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Restructuring and Privatisation of the UK Electicity Supply Industry: the likely effects on efficiency

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I INTRODUCTION

1. Interest in the privatisation of electricity seems to be increasing. The Energy Act of May 1983, which facilitates the generation and supply of electricity by persons other than Electricity Boards, represented a first step towards increasing the role of market forces. The Conservative election manifesto of June 1983 contained an explicit commitment "to seek other means of increasing competition in, and attracting private capital into, the gas and electricity industries". The incoming Chairmen of the CEGB and Electricity Council were set objectives to like effect. Department of Energy proposals concerning the election commitment are reported to be imminent.

2. As a means of increasing market forces, restructuring the industry into smaller units must be considered both as a complement to privatisation and as an alternative to it. This paper explores the implications, and attempts to evaluate the likely effects on efficiency, of various alternative schemes for restructuring and/or privatising the electricity supply industry in England and Wales.

3. Appraising efficiency is invariably difficult and subjective. It requires conjectures about a hypothetical future or a hypothetical alternative past. Quantitative calculations have been made in various public reports and independent judgements on the electricity industry. Here, evaluation is limited to qualitative judgements or rankings as to "more"

or "less" using the present performance of the industry as a benchmark against which all other schemes are evaluated.

4. An attempt to structure thinking in this area, to consider what privatisation would involve, to marshall some of the available evidence, and to indicate crucial topics for further research, can be a valuable first step. Experience with the British Telecoms bill - especially public concern over the "transfer from public to private monopoly", the balance of liberalisation versus privatisation, and the absence of restructuring - suggests that thinking should better precede legislation than accompany it.

II MAJOR ALTERNATIVE SCHEMES

5. Everyone with an interest in the electricity industry has his own idea as to how it should be changed. To focus the discussion, we shall concentrate on five alternative industrial structures. For each structure, all the constituent organisations may be publicly owned, or all may be privately owned, or some may be public and some private. In principle, then, there are at least 15 alternative schemes to consider. It will be argued later that attention need be concentrated on only a few of these.

6. The first structure consists of the status quo: that is, the CEGB and the 12 Area Boards, together with a statutory co-ordinating role for the Electricity Council.

7. The second structure is a Central Electricity Board, comprising the whole supply industry. A proposal to this effect was made by the Plowden Committee (1976), adopted by the Labour government in 1978, then shelved by the incoming Conservative administration. A single functional organisation is still favoured by several in the industry.

8. The third structure consists of five all-purpose regional power boards, each responsible for both generation and distribution of power. A typical board would comprise one region of the CEGB plus two or three coterminous Area Boards. The national super-grid would be organised as a jointly-owned subsidiary of the regional power boards,

repsonsible for grid control, transmission planning, co-ordination of power station investment and certain other strategic decisions. The Electricity Council would be abolished. A scheme of this kind has been advocated by the former Chairman of the MEB (Shepherd, 1983).

9. The fourth structure involves splitting the CEGB into five generating boards, corresponding to the present CEGB regions. The national supergrid would be organised as a separate and quite independent entity. The Area Boards would be unchanged. The Electricity Council would again be abolished. This structure, with complete private ownership, has recently been proposed by Eggar et al. (1984).

10. The fifth structure is one in which CEGB and Area Boards are split into much smaller organisations, such as small groups of power stations, local distribution networks for towns or estates, etc. A scheme of this kind seems to be envisaged by some advocates of dynamic pricing (e.g. Berrie 1983).

11. Those organisations remaining in private ownership will continue to be monitored by the Department of Energy. Private companies will be subject either to a specific Regulatory Agency (like Oftel?) or to general provisions of competition policy.

12. In all cases, freedom of entry and obligations to transmit power are provided for as in the 1983 Energy Act. The effectiveness of competition from this source will depend in

part upon the details of structure and ownership.

13. All schemes are starting structures only which will be modified over time. Thus, organisations will build, buy and sell power stations; take on or relinquish customers or areas of distribution; merge, demerge, diversify or exchange assets. Such changes will be constrained by statute and departmental or ministerial approval in the case of public ownership, and by the Regulatory Agency and competition policy in the case of private ownership.

III ASPECTS OF EFFICIENCY

14. Economic efficiency is the allocation of scarce resources so as to provide maximum satisfaction for consumers. Economists typically distinguish three main aspects of efficiency. Productive efficiency refers to meeting existing demands at lowest cost using known technology. Allocative efficiency refers to the allocation of available resources between different goods and services so as to maximise consumer satisfaction (given the level and distribution of incomes). This is promoted by prices which closely reflect costs of production. Dynamic efficiency refers to the process of creating and responding to change: the discovery of what consumers want, what innovatory techniques can provide the desired services at lowest cost, what forms of organisation are best suited to accomplishing these aims, and so on.

15. In order to compare the alternative schemes for the electricity supply industry, it will be helpful to divide the above three aspects of efficiency into twelve sub-headings. In each case, examples are given of recent criticisms (Plowden 1976, Price Commission 1976, MMC 1983, 1984a, b, Redwood 1980, Pryke 1981).

Productive Efficiency:

(1) Investment - the timing, size, location and type of investment in new power stations. (**Criticisms:** Choice of wrong nuclear reactor type (AGR versus LWR). Excessive planning margins. Inadequate technique and presentation of investment appraisal by CEGB.)

(2) Construction - the cost of designing, constructing and commissioning power stations. (**Criticisms:** Delays in power station construction and failure to control construction costs.)

(3) Purchasing - the cost of acquiring a given set of factor inputs such as (coal, transport, labour, etc.). (**Criticisms:** Willingness to pay high prices for UK coal, and to hold high stocks. Failure to import or enter into long term import contracts. Costly 'Buy British' policy in procurement of plant.)

