of smaller consumer, and if necessary each individual large consumer, should be recovered through the tariff. The marginal cost, together with an adequate contribution to overheads, would form the basis of individual prices.

3.28. The French generating system is not optimal at present - there is too much oil-fired capacity - and prices are set at a compromise between the marginal cost of the existing system and the more balanced one towards which EdF is rapidly moving. By 1985 EdF intend that the tariff structure should reflect the marginal costs of supply in the period 1985 to 1990. This complements the French Government's objective of increasing reliance on electricity, and on nuclear power as a way of generating it, in order to switch away from oil. The new counter-inflation strategy in force, however, means that prices have not been allowed to rise fast enough to prevent EdF incurring substantial deficits.

3.29. EdF has access to a wider range of loan facilities than the electricity supply industry in the United Kingdom; on some of them, interest is payable only at low rates (3-5 per cent) or not at all for some time, but on others EdF must bear exchange rate risks. EdF works closely with several different parts of the Government but has to accept constraints (sometimes severe) on the quantity of capital of various kinds to which it has access, constraints that the French Government might choose to impose for wider economic reasons.

3.30. Recently EdF's deficit has been causing concern; the foreseeable 1982 deficit of FF8bn (about £700m) could almost double the 1981 figure of FF4.4bn. A substantial part of the problem is exchange losses on borrowings abroad, caused by depreciation of the franc; about a third of EdF's debt is in foreign currency.

Germany

3.31. The German electricity system is the product of economic evolution, and changes in structure and trading relationships have taken place largely in response to market forces rather than government pressures. The system today consists of nearly 1000 separate undertakings ranging in size from small local distribution companies to large integrated regional authorities, of which RWE in Essen is by far the largest, accounting for 36 per cent of generating capacity. The various utilities form part of the private sector although the majority of the undertakings have an element, often a controlling

element, of public capital in their equity. The public element is provided by the local Lander governments which have a direct relationship with the electricity undertakings operating within their territory. The federal government provides a framework for the electricity industry. The utilities are partially regulated by government, both national and local.

3.32. The German pricing structure contains three elements -

- tariff customers (mainly domestic and commercial);
- special tariff customers (mainly industry); and
- special agreements (only for large industrial customers).

Prices for the first category are the subject of published tariffs which are controlled by a price commission in each state authority under criteria set by the federal government. Prices to special tariff customers are separately negotiated and are subject only to oversight by the Cartel Office. These two categories of prices are publicly available and are inevitably closely related. The third category, special agreements, are for a small number of large industrial users and are privately negotiated and confidential.

3.33. In principle, cross subsidisation, undue preference and subsidy should play no part in any of these categories. There is, however, a significant amount of flexibility in price negotiations for special tariffs and special agreements. The Cartel Office can check any contract in these categories provided there is a basis for believing that misuse of monopoly power is involved.

3.34. The tariffs and the special contracts appear to be very degressive and the sensitivity of the system to particular groups is often reflected in special terms. For example, German iron and steel producers have their "peak demand" measured during a much smaller number of hours than ordinary consumers on tariffs; in the summer it can be as little as one hour a day. To the extent that they can avoid using electricity in these hours, they can reduce their bills. It has been argued that this approach is in effect a load management scheme and that there is an economic rationale behind it.

3.35. The independence of the different utilities results in significantly different cost structures and hence prices among different authorities. RWE with access to cheap brown coal is probably the lowest cost utility and one which supplies power to a large amount of heavy industry in the Ruhr area, particularly steel and chemical plants. However brown coal is running out and the extent to which RWE maintains its position as a low cost authority depends on the speed with which it can build nuclear capacity. Some utilities have achieved a substantial proportion of nuclear plant in their generating mix eg 39 per cent at NWK (supplying ICI at Wilhelmshaven).

3.36. As far as the special agreements are concerned, we have not been able to establish to our satisfaction that the lowest prices do cover current marginal costs of supply. We have the impression that many of these arrangements are below costs, assessed on today's terms, and that in some cases prices do not fully cover full nuclear costs, though they may cover variable nuclear costs.

3.37. These special agreements seem to have two separate rationales. In the case of the large utilities such as RWE they have been based initially on falling marginal costs, which resulted in cost-related contracts which were below average costs. However these conditions have passed; marginal costs are no longer falling and the economic justification for these special agreements has disappeared. The special agreements with RWE, enjoyed by a number of chemical and steel companies, expire in 1983, and RWE's intention is that they should not be renewed. With German heavy industry under pressure, and with high levels of unemployment, RWE will come under political pressure to renew such special contracts. The outcome is difficult to predict, but it seems certain that, if renewed, these special contracts would be on substantially less favourable terms.

3.38. A quite separate rationale is that of local industrial policy. Smaller utilities are more vulnerable to local political pressure designed to attract and retain heavy industry. Some subventions are in the form of rate relief etc; others are in the form of special agreements where there is likely to be a major element of cross-subsidisation. Such agreements generally have many years to run, and the political pressure for them is unlikely to diminish. It

would appear that the Reynolds Aluminium contract in Hamburg (HEW) and the ICI contract at Wilhelmshaven (NWK) fall into this category. However increasing costs are likely to result in significantly higher prices when the contracts come up for renewal, even if some form of subsidy is retained.

3.39. Although the federal Government generally distances itself from the operations of German utilities, it does operate the Coal Utilisation Fund, through which domestic coal production is subsidised. German hard coal is expensive to produce and the utilities would prefer to use imported coal which is cheaper. The Government imposes a levy, called the Kohlepfennig, of about 5 per cent on electricity prices. The fund is needed to reduce the price of German coal bought by utilities to levels closer to (but not as low as) imported coal. Utilities are then allowed to import coal according to a formula based on the amount of German coal they buy.

Italy

3.40. Tariffs are controlled by CIP (Inter-Ministerial Pricing Committee) and have resulted in large operating deficits for ENEL, the state electricity utility; over the past year these amounted to 1,000 billion lire (about £400 million). The three areas of difficulty are -

i. the social tariff to domestic consumers. This was originally designed to protect the poorest citizens but now 90 per cent of household consumers benefit. Despite counter-inflationary pressures, some moves have been made to restrict the concessions but ENEL still fails to recover costs from most users;

ii. concessionary tariff levels to certain sectors of industry eg electric arc steel producers, who pay reduced rates during certain low load hours;

iii. the "thermal surcharge" (reflecting the increased costs of fuel) that ENEL has not been allowed to collect for the past 18 months, resulting in a deficit of 1,800 billion lire (and, in turn, interest charges of almost 400 billion lire a year). Industrial users on 80 per cent load factor or above enjoy a special reduction in the thermal surcharge.

3.41. The Government have recently announced a 2 per cent increase in electricity prices every 2 months in 1982, which should bring in 800 billion lire in 1982. In ENEL's view this and other measures fall far short of providing the 3,200 billion lire it needs. ENEL's financial health will, however, be a key factor in Italy's ability to carry forward its new National Energy plan.

Other countries

3.42. In the second group of countries, electricity prices are generally regulated in some way. In some cases prices for certain groups of users can be kept at an artificially low level. For example, recent price trends for high load factor users in Belgium indicate that they are being relieved of the burden of the nuclear building programme. This appears to be a commercial decision, there is no evidence of Government pressure, and apart from subsidising high cost domestic coal down to import price levels, energy is not generally subsidised in Belgium. Another example is provided by some American electricity utilities which are financially weak because, in general, regulatory Commissions are not prepared to allow them to pass on to consumers the financing cost of the construction of new capacity or conversions to coal until the plants are actually in operation. This clearly acts as a disincentive to utilities considering new investment which from the national point of view is needed, and is causing concern. The Public Utility Regulatory Policies Act of 1978 contained measures designed to ensure that regulatory bodies re-examine rate structures; the main responsibilities in this area now lie with the State, rather than Federal, governments.

3.43. In July 1982 the Dutch government announced a scheme to reduce prices paid by large consumers with high load factors, by allocating cheap gas to utilities. All units consumed over 30 GWh a year attract a discount of almost 1p/kWh.

Conclusions

3.44. The main conclusions of this chapter are -

i. There is no systematic bias in the present BST against large high load factor industrialists. Indeed, some load management terms, by going beyond what can be strictly justified on cost grounds, may be unduly generous.

ii. The various proposals for changes in the BST made by Coopers would benefit most industrial consumers, but would give less help - in some cases no help - to the high load factor industrialists who are already on load management terms.

iii. There is no economic case for allocating CEGB plant to industrialists so as to result in lower prices.

iv. Although some changes are proposed in pricing policies, and more should be done to explain and justify to industry the methodology of pricing, the CPRS considers the marginal cost pricing approach to be sound.

v. Lower prices for all industrial consumers in France are related to EdF's costs later in the 1980s when it will have completed its successful nuclear programme. In the meantime its prices involve EdF in substantial deficits. German tariffs are more degressive than elsewhere. Some large industrialists on special contracts in Germany, and high load factor users in Italy, pay lower prices than can be economically justified. The German special contracts are largely historically based and are being renegotiated to reflect current costs. An element of local Government subsidy is included in a few cases and is likely to be retained. Subsidy also plays a large role in the prices paid by large Italian industrialists.

CHAPTER 4 - PROSPECTS FOR PRICES

4.1. Given present prices for fossil fuels, nuclear power is much cheaper than oil generation and quite a lot cheaper than coal generation. These differences are likely to increase by the end of the century as real prices for fossil fuels rise. This Chapter therefore discusses the prospects for nuclear power in the United Kingdom and in other countries. It also briefly discusses utilities' fossil fuel costs and the possible impact of private generation in the United Kingdom.

Nuclear Prospects

4.2. The most important factor in containing future United Kingdom electricity costs will be our success in increasing the proportion of nuclear generation through the efficient construction of nuclear power stations. This is true even though on strict demand and capacity considerations, new generating plant will not be needed until some time in the the 1990s. The CEGB case for Sizewell shows that - provided it is able to meet its cost and performance targets - its net effective cost is negative ie building Sizewell B will reduce the overall costs of meeting current demand projections.

4.3. Nuclear plant at present meets only a part of the system's base load. The Department of Energy's Energy Projections prepared for the Sizewell Inquiry estimate that on existing programmes nuclear plant is not likely to meet full base load until about 2025. Existing plans were assumed in the central cases to involve the building of 5½ GW of nuclear capacity in the 1980s and a further 15 GW in the 1990s. Clearly an acceleration would be worthwhile. But a definite credibility problem exists. Sizewell (1.1 GW) alone will cost £1.1 billion to construct. Any substantial acceleration of the nuclear programme would entail a vast additional commitment of resources - both real and financial. The United Kingdom's past performance in building nuclear power stations not unnaturally causes hesitation and caution. Before resources on the required scale can be committed, we must be absolutely certain that the United Kingdom is building a sound system, and that construction performance will be adequate. Clearly the outcome of the Sizewell Inquiry will be crucial. And we cannot mount a nuclear programme on the scale required if there is widespread public opposition. The task of winning over public opinion is not made any easier by the current degree of excess capacity.

4.4. On current policies, assuming countries are able to meet the targets they have set themselves, the following pattern of electricity generation in 1990 emerges.

Table 9 - Electricity Generation in 1990

	Nuclear	Hydro and Other	Coal	Oil	Gas	Per Cent Total
UK	24	1	63	12	0	100
France	72	19	9	0	0	100
Germany	32	4	52	3	10	100
Italy	11	19	32	34	4	100
USA	24	12	50	5	9	100
Japan	33	16	12	21	18	100
Canada	17	64	16	2	1	100
Sweden	44	51	3	3	0	100
Norway	0	100	0	0	0	100
Austria	0	72	14	6	8	100
Belgium	46	3	37	10	5	100
Netherlands	8	4	52	4	33	100

Source: Energy Policies and Programmes of IEA countries, IEA, 1982.

Countries have in the past proved to be over optimistic about their planned nuclear construction. Downward revisions have been common and substantial. Table 10 compares the amount of nuclear plant already operating or under construction with what is required to meet each country's 1990 target. Only France and possibly the USA have the kind of track record that inspires any confidence they will meet their target. Some, eg Germany, Japan and Italy, have put forward projections for 1990 (which means that the last

Table 10 - Status of Nuclear Programmes at end of 1981 GW

Table 10 - Status of Nuclear Programmes at end of 1981

GW

	Operating	1990 Country Projections	Difference	Under Construction	Sites Approved & Authorised	Planned but no site Approval	Experience since end of 1978 New orders	Cancellations
United Kingdom	6.5	14.8	8.3	5.6	-	1.2	4.2	-
France	21.6	56.5	34.9	28.9	7.4	-	26.5	-
Germany	9.8	25.5	15.7	9.3	1.3	11.3	1.3	-
Italy	1.4	5.4	4.0	2.0	-	4.0	-	-
United Kingdom	6.5	14.8	8.3	5.6	-	1.2	4.2	-
United States	57.4*	121.0	63.6	80.7**	2.6	12.7+	-	30.9
Japan	15.5	51.0	35.5	10.1	6.1	17.0	3.8	-
Canada	5.2	15.0	9.8	4.9	-	5.2	-	-
Sweden	6.4	9.4	3.0	3.0	-	-	-	-
Belgium	1.7	5.5	3.8	3.8	-	-	-	-
Netherlands	0.5	0.5	-	-	-	-	-	-

* Not included 1.1 GW installed but not operating
** Of which 15.7 GW are less than 20 per cent completed and subject to delays or cancellations
\+ Not included 3.5 GW ordered but no permit application

Source: World Energy Outlook, IEA, 1982.

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station required to meet these projections must be started around 1984) that invite scepticism. The United Kingdom figures are somewhat above those implied by the Department of Energy's Energy Projections.

4.5. Nevertheless, Table 9 vividly shows the basis of France's cost advantage. If we make realistic assumptions about slippage of the programmes, in 1990 the United Kingdom will be roughly level pegging with Germany, USA and Japan. Prospects beyond 1990 are much more difficult to assess. The existing programme will - assuming its achievement - ensure that the proportion of CEGB's generation from nuclear plant will rise from about 20 per cent in 1990 to 35-40 per cent in 2000. The rise is in part held back by the retirement of 3½ GW of the Magnox generation of reactors. The problem of public acceptability is not confined to, or indeed most acute in, the United Kingdom. If however this problem is overcome, Germany, United States and Japan could establish sizeable nuclear programmes in the late 1980s, which would have a significant impact on their electricity costs by the turn of the century. The French have shown what is possible. The United Kingdom must at least match this possibility, otherwise electricity price disparities will widen to our disadvantage.