(4) Operation - the cost of operating power stations at given factor prices. (**Criticisms:** High manning levels at generating stations. Low thermal efficiency of power stations and low availability of generators.)

(5) Scheduling - the cost of meeting a given pattern of electricity demand by selection of stations in merit order. (**Criticisms:** Modifications and alternatives to CEGB simulation model should be considered.)

(6) Distribution - the cost of distributing a given pattern of electricity output from power stations to customers.(**Criticisms:** Overmanning of Area Boards, including duplication of staff with CEGB and Council.

Inadequate control over nationally-agreed salary scales. Lack of urgency in implementing needed reforms. Inadequate development of information system.)

Allocative Efficiency:

(7) Price Structure - the degree to which relative prices to consumers reflect relative costs of production.

(8) Generating Monopoly - the degree to which the general level of bulk supply prices exceeds generating costs.

(9) Distribution Monopoly - the degree to which the general level of retail prices exceeds bulk supply price plus distribution costs.

Dynamic Efficiency:

(10) Marketing - the discovery and satisfaction of hitherto unknown or neglected consumer preferences. (**Criticisms:** Failure to adopt 'dynamic' or 'spot' pricing. Poor demand forecasting and slowness to respond to changing economic conditions.)

(11) Innovation - the discovery and profitable use of new techniques of production and distribution. **Criticisms:** Inadequate incentive to conservation and CHP schemes.)

(12) Flexibility - responsiveness of the industry's organisational structure to changing technological and economic conditions. (**Criticisms:** Present structure of the ESI no longer appropriate and too inflexible.)

16. Criticism of the industry has been especially strong with respect to investment planning, design and construction, and purchasing. In the case of nuclear power, the alleged losses due to error or inefficiency amount to billions of pounds (Henderson 1977, Burn 1980, Collingridge 1984).

17. The electricity industry would reply that some of these criticisms are inadequate, unjustified or misconceived (e.g. spot pricing and CHP schemes are not yet economics); that some of the blame is attributable to others (e.g. the manufacturers in the case of construction delays); that progress has already been made in meeting certain criticisms (e.g. construction delays have been reduced, manpower is down by 40 per cent since 1968, thermal efficiency and availability have steadily improved, advantageous load management tariffs have been introduced for the largest consumers, losses on retailing have largely been eliminated); and that further beneficial changes are envisaged (e.g. internal reorganisation of the CEGB). (For an extensive response to an MMC report, see CEGB 1982.)

18. Efficiency has also been reduced by actions of government, which has intervened repeatedly in the electricity industry. For example, the government has pressured the CEGB to buy British plant and equipment, increase the power station ordering rate, maintain higher coal stocks than planned, and restrict or abandon coal imports. There have been frequent constraints on the industry's pricing, tariff, financing and

investment policies. The electricity industry has been used to maintain workload, revenues and wages in ancilliary industries (including the main UK generator manufacturers, the National Coal Board and British Rail), to reduce the PSBR, and to facilitate the management of aggregate demand in the context of ever-changing macro-economic policies.

19. For present purposes, arguments about the past are of relevance only insofar as theye enable us to predict whether a change in the structure of ownership of the industry is likely to improve or worsen performance. Limited empirical information is available from other countries and industries. In the main, predictions will have to be based on economic theory and managerial experience.

IV STRUCTURE, OWNERSHIP AND EFFICIENCY

20. Where the structure of an industry is determined by political rather than market forces, there is n o systematic tendency for inefficient structures to be superceded by more efficient ones. Enforced restructuring may lead to economies or diseconomies of scale or scope. Transacting between organisations may be more or less expensive than transacting within an organisation. Economic theory provides no definitive guides: in each case an empirical judgement has to be made of the likely consequences, of change.

21. Competition may be generally predicted to increase all aspects of efficiency. It forces firms to produce at lowest cost, to relate prices to costs, and to seek better ways of serving customers. In its most general form, competition is rivalry; it exists within organisations as well as between them. Wherever decisions have to be made, there is potential for competition. Nevertheless, competition between organisations is arguably more effective, and certainly more likely to rebound to the benefit of the consumers.

22. Restructuring can increase competition in various ways: by increasing the number of existing competitors in a market (e.g. by horizontally dividing up existing producers); by encouraging new entry (e.g. by reducing the size of existing

competitors); by creating new market relations (e.g. by vertically dividing up existing producers); by reducing political pressures inhibiting a commercial approach (e.g. by multiplying the number of organisations whose aquiescence is required). In short, multiplying the number of organisational boundaries (by creating more organisations rather than less) may be expected to improve the quality and extent of all aspects of competition.

23. Until the 1983 Energy Act, the Electricity Boards had a statutory monopoly of generation (excluding self-generation) and distribution in the UK. A degree of competition exists within the Boards - for example, reductions from three-shift to two-shift working, and decisions on closure, are based on comparative performance of CEGB power stations. However, there is no competition between Boards, even though this would be feasible in several respects (e.g. direct supply by CEGB, or generation by Area Boards).

24. Limits to the Boards' monopoly power are provided by (a) the possibility of self-generation by large customers, (b) substitution by other fuels for certain uses such as heating, and (c) the costs of discriminating between high and low value uses and customers. Political pressures also constrain the extent to which monopoly power is exploited in the form of higher prices.

25. Splitting up the CEGB to form power boards, generating boards or groups of power stations would strengthen competition in generation and indirectly facilitate competition in distribution. Such schemes would improve efficiency, especially with respect to construction, pricing and innovation. Conversely, creating a Central Electricity Board would severely reduce the number of organisational boundaries. This is unlikely to improve efficiency, and will discourage innovation and change.