Fossil Fuel Prices

4.6. The price of fossil fuels to utilities will continue to be the dominant factor in the price of electricity for most of our major competitors up to 1990, perhaps beyond. There is considerable uncertainty both about the trend in world traded coal and oil prices, and how individual countries (particularly in regard to coal) will react to these. We believe that the basic presumption must be that they will broadly keep the price trend of fossil fuels to their utilities in line with those of world prices. It will be necessary to ensure that the NCB's coal prices match this (see paragraphs 2.8-2.18).

France

4.7. The French generating system is not optimal at present, as there is too much oil-fired capacity, but by 1990, almost three-quarters of France's electricity is expected to be generated by nuclear power. There has been a substantial (and successful) nuclear power station building programme for many years, and the expectation must be that the 1990 target will be met.

French prices at present anticipate some of the future benefits of its nuclear programme. When, about 1990, the French generating mix almost reaches the optimum, French prices can be expected not to decline any further; as the United Kingdom's nuclear capacity share increases, the disparity should then begin to narrow.

Germany

4.8. The German government is committed to the expansion of nuclear power but progress has in the past been constrained because of the complexity of the licensing system for PWRs; problems with reprocessing and waste disposal; and a combination of a lack of public acceptance of the need for nuclear capacity with laws and procedures that permit objectors to get court rulings to halt power station construction. The government has taken steps to streamline the licensing procedure and to try to resolve or defer the waste problems, but the climate of public opinion is still uncertain.

4.9. The United Kingdom Government is not alone in coming under political pressure on electricity prices; there is a similar debate going on in Germany. German industrialists are complaining bitterly about rising electricity prices and the impact on international competitiveness, particularly compared with France. The German electricity supply industry is mounting a major campaign to justify price rises on cost grounds and is strongly pressing the point that the only way to keep electricity-intensive processes competitive in Germany is to accelerate and extend the nuclear power programme. The nuclear power record has been markedly better in CDU than in SPD governed states, to the benefit of consumers in the former areas. It remains to be seen whether any new CDU national government would provide additional impetus to the nuclear programme in the face of continuing electoral progress by the Greens. If it does, and the Germans can maintain their good power station construction record, Germany could get well ahead of the United Kingdom in building up the proportion of nuclear plant in her electricity generating system.

4.10. As far as special contracts offering favourable terms to large industrial users are concerned, we have pointed out in Chapter 3 that the majority of those contracts are likely to be renegotiated on to current cost related terms as they come up for renewal. There may be a few cases where an element of subsidy is continued because of local government pressure, but even in these cases, the current differentials with United Kingdom industry can be expected to narrow.

Italy

4.11. In the 1970s Italy adopted an energy plan that involved a rapid increase in nuclear generating capacity, but this turned out to be impracticable mainly because of difficulties in getting agreement at regional and local level to the use of sites.

4.12. The new National Energy Plan adopted in 1981, and designed to reduce Italy's dependence on imported oil, involves a more modest expansion of nuclear capacity, energy conservation and the development of coal and gas imports. The plan involves a 50 per cent increase in the use of electricity, with oil burn held roughly constant, the nuclear contribution increasing from 0.5 to 8 mtoe and most of the increment being met by increased coal burn. Nevertheless, Italy will continue to be heavily dependent on oil, and hence on price movements in the world oil market, over the whole period to 1990. The other main generating fuel will be imported coal, again at world market prices.

4.13. The success of the plan depends on Italy's ability to carry forward a many-faceted development plan, not all of it involving direct action by the State. It requires the development of three major coal ports and inland distribution facilities, at an estimated total cost of 1,200 billion lire (£500m). The power plant construction element (17 GW new coal plant and 6 GW nuclear) requires ENEL to spend 34,000 billion lire (£14 bn) over the next ten years. ENEL's ability to fund this development will depend heavily on government decisions on pricing and indirect funding. There must remain doubts, both as to whether the plan goes far enough to meet Italy's problems, and whether it is achievable.

Other countries

4.14. The successful Belgian nuclear programme is near completion but there has been no debate or decision yet on further expansion. In several of the other countries, however, prospects for the development of nuclear power are uncertain because of the strength of public opposition. Austria's one nuclear plant has been mothballed after a referendum and Sweden is committed to no more nuclear capacity after the twelve reactors approved by referendum. In the Netherlands, the Dutch Parliament is due to decide in 1984 whether to proceed with nuclear. But the new government is unsympathetic to the nuclear option and is exploring the consequences of closing down or mothballing two stations.

4.15. As in other countries, delays are caused in Japan by the difficulty of finding suitable sites and the negotiation of compensation with local residents. A leakage of radioactive water at a plant in 1981 drew public attention to safety matters but does not seem to have affected the nuclear programme so far. In order to make siting easier, grants are now provided to local governments to reduce electricity rates for residents and firms close to nuclear plants.

4.16. The expansion of nuclear power is seen by the American government as an important objective; and the President's statement in October 1981 announced moves to speed up licensing procedures, lift the ban on reprocessing and resolve waste storage problems, develop fast breeder reactor technology and remove obstacles to the increased use of nuclear power. Among these obstacles is the weak financial state of utilities, which with the sharp decline in the growth of energy consumption has resulted in no new orders for nuclear power stations since 1978, and 22 cancellations. Another is growing public doubt about safety in the wake of the incident at Three Mile Island. A third is the lengthening of construction times as a result of safety regulations being changed during construction; the acceleration of the licensing procedures should help to reduce this though the President's target of 6-8 year lead times still looks ambitious.

Private Generation

4.17. We have also examined the potential impact of private generation and combined heat and power schemes on United Kingdom industry's costs. The Government's proposed new legislation for allowing private generation as a main business is designed to change the present culture and to provide a suitable environment for competitive and innovative enterprise. The proposals include the use of the national grid as a common carrier for private suppliers which will give the opportunity for private industry consortia to generate power in one place and sell it in another. This will enable industry to challenge the monopoly position of the esi and to test their feeling that prices would be lower in a competitive environment.

4.18. We consider that such schemes could be economically attractive, principally for nuclear stations but also perhaps for modern efficient coal stations, particularly at coastal locations using imported coal. However, there must be some doubts about the willingness of the private sector to invest in such projects. The public opposition to private sector nuclear power stations is likely to be a major constraint and any private investment would involve massive financial and managerial resources to build the size of power station that economies of scale require for viability. The electricity intensive industries tend to be under considerable competitive pressure for a wide range of reasons and it seems unlikely that such industries would want to commit resources to private sector power stations in the near future. Nevertheless there could be firms in other sectors which would be interested in supplying power both to their own industries and to the troubled electricity intensive sectors. There could also be some merit in private industry developing private generation projects in parallel with the CEGB in order to share expertise and assist construction.

4.19. The economics of private sector generation could be greatly improved by linking this approach with combined heat and power schemes. The electricity intensive industries tend also to be energy intensive and if the process heat demand can be matched to the heat produced from power generation, overall thermal efficiency can be increased from about 30 per cent to over 80 per cent. As well as schemes wholly within the private sector, we also consider that there is further potential for the esi to develop combined heat and power schemes in conjunction with industry.

4.20. We have also examined whether the sale of CEGB plant to the private sector would be both economic and desirable. We concluded in Chapter 3 that allocation of efficient coal fired plant would not provide industry with lower prices than the BST, and that allocation of nuclear plant would result in an unjustifiable cross-subsidy from other consumers. A similar argument applies to the sale of CEGB plant to industry. On the positive side, the long lead times and construction risks would already have been borne by the CEGB and it is possible that the private sector could operate such stations more economically, both through higher efficiency and, for coal stations, through imported coal. However, these factors are likely to be out-weighed by the fact that the sale of any stations which are attractive to the private sector is likely to increase the average costs of the esi and hence result in cross-subsidisation of the sale by other electricity consumers.

Conclusions

4.21. The main conclusions of this chapter are -

i. Looking ahead to 1990, and assuming that NCB coal prices remain related to the price of imported coal, the CPRS cannot see any cause for assuming that the costs which underlie United Kingdom electricity prices are likely to fall relative to those in competitor countries. The gap between the French and ourselves is likely to widen.

ii. Most of the advantageous contracts for German industrialists are to be renegotiated soon. They are then expected to be more related to current costs. Differentials with United Kingdom industrial prices can therefore be expected to narrow somewhat.

iii. Looking further ahead to say the year 2000, other countries could by then have achieved a substantial impact on costs through accelerated nuclear programmes. It is essential for us to be able to match this.

4.22. This chapter has implicitly assumed a constant exchange rate. Chapter 1 indicated that the deterioration in recent years in relative industrial electricity prices against the United Kingdom in the main reflects our

substantial loss in competitiveness. Compared with 1979, competitiveness had by early 1981 deteriorated by over a third. Since then it has improved by some 10 to 15 per cent. Further improvements in competitiveness, as domestic costs continue to adjust, can be expected to contribute towards improving the United Kingdom's relative industrial electricity prices. The timing and extent of this is however uncertain.

CHAPTER 5 - THE IMPACT OF ELECTRICITY PRICES ON UK INDUSTRY

The General Picture

5.1. Figures derived from the 1974 census of production show that, on average, direct purchases of electricity accounted for 1.36 per cent of the costs of manufacturing industry. In only 18 of the 82 sectors was the average higher than 1.5 per cent and in only one (cement manufacture) did it exceed 5 per cent. A few figures for 1979 have recently become available. They confirm this general picture, although the overall average has risen to 1.54 per cent of total costs.

5.2. In addition to direct purchases of electricity by industry, electricity prices enter industry's costs indirectly through their impact on the cost of purchases of, for example, raw materials and components. Taking direct and indirect purchases together raises the average proportion of manufacturing industry's costs attributable to electricity to about 2½ per cent.

5.3. Thus a major reduction in the cost of electricity to industry - say of the order of 20 per cent - would have a very modest impact on total costs - it would not lower them more than ½ per cent in most cases. Such a reduction would of course be welcome and helpful to all parts of manufacturing industry, but it could not be regarded as a critical element in industrial competitiveness.

5.4. Within this broad picture, however, there are of course some businesses for which the cost of electricity is or could be a significant factor for international competitiveness and for future strategic and investment decisions. With the help of Departments and from other enquiries we have identified those industrial sectors which could be most seriously affected by the cost of electricity and we have examined its actual impact on them. By no means all heavy users of electricity will be at a disadvantage facing overseas competitors in the market place. Some electricity intensive products are not internationally traded to any great extent, usually because, like cement, their bulk to value ratio is very high and the cost of transport would be too high. Nevertheless if the price difference between these products in the United Kingdom and on the Continent goes on increasing, trade will eventually become attractive. There are signs for example that cement is beginning to be traded. These "non traded" products cannot therefore be ignored completely, though they are at present less important.

5.5. The sectors we have identified that could be at a serious disadvantage in competitive terms as a result of electricity prices are chemicals, iron and steel, textiles, paper and board and aluminium. As a result of our work we consider the first two to be the most important. In the following paragraphs we summarise our findings on all five industries, describe briefly the position of some other industries, and draw some general conclusions. Annexes A-D discuss the position of chemicals, iron and steel, textiles and paper and board more fully.

Chemicals (Annex A)

5.6. The chemicals sector uses more electricity than any other; it accounts for about 17 per cent of all industrial demand and 6 per cent of all electricity supplied by the esi. As a generalisation, the importance of electricity to costs is greatest at the beginning of the production chain and declines along the chain through intermediates to final products. For intermediates, electricity will typically account for 5 - 7 per cent of costs; in final products it will be as little as 2 per cent. Where figures of this order apply, electricity costs though important are only one of many factors affecting international competitiveness.

5.7. There are however a number of processes where electricity costs are of a much higher order of significance for competitiveness. The most important of these is the production of chlorine by the electrolysis of brine; a process in which electricity accounts for 50 per cent of total costs and 80 per cent of variable costs. ICI, the major United Kingdom firm involved, have waged a long campaign for electricity prices nearer to the very favourable electricity prices which ICI themselves currently pay in their German plant at Wilhelmshaven. (This is the result of a special contract, of the kind described in Chapter 3 above, which in our understanding results in prices which are below cost, at least in today's terms.)

5.8. Even in the case of chlorine, however, the importance of electricity prices can be exaggerated. Chlorine itself is not readily traded. Its most important uses are as an input, via intermediate products, to the production of PVC and of various chlorinated solvents. As we show in Annex A

electricity accounts for some 10 per cent of the total cost of PVC. ICI have shown that at similar high load factors (90 per cent) electricity at Runcorn costs 1.7 times what it costs them in Germany; based on this figure the final cost disadvantage to the United Kingdom in the production of PVC is 4 per cent. Figures of the same order apply to other chlorine based products and put the disadvantage into proper context.

5.9. Moreover, under current conditions of depressed demand Runcorn is only 67 per cent loaded and application of the German tariff which strongly favours high load factor operation would in fact increase Runcorn's electricity bill. But, of course, if the German tariff applied in the UK ICI would have the incentive to load up Runcorn at the expense of smaller plants.

5.10. Unfortunately the PVC chain brings together the problems associated with chlorine production and those of ethylene based products. All European petrochemical producers are under severe pressure but ICI, dependent on naphtha rather than ethane as a feedstock for ethylene, have particular problems. ICI are currently making massive losses in PVC which is selling at 40 per cent of fully built up costs. It is doubtful whether ICI are even covering variable costs along the production chain from chlorine to PVC.

5.11. This helps to explain why ICI attach so much importance to electricity prices. And they are quite entitled to point out that if they operated in the UK at high load factor and they enjoyed the sort of electricity price they have obtained in Germany, their losses on chlorine based products would be substantially reduced. It is also possible that unless the differential between the prices currently paid by ICI in the UK and in Germany is significantly reduced ICI might withdraw from at least part of the chlorine based sector in the UK. However, the advantage enjoyed by ICI in Germany results from a special agreement which on today's terms would not appear to be covering costs. Although the renewal date of this contract is confidential, it seems likely that any renegotiation will result in higher German prices which will reduce the differential with UK prices significantly. The same result is likely for ICI's competition in Germany. In addition current ICI UK chlorine capacity is ten times that in Germany so any major shift of chlorine production by ICI to Germany would necessitate new electricity supply arrangements. We therefore consider that the threat to ICI's UK operations

is less a function of competitive electricity prices, although we do not deny that this is one relevant factor, than a result of the general problems besetting the chemical industry - world overcapacity and, for the United Kingdom, a high sterling exchange rate. This conclusion is to some extent reinforced by ICI's recent announcement of its intention to increase its exposure in PVC through a portfolio swap with BP which presumably indicates a degree of confidence in the future.

5.12. Assuming however that a significant electricity price differential still remained, the logical course for ICI, when existing capacity needs replacing, would be to build this in Germany, closing down or substantially reducing chlorine production in the United Kingdom. It is unclear whether withdrawal would take the form of (i) the loss of all chlorine based production chains at Runcorn (of which PVC is only one); or (ii) the loss of only the upstream electricity-intensive processes in these production chains ; or (iii) the loss of only the total PVC production chain; or (iv) the loss of only the upstream electricity-intensive products from the PVC production chain. The first and third cases would lead to the import of finished products while in the other two cases imported intermediate products either from ICI or from competitors could be used to supply the UK downstream plants. Total job losses could range from 1,700 to 12,000 with possible detrimental effects on the balance of trade of between £50 million and £760 million a year.

5.13. The CPRS does not consider that such drastic measures are imminent and indeed they may never occur. However some form of withdrawal is a distinct possibility in the longer term. Although the extent and consequences of future ICI decisions cannot be predicted the CPRS considers that the cases (iii) and (iv) above are more likely than (i) or (ii). If so total job losses could be between 1,700 and 4,000 and the detrimental impact on the balance of trade could be between £50 million and £250 million a year.

5.14. As far as other chemical sectors are concerned, we list in Annex A three other processes known to be under competitive pressure and in which electricity prices are an important factor. In the case of magnesia (700 jobs involved) and titanium dioxide (1800 jobs), higher electricity prices here than in competitive countries probably contribute two or three per cent to total costs. In the case of aluminium oxide (50 jobs) the cost penalty is much

higher, and closure of the plant must be a real possibility. It has been argued that aluminium oxide and magnesia are products of strategic importance; but they are internationally traded and supplies are unlikely to be restricted if domestic production ceases.

Iron and Steel (Annex B)

5.15. In Annex B we consider first the position of steel made by the electric arc process. BSC are the major force but the private sector also operates the process. About 25,000 jobs are directly involved and another 25,000 men work in the private sector's rerolling and finishing plants, whose existence would be in jeopardy if United Kingdom steel production ceased. The electric arc sector has suffered, and continues to suffer, severe competitive pressure, despite considerable demanning and closure of capacity.

5.16. Electricity accounts for between 8 and 15 per cent of total costs in the electric arc process. Our principal competitor is Germany and their steel producers may enjoy electricity prices 15-20 per cent lower; our disadvantage would thus amount to around 2-3 per cent on total costs. In today's hard times a penalty of this size is clearly material. But to put it in context, labour accounts for some 20 per cent of the cost of steel made by this process and the German labour rates are 80 per cent higher than United Kingdom rates.

5.17. In our view the cost of electricity in the United Kingdom imposes a material handicap on United Kingdom arc-based steelmakers in the public and the private sector. It has a more serious effect on those steel activities at the lower end of the range of value added, but it is material to all. Electricity prices could be an important factor in the future of certain very vulnerable activities like non-alloy rod and bar. But we conclude that for most arc-based activities electricity is unlikely to determine their long-term future.

5.18. Electricity is less important to the costs of BSC's integrated works which make steel by the hot metal route, but it is still very significant at between 5 and 8 per cent of total costs of saleable products. The problems of

the BSC's integrated works do not need repetition here. In our opinion there is still very significant scope for reducing costs by improving capacity utilisation, productivity and other aspects of performance, and the cost penalty of higher electricity prices (perhaps 1-2 per cent of total costs) must be seen as a minor factor in this context. It is unlikely to affect the major decisions that BSC and the Government will need to take about the industry's future and financial support.

5.19. Electricity is also significant for the dispersed steel foundry sector at between 2 and 8 per cent of total cost of saleable products. The major problem for this industry is volume and major efforts are being made to improve capacity utilisation.

Textiles (Annex C)

5.20. In Annex C we consider textiles under three separate headings, - manmade fibres, yarn processing and downstream activities (eg bleaching and dyeing, cloth manufacture, making up final products).

5.21. In manmade fibre production electricity accounts for 5-7 per cent of manufacturing costs. The United Kingdom sector has contracted drastically in recent years and now employs some 12,000 people. There is still overcapacity and competitive pressure remains severe. Electricity costs must obviously have some impact on competitiveness (perhaps giving a disadvantage of 1 per cent or so on total costs compared with European competitors); but other factors are likely to be much more important for the future size of the UK industry.

5.22. Yarn processing is an interesting sector. It employs some 4,000 people often on short term contracts. Electricity accounts for as much as 25 per cent or more of total costs and many if not most of its competitors in Germany, France and USA enjoy a substantial electricity cost advantage. Although this sector has withstood the pressures of recent years, apparently able to remain competitive through technological excellence and quality of service, closures seem likely unless market conditions improve.

5.23. In the downstream sectors of textiles, where 600,000, the vast majority of the industry's workforce, are employed, electricity tends to represent such a small proportion of total costs (less than 2 per cent) that any differences with competitor countries are unlikely to be a significant factor in the industry's future.

Paper and Board (Annex D)

5.24. As with chemicals and textiles, the major significance of electricity for the paper industry lies in the upstream sector, ie pulp and bulk paper production. However, as with the other sectors, upstream operations are under competitive pressure and threat for reasons which are mainly structural. For conventional United Kingdom paper mills relying on imported pulp, electricity accounts for about 5 per cent of costs on average. Although it is therefore one of many factors influencing the competitive future of bulk paper production, the sector is likely to decline for more fundamental reasons related to the natural competitive advantages of overseas competitors.

5.25. For modern integrated pulp and paper mills, which will become an increasingly important part of the industry in other countries, the conclusion is even clearer. These plants are very electricity intensive (up to 40 per cent of total costs) and the price of electricity is a very severe handicap to their viability in the United Kingdom. The natural advantages (including cheap hydro power) enjoyed by competitors in for example Scandinavia are very large. Such integrated plants are both unlikely to have a competitive future in the United Kingdom and also likely to lead to even further contraction of the current United Kingdom industry.

5.26. In the downstream sectors, where the paper industry is likely to have a competitive future, electricity is not an important factor in competitiveness.

Aluminium

5.27. Following the closure of Invergordon, aluminium smelting in the United Kingdom consists of two substantial smelters, Anglesey and Lynemouth, enjoying special contracts negotiated in the late 1960s which result in cheap electricity, and two small smelters in the North of Scotland, owned by Baco and benefiting from hydro-electric facilities also owned by Baco.

5.28. Aluminium is often described as 'solid electricity'. Even with heavily subsidised power contracts the cost of electricity is usually at least 30 per cent of total costs of aluminium smelting. The basis for investment in the three substantial United Kingdom smelters built in the early 1970s was cheap nuclear power (except in the case of Lynemouth, where there is a special coal contract which is currently subject to renegotiation). Quite apart from the special problems of the particular new nuclear power stations, part of whose power was dedicated to smelting, the economics of nuclear power has not developed as favourably as was then hoped.

5.29. Aluminium smelting in the world today is based on electricity at about 1.0p/kWh or less. Where countries have sufficient hydro-electricity this can be provided commercially. The effect of this is that new aluminium smelting capacity is being and will be constructed on the basis of hydro-electricity in countries such as Venezuela and Canada. Elsewhere (eg Germany) aluminium smelters continue to benefit from specially favourable contracts, for which there can be no economic justification. No method of electricity generation, other than hydro or that based on other fuel whose opportunity cost is around zero, can provide competitive power: thus in France aluminium producers are under intense pressure. Special subsidies or cross-subsidies will be required, usually on a substantial scale, if production is to continue. In Japan the policy for the industry is leading to major contraction, and increasing reliance on imports.

5.30. The price of electricity to heavy industrial users will continue to be irrelevant to the future of the two remaining substantial United Kingdom aluminium smelters. Aluminium smelting is a case apart, requiring in the United Kingdom massive special power subsidies to be profitable; its future in the United Kingdom is likely to depend on the willingness of Government to make these available. Any decision to subsidise would therefore be based principally on the employment situation at the smelters (each of which employ about 1,000) and at any downstream activities which are considered to be dependent on them.

Industrial gases

5.31. Electricity, together with air, is the principal raw material of industrial gases and makes up 70 per cent of production costs, or 50-60 per cent of sales value. Because of the high bulk to value ratio there are no imports of oxygen or nitrogen (although small quantities of argon are now imported from Dunkirk), and the £300 million United Kingdom market is dominated by BOC, with Air Products providing some competition. Like the industrial gases business elsewhere it enjoys rapid growth and is profitable.

5.32. We understand that industrial gases are 10-15 per cent more expensive here than in Europe, and that this is due to higher electricity prices. This may at the margin reduce their growth in developing new markets for nitrogen in competition with natural gas, and this means that argon, as a by-product of nitrogen, has become liable to import competition and even shortage. Current imports of argon are about £10 million per annum.

5.33. The higher cost of industrial gases in the United Kingdom has an effect on their major users in the steel and chemical industries. Integrated steelworks use about £3.50 worth of gases per saleable tonne, so that gases account for about 1½ per cent of costs. The effect on total steel costs of higher prices for industrial gases may be about 0.15 - 0.2 per cent. This is a substantial aggregate bill for BSC, but not material for competitiveness. The impact of industrial gases on the cost structures of chemical processes is similar.

5.34. BOC have campaigned for many years for lower electricity prices. We conclude, however, that BOC's position in the United Kingdom in its main business (industrial gases) cannot be affected more than marginally by electricity prices, because that business is not under serious competitive pressure from overseas suppliers. Electricity prices were however clearly material in BOC's recent decision not to site in this country a new plant for making carbon graphite electrodes (see Annex A).

Cement

5.35. Cement production is an electricity-intensive process; about 10 per cent of costs are attributable to electricity. Coal is even more important, however, accounting for some 16 per cent of costs.

5.36. Over 90 per cent of the United Kingdom cement industry is accounted for by three large groups - Blue Circle Industries, RTZ (which now includes Ketton, Ribblesdale, and Tunnel) and Rugby Portland. These activities have been consistently profitable and enjoy a legal restrictive price agreement. Because of the high distribution costs international trade in cement is very limited.

5.37. Cement has been available in continental Europe at substantially lower prices than in the United Kingdom. This has prompted major cement consumers, such as the British Precast Concrete Federation, to investigate the possibility of constructing major import facilities at East Coast ports. However it would be difficult to make this viable because of the need for long term supply agreements, technical and quality problems, and high distribution costs.

5.38. United Kingdom cement manufacturers have reacted to this threat by price restraint, and if they continue with this policy, it seems probable that they will not be seriously threatened in the United Kingdom market. This market, although somewhat contracted because of the decline in construction activity, is broadly stable. It is important that the manufacturers have access to coal at international prices, which they now effectively have.

5.39. We conclude that electricity prices are one factor making for relatively high prices for cement in the United Kingdom. The cement industry is however well insulated from international competition because of the high transport and distribution costs of the product and the industry is not in a really vulnerable position. Electricity costs in the United Kingdom do of course increase the costs of products with a high cement content, but the impact of electricity prices to cement manufacturers on the final costs of construction projects is very small indeed.

Conclusions of Chapter 5

5.40. There are a few industrial processes where electricity is the principal element in costs. In some cases - cement and industrial gases are good examples - there is little international competition and so no great problem arises. Of course the cost of electricity is reflected in the prices of these goods, which in turn impact on other industries eg construction, steel and chemicals. But their significance in final costs is small.

5.41. In the case of other electricity intensive products, however, there is effective international competition and the United Kingdom's position is very vulnerable. Some industrialised countries (eg in Scandinavia and North America) enjoy significant natural advantages which lead to much cheaper electricity than we could ever expect. Other countries may enjoy a real but manmade advantage (eg more nuclear generation), or they may decide to subsidise the processes involved.

5.42. Two signal examples are aluminium smelting and integrated pulp and paper manufacture. The United Kingdom cannot ever hope to be competitive in these processes without very large subsidies to the producers. The impact of economically justified United Kingdom electricity prices on these processes would be very damaging but this cannot be regarded as giving us any useful messages about electricity pricing policy. It does of course raise questions about industrial support.

5.43. There are indeed some processes and investment projects which have already gone abroad because of the lower electricity prices to be enjoyed there. This was a significant factor in BOC's decision to site its carbon graphite electrode plant in the USA, not in Consett. Parts of our native chemical industry, such as the electrothermal processes for carbide, phosphorus and nitride production, have emigrated to areas of lower electricity prices.

5.44. The production of chlorine and part at least of the production chains derived from chlorine could join the list of emigrant industries. We have discussed the position of ICI's chlorine processes at some length above, and

in Annex A. This is because it has been argued that the future in the United Kingdom of a large part of ICI's Mond Division is largely dependent on electricity prices. ICI faces many problems and in our opinion the importance of electricity prices, even in chlorine based products, can be exaggerated; we have attempted to set them in context. And the differential between UK and German electricity prices for chlorine makers may well close somewhat as the German utilities seek to phase out below-cost contracts. We do not think ICI is imminently intending to close or run down its UK chlorine operations. In the longer term, however, if wide price differentials persist, ICI could well close or transfer some at least of its chlorine-based business overseas. Our best guess is that up to 4,000 jobs could be lost, with a loss to the trade balance of up to £250 million a year.

5.45. Next, there are quite large tracts of basic United Kingdom industries - steel, upstream chemicals, manmade fibres, yarn processing, conventional bulk paper production - for which electricity costs are an important but not the major factor. All these industries are passing through very difficult times for more fundamental reasons. In principle, therefore, they must be even more than usually affected by electricity costs which are higher than their competitors'. But in each case the future of the United Kingdom industry is likely to be decided by more fundamental and important factors such as labour rates, productivity, technical innovation and adaptability in the face of changing world trade patterns, and especially of emerging competition from newly industrialised countries.

5.46. Finally, for the rest of United Kingdom industry - and it is much the greater part of it - electricity costs are not really significant for competitiveness. As pointed out above, in most industries a major reduction of say 20 per cent in electricity prices would lower total costs by $\frac{1}{2}$ per cent or less.

CHAPTER 6 - DISCUSSION AND CONCLUSIONS

6.1. In the previous five chapters we have examined prices, and prospects for prices, in the United Kingdom and our main competitor countries; the main factors influencing them; and the effect they have on the competitiveness of industry. In this chapter we -

a. draw the threads together in a summary (paras 6.2-13);

b. discuss the arguments for giving industrial consumers some relief from the impact of electricity prices (paras 6.14-26); and

c. set out some points on which we recommend action (paras 6.27-33).