26. Public ownership constrains the extent to which a competitive commercial approach is sought or tolerated. It thereby limits the scope and magnitude of improvements in efficiency. It turns out that the set of schemes involving full or partial private ownership dominates the set of schemes involving public ownership. A more detailed comparison of alternative structures under public ownership is contained in the Appendix; we focus here on schemes involving privatisation.

27. Private ownership strengthens and extends competition in several ways. It provides greater incentive to produce what consumers prefer; faster growth by more successful companies; market discipline rather than public influence; greater freedom to redeploy assets and enter new markets; discipline by the capital market, with its threat of takeover (i.e. competition for control of the organisation); and bankruptcy as the ultimate sanction on performance.

Empirical evidence from the US electric power industry (1974, 1980) confirms that private ownership yields improved efficiency in a variety of respects.

28. It is widely believed that private ownership is efficient only where there is competition, otherwise there will be losses in allocative efficiency as a result of higher prices and lower output. Price discrimination may, of course increase both profits and output, thereby increasing allocative efficiency. More important, the common belief fails to appreciate that there is an incentive to exploit monopoly power under whatever circumstances it exists. Monopoly rent may be extracted in a variety of ways. Unrestricted private ownership encourages commercial exploitation. Other forms of ownership facilitate exploitation by other groups, such as employees, managers, suppliers, civil servants, politicians, or influential customers. Depending upon the type of exploitation, the effect is higher prices, profits, wages, input prices; more congenial working conditions, including insulation from commercial pressures; pricing, investment and financing policy influenced by political considerations; provision of certain services free or below cost, etc. Thus changing ownership will change the type, but not the fact, of monopoly exploitation. Whether (for a given degree of competition) private ownership will have greater adverse effects on allocative efficiency, compared to alternative forms of ownership, is not at all obvious.

29. In sum, there is a general presumption that restructuring into smaller organisations and introducing private ownership will encourage competition and efficiency. However, in specific instances there may be reductions in efficiency due to loss of economies of scale or scope, increased transactions cost or different exploitation of monopoly power. We now have to examine how these general principles apply to the alternative privatisation schemes under consideration.

V PRIVATE GENERATING COMPANIES

30. The most explicit scheme for privatising the electricity industry is that of Eggar et al (1984). This envisages (a) that the five regions of the CEGB are each constituted as separate private generating companies, (b) that the National supergrid is constituted as a separate private company and (c) that the twelve Area Boards are transferred to private ownership. The Electricity Council would be abolished. There would be a government Regulatory Authority supervising the Grid and Area Boards (but not the generating companies). Table 1 presents a rough calculation of the sizes of the new companies.

31. There is some flexibility in the number, size and composition of these generating companies. One or two additional companies might be formed by splitting up the Midland and South Eastern regions, which each had (until recently) two Area Grid Control centres. Power stations could be transferred from one company to another to equalise initial capacity or composition. Generating companies do not necessarily have to be organised. One or two specialised nuclear boards could be set up. This would economise on the costs of design and construction, and of meeting and enforcing safety standards. On the other hand, specialising boards by type of fuel exposes them to greater risks from unexpected changes in fuel input prices. For simplicity, we leave these possibilities for the moment.

(i) Investment

32. One familiar argument against splitting up the CEGB is that investment in power stations - their number, size, location, reactor type, etc. - would no longer be determined so as to minimise cost on a national basis.

33. The cost of building a large coal-fired power station is of the order of £10000m., perhaps half as much again for a nuclear station. Could a private company finance this? Table 1 suggests that the generating companies will be quite substantial organisations, each with assets valued at £3000m. to £6000m. and turnover ranging from £800m. to £2000m. They would rank in the top 40 UK public limited companies on the basis of turnover, but very much higher on the basis of assets. The assets of the largest generating company would be comparable to those of the entire National Coal Board; the assets of the smallest generating company would be approximately equal to the assets of the Post Office, British Airways and British Shipbuilders combined.

34. Even the smallest generating company would be larger than most US electric utilities. In the USA, only 14 out of 203 private companies had capacity exceeding 8000 MW in 1980. (Publicly owned utilities are very much smaller.) There are, however, about a dozen electric utility holding companies. The largest such holding company controlled over 25000 MW capacity. (Joskow and Schmalensee 1983, pp.12-13).

As in the USA, one would expect some joint financing of power station construction. Direct collaboration between generating companies would probably be ruled out, for reasons of competition and competition policy, but long-term contracts for supply to the National Grid and the Area Boards would be a means of pooling funds and reducing risk. It should be thus quite possible to finance the construction of large power stations.

35. Would the pattern of investment minimise total cost on a national basis? More accurately, would the combination of cost and risk be more or less efficient than the CEGB pattern? One commentator has suggested a central investment planning organisation that would identify preferred projects which private investors would be invited to finance (Webb 1984, p.12). The present scheme envisages no such central direction. Nonetheless, each generating company would have to take into account the national picture since it would be competing (via the grid) in a national market. It would be able to locate a new station wherever costs were lowest (e.g. near coalfields), regardless of whether this were in its initial region. Each generating company would take into account the commissioning and decommissioning plans of other companies. It would pit its own judgement of future market conditions against the judgement of other companies. Private ownership and the multiplicity of competing decision-makers is likely to lead to faster and more accurate response to changing market conditions (especially

bearing in mind the vulnerability of nationalised industries to official government forecasts).

36. Private generating companies will be more willing to recognise risk than the CEGB. Rather less capacity might be built, resulting in lower industry planning margins and nuclear power would be less attractive. On the other hand, as noted above, the CEGB has been vulnerable to pressure to bring forward its ordering rate and slow in reacting to changes in demand. It has been criticised for its over-capacity and excessive planning margins. Private enterprise has an greater aversion to risk of financial loss resulting from excess capacity, while public enterprise has an greater aversion to risk of loss of reputation resulting from insufficient capacity. In future the latter risk may not be as serious as in the past, insofar as dynamic pricing techniques will be able to alleviate the costs of shortage.

37. A further consideration is that the National Grid company and the Area Boards may wish to become directly involved in generation. They may believe themselves better placed to judge peak demand, or how far it is preferable to generate rather than interrupt supply to customers on load management tariffs. Whether they will be allowed to do so (engage in generation) depends upon the terms of their license (if this is the means of regulation) and the policy adopted by the Regulatory Agency. As sources of new entry, National Grid and Area Board involvement would increase competition in generation. This

may also provide a partial solution to the problem of providing and/or financing reserve capacity.

38. A potential problem is that the National Grid and Area Boards, as regulated private companies, may have an incentive to overcapitalise. Most forms of rate of return regulation increase the incentive to build plant rather than buy in power (because total profit is related to capital rate base). Perhaps this could be handled by requiring the National Grid and Area Boards to form separate subisidiaries for generation, though it would also be necessary to monitor the transfer prices of power from the subsidiaries to ensure that loss making is not concealed. On the other hand, any over-investment by Area Boards will tend to offset any reluctance to invest by generating companies.

39. In the absence of perfect knowledge of the future, perfection cannot be guaranteed. On balance, it seems likely that private ownership, without central planning, will provide a pattern of investment in new power stations which is more efficient, more cost-effective and more responsive to changing market conditions, than the CEGB is able to provide.

(ii) Construction, Purchasing and Operation

40. The private generating companies will be directly competing against each other, to supply the Grid, Area Boards and private customers. As noted above, there is already a significant degree of competition between CEGB power station managers. However, success or failure for the companies would depend upon efficiency in all aspects of the business, not merely in operating existing plant. One would expect greater efficiency in design and construction of power stations - for example, by greater use of existing "off-the-peg" technology, fewer design revisions, alternative contractual arrangements and faster completion times. There would also be greater pressure on general overheads.

41. The removal or reduction of political pressures and government intervention would allow management significantly greater freedom to act commercially in buying plant and equipment and in negotiating prices of fuel, transport and labour. Imports would be a more realistic treat. There would be greater variety of executive contracts, including more performance-related options.

(iii) Scheduling

42. The CEGB's National Grid Control procedures are highly respected. Some believe that these procedures are now so ingrained in the thinking of UK power engineers and managers that the system could be maintained whatever form of ownership and organisation is adopted. There are several so-called "tight" power pools in the USA which have central scheduling of generating plant owned by different private utilities. Moreover, the New York Power Pool is considering central dispatch, as in the CEGB.

43. Against this, a small number of private generating companies would have a greater incentive than CEGB regions to engage in opportunistic behaviour e.g. to overstate their costs, or to restrict supply at the margin (and thereby drive up price) by not starting up plant or prolong maintenance periods. US power pools do not report such difficulties. It may be that participating utilities there are more nearly self-sufficient: utilities that find themselves exporting at one moment and importing the next are co-operating as often as competing, so have a stronger incentive to "play by the rules". Alternatively, it may be that the threat of new construction, and conceivably new entry, is sufficient to discourage opportunistic tactics.

44. The organisational structure envisaged for the UK is also different from the USA. Wherease US utilities are typically each responsible for both generation and distribution, here these functions are envisaged in separate organisations, whereas the grid control units in the US are jointly owned by the participating utilities, here a quite independent organisation is envisaged, which will initially own the major transmission plant. In addition to the long term contracts pertaining to construction of new plant, a variety of short-term and medium-term contracts are likely to emerge between the generating companies. National Grid, Area Boards, independent generators and major customers. These contractual arrangements might cover periods from, say, 2 hours to 5 years ahead, for power on a fixed or standby basis. Minute-to-minute and hour-to-hour scheduling would thus be set in a rather different context than at present.

45. Instead of central scheduling by the grid, a system of co-ordinating bids to supply and purchase power may be preferred. Systems of this kind are in use in the USA (e.g. the Florida brokerage system). It is not claimed that they are as efficient at scheduling as more centralised systems. (Members of brokerage systems rate the advantages of independence more highly than the cost savings from centralised scheduling.) However, they reportedly operate satisfactorily, and savings have been documented compared to individually-negotiated side contracts.

(iv) Distribution

46. How would the pattern of investment in transmission and distribution compare with the present? As in the case of new generating plant, a private company would be more conscious of risk (of inadequate future demand), which might be offset by a regulatory incentive to over-capitalise. In the CEGB, the avoidance of risk (of shortage) has tended to encourage ample provision of transmission plant. The 400 kv spuer-grid was designed at a time when continued rapid expansion was envisaged, and it was feared that planning permission to extend might be refused. Many east-west lines are now substantially under-used. On the other hand, the oil price rise has led to greater reliance on coal-fired stations than expected, and consequent stress on some north-south lines. Again, perfect performance cannot be expected, but one would expect a private transmission company to be at least as adept as the CEGB at judging and responding to market conditions. Similar remarks apply to distribution networks.

47. There would be greater pressure for the efficient use of plant and staff. This pressure would stem partly from the increased competition in both transmission and distribution (see below) and partly from private ownership itself, though the latter may be modified if regulation preserves the "cost-plus" mentality of public monopolies.