Summary

6.2. Some countries such as Canada and Sweden have access to cheap and plentiful hydro-electric power. They enjoy a natural and significant advantage over the United Kingdom and their electricity prices are always likely to be well below ours. But our main competitors in the EC, the USA and Japan are not in that position.

6.3. Prices in France are significantly lower than ours for industrial consumers. Prices in Germany tend to be broadly comparable with ours for most industrial consumers, but significantly lower for high load factor users and particularly for some large users on special contracts. The same sort of picture applies in Italy. Japanese prices are higher than ours. It is impossible to generalise about the USA, where some utilities with access to cheap power offer lower prices than ours, but other are dearer.

6.4. In making these comparisons we must remember that the picture looks a good deal more unfavourable to the United Kingdom now than it did up to about 5 years ago, and this is not in the main due to changes in the comparative efficiencies or tariff policies of the electricity industries here and overseas, but rather to changes in the exchange rate. While it is true, generally speaking, that United Kingdom industry has a somewhat greater competitive

problem than 5 years ago because of a relative rise in the sterling cost of electricity, the same is true of a whole range of other inputs. The deterioration in our relative position in relation to electricity costs is in the main simply a reflection of the general problem of loss of competitiveness; and for most of industry it is a minor aspect of that problem.

6.5. The CPRS considers that the costs of the United Kingdom electricity supply industry can be minimised in the long run by a vigorous programme of building nuclear power stations, and this should be done. However there are problems over gaining public acceptance; and the required improvements in the planning and construction of the nuclear programme may not be achieved. The existing programme will not make a major impact on costs until well into the next century. In the short and medium term, the scope for improvements in operating efficiency would not make much difference to costs.

6.6. One very important factor which we discuss in Chapter 2 is coal prices. It will in the CPRS view be necessary to keep under careful review the price at which the NCB sells coal to the CEGB, in particular when the current understanding between the NCB and CEGB expires. We believe that the price to the CEGB should be related to the price of imported coal and that the financial framework for the two industries should be set with this in mind. We have considered and rejected the argument that the NCB's coal prices should be based on their net realised export prices. In our view therefore the NCB price is about right at present, but it is likely soon to rise above the price of imported coal. It would be possible in principle to avoid this by closing high cost pits, and by opening up the coal market to imports and competition. But if in practice the industrial relations situation rules out such measures and NCB production needs to be further subsidised, this should in our view be at the expense of taxpayers generally and not of electricity consumers.

6.7. In Chapter 3 we discuss pricing policies. We conclude that certain changes are required in the United Kingdom electricity tariffs. Coopers and Lybrand have argued persuasively that the capacity charges in the Bulk Supply Tariff are too high. If these recommendations are accepted, the result would

be to lower CEGB prices by 5 to 10 per cent. Ironically, however, lower capacity charges would do little to help the large users who are amongst the most vociferous complainants about electricity prices. This is because the current CCL scheme allows such users to avoid or reduce capacity charges. This CCL scheme, and the flexibility allowance which Area Boards use in dealing with large consumers, are not wholly justified on cost grounds, and incorporate some bias in favour of large users. We recommend in paragraph 29 below that in due course these schemes should be phased out. This might leave some consumers who are currently taking full advantage of the concessions somewhat worse off than they are now. We set out in paragraph 30 a recommendation about tariff changes which are economically justified; but the important point is that taken together they are not likely to result in any major change in the prices paid by most large industrial users, including the principal complainants.

6.8. In Chapter 3 we also examine and reject two of the main arguments which industrialists put forward to justify changes in the tariffs, namely that pricing should be related to an optimal generating system, and that efficient low cost plant should be dedicated or allocated to industrial users. In paragraph 31 below we recommend measures to improve communication between the CEGB and industry.

6.9. The fact remains that some industrial users in our main competitor countries enjoy very significantly lower electricity prices than their United Kingdom counterparts. The French have a better generating mix than we do, with more nuclear capacity, and are improving it further very rapidly. They are now moving towards prices that reflect the (lower) cost of supply in 1990, and in addition EdF is currently incurring heavy operating losses. In Germany tariffs tend to be more degressive than ours and thus to favour high load factor users; and some larger German users in the steel, chemicals and aluminium industries are on special contracts with even more attractive terms. Some at least of these result in prices which do not cover costs, and reflect local Government subsidies and pressures. Italian high load factor users and arc steel producers enjoy substantial concessions which reflect Government subsidy.

6.10. In Chapter 4 we examine the prospects for prices. In brief, the considerable difference between French prices and ours will persist until we match their nuclear capability and costs; the gap will widen before it begins to narrow. German utilities will seek to renegotiate their special contracts to cover costs more fully. Although a subsidy element may be retained in some cases, we would expect this to be reduced. We cannot predict a significant lowering of United Kingdom electricity prices in relation to other countries unless and until the United Kingdom has a much higher proportion of nuclear plant; and unless we achieve that rapidly, there is a danger that other countries will keep up with or outstrip our performance.

6.11. In Chapter 5 we assess the impact on United Kingdom industry of present electricity prices. For most of British industry the cost of electricity is such a small component of total costs that even a major cut in the price of electricity would have only a very modest impact on competitiveness. There are some industrial sectors which are more seriously affected by electricity prices; these include chemicals, iron and steel, aluminium, textiles and paper and board. For the most part these are sectors which are in any case having to face severe competition and world overcapacity. A few processes eg aluminium smelting and integrated manufacture of pulp and paper are so electricity-intensive that they cannot be expected to survive in the United Kingdom without very large and permanent subsidies. There have already been casualties in these and other sectors, notably chemicals, from which some electricity-intensive processes have emigrated.

6.12. The most important process now at risk is the production of chlorine and part at least of its production chains of which PVC is probably the most significant. As we make clear in Chapter 5 and Annex A, ICI is suffering from the numerous problems which beset the chemical industry, of which the price of electricity is only one. And while electricity for chlorine manufacture is very much cheaper in Germany than here, the low price enjoyed by ICI in Germany results from a special agreement which on today's terms does not appear to be covering costs. Although the renewal date of this contract is confidential, we would expect that any renegotiation will result in higher German prices which would probably reduce the current

differential significantly. The same result is likely for ICI's competition in Germany, not all of whom enjoy prices as low as ICI's German plant. In addition current ICI United Kingdom chlorine capacity is ten times that in Germany so any major shift of chlorine production by ICI to Germany would necessitate additional electricity supply arrangements almost certainly on less favourable terms. All this should not however obscure the point that if the prices currently paid by ICI in the United Kingdom and in Germany are not brought closer together, ICI might well withdraw from at least part of the chlorine based sector in the United Kingdom. We do not think this is imminent. Our best guess is that ultimately up to 4,000 jobs could be lost at ICI, with a loss to the trade balance of up to £250 million a year.

6.13. There are a number of other industrial processes whose future in the United Kingdom is uncertain and which are affected significantly but not crucially by electricity prices. The most important example is steel production via the electric arc process. This sector is vulnerable for many reasons, and it is not possible to assess how many jobs might be lost or saved by changes in electricity prices.

Industry's case

6.14. Our analysis is that a relatively small part of British industry is seriously affected by electricity prices; that some changes in United Kingdom tariffs are justified but that in general these changes are likely to give least help to those who are most affected; and that relativities between United Kingdom and overseas prices are unlikely to improve very much. The fact remains that some United Kingdom firms' costs are higher than those of their overseas competitors because of differences in electricity prices; and that lower prices in the United Kingdom would help them (at least in the short term) to protect economic activity and jobs.

6.15. Some industrialists have sought to rationalise their case by arguing that the esi's tariff policies are seriously wrong. As we show in paragraphs 3.13 to 3.19 above, we do not find these arguments convincing: broadly speaking there is no systematic bias against industry in the tariff structure. Industrialists can however mount a case on more general grounds: they argue that they should not pay for the past mistakes and present inefficiencies of

the monopoly esi; that electricity prices have risen sharply over the last two years while industry has been in recession and unable to pass on increased costs fully; that other countries favour their industrial electricity consumers and so we should too; and that while electricity may not be the critical factor for many jobs, it is for many firms one of the straws that threaten to break the camel's back. We discuss these arguments below.

6.16. It is true that today's electricity costs would be lower if mistakes and errors (identified with the benefit of hindsight) had been avoided in the past. It is sometimes suggested that industrialists are paying the cost of today's excess capacity. In fact the esi, having built more capacity than is at present needed, has ensured that the plant now used for generation is more efficient than it otherwise would have been. Moreover, in moving over to CCA accounting the esi wrote off some of the costs of excess capacity as assets were revalued. And, as we have shown, the CCL scheme and flexibility allowance already favour many large users by insulating them from capacity charges which are too high.

6.17. A second argument is that consumers today are paying too much because we now have the wrong type of capacity; and indeed it would be very advantageous today to have a lot more nuclear plant. We must here distinguish between illusion and reality. Unless we very rapidly reverse the errors of the past, and embark on a large and successful nuclear programme (which is not the present prospect) then past mistakes will effectively dictate the future's costs. The French have a vigorous programme and have justifiably decided that they do not wish the accounting cost burden of their past electricity system to prevent them from fully realising the benefits of their new system. Therefore they have a financial regime for their esi which anticipates the imminent benefits of a high proportion of nuclear plant. We are not in that position. On the other hand we are not alone in having a shortage of nuclear capacity. It is a problem that afflicts most other European countries, who have to live with and pay for, now and in the future, the errors of the past. Italy, for example, no doubt now regrets the extent to which it became locked into heavy dependency on oil generation.

6.18. Since 1979 industry has been faced with increasing pressures on its competitiveness which have forced it to make continuous and major adjustments in order to survive, and over the same period it has suffered significant real price increases from nationalised industries. Nevertheless, we consider that, after a decade of varying degrees of pricing restraint, the Government has been right to insist on pricing at economic levels in order to avoid distortions in the economy. The esi's required rate of return of 1.7 per cent on CCA assets is by no means excessive either in isolation or in comparison with that of manufacturing industry (2.1 per cent on replacement cost assets in 1981).

6.19. But it can be argued that while there is an unassailable case for economic pricing in theory, in practice prices should be restrained in the short term to help industry survive the recession. However it should be noted that German electricity utilities reject the argument that they should phase price movements in sympathy with the economic cycle. More fundamentally, as many sectors (eg chemicals, steel) have painfully come to realise, the current period is for them not primarily one of cyclical recession, but one of structural adjustment. Price trimming does not provide an appropriate solution to this sort of problem.

6.20. It would clearly be unfortunate if the process of structural adjustment was unnecessarily distorted by unfair competition based on subsidised electricity prices. For this reason we welcome the fact that a number of the German special contracts are shortly coming up for review, and we consider that the Government should not rush to phase out concessions such as CCL which partially compensate for current German practices. However it would be wrong to increase such concessions at the present time, since this might make it less likely that the favourable terms enjoyed by some German industries will be phased out. But where relatively favourable terms are likely to continue overseas, whether because of genuine cost disparity or, in a few cases, because of sustained willingness to subsidise, we would regard it as a misallocation of resources for the United Kingdom to follow suit. Given that the United Kingdom will not become a low cost electricity country in the foreseeable future, it would not be sensible to encourage the continuation of

processes which will go on requiring subvention to survive. We should do better to compete in areas in which we can develop a sustainable comparative advantage.

6.21. While electricity prices are not crucial to more than a few sectors of British industry, it is true that for a much larger part they are another 'straw on the camel's back'. Among the wide range of cost increases which industry has faced, electricity prices are seen as among those more directly under the Government's control, along with other nationalised industry prices, non-domestic rates and the national insurance surcharge. But if it is accepted that Government should, as far as possible, act to lighten the burdens on industry, the only reason why electricity prices should be chosen as the means of or criterion for giving relief is that the threat to jobs in electricity intensive industries is visible and concentrated. But since these areas are in any case under intense pressures there is no guarantee that relief on electricity prices would do more than delay job losses. Taking industry as a whole, there are certainly more cost-effective methods of reducing the burden on industry with better prospects for successfully supporting employment overall.

6.22. Because the problems of electricity-intensive industries are visible and concentrated we do not rule out the possibility that there may be particular cases where temporary and specifically targetted subsidies might be justifiable but each case would have to be considered very carefully on its merits.

6.23. We recognise that the arguments deployed in paragraphs 16-21 above may not convince the industrialists who have been most vocal in the past; and certainly political difficulties lie ahead if, as seems likely, high load factor users stand to gain little or nothing, compared with other users, from economically based revisions of the electricity tariffs. We do not think that the Government should alter its basic policies but it may be helpful to comment briefly on some points that would arise if special relief for heavy industrial users were to be considered.

6.24. Relief could be given to industry in a number of different ways. First, some or all industrial users could be cross subsidised by other electricity users. This would obviously be open to serious political as well as economic objections. It would also fall foul of the statutory provisions on undue preference. Repeal of the provisions is possible at least in theory but would expose electricity pricing to a flood of special pleading - and it would run the very real risk that in due course industry would find itself subsidising domestic consumers.

6.25. A second possibility is that assistance could be channelled to industry from the taxpayer via electricity prices. This is in effect what happened when the esi's EFL was relaxed to allow Area Boards flexibility in dealing with large users and when the CCL scheme was introduced. This method of giving help is difficult to target accurately, but at some considerable cost (£100 million in 1982/83) it has relieved many of the worst affected firms. It also avoids discrimination in favour of particular firms or industries and therefore seems to have escaped challenge on grounds of undue preference or as a breach of international obligations. But it cuts across the Government's policy of economic pricing for energy and risks reducing the incentive for efficiency in the esi.

6.26. The whole thrust of our conclusions has however been that electricity should be priced on economic principles and that economic pricing would not result in very marked changes from the present position. We would therefore argue that if Government wished as a long term policy to assist firms which are adversely affected by electricity price differentials, this would represent an aspect of industrial policy, and that the aid should be given directly, not through distortion of the electricity pricing system. International obligations do of course limit what could be done by way of overt state aids; but given that the sectors worst affected by electricity prices (chemicals and steel) are distressed for a wide range of reasons, general measures to help with their problems are possible. But we repeat our view that there are more cost effective ways for the Government to reduce burdens on industry and support employment than through subsidies to heavy users of electricity.

Recommendations

6.27. We have in the course of this study identified a number of points on which action is desirable. None of them is likely to make a big impact on electricity costs or prices in the short or medium term. We list these points in the following paragraphs.

6.28. Our first two recommendations are aimed at the general containment of generation costs. They are not new, but they alone of our recommendations can, in the longer term, make more than a modest impact on electricity prices.