(v) Price Structure

48. The Bulk Supply Tariff in its present form would cease to exist. A multiplicity of side-contracts would emerge. The "spot market" would account mainly for marginal and unexpected variations in demand. In the Florida brokerage system the "spot-price" is determined as the average of the incremental and decremental costs of the selling and buying parties. Here, the grid company might buy and sell on its own account, or act as the agent of the Area Boards (and large consumers) in buying power at the cheapest available rate.

49. In any event, the price at the margin would undoubtedly reflect costs much more closely than does the present bulk supply tariff. Although the number of pricing periods has recently been substantially increased, these periods are defined in terms of fixed pre-specified times of day and months of the year. Price is not contingent on variations in level of demand above or below the average for that period. It is true that load management schemes have recently been introduced. But these apply only to the very largest customers, and focus on a very few peak periods. Schemes for "dynamic" or "responsive" pricing are still at the experimental stage.

50. Changes in the terms of bulk supply would feed through to the retail level. Private Area Boards would show greater

willingness to differentiate prices according to the demand and supply conditions of each group of users, and to relate tariffs to peak demand and cost conditions. Evidence from the USA also suggests that private companies would revise tariffs more often and in response to smaller changes in economic conditions.

51. Whether there would be less government pressure to price selected services below cost is not clear: the Regulatory Agency would presumably have authority over tariff structures. Services presently provided free, with a view to developing the business (e.g. advising on customer requirements) would be looked at more critically. Customers requiring special investment (e.g. farms) might have to pay a greater contribution to capital cost, rather than have this annualised.

(vi) <u>Generating Monopoly</u>

52. Monopoly power in generation should not be too serious, with 5 competing companies and the possibility of entry by Grid, Area Boards and others. It will be the responsibility of the OFT and related institutions to monitor behaviour here.

(vii) Distribution Monopoly

53. Monopoly power in transmission and distribution is more serious. There will be greater pressure to raise prices, particularly where demand is least elastic (e.g. commercial and domestic customers). If this were unchecked, it could lead to a proliferation of home generators, but the Regulatory Agency will presumably limit prices before that stage is reached. There will also be some reduction in monopoly power in distribution. The 1983 Energy Act removed the previous restriction on the generation or distribution of energy by persons other than an Electricity Board, and obliges the Area Boards to transmit electricity at cost (including a return on assets) between a private generator and his customer(s). At present this facility is somewhat of a dead letter, since supply by private generators is negligible. But if the entire CEGB were restructured into competing generating competing, the 1983 Act would take on a new significance. It would allow any customer to purchase electricity direct from a variety of suppliers (including the grid itself), as an alternative to the Area Board in whose territory the customer resides. This would provide a tariff more closely tailored to the customer's initial load pattern and his opportunities for modifying it (e.g. via responsive pricing) than the Area Boards presently find it worthwhile to provide.

54. Perhaps only large customers would initially find it worthwhile to buy direct from a generating board. But the principle could be extended to groups of adjacent consumers (e.g. businesses on an industrial estate or households in a particular street or neighbourhood). It might be possible for non-adjacent customers to form a group to purchase power on more favourable terms than the Area Board offered. Trade associations might organise such groups, or electricity "brokers" might develop, specialising in a knowledge of market conditions of supply and demand and matching the needs of buyers and sellers.

55. Area Boards might try to exploit their monopoly power, and protect their revenues, by raising changes for distributing such power purchased from others. The Regulatory Agency would attempt to ensure that these charges were related to cost. (The present structure of charges will probably need to be revised. Charges on a distance basis, which take no account of the direction in which current is flowing within the network at any time, may be adequate for independent suppliers selling <u>to</u> the network, but unduly discourage sales to consumers <u>across</u> the network.) There is also the threat of suppliers and consumers installing a new direct line, though this is unlikely to be viable except for very large consumers. (For the same reason, widespread resale by large consumers is unlikely to be viable.)

56. Some have feared that electricity prices would rise under privatisation, quite apart from any danger of monopoly, because private owners will require a competitive return on their assets. In 1982-83 the CEGB earned only 3·8 per cent on average net assets, the Area Boards only 2 per cent. These are below market rates. However, Plant is valued in the ESI accounts at replacement cost, whereas in present times of excess capacity its market value is somewhat lower: the return on average market value is therefore higher. Moreover, the average value of existing plant may be quite different from the marginal value of new plant: the CEGB certainly claims that its new investment plans will earn a competitive return on capital. Bearing in mind, finally, that costs should be lower under private ownership, it is by no means obvious that present prices would be insufficient to call forth new investment.

57. The regulatory agency will require a staff and premises to be be paid for, but this is likely to cost less than the present Electricity Council. (A staff of 50 and a budget of £ m is envisaged for offices.)

(vii) Dynamic Efficiency

58. As to Marketing, there will be greater incentive to search for, create and provide whatever combination of price, reliability, load management, interruptibility, dynamic pricing, etc., each group of consumers prefers, at least insofar as this yields greater profit.

59. There will be less inclination to take risks with expensive untried technologies. Against this, there will be greater willingness to experiment in other respects (e.g. contractual and managerial arrangements) and faster adoption of new cost-reducing technology. Better functioning markets for executive talent will allow more able and imaginative managers to rise more quickly to positions of influence.

60. The absence of statutory restrictions, the incentive of profit, and capital market pressures will yield greater flexibility with respect to forms of organisation. Merger and demerger in horizontal, vertical or conglomerate directions will be facilitated, subject of course to competition policy and regulatory approval.

Conclusion

61. To summarise, we have considered creating private generating boards and transferring the national grid and Area Boards to private ownership. It may not be possible to maintain a national scheduling system as efficient as the present one. There will be potential problem areas, including over-capitalisation and monopoly in transmission and distribution, where gains are uncertain. Nevertheless, privatisation in this form seems to promise significant and widespread increases in all other aspects of efficiency.

62. We now consider various alternative organisational structures. It will suffice to compare the predicted outcomes with those of the Eggar scheme discussed in the last section, by drawing attention to the major differences.

VI PRIVATE ALL-PURPOSE REGIONAL POWER COMPANIES

63. An argument for all-purpose regional power boards was put forward by the Midland Electricity Board in its submission of evidence to the Plowden Committee. The then-chairman of the MEB has since expanded on this theme (Shepherd, 1983). The proposal is that each power board should comprise one CEGB region plus the two or three Area Boards with which that region is essentially co-terminous. Ownership and control of some of the 275 kV and lower voltage lines would be transferred to the regional boards, and similarly for transformers and substations. The Generation, Transmission and Research divisions would be disbanded, with staff taken on by the power boards or manufacturers as required (though joint ownership could be considered). The Electricity Council would be abolished.

64. There would be a National Grid company jointly owned by the regional power boards, each of which would appoint one director. The functionsof the National Grid company would be, inter alia, to operate national grid control exactly as at present, to schedule certain plant directly (e.g.

Dinorwic), to fix tariffs and keep the books for imports and exports of power between power boards, to decide on investment in new 400 kv super-grid transmission lines (though each regional power board would actually build, own and maintain the transmission plant in its region), to authorise new investment in power stations by the regional boards and to organise joint financing of certain plant (again such as Dinorwic).

65. Shepherd's own proposal envisaged power boards in public ownership. If they were privately owned, a government Regulatory Agency would be postulated.

66. Table 1 presents a rough calculation of the initial sizes of these all-purpose regional power companies (based on 1982/83 Accounts). The smallest board (North West) would have annual sales of over £1 billion on net assets of about £5 billion and a staff of about 20,000. The largest board (South East) would have sales of about £2.4 billion on net assets of about £7 billion and a staff of about 34,000.

67. There is limited flexibility in the number of power companies. Fewer than 5 companies would seriously reduce the strength of competition since, for much of the time, there might be only one "exporter" from which to buy (see below). If it were thought desirable to have more boards, up to a dozen could be created, based on the existing 12 Area Boards plus the appropriate parts of the CEGB regions.

(Before the setting up of the CEGB in 1958, the generating side of the industry was in fact divided into 12 divisions co-terminous with the Area Boards.) However, some of the power boards thus created would initially have few, if any, power stations.

68. Because power companies combine generation and distribution, the risks of investment would be somewhat less than for generating companies. More precisely, the risks are borne by the consumers rather than by the shareholders, because (with rate of return regulation) the power company can pass on any higher costs of its own generating plant in the form of higher prices to consumers. Compared to generating companies, there would be a higher level of investment.

69. There would also be a tendency towards self-sufficiency within each power company. The generating divisions of the power companies would admittedly be competing with each other, whether they were not exports or importers (since imports compete with self-generation). But a power company subject to rate of return regulation would have an incentive to overcapitalise: imported power is merely expensed, while owned plant earns a profit. (There will only be overcapitalisation if the allowed rate of return exceeds the cost of capital. In the USA in recent years the opposite has frequently been the case, leading to marked reluctance to invest and consequent shortages.

70. Rate of return regulation on the distribution side will

similarly modify the pressure to increase efficiency of construction, purchasing and operation (though the pressure will nonetheless be greater than under the present system).

71. Bearing in mind US experience of "tight" power pools, it should be possible to continue the present system of central scheduling. There would probably be less impetus towards centralised dispatch, however.

72. It is widely acknowledged that there is at present some duplication of staff between Area Boards, CEGB and Council. Examples given are mainly from central and regional HQ staff (surveyors, wayleave officers, labour relations, control rooms, maintenance teams, etc.). The effect on total cost of eliminating any such duplication will not be large, since salaries account for only 15% of industry costs, and HQ staff perhaps only 1%.

73. Judging by the total production and consumption figures for each power board, net imports and exports between boards will initially account for about a quarter of total power supplied. Two boards (Midland and North East) are currently substantial net exporters while South East is a substantial importer. With such small numbers, there is an obvious danger of monopoly power - at least in the short term. In the longer term, new entry and long term contracts would limit this. The danger of generation monopoly is thus less than with the present single supplier, but greater than with generating companies.

74. Monopoly in distribution would be reduced insofar as major customers would have alternative sources of supply. Competition would be less strong than with generating companies, insofar as one of the potential direct suppliers in that structure - in fact, the nearest one - is here part of the very power board with which it is desired to compete. Moreover the national grid does not have the authority to act as an independent supplier.

75. As regards innovation and marketing, there will be 5 private organisations compared to 13 public ones. Breaking up the CEGB and changing ownership is likely to more than offset the effect of merging Area Boards. However, the climate would be even more encouraging with 5 + 12 + 1 = 18 private organisations in the scheme discussed earlier. With private ownership, organisational flexibility would be increased, but would be hampered by regulation.

76. In sum, private all-purpose power companies offer comparable advantages to the previous scheme in many respects. The magnitude of these improvements is likely to be less, mainly because the strength of competition will be less. It is only in scheduling (where the efficiency of the present system could probably be maintained) and perhaps in investment (if generating companies are thought likely to under invest) that private all-purpose power companies seem to offer advantages over private generating companies.