We recommend that every effort is made to ensure a vigorous and well executed nuclear programme aimed at substantially increasing the contribution of nuclear plant to electricity generation by the end of the century.

We recommend that NCB coal prices to the CEGB should be set on economic energy pricing criteria related to import prices and that the financial framework for the two industries should be set with this in mind. If NCB production is to be further subsidised, this should in our view be at the expense of taxpayers generally and not of electricity consumers.

Electricity prices to Industry

6.29. The electricity tariff structure is basically sound and involves no bias against those industrial consumers whose electricity prices are higher than in other countries. If anything, with the present temporary CCL terms and flexibility (which are specifically allowed for in setting the EFL), it is too generous. We believe that electricity prices in the United Kingdom should be properly based on economic prices, without any subsidy from the taxpayer or cross subsidy from other consumers. We consider that certain refinements to the tariff structure are justified, and that there is a permanent place for a load management scheme. Relations between the esi and its major customers could also be improved. There can be no doubt however that the recommend-ations in this section will not on balance be seen as of significant help to the industries at risk.

We recommend that in the course of the review of the BST that takes place as a result of the Coopers' report a permanent, cost reflective load management scheme be devised.

We recommend that the present 3 per cent flexibility allowance for Area Boards to use in negotiating with large industrial electricity consumers should be phased out.

We recognise, of course, that the existing CCL scheme still has two years to run, and in any case we would not recommend an abrupt withdrawal of the concessions which heavy industrial users now enjoy. The timing of the withdrawal of any of these concessions will have to be decided in the light of other changes in the tariff structure and level, and perhaps in the level of overseas subsidies (see para 6.20 above). We would hope that the esi would consult some of its largest customers about its proposals for new load management terms. The esi does not have a monopoly of wisdom - and needs to dispel the impression that its attitude is essentially one of 'like it or lump it'.

6.30. The BST averages the CEGB's cost structure into four time of day energy rates and the capacity charges element. Area Boards average further in their tariffs and contracts. This has in our view obscured the cost signals that should encourage the most efficient pattern of use.

We recommend that the esi should make more sophisticated terms available in their tariffs and contracts, and make more effort to explain and justify them publicly.

6.31. There could be cases where negotiation between large industrial users and the CEGB - something which currently requires the Secretary of State's approval - could lead to special terms which were more advantageous to both sides. Such direct negotiation would also increase the generating side of the industry's market awareness of the concerns of its consumers.

We recommend that large industrial users should be given a real opportunity to deal directly with the CEGB.

Private Sector Electricity Generation

6.32. There is scope for private generation, particularly when linked with combined heat and power schemes, although we have some doubts about the extent to which the private sector will respond. It is important that the esi is not allowed to stand in the way by unfairly influencing the prices paid for electricity transferred between the esi and the private sector. The principle which should be adopted is no subsidy by either side, but within that the prices should be such as to encourage competition to the maximum extent.

We recommend that the definition of fair terms and conditions in the proposed new legislation on private generation should be interpreted so as to stimulate competition with the esi, consistent with economic pricing.

6.33. There is no economic justification for dedicating CEGB plant to particular industries or firms if this results in higher prices to other consumers. For this same reason it is doubtful whether the sale of CEGB plant on economic terms would be attractive to industry. Some industrialists may however feel that they could run a power station more cost effectively than the CEGB.

We recommend that the case for the sale or lease of CEGB plant should be explored, and applications from industry considered on a case by case basis.

ANNEX A

THE CHEMICAL INDUSTRY

General Discussion

A.1. The chemical industry is the largest industrial consumer of electricity in the United Kingdom accounting for 17 per cent of the demand by manufacturing industry. Current purchases total about 13,000 GWh a year. The industry is also the largest self-generator of electricity, the output being about 6,000 GWh a year, mainly in combined heat and power schemes of high thermal efficiency. Unless there is considerable growth in combined heat and power schemes, it is expected that purchased electricity consumption will grow fairly closely in line with chemical output.

A.2. The importance of electricity tends to decline along the chemical production chain from upstream intermediate products to downstream end-use products. For the chemical industry as a whole, the average contribution of electricity to total manufacturing costs of intermediate chemical products is about 5-7 per cent compared with about 2 per cent for end-use products.

A.3. Nevertheless, in terms of electricity consumption, the chemical industry has some large plants - one of 200 MW (ICI Runcorn), 15 of 20 MW, 33 of 5 MW and 88 of one MW. About 130 consumers operating with load factors of 60 per cent or more account for over 60 per cent of the total value and cost of electricity purchased. For these users, electricity costs range from 10-50 per cent of total costs for intermediate products and 2-10 per cent of total costs for end-use products. Chlorine manufacture is the most electricity intensive process where electricity accounts for 50 per cent of total costs or 80 per cent of variable costs. However, the dominance of electricity in the cost structures of downstream chlorinated products is less marked and in the case of polyvinyl chloride (PVC), for example, electricity represents about 10 per cent of total manufacturing costs.

A.4. Of the 3 broad categories of electricity use in the chemical industry - mechanical power, direct process use and thermal use, only the first 2 are of major significance in the United Kingdom. Over two-thirds of total United

Kingdom consumption is for the provision of mechanical power. Direct process use is mainly limited to electrolysis, and indirect use of electricity as a source of heat is mainly confined to specialist operations such as the production of metals and metal oxides. Most electro-thermal processes have been lost from the United Kingdom.

A.5. The chemical industry's ability to take advantage of load management varies considerably although nearly all users taking more than 20 MW are on load management terms. Most chemical processes operate most efficiently at steady, continuous load, so there are usually cost penalties arising from load management.

A.6. The chemical industry faces intense international competition and the petrochemical sector is particularly exposed. The problems of this sector are acute and widely documented and can be briefly summarised as massive over-capacity, access to and costs of feed-stocks, severe international competition and the effects of the current recession. The problems are similar to a greater or lesser extent for all European countries and are resulting in a major rationalisation and reconstruction of the European industry. The result is, and will continue to be, a severe decline in the production of bulk petrochemical intermediates and a move downstream to speciality and higher value added products.

A.7. Against this background it would appear that electricity is the least of the industry's worries. Electricity, for example, contributes less than 2 per cent to the cost structure of ethylene and although it is certainly one of many factors affecting international competitiveness, it does not appear that electricity is the major consideration influencing the survival of the industry. Chlorine and chlorine based petrochemicals are perhaps the one exception to this rule and are discussed at length in the following sections.

A.8. The general problems of the inorganic sector are less acute although the sector is dependent upon the general health of the United Kingdom industry. Electrical energy is of critical importance for the production of chlorine, caustic soda, carbides, phosphorus, nitrides and industrial gases.

Of these, the electro-thermal processes for carbide, phosphorus and nitride production have emigrated from the United Kingdom to areas of cheap electrical energy. The industry has expressed some concern about the viability of downstream sectors which depend upon the import of electro-chemical intermediates although there are no difficulties in importing these products. Of the others, caustic soda is produced with chlorine by the electrolysis of brine and is discussed below. Industrial gases are discussed separately in Chapter 5. For the longer term, substantial improvement in the international performance of the United Kingdom inorganic sector should not be expected and it is probable that a small number of energy intensive products may be gradually lost from the United Kingdom.

A.9. In summary, the CPRS view is that for most processes in the chemical industry, electricity costs, although important, are only one of many factors affecting international competitiveness and the survival of the United Kingdom industry. There are, however, a limited but significant number of processes where electricity costs will have an important impact on the long term future. Of these, the most important is the production of chlorine and chlorine based products, although the list also includes certain metal oxides such as magnesia, titanium dioxide and aluminium oxide. The Chemical Industries Association agrees with this assessment and we discuss the processes concerned below.

CHLORINE AND CHLORINE-BASED CHEMICALS

Introduction

A.10. The production of chlorine by the electrolysis of brine is the most electricity intensive process in the chemical sector. 1.1 tonnes of caustic soda are produced in conjunction with 1 tonne of chlorine with electricity accounting for 80 per cent of variable costs and 50 per cent of total manufacturing costs. This explains why the chlorine-based sector has received most attention in the electricity price debate.

A.11. Total chlorine capacity in Western Europe is 11.6 mta with the major producers being West Germany (3.9 mta), France (1.7 mta) and the United Kingdom (1.4 mta). 1.1 mta or 80 per cent of United Kingdom production is by ICI, whose total European production is 1.2 mta. ICI's Runcorn complex, part of the Mond Division, produces about 0.75 mta chlorine and 0.8 mta of caustic soda. A further 0.36 mta is shared between four sites in the north of England. Runcorn, with a demand of about 200 megawatts, is the largest single electricity charge point in the United Kingdom and probably also in Europe.

A.12. ICI have provided information indicating that at average load factors of 90 per cent, electricity prices paid at Runcorn (with load management) and at Teesside (for technical reasons without load management) are higher by a factor of 1.7 and 2 respectively than ICI's 0.12 mta chlorine plant at Wilhelmshaven in Germany which pays about 1.5p/kWh. The difference is mainly a result of the degressive nature of the German special contract which gives greater benefit to high load factor users than the United Kingdom tariff. In addition the prices paid by ICI in Germany appear to be below cost, at least in today's terms.

A.13. ICI have also confirmed that the throughput of the Wilhelmshaven plant over the last year was 99 per cent of the nominal chlorine capacity of the plant (120,000 tpa). Because of the differences in electricity prices, the Wilhelmshaven plant is run flat out and chlorine production is balanced in the United Kingdom. The throughput of the Runcorn plant over the last year was 67 per cent of the nominal chlorine capacity of 750,000 tpa and for Teesside 40 per cent (nominal capacity 170,000 tpa).

A.14. If average load factors are equated to capacity loadings the corresponding electricity prices for Wilhelmshaven, Runcorn and Teesside would be 1.4p/kWh, 2.3p/kWh and 3.0p/kWh respectively. The ratio of Runcorn and Teesside prices compared with Wilhelmshaven would then be 1.6 and 2.1 respectively.

A.15. It is, however, relevant to note that the less degressive nature of the English tariff enables ICI to optimise operations at periods of depressed market demand. If Runcorn was operating under the German tariff at an average load factor of 67 per cent, the price paid would be 2.6p/kWh, ie more than the current Runcorn price. This point also applies to Teesside at 40 per cent average load factor which on a German tariff would pay 3.2p/kWh. These results mean that at current loadings ICI would be worse off if the German tariff applied to United Kingdom operations.

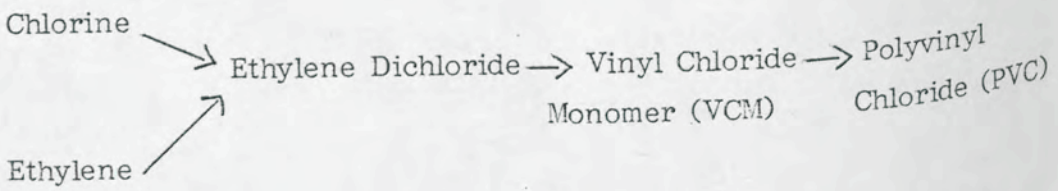
A.16. However, if the German tariff did apply in the United Kingdom, ICI would have an electricity price incentive to shut Teesside and Wilhelmshaven and load up Runcorn to 92 per cent throughput. Nevetheless, such rationalisation decisions are usually not as straightforward as economic logic would imply and it is relevant to ask why ICI do not shut the Teesside chlorine plant and load up Runcorn under today's conditions. The answer has partly to do with expectations of an upturn in the market and is partly because the Teesside plant is one of ICI's newest and one which received a regional development grant.

A.17. ICI do not have definitive information on the electricity prices paid by their European competitors. Nevertheless, their strong impression is that these are in line with the ICI German contract at Wilhelmshaven. Our understanding is that this special contract results in prices which are below cost and reflects both the economic conditions prevailing at the time of negotiation and an element of subsidy. Dow Chemicals have chlorine capacity in the same region of Germany and probably have a similar contract. The other German plants probably also enjoy special contracts, but not on such favourable terms as ICI at Wilhelmshaven. Most French chlorine capacity is found in the South East of France where hydro power would be expected to lead to cheaper than average electricity prices. Despite some uncertainty about

these figures, it is clear that United Kingdom operations are at a significant disadvantage although it should also be pointed out that, under current depressed market conditions and reduced plant loadings, ICI would not necessarily be better off if the German tariff applied to United Kingdom operations.

The Sector

A.18. About 13 per cent of ICI's chlorine is sold for chemical manufacture and water purification. The remainder is used to produce large tonnages of chlorine derivatives. The most important production chain (accounting for 21 per cent of chlorine) is:



It is on this production chain, which brings together the problems of chlorine based chemicals and ethylene based petrochemicals, that ICI has particularly sought to focus attention in complaining about electricity prices. A further 16 per cent of ICI chlorine is used to produce such chlorinated solvents as Triklone and Genklene (mainly used for metal cleaning and a variety of formulation applications) and Perklone which is used in dry cleaning. Chlorine is also used in the manufacture of a variety of chloromethanes (9 per cent) which are in turn used in making additives for motor fuels, cellulose ethers and specialised solvents for the manufacture of acetate rayon, paint removers and so on. Among the other uses of chlorine are hydrochloric acid (9 per cent) and sodium hypochlorite (3 per cent).

A.19. The caustic soda which derives from the same process is sold, in the case of ICI, as follows:

direct exports	28 per cent
soap and detergents	17 per cent
synthetic fibres	15 per cent
chemicals	12 per cent
water treatment	5 per cent
others	23 per cent

A.20. The businesses grouped under the Mond banner represent 15-20 per cent of ICI's interest in the United Kingdom in terms of assets, sales and number of employees. 10,000 people work for Mond, of whom 7,000 are at Runcorn. To maintain competitiveness Mond has in recent years invested heavily (£400 million in 1977-81) in the United Kingdom in the latest technology, bringing the total replacement value of its plants and equipment to over £2,500 m. About 70 per cent of Mond's external sales are to United Kingdom customers - to other chemical companies, to the glass and engineering industries, to textiles, iron and steel. It has been calculated that over 20 per cent of these sales find their way into customers' exports. The remaining 30 per cent of Mond's external sales are direct exports.

A.21. The production of chlorine and chlorine based products accounts for about 70 per cent of Mond's total business. Although VCM, the building block of PVC, is one of Mond's largest products and its financial impact is substantial, it is clear from the preceding paragraphs that VCM represents a relatively small part of the total Mond business.