VII PRIVATE POWER STATIONS AND LOCAL DISTRIBUTION NETWORKS

77. Suppose the CEGB were split up into small groups of privately-owned power stations. Some of these might be independent companies, others might be associated with particular coalfields, ports, oil refineries, equipment manufacturers, etc. The Area Boards too would be split up, into two or three hundred privately-owned companies, each operating the local network for a town, industrial estate, housing estate, etc. The national grid would remain as a separate private entity. A Regulatory Authority would regulate the companies operating the transmission and distribution networks, but would not control investment in power stations.

78. The performance of such a scheme would clearly depend upon the detailed pattern of size and ownership, but some general properties may be noted.

79. Financing large investments will pose a problem for smaller organisations, which will need to seek ways of raising funds and spreading risks. Joint ownership is a partial solution, long term contracts another, but each solution has costs. It may be difficult to draw up and enforce appropriate contracts. Some economies of large scale power stations could well be lost.

80. Competition between the generating companies would encourage efficiency in construction, purchasing and generation. It is not clear whether the relatively small size of the organisations would be a handicap. They could buy-in expertise on design, construction and maintenance. They might not have the bargaining power alone to negotiate lower input prices, but purchasing co-operatives are conceivable. Providing continuity of employment may be more difficult. Plant out of action will have a more severe conseqence for a small firm. Some economies of scale in distribution will be lost, though these are unlikely to be of great magnitude and may be offset by the greater competition in distributiton.

81. Of course, the initial size distribution of generating organisations will not remain static. If there are significant economies of scale, private generating companies will tend to merge or expand to take advantage of them. Indeed, a significant merit of this scheme is the flexibility of organisational boundaries: smaller companies are more responsive to market pressures than are larger ones. Any disadvantages of this scheme with respect to size of organisation are thus short-term rather than permanent. The period of adjustment need not be substantial, since take-overs take little time to effect, and it may be possible to auction off the power stations in approximately optimal groupings in the first place. Of course, mergers will be subject to constraints of competition policy.

82. A brokerage system of bids seems more appropriate, especially since extensive side-contracts between organisations will need to be arranged. Nonetheless, existing grid control procedures will need to be modified. It will not be necessary for each power station group and each local distribution network to have its own grid control centre: arrangements could be made to share these. (One possibility is that the National Grid Control could be extended to encompass present Area Board control centres.)

83. There is little threat of monopoly in generation. There will be close contact between local generation and distribution companies, and prices should be closely related to marginal costs. Given the multiplicity of generating and distribution companies, competition in distribution will be as active as is possible. Private ownership of distribution networks will increase the incentive to raise prices where demand is inelastic, but no more than in the case of private Area Boards.

84. R & D in generation may be discouraged by the costs and risks involved. However, diffusion of new technologies and procedures, and innovation in marketing will be encouraged by the variety of organisations. In particular, conditions might be ideal for the emergence of dynamic pricing.

85. To summarise, complete disaggregation offers similar advantages and disadvantages to the Eggar et al scheme of privatisation: it is in fact a varient of that scheme. Up to a point, having more than 5 generating companies and 12 distribution networks, will increase competitive pressures with little loss of efficiency. The problem is deciding where to draw th line in designing initial structure.

VIII OTHER SCHEMES FOR PRIVATISATION

86. It would be possible to transfer the present organisational structure directly into private ownership. This would bring a more commercial approach to generation, while preserving the present method of grid control. However, there would initially be no competition in generation. New entry, and self-generation by Area Boards, would take time to emerge. The CEGB's monopoly power would be exploited more commercially. Regulation would be required, which would blunt the incentives to eliminate inefficiency and over-capitalisation. The advantages of privatising the Area Boards would be as before, except that there would be less competition in distribution compared to several independent generating companies able to sell direct. The CEGB, as a monopoly seller, would be able to exercise considerable price discrimination. It seems unlikely that the advantage of preserving existing grid control procedures would be sufficient to outweigh the other disadvantages of this scheme compared to either of the other two privatisation schemes just discussed.

87. For similar reasons, forming a Central Electricity Board and then privatising it would be even less attractive.

88. Hybrid schemes involving partial private ownership are worth exploring. For example, suppose private generating companies were formed but the national grid and Area Boards were

left in public ownership. On the generating side this would secure practically all the increases in efficiency attributable to the Eggar scheme of full private ownership. There would also be increased competition on the distribution side (via direct supply). Compared to the Eggar scheme, there would be less pressure to exploit monopoly commercially, but also less incentive to innovate and less flexibility of organisational structure.

89. Similar remarks apply to the disaggregated scheme. Local distribution networks could be owned by local authorities or by co-operatives. Nuclear power stations could be left in public ownership if there were concern over national security or health risks.

90. Yet another possibility would be to privatise generation and distribution companies, but to leave the national grid in public ownership. The present analysis has not focused on the role of the grid in sufficient detail to evaluate this possiblily.

IX CONCLUSIONS

91. This paper has attempted to evaluate the directions of change in efficiency of various alternative schemes for restructuring and/or privatising the UK electricity supply industry. Judgements were made in qualitative rather than quantitative form. Table 3 attempts to summarise the likely consequences in the form of a matrix. The signs + and - indicate a predicted increase or decrease, while ? indicates some doubt as to the magnitude. In a crude attempt to summarise the results for each scheme, an aggregate figure is given for each of the three main aspects of efficiency and for the total. A judgement is also made about the ease of transition to a different scheme.

92. The present organisational status quo is taken as the benchmark. Where a zero is recorded for all schemes this does not mean that no improvement in efficiency is possible, but rather that no alternative scheme can confidently be expected to discover and implement any such improvements more effectively than the present scheme.

93. The main conclusions may be summarised as follows:

STATUS QUO

(1) The present scheme scores relatively highly on the operation and scheduling of power stations, but most other schemes offer improvements in construction, a reduction in monopoly power especially in generation, and somewhat better conditions for fostering innovation.

PUBLIC OWNERSHIP

(2) None of the schemes for restructuring alone offer significant net improvements in productive efficiency or in dynamic efficiency. A transfer to private ownership is necessary to secure such benefits. There is, however, some prospect of reducing monopoly power, without loss of productive efficiency, by breaking up the CEGB without privatising. (2) Whatever its other merits, the formation of a Plowden-type Central Electricity Board embracing the whole industry would not yield a significant overall increase in efficiency compared to the present structure.

PRIVATE OWNERSHIP

(3) Complete private ownership via separate generating companies would offer significant improvements in almost all aspects of productive efficiency, in large part because of the increased freedom to take a commercial approach. A different and probably less efficient system of scheduling would have to be adopted. There would be substantial reduction in

monopoly power, with direct supply by generating companies increasing competition on the distribution side as well. Structure and ownership would foster innovation and flexibility to change.

(4) Private all-purpose power companies offer comparable advantages. It may be possible to preserve the present scheduling system, but the extent of competition in both generation and distribution will be less.

(5) Breaking the CEGB into individual power station companies could reduce aspects of productive efficiency, though there would be gains in the reduction of monopoly and in flexibility.

(6) The benefits of privatising the CEGB and Area Boards in their present form, or after a forming Central Electricity Board, are outweighed by the advantages of other privatisation schemes.

HYBRID

(7) Private generating companies with public grid and/or Area Boards would capture almost all the benefits of full private ownership, expect for the flexibility and innovation on the distribution side.

94. A number of qualifications obviously need to be made. The analysis has rested on certain key arguments e.g. that

investment patterns would be more efficient under private ownership, or that competition plus regulation of private ownership would reduce monopoly losses in distribution. These claims might be challenged, and therefore need further investigation. Second, there has been no attempt at quantification of efficiency gains beyond "more" or "less" judgements. Numerical estimates, if made, might suggest that the present system cannot be signficantly improved upon, or that some likely gains greatly outweigh others. Some rough calculations would seem worthwhile here. Third, a number of details needs clarifying - the nature of regulation, the precise pattern of ownership in the disaggregated scheme, the role of the national grid, etc. Finally, many variants of the schemes analysed would be worth exploring - for example, forming a dozen generating companies instead of only 5, or grouping them other than on a regional basis.

95. The analysis has focused on efficiency, yet there are many social or non-market objectives which might be valued by certain groups of consumers, voters, politicians, civil servants or ministers. Examples include the provision of subsidised electricity services (e.g. in rural areas or to low-volume customers), support of ancilliary industries (especially "Buy British"), encouragement of conservation and new technologies (wind, solar, geothermal etc.), development of a nuclear programme, contribution to macroeconomic policy, and so on.

96. Decisions about future policy involve both predictions and value judgements. Any policy recommendations must necessarily be contingent. If it is believed that central planning is necessary to secure an efficient investment programme and to schedule power stations efficiently, and if there is not thought to be much scope for improvement in design and construction and purchasing, and if greater weight is attached to productive efficiency of the present industry than to reductions in monopoly power, or to potential future improvements in efficiency, then there is a strong case for retaining the status quo. But if, on the other hand, the efficiency of present investment processes is open to question, if significant savings in construction and purchasing are thought to be available, if competition, innovation and responsiveness to market forces are thought to be desirable important, then there is a much stronger case for changes in both structure and ownership of the electricity supply industry.

97. The results of this paper suggest that restructuring plus privatisation offers greater benefits than restructuring alone, and that splitting up the CEGB to form private generating companies will form the core of any privatisation scheme. Privatising Area Boards seems marginally beneficial. Further attention needs to be given to the size and composition of the generating companies and to the ownership of the national grid.

TABLE 3 Summary of Evaluation of Effects on Efficiency

	PUBLIC OWNERSHIP				PRIVATE OWNERSHIP			HYBRID	
	Status Quo	Central Elec. Bd.	All-Purpose Reg. Power Bds.	Reg. Gen. Bds.	Status Quo	Reg. All-Purp. Power Cos.	Reg. Gen. Cos.	Power Stations and Distrbn N'works	Private Gen. Cos. Public Grid & Area Bds.
Productive Efficiency									
Investment	0	0	–	0	0	0	+	––	+
Construction	0	0	+	+	+	+	++	+	++
Purchasing	0	0	0	+?	+	+	++	0	++
Operation	0	0	0	0	0	0	0	0	0
Scheduling	0	0	–?	–	0	–	–	––	–
Distribution	0	0	+?	0	+?	+	+?	–	0
Allocative Efficiency									
Pricing	0	+?	+	+	–	+	+	+	+
Monopoly–									
Gen.	0	0	+	++	–?	+	++	++	++
Dist.	0	–?	+?	+	0	+	+	+	+
Dynamic Efficiency									
Marketing	0	0	+	+	0	+	+	–?	+
Innovation	0	–	0	0	+	+	+	+	0
Flexibility	0	+?	0	0	+	+	++	++	+
Aggregate Point Score:									
Productive	0	0	0		2	2	4	–4	4
Allocative	0	0	2	4	–1	3	4	4	4
Dynamic	0	–	1	1	2	3	4	2	1
Total	0	–	3	5	3	8	12	2	10
Ease of Transition	0	–?	–	–	–	––	––	–––	––