Cost Structures

A.22. ICI have provided information on the contribution of electricity to the cost structures of intermediate products in the PVC production chain together with the figures for Triklone and Perklone. More detailed cost structures are shown in the Appendix to this Annex. Table 1 below distinguishes between electricity attributable to chlorine production only and the total contribution of electricity to manufacturing cost. The former figure is relevant because the electricity price debate tends to concentrate on high load factor operations, ie chlorine and less on lower load factor operations, ie downstream processing. Nevertheless, in terms of international competitiveness the full contribution to the cost structure is significant.

Table 1

Electricity as a % of total costs

	From Chlorine	From other	Total
Chlorine	51	-	51
EDC	16	3	19
VCM	7	4	11
PVC	5	5	10
TRI/PER	11	2	13

A.23. If average load factors of 90 per cent were achieved in both United Kingdom and German plants, so that the electricity prices paid by ICI at Runcorn were 1.7 times prices paid at Wilhelmshaven in Germany, Runcorn's competitive disadvantage would be:

Table 2

	Based on electricity in chlorine only	Based on total electricity
Chlorine	21%	21%
EDC	7%	8%
VCM	3%	5%
PVC	2%	4%
TRI/PER	4%	5%

These figures put the competitive disadvantage into context and raise questions about the true significance of electricity for the total chlorine industrial sector, particularly given the earlier comments that ICI would not be better off at current production rates with a German type tariff for United Kingdom operations. ICI have been asked whether there are any offsetting

United Kingdom competitive advantages compared with Germany but the company considers that in terms of technical knowledge, age of plant, level of skill, productivity and infrastructure, the United Kingdom chlorine based operations are competitive with their own German plant and with other overseas suppliers.

A.24. As a further indication of the competitive pressures on ICI, it should be appreciated that VCM and PVC are currently selling at 57 per cent and 40 per cent respectively of fully built up costs. It is doubtful, therefore, whether ICI are even covering the total variable costs of PVC production, both direct and indirect, which are about 40 per cent of total manufacturing costs. As electricity represents about 80 per cent of the variable costs of chlorine and about 25 per cent of the variable costs, both direct and indirect, of PVC, any change in electricity prices would have a major impact on revenues.

A.25. It appears that ICI's losses on the chlorine/caustic business totalled £35-40 million in 1981 although isolating the profitability of these products is difficult. ICI's total electricity bill in 1982/3 is expected to be £110 million of which about £48 million will be incurred by Mond Division and about £38 million by Runcorn. (Without load management and load manipulation, Runcorn's bill would be about £44 million.) ICI consider that their corporate disadvantage resulting from electricity differentials will be about £30-35 million (£13.5 million at Runcorn).

Polyvinyl Chloride (PVC)

A.26. One reason for the great prominence given to the competitive position of PVC is that this product brings together both the problems of chlorine based chemicals and ethylene based petrochemicals. As explained above, chlorine and ethylene are made into ethylene dichloride (EDC) which is the link in the PVC production chain.

A.27. It should also be appreciated that chlorine accounts for only 10 per cent of PVC costs whereas ethylene accounts for 31 per cent. The contribution of electricity to the costs of ethylene is less than 2 per cent.

A.28. ICI are suffering major difficulties in ethylene based petrochemicals, not only because the European industry in general is under pressure (heavy losses, overcapacity etc) but also through ICI's dependence on naphtha rather than ethane as a feedstock. ICI recently sought, and the Government refused, tax relief on naphtha feedstocks.

A.29. The result is that PVC is under threat for two main sets of reasons - one set chlorine based and the other ethylene based. The former affect principally Runcorn, employing 7,000 people while the latter affect principally Teesside, employing 9,000 people.

A.30. The following figures for the United Kingdom industry as a whole illustrate the degree of both import penetration and overcapacity in the producton of EDC, VCM and PVC during 1981.

	EDC	VCM	PVC
Capacity mt	1195	620	670
Production mt	505	315	325
Imports mt	15	22	110
Exports mt	-	2	90
Home consumption mt	520	335	345
Overcapacity %	68	49	51
Import Penetration %	3	7	30

The relevant figures for overcapacity and import penetration for PVC in 1977 were 35 per cent and 23 per cent respectively.

Rationalisation

A.31. In response to the problems of overcapacity in the petrochemicals sector, ICI and BP have recently announced a joint major reconstruction programme. In very general terms the effect will be to increase the importance of PVC in ICI's operations. As United Kingdom PVC capacity is currently split ICI 48 per cent, BP 27 per cent and other producers 25 per cent, this is likely to give even higher profile to ICI's concerns over electricity prices.

A.32. If approved, the BP/ICI rationalisation will increase loadings on ICI's chlorine and downstream plants in the PVC chain from about 50 to 75 per cent. Although this will reduce fixed costs per ton, variable costs per ton will increase as a greater proportion of day time electricity will need to be used. As ICI are not even covering variable costs on VCM production at the moment, the reconstruction will not improve short term profits.

A.33. One effect of the BP/ICI rationalisation will be much higher loadings on ICI's new Teesside chlorine plant. This plant and its associated EDC plant have always been aimed at the export market, particularly as the PVC capacity at Wilhelmshaven is currently much greater than the chlorine capacity. It is therefore ironic that in practice Wilhelmshaven is being partly sourced by EDC produced in the United Kingdom. This situation is based upon the earlier strategic decisions which were made at a time when electricity was not considered such a significant factor. However, unless the price differentials change, ICI's inclination in future will be to source PVC production in the United Kingdom from imported EDC.

A.34. In the circumstances it is relevant to ask why ICI should wish to increase their dependence on PVC which is a loss making business subject to considerable price cutting. Presumably the company hopes that capacity rationalistion will lead to some strengthening of prices; but have they also assumed that help will be forthcoming on electricity prices and/or naphtha feedstock taxation policies?

A.35. ICI have not revealed whether their assessment is based on anticipated changes in electricity prices and feedstock taxation, but it seems unlikely that they have gambled to that extent. Our opinion is that they consider that the PVC business will be viable in the future. However, we cannot rule out the possibility that, if the United Kingdom continues to be more costly than Germany, ICI's next step would be to supply the United Kingdom from an extended ICI complex at Wilhelmshaven.

A.36. It is relevant here to discuss the likely future of ICI's German contract. We do not know when this special agreement, which on today's terms would not appear to be covering costs, comes up for renewal. But it seems likely that any renegotiations will result in higher German prices which will reduce the differential with United Kingdom prices significantly. The same result is likely for ICI's competitors in Germany not all of whom enjoy such low prices as ICI's German plant. Moreover, ICI's chlorine capacity in the United Kingdom is ten times that in Germany so any major shift of chlorine production by ICI to Germany would necessitate new electricity supply arrangements. We therefore consider that the threat to ICI's United Kingdom operations is less a function of competitive electricity prices, although we do not deny that this is one relevant factor, than a result of the general problems besetting the chemical industry.

A.37. Assuming however that a significant electricity price differential still remained when existing capacity needs replacing, it would be logical for ICI to build this in Germany, closing down or at least cutting back production of chlorine in the United Kingdom. If this happened, it is unclear whether United Kingdom withdrawal would apply to all stages of the PVC production chain. Chlorine is hazardous to transport and is not a traded commodity. EDC, VCM and PVC are all internationally traded, and in a fiercely internationally competitive market the scale of operations for any petrochemical sector must be aimed at European markets to be competitive. Given the efficiency of the United Kingdom PVC plants, it is plausible to imagine EDC or VCM sourced from Germany for conversion to PVC in the United Kingdom for the United Kingdom market. This would remove the production of PVC intermediates from Runcorn with major consequences for that site but preserve a United Kingdom based PVC sector. It should also be noted that the newest, largest and most efficient PVC plant in the United Kingdom, built only 3 years ago at a cost of £35 million, will be transferred to ICI from BP as part of their restructuring. Given the other activities of ICI Mond, the withdrawal of ICI from EDC and VCM manufacture would not necessarily close down the other chlorine sectors and the caustic soda activities. Their future would depend upon the viability of continuing chlorine production at Runcorn without a requirement for EDC and VCM.

A.38. The potential effects on ICI's operations world wide are difficult to predict. Although ICI have in recent years expanded overseas facilities, this has been with the aim of strengthening their competitive ability in overseas markets. Some 60 per cent of the Group's assets are in the United Kingdom and in the case of Mond Division their re-equipment programme in the late 70s reflected an expectation that the United Kingdom would continue to be a major manufacturing centre. This is why they are now pressing so strongly for a long term solution to the problem of electricity costs.

A.39. ICI have themselves expressed some doubts whether it will be possible to preserve a PVC business in the United Kingdom of current size given continuing electricity price differentials. Certainly any expansion, unlikely though that appears at the moment, would be sited in Europe and not in the United Kingdom. It is also possible that United Kingdom plants would tend to be phased out as and when major spending is required.

A.40. Although ICI are obviously concerned about chlorine competitors, it does appear that the location of ICI's own chlorine production is also a major factor. ICI will need to take strategic decisions about expanding German production capacity at the expense of United Kingdom capacity if the current price differentials continue. Although this is an issue relating to ICI's own rationalisation, the consequences for the United Kingdom industry are similar whether German production is by ICI or competitors. The downstream impact may be slightly mitigated as the prospects of preserving ICI's downstream United Kingdom PVC operations are greater if imported EDC and VCM is sourced by ICI rather than competitive plants.

Consequences of Withdrawal

A.41. The following factors are relevant in assessing the competitive position of the ICI Runcorn site and the implications of withdrawal by ICI from chlorine based operations. Such assessments are difficult, particularly as in an integrated operation overheads are spread over a wide range of different products. It is, therefore, difficult to make specific cutbacks without weakening the operations which are left. There is thus a tendency to put off the evil day in the hope of recovery, which results in giving short term cash requirements priority over long term profitability.

A.42. If all ICI chlorine and downstream operations including PVC and other products were shut down, the loss of employment would be about 9,000 including 7,000 in Mond Division, 1,400 in Petrochemicals and Plastics and 200 HQ support staff. There would also be a loss of about 3,000 jobs in the chlorine based plants of Albright and Wilson, Tioxide and other downstream manufacturers. Assuming the same level of home consumption, the detriment to the balance of trade would be about £660 million a year.

A.43. As a second case, consider all chlorine production plus upstream intermediates being shut down and the downstream production chains being sourced by imported intermediates, eg EDC and carbon tetrachloride. The total loss of employment would be 9,000 jobs, compared with 12,000 in the above case, and the detriment to the balance of trade would be about £540 million a year.

A.44. If the PVC production chain alone, including the part of the chlorine operation relevant for PVC, was shut down, about 3,500 ICI employees and 500 workers in other companies would become surplus. The detriment to the balance of trade would be about £150 million a year.

A.45. If the chlorine and EDC in the PVC production chain were shut down, but the United Kingdom PVC plants were sourced by imported EDC and the production of other chlorine based products continued at Runcorn, 1,700 jobs would be lost within ICI. The balance of trade loss would be £50-70 million a year. There would be a further penalty to the balance of trade of perhaps £100 million a year in each of the four cases quoted above if PVC prices eventually rise to cover total costs.

A.46. It is unclear whether the operations at Runcorn would be viable if the chlorine and downstream plants associated with PVC were shut down. It would be possible to shut down particular chlorine cell rooms, leaving the complex to produce the other chlorine based products although this would involve a greater allocation of overheads to these products. It is probable that the site could continue on this basis although such proposals would need greater study.

A.47. Although PVC is currently a much more fiercely competitive market than the other chlorine based products and the caustic soda products, it is not possible for ICI to allocate a greater share of costs to these other sectors in order to improve the competitive position of chlorine based petrochemicals. As both the major caustic soda and most of the other chlorine based products are traded in bulk and customers have access to alternative sources of supply, ICI must price competitively.

A.48. The CPRS does not consider that withdrawal by ICI is imminent; and it may never occur. However some form of withdrawal is a distinct possibility in the longer term. On balance, loss of part or all the PVC production chain would seem more likely than withdrawal from all chlorine based products. If this is right, total job losses would be in the range of 1,700-4,000.

Conclusions on chlorine

A.49. The cost of electricity is very important indeed in the production of chlorine, although chlorine is not a traded commodity. Its derivatives are traded but electricity contributes progressively less to costs as the production chain lengthens. Electricity prices in the immediate future are likely to influence the balance of new investment by ICI in the United Kingdom and Europe, rather than to lead to actual cutbacks in the United Kingdom. If the current electricity price differentials continue on a long term basis, withdrawal by ICI from at least part of the chlorine based United Kingdom sector is possible, even likely. The consequences for United Kingdom employment and the balance of trade would be serious but not catastrophic.

OTHER CHEMICAL PROCESSES AT RISK

A.50. Three other smaller companies in different sectors which have made representations to government about electricity prices are Steetley Chemicals, Tioxide and Electro-Furnace Products.

Steetley Chemicals Ltd

A.51. Steetley is the only magnesia plant in the United Kingdom. The company was originally set up with government encouragement during the war to provide a strategic source of magnesia products.

A.52. Magnesia is used in high temperature technologies and is produced in two grades. The refractory grade is used in the steel industry and for refractory bricks; the chemical grade is used in oil and rubber additives and in sugar processing.

A.53. Steetley's plant at Hartlepool provides 60 per cent of the total United Kingdom chemical and refractory magnesia products. The other 40 per cent is imported. In addition 60 per cent of the Hartlepool plant's production was exported in 1981.

A.54. The process is electricity intensive requiring electricity for the electrolysis of brine and for pumping vast quantities of sea water to the plant. Electricity contributes 11 per cent of total production costs. As magnesia is internationally traded the plant is under severe competitive pressure from overseas companies. Octel uses a similar process at Anglesey to make bromine from sea water but as bromine is not a traded product it is not under the same competitive pressure.

A.55. Closure of the Hartlepool plant could also have serious consequences for dolomite production. Steetley operate 2 quarries producing a range of grades of dolomite, one of which is used in magnesia production. The loss of the magnesia business would seriously jeopardise the total dolomite production and in particular the production of calcine dolomite used in the steel industry. Steetley is the only United Kingdom producer of this product.

A.56. The total complex employs 700 people, 400 of whom work in the magnesia plant. The impact on the balance of trade if the magnesia plant was forced to close, taking into account both lost export earnings and the consequential need for imports, would be £25-30 million a year. If the two quarries also closed the additional effect on the balance of trade would be £10 million a year.

A.57. It would be possible to make the production of these products competitive if the plant was radically redesigned to make it less energy intensive at a cost of £14 million. The company say they cannot afford this and the Department of Industry are currently looking at options under Section 7 of the Industry Act.

A.58. Although the loss of this process would not be very significant in terms of employment and industrial production, the company argue that magnesia is a strategically important material. However, availability of magnesia for United Kingdom industries is unlikely to be restricted if United Kingdom production is not available.

Tioxide Ltd

A.59. Tioxide are one of two manufacturers in the United Kingdom (Laporte is the other) of titanium dioxide pigments which are primarily used in paint and related products. Tioxide have plants at Greatham and at Grimsby employing 1800 people.

A.60. Electricity accounts for 8-9 per cent of total manufacturing costs. Tioxide also operate plants in Spain and France where, they say, electricity prices are 73 per cent and 63 per cent of the levels of Greatham respectively. Greatham is not able to take advantage of load management for technical reasons. The Grimsby plant is, and presumably therefore pays rather less than Greatham.

A.61. It appears that if Tioxide were paying in the United Kingdom the same sort of prices for electricity that apply in France or Spain, their manufacturing costs would be 2-3 per cent lower. At this level, therefore,

electricity prices are an important, though not necessarily decisive, factor in the long term competitiveness of the United Kingdom plants. Titanium dioxide is a traded commodity and the United Kingdom industry would be able to import titanium dioxide if electricity prices and other factors forced Tioxide's withdrawal.

Electro-Furnace Products Ltd

A.62. Electro-Furnace Products Limited at Saltend manufactures fused aluminium oxide, an important artificial abrasive for the production of grinding wheels, sandpapers etc, and a material which is also used in some refractory products. The main markets are in the engineering and steel industries.

A.63. Electro-Furnace Products supply approximately two-thirds of the United Kingdom market and until late 1980 supplied significant export tonnage. It is the only United Kingdom source and until 1960 all United Kingdom requirements were imported. The balance of trade contribution attributable to United Kingdom production is about £3-4 million.

A.64. The plant's capacity is 30,000 mt but a market collapse has seen utilisation drop from 84 per cent in 1979 to 40 per cent in 1981. The more labour intensive half of the plant has closed with a reduction in jobs from 134 to 52.

A.65. Electricity charges comprise 30 per cent of the plant's production costs compared with employment costs of 17 per cent. Electricity is therefore a major competitive factor particularly as the main competitors for this company are sited in France, Germany and the USA.

A.66. There is little chance of the plant increasing its utilisation unless the electricity price differential is reduced. Even then customers lost in recent years would be difficult to win back. The consequences of closure would be that United Kingdom industry would depend on imports, as was the case before 1960.

Graphite Electrodes

A.67. Graphite electrodes is an example of an electricity-intensive process industry lost to the United Kingdom. Airco, a wholly owned subsidiary of BOC, recently investigated the possibility of siting a carbon graphite electrode plant at Consett. Although various schemes were considered, including autogeneration of electricity, the company eventually decided to site the plant in the USA. The high cost of electricity in the United Kingdom was a major factor in this decision.

A.68. Carbon graphite is used to produce the graphite electrodes which produce the arc which melts the steel in electric arc furnaces. World wide demand for electrodes is expected to rise to 1.2 million tons by 1985 against 920,000 tons in 1980. Alongside this growth in demand, customers are intent on reducing the high price of electrodes, currently about £6 per ton of steel produced. BOC's decision to invest in the USA is based on assurances of a plentiful supply of cheap electricity.

APPENDIX TO ANNEX A

COST STRUCTURES FOR THE ECU, EDC, VCM, PVC AND TRI/PER EXPRESSED AS PERCENTAGES

%	ECU
Electricity	51
Other Variables	13
Fixed Costs	13
Other Fixed*	23
TOTAL	100

1 ECU is equivalent to the co-production of:

1 t chlorine
1.13 t caustic soda
and 0.027 t hydrogen

%	EDC	VCM	PVC	TRI/PER
Chlorine	31	14	10	21
Ethylene	52	45	31	25
Other Variables	-	7	11	9
Fixed Costs	5	17	23	22
Other Fixed	12	17	25	23
TOTAL	100	100	100	100
Electricity as a % of total cost				
via Chlorine	16	7	5	11
Service Electricity	3	4	5	2
TOTAL	19	11	10	13

*Other fixed costs include Support Costs to Division Level, CCA depreciation and adjustments and a 2% CCA Rate of Return.

Source: ICI

ANNEX B

IRON AND STEEL

B.1. All steelmaking by current technologies involves heavy use of electricity. However semi-finished and finished steel products from the electric arc route have a higher proportion of electricity costs (8-15 per cent) than do products from integrated hot metal steelworks (5-8 per cent).

Arc Furnaces

B.2. The price of electricity is a major factor in the economics of arc furnace based steel. Information made available to CPRS demonstrates that electricity accounts for at least 8 per cent of total costs (including historic cost depreciation but excluding interest on capital); the figure ranges from about 8 per cent in special exotic and aerospace steels, to 10-11 per cent in engineering steels and between 10-15 per cent in common grade steels. The typical figure in BSC Special Steels, which accounts for the bulk of BSC's electric arc steelmaking, is 13-13½ per cent. In comparison labour costs range from 11 per cent to 30 per cent (most between 16 per cent and 21 per cent).

B.3. The principal United Kingdom operators of electric arc furnaces are -

	Location	Manning '000	Turnover £m (1981/82)
BSC Special Steels	Rotherham Tinsley Park (Sheffield) Stocksbridge	12.2	409
BSC Tubes	Clydesdale	2.5	(est) 50
BSC Stainless	Tinsley Park Panteg (South Wales)	3.5	150
Firth Brown (to become 50% of Sheffield Forgemasters - BSC/JFB)	Sheffield	2.9	50

	Location	Manning '000	Turnover £m
GKN Brymbo	North Wales	1.5	(est) 80
Allied Steel (BSC/GKN)	Cardiff	0.3	(est) 80
Round Oak (99% BSC)	Dudley	1.3	(est) 60
Hadfields	Sheffield	1.0	32
Manchester	Manchester Bidston	0.8	39
Sheerness	Sheerness	0.8	(est) 65
Alpha	Newport (South Wales)	0.3	(est) 40
Aurora	Sheffield Manchester	0.4	15
Lloyds	Wednesbury Dudley	0.4	60

The employment figures of 26,000 (plus) shown above exclude about 25,000 employed in separate private sector steel rerolling and finishing plants, whose existence is partly dependent on the continuation of United Kingdom steel production.

B.4. These activities have been under severe pressure in the last three years. Manning and capacity have been substantially reduced both in the private sector and within BSC. These pressures continue in the form of a depresed United Kingdom market, and continuing overcapacity in Europe causing intense competition and reduced real prices. In addition certain of BSC's most modern activities are threatened by United States anti-dumping actions.

B.5. The competitive position of the industry may be summarised as follows -

a. Special tool steels (Aurora and certain smaller companies) suffer from intense competition from Austria, Italy, France and Sweden and imports enjoy a 70 per cent market share. Investment is planned (especially by Aurora), and combined with major rationalisation, should help the industry match the productivity of its competitors.

b. Exotic and aerospace steels (Firth Brown and part of BSC Special Steels) has suffered principally from loss of volume (eg from Rolls Royce).

c. BSC Stainless suffers severe overcapacity, and a historically dominant import market share.

d. Engineering steels (GKN Brymbo, Hadfields, part of BSC Special Steels) have suffered major loss of volume (eg from the automotive industry). The strongest international competition is from Germany.

e. BSC Tubes (Clydesdale) has benefited from oil activity in the United Kingdom and United States, although substantial new mill investment will be required to ensure the continuation of the business in the face of competition from Germany, France and Italy.

f. Non-alloy rod and bar (Sheerness, Manchester and parts of BSC Special Steels) suffer severe international competition based on price, led by the "Bresciani", the Italian electric arc steelmakers. Despite high productivity, these facilities are under extreme commercial pressure.

g. Strip (Alpha) is an opportunistic producer, whose investment was regarded as undesirable by the EEC Commission, and which only operates when market conditions are favourable.

B.6. United Kingdom arc furnaces generally have load factors between 35 per cent and 45 per cent. The major use of electricity is at the time the steel-making vessel is charged, with lesser amounts required thereafter. Hence this use is not continuous, and it is possible to adjust the load pattern by rescheduling production.

B.7. United Kingdom arc based steelmakers believe that they will pay about 2.7p/kWh in 1982/83 by taking advantage of the Contracted Consumer Load Scheme. This compares with the latest information on 'as found' prices, adjusted for recent tariff increases, as follows -

p/kWh	80MW	25MW
Germany	1.99 - 2.24	2.12 - 2.36
France	1.74 - 1.98	1.82 - 2.15
Italy	3.22 - 3.40	3.24 - 3.65

(Source IMR Report (Oct 1981), adjusted for changes in tariffs and exchange rates; load factors not available, and not always meaningful since definitions vary; see para B.11 below). The information on which the German figures are based is not wholly reliable, and it may be that these figures should be slightly higher. The Italian figures are based on load factors of less than 80 per cent. At that level, substantially reduced prices obtain and this benefits electric arc furnaces.

B.8. Taking a price of 2.3p/kWh for Germany would give a disparity of 15 per cent on electricity costs. This would be equivalent to about 2 per cent on total costs. However some steelworks in Germany are paying lower prices - say 2.1p/kWh, which gives a disparity of 22 per cent and which would be equivalent to up to 3 per cent on total costs. These figures are clearly material to competitiveness. On the other hand German steelmakers suffer a cost disadvantage of about 80 per cent on labour rates, which account for a higher proportion of costs (say 20 per cent) and hence potentially a very much higher overall burden than electricity prices. They compensate for this by achieving much higher labour productivity.

B.9. French steelmakers enjoy a much greater advantage in the price of electricity. In general the French steel industry has not been a major competitive threat to United Kingdom arc-based steelmakers, but it should be noted that, as part of French steel rationalisation, major capital investment in higher-grade steel is planned. This could in time become a more serious threat, especially in stainless and special tool steels.

B.10. United Kingdom arc steelmakers are convinced that further adaptation of their load pattern might be possible if incentives were made available. It is likely that their particular characteristics would only be matched to the

of the electricity supply industry if this were done by direct negotiation, or a tariff related to these characteristics. However the normal pattern of United Kingdom working is 18 shifts, round-the-clock. Apart from a greater use of Sunday working there is a limit to the rearrangement of production which would be possible. In principle it would be possible to concentrate production at night by increasing capital investment. However the penalties of running plant at low overall utilisation and the higher labour costs involved would far outweigh the advantages of lower electricity prices. We therefore doubt whether rearrangement of steel production to take more precise account of the costs of the electricity industry will lead to a significant reduction in electricity charges.

B.11. German electricity prices are based on a degressive tariff which favours both high load factor and large users and steelmakers enjoy the added benefits of special arrangements. The effect of the special arrangements is to allow steelmakers to calculate an artificially high load factor, and achieve major consequent benefits under the German tariff. The German electricity utilities have indicated that they intend to phase out these special arrangements in 1983/85. It will be hard to implement this and even if this is achieved German steelmakers will still enjoy the benefit of a degressive tariff.

B.12. The importance of these United Kingdom steelmaking activities to manufacturing industry varies. Some steel products (eg non-alloy rod and bar) are common grades, ie commodities which are easily available internationally. Some engineering steels as well as the exotic and aerospace steels are more specialised, and it is convenient to source these steels nearby, particularly at times of intensive product development. However, it is unlikely that the future development of any United Kingdom manufacturing activity would be materially hindered if the source of these steels was outside the United Kingdom.

B.13. The size of the electricity price difference with Germany, the principal competitor, is significant for total costs in this sector. However it is dwarfed by the reverse difference in labour rates, even though higher German productivity compensates for this. The electricity price difference in itself

will not determine the fortunes of these activities. They will be dominated by the speed of recovery of the United Kingdom market, by what happens to the European steel industry overall, and in the case of BSC by HMG's overall policy of financial support and by the outcome of the United States anti-dumping action.

Integrated Plants

B.14. The price of electricity is less important in United Kingdom integrated steel-making from the hot metal route, but it still amounts to about 5-8 per cent of the total costs of saleable products. Furthermore these activities, all of which are within BSC, are considerably larger than the arc-based sector. Within the five integrated sites BSC employment is about 35,000 and BSC's separate mills, with an employment of a further 22,000, currently depend on BSC steel. The value of the semi-finished steel from these activities is about £1.7 bn, and the total turnover attributable to finished steel products from the hot metal route is about £2.5 bn.

B.15. The major raw materials used are iron ore and coking coal, and coke acts both as material and source of energy in iron-making. For most products electricity accounts for about 5-6 per cent of costs, rising to 7-8 per cent in certain cases. Taking account of the electricity required to make the oxygen used in the BOS process can raise these figures by ½-1 per cent. The proportion of electricity used in semi-finished steel is maintained in finished steel: thus the proportion of electricity used in hot rolled strip (including that attributable to oxygen) of 6.5 per cent is maintained, after two other major processes, at 6.5 per cent in tinplate. These costs are based on a price of about 2.7p/kWh which these plants will pay in 1982/83 by taking advantage of the Contracted Consumer Load Scheme.

B.16. Of the electricity used in United Kingdom integrated plants 27 per cent is self-generated by taking advantage of waste gas. It would not be economic for BSC to increase this proportion, unless electricity prices were significantly higher than at present.

B.17. The principal sources of imports into the United Kingdom of steel made in integrated plants are Germany, Belgium, the Netherlands and France in that order. Competition is especially acute in strip products, where BSC lost substantial market share in the early 1970s due to production and quality problems. Producers in Germany and France enjoy the advantages shown in paragraph B.7 above; Belgian steel producers pay similar electricity prices to those in the United Kingdom; and Dutch steel production is based on electricity prices believed to be about 10 per cent higher than those in the United Kingdom.

B.18. BSC's objective is to achieve cost competitiveness with Europe by further increasing labour productivity, and by improving manufacturing performance and utilisation of energy (including coke). The scope for improvement remains substantial, and will depend partly on matching facilities to effective demand so as to achieve the fullest possible utilisation of the assets in use.

B.19. The enormous pressures on these plants are well known. Despite drastic reductions in manning and major improvements in productivity these works have only survived because of substantial subventions from HMG. The fundamental problems of a depressed United Kingdom market and continuing overcapacity in Europe continue, and are particularly acute in strip products which account for three of the five integrated works. The survival of these plants will depend on the evolution of the steel market and HMG's willingness to continue financial support: this in turn will be based principally on the progress of the plants in achieving their objectives of costs competitive with Europe. The price of electricity is a significant factor in this, but it is unlikely to be critical to the major strategic decisions on financial support.

Steel Foundries

B.20. Electricity costs in steel foundries account for between 2 and 8 per cent of the costs of production. The industry has a turnover of about £150 m and 12,000 employees. Comparative figures exchanged within the industry indicate electricity costs in French steel foundries of about 52 per cent of United Kingdom costs, and German electricity costs 68 per cent.

B.21. The industry is dispersed among seventy small and medium-sized operations. The three largest private companies in the industry are F H Lloyd, North British and Lake and Elliott, and BSC have steel foundries in Sheffield and Motherwell. Of these, F H Lloyd, with three foundries in Burton, Wednesbury and Cardiff, and North British, with two foundries in central Scotland, are likely to be seriously affected because their products have a lower value added than those of Lake and Elliott.

B.22. The major problem for the industry is volume, and major efforts at rationalisation are being made to improve capacity utilisation. Import/export trade is limited, but imports could be increased if price disparities of steel castings become too great for United Kingdom customers to tolerate.

ANNEX C

TEXTILE INDUSTRY

INTRODUCTION

C.1. The textile industry can be sub-divided into upstream operations - fibre production, and yarn processing; and downstream activities - finishing and final products. As with chemicals and paper, the importance of energy and electricity decreases along the production chain to finished products.

C.2. The contribution of electricity to man-made fibres sectors is about 5-7 per cent of total manufacturing costs. The contribution of electricity to natural yarn production is minimal. 20-28 per cent of yarn processing costs are electricity but, as these costs are only about 2 per cent of man-made fibre production costs, the combined upstream electricity cost contribution remains at about 5-7 per cent. For downstream operations, electricity represents only about 1-2 per cent of total production costs and the average contribution of electricity across the total production chain is less than 3 per cent.

Man-Made Fibre Production

C.3. The United Kingdom man-made fibre producing industry is technologically based and capital intensive. Its operations are highly concentrated in the hands of a small number of major companies. The United Kingdom has shed 40 per cent of capacity in this sector in recent years and there are currently only two major producers - Courtaulds and ICI Fibres. Hoechst and Monsanto have factories in Northern Ireland supported by Government assistance. Total United Kingdom production has fallen to about 400,000 tons compared with a peak level in 1973 of 730,000 tons. Total employment in this sector has fallen from 28,000 in 1979 to about 12,000 by mid-1982. With the contraction of the United Kingdom industry there is now virtually no bulk man-made fibre production in the United Kingdom and the activities of Courtaulds and ICI in man-made fibre manufacture are directed towards speciality fibres.

C.4. Despite the restructuring, the sector is still suffering from over-capacity of about 30-40 per cent. The competitive pressures for rationalisation and restructuring are not unlike those acting on chemicals and steel. The future of the sector will depend heavily on the growth of customer demand and on the trading performance of the textile and clothing industries.

C.5. Electricity accounts for 5-7 per cent of the total costs of man-made fibre production. It is a continuous process with the result that little advantage has been taken of load management schemes.

Yarn Processing (throwsters)

C.6. The next stage in the production chain belongs to the throwsters who pass the yarn through a texturising process. Yarn processing is electricity intensive, with electricity representing 20-28 per cent of costs. However, firms in this sector are normally too small to qualify for load management schemes; and they depend upon high through-put and continuous operations to preserve profit margins.

C.7. The British Throwsters Association, which represents yarn processing companies, has expressed grave concerns to the Government about the effects of electricity costs upon its members.

C.8. The sector is operated as a service to the textile industry and consists of 30 small firms ranging in size from a dozen to 600 employees with an average of 130. About 4,000 people are employed often on short term contracts of about 3 months. These companies are concerned entirely with the processing of man-made fibres into higher value added yarns, frequently of specialist specifications. Their market is international but competition is almost entirely from other developed countries particularly the USA, Germany and France. The process is capital intensive and the rate of technological change rapid. Competitive pressure, particularly from overseas, means that investment in new plant must be maintained and the combination of a strong pound and high interest rates has created great problems in cash flow.

C.9. Texturising is an international business and some of the United Kingdom firms, for example, take flat yarn from Mexico, texturise it in the United Kingdom and sell it to Nigeria. The United Kingdom has established a competitive advantage in this sector through technology and quality of service which currently appears to outweigh the disadvantage created by electricity prices. As a result in recent years only a few firms have closed although the pressures on the remaining firms are considerable. Unless there is an upturn in the market more closures are likely.

Downstream Sectors

C.10. The final stages in the production process from finishing to final products are highly diversified and are normally the domain of small firms employing perhaps 100 people. The finishing processes - bleaching, dyeing etc are sometimes but not always integrated with the weaving and knitting industries. The latter's financial difficulties have slowed down restructuring programmes despite labour costs savings offered by modern machinery. A number of insufficiently specialised spinning firms have closed.

C.11. These downstream operators employ about 600,000 people (60 per cent in cloth manufacture and 40 per cent in making up final products) compared with over 1 million 10 years ago. About 160,000 jobs have been lost in the last two years. However, these parts of the textile industry are not particularly intensive users of electricity which accounts on average for about 1-2 per cent of total costs. The major competitive threat is from cheap labour countries and any changes in electricity prices would be unlikely to alter the United Kingdom competitive position significantly.

Summary and conclusions

C.12. The textile industry as a whole continues to be under the very severe competitive pressures which have already resulted in the loss of some 175,000 jobs in the last two years. The industry faces competition both in the upstream and downstream sectors. Upstream operations are dependent upon capital intensive continuous processes and competition is from developed countries with access to cheaper energy sources. Downstream operations face competition from low wage suppliers, principally in the developing countries. As a result the United Kingdom industry is having to concentrate on specialised products upstream and high quality products downstream.

C.13. In the production of man-made fibres electricity accounts for some 5 per cent of costs. There is little scope for reducing the cost through load management. The lower prices enjoyed by overseas competitors should not be a crucial factor in the industry's future but could have an impact at the margin.

C.14. Electricity costs are very important in yarn processing (up to 28 per cent of total costs) and there is little scope for cutting costs by load management. So far this small sector (4,000 employees) has survived despite the recession and the electricity cost disadvantage. However, if these disadvantages continue, they could well contribute to a major contraction in this sector.

C.15. Much the greatest part of the textile industry in terms of employment is involved in manufacturing cloth and making up final products. Here electricity is not a major factor in costs.

ANNEX D

PAPER AND BOARD INDUSTRY

Introduction

D.1. This industry can be sub-divided into three sectors - pulp, bulk paper and downstream products. The industry in Britain is not vertically integrated and there are some 125 manufacturing sites, mostly engaged on the production of bulk paper or in downstream processing operations. These sites consume anything from 1 to 50 megawatts of electricity.

D.2. The United Kingdom is involved only to a very limited extent in the first stage, the production of pulp, and the majority of pulp is imported. However, waste paper is becoming an increasingly important alternative feedstock for the second stage of the production process and now accounts for over 50 per cent of the fibre input.

D.3. Bulk paper itself is also traded internationally, and the overall import penetration into the paper sector is over 50 per cent.

D.4. The downstream sectors - printing and publishing and paper conversion - are not of particular interest to this study. The end products are not internationally traded on a large scale, import penetration is only 5 per cent, and the contribution of electricity costs is no higher than the average industrial level. If the upstream United Kingdom industry declined through lack of international competitiveness, it is probable that the downstream paper processing industry could continue, sourced by imported materials.

D.5. The important parts of the United Kingdom industry for this study are therefore those concerned with pulp and bulk paper production which have to be internationally competitive to survive. For the traditional United Kingdom mills which mainly rely on imported pulp, electricity costs average about 5 per cent of total manufacturing costs. (The NEDC reports included an averaged figure for the whole industry's electricity costs which did not bring out the greater importance of electricity for upstream operations.)

D.6. Between 1970 and 1979 the labour force in the United Kingdom industry fell by 25 per cent. The problems have continued over the last three years. Since January 1980 24 mills have closed, 62 machines have been shut and nearly 11,000 people have been made redundant. The industry's total capacity has been reduced by about 20 per cent in this period.

D.7. The demand for paper and board closely reflects the state of domestic economic activity and thus tends to be cyclical. The strength of sterling against the US dollar was also an important factor in the closure of about two-thirds of United Kingdom news print capacity in 1980/81 - news print is effectively sold in dollars. As pulp is also sold in dollars, a strengthening dollar has not helped those parts of the United Kingdom industry which use imported pulp, although higher pulp costs do improve conditions for mills making competing products from waste paper. In general prices continue to be depressed and profitability is low or non-existent.

D.8. This position, coupled with shortage of cash flow, high interest rates and a general lack of confidence about the future has depressed investment. There are a few projects in progress which were started before the current recession when market forecasts were more optimistic, the largest of which is the Thames Board mill at Workington which is due to start production this year. The proposed United Paper Mill at Shotton in North Wales would be an exception.

Electricity

D.9. The paper and board industry is the sixth largest energy using industry in the United Kingdom and the second largest private generator of electricity. Combined heat and power has been an important factor in making the most efficient use of primary energy fuels and decreasing the dependence on purchased electricity. However, although the older manufacturing mills require both heat and power in sufficient quantities to justify CHP schemes, the more modern integrated mills require much less steam ie heat. The result is that the scope for CHP schemes is decreasing and the share of purchased electricity increasing. The percentage of self-generated electricity has fallen from 66 per cent to 38 per cent in 1980 as a result.

D.10. The current cost of energy is estimated to be about 17 per cent of total manufacturing costs for an average paper mill, ranging to over 30 per cent at the top end of the scale. The average contribution of purchased electricity to this total is 11 per cent on a calorific basis but 30 per cent on a cost basis. The average electricity contribution to total United Kingdom manufacturing costs of bulk paper is therefore about 5 per cent although there is a wide divergence around this figure. In conventional mills reliant on electricity and with no auto-generation facilities, electricity costs can rise to 14 per cent of total manufacturing costs.

D.11. Most United Kingdom mills are in the range of 1 - 10 MW. 85 mills take more than 1 MW, 25 more than 5 MW and 3 more than 20 MW. Load factors are generally 50-60 per cent although there is a significant distribution between 30 per cent and 80 per cent. Without auto-generation, typical load factors would be of the order of 80 per cent. Paper mills are continuous processes and for technical reasons it is not possible to stop the process at short notice. The paper industry has therefore only been able to take advantage of load management to a limited extent, usually where alternative auto-generation facilities are available.

Competition

D.12. The main sources of international competition in the pulp and paper sector are Scandinavia and North America, which account for nearly half the United Kingdom market. The EEC is less important although competition from waste based production and non-volume production could develop. The German paper industry, in contrast to the United Kingdom industry, has been investing heavily in modern equipment and the current capital stock is significantly more competitive than that in the United Kingdom.

D.13. All EEC countries will be under increasing competitive threat from Scandinavia as existing trade barriers will be abolished by 1984. In Scandinavia, paper mills are usually integrated with power stations, often with common ownership. Although competition is mainly based upon natural competitive advantage, the wood industry is extremely important to Scandinavia and there have been some suspicions of state aids to this sector. There is currently an EEC case being brought against pulp suppliers.

D.14. Import penetration in the bulk paper grades reached 51 per cent in 1980. These grades can be produced more economically in integrated mills in which pulp mill production is fed directly on to a paper machine. Since the 1960s the Scandinavians in particular have sought to exploit their natural advantages by adding value to their wood products and moving increasingly from pulp production to paper and board production. By comparison with North America and Scandinavia, the United Kingdom has limited and fairly scattered timber resources and depends for over 40 per cent of raw material on imported pulp supplied mainly by countries who are also our main competitors. In finished paper and board this places the United Kingdom industry in a vulnerable position.

D.15. In the future the main sectors of the European industry are likely to be -

i. integrated pulp and paper manufacture;

ii. downstream conversion;

iii. some production of speciality grades;

iv. bulk and speciality grades based on waste paper.

D.16. It is unlikely that the United Kingdom has a long term competitive future in the first category in view of the natural advantages enjoyed byScandinavian and North American producers (local timber and cheap hydro power). This conclusion is supported by the fact that, for a modern integrated pulp and paper plant, electricity costs can be of the order of 40 per cent of total manufacturing costs. There is currently only one modern integrated plant of this type in the United Kingdom and the proposed UPM plant at Shotton would be a second.

D.17. The absence of a pulp and paper sector will have a major impact on wood suppliers of which the Forestry Commission is the largest. However, United Kingdom wood would at the most provide feedstock for two modern integrated pulp and paper mills and a wood resource does not in itself guarantee a viable paper industry.

D.18. The alternative of importing pulp would be difficult to sustain in the longer term, both because of cost disadvantages and because overseas pulp suppliers are likely to develop downstream into bulk paper production. Part of the United Kingdom cost disadvantage is that by contrast with integrated mills, pulp has to be dried before export to the United Kingdom, remixed with water to make paper and dried again, thus increasing energy costs.

D.19. The competitive sectors for the United Kingdom industry are therefore likely to be downstream conversions and speciality grades, in some grades of which United Kingdom companies are world leaders. It is generally true that downstream industries have been, and will tend to be, unaffected by upstream closures. There is also some scope for products which use pulp but which are unsuited to large scale integrated processes and for products which are better produced at the source of consumption eg tissues. In none of these sectors is electricity critical to survival.

D.20. That part of the United Kingdom industry based on waste paper fibre rather than imported pulp is also likely to have a future. In some sectors, notably corrugated case materials, the United Kingdom industry has been successful in developing waste based alternatives and import penetration has been held back. But the industry still has to sell such products at a discount to those made from virgin fibre and is vulnerable to a weak market and a strong pound.

Conclusion

D.21. As with chemicals and textiles, the major significance of electricity for the paper industry lies in the upstream sector, ie pulp and bulk paper production. However, as with the other sectors, upstream operations are under competitive pressure and threat for reasons which are mainly structural. For conventional United Kingdom paper mills relying on imported pulp, electricity accounts for about 5 per cent of costs on average. Although it is therefore one of many factors influencing the competitive future of bulk paper production, the sector is likely to decline for more fundamental reasons based on natural competitive advantages.

D.22. For modern integrated pulp and paper mills which will become an increasingly important part of the industry in other countries, the conclusion is even clearer. These plants are very electricity intensive (up to 40 per cent of total costs) and the price of electricity is a very severe handicap to their viability in the United Kingdom. The natural advantages (including cheap hydro power) enjoyed by our competitors are very large and such plants are both unlikely to have a competitive future in the United Kingdom and are also likely to lead to even further contraction of the current United Kingdom industry.

D.23. In the downstream sectors, where the paper industry is likely to have a competitive future, electricity is not an important factor in competitiveness.