CHAPTER VI

NATIONAL ELECTRICITY PLANNING

THE SIGNIFICANCE OF ELECTRICAL DEVELOPMENT

Post-war Britain, like most of the countries of the western world, has been conscious of the enormous social and industrial benefits to be obtained from a cheap and coordinated supply of electrical power. Like Germany, Austria, Italy, and other countries, Great Britain has concluded, as evidenced in the Electricity (Supply) Act of 1926, that the best means of modernizing industry and of keeping pace with world competition is to plan a coordinated scheme of electrical generation and transmission for the entire nation. The national electricity policy is impregnated with more industrial, social, and governmental potentialities than any public utility development yet undertaken in Great Britain.

Parliament decided upon rationalization in electricity production after a long and stubborn fight against vested interests and sheer complacency. If the Electricity (Supply) Act of 1919 had not been emasculated by the House of Lords, Great Britain would have led the countries which have given the State effective powers to unify the generation and distribution of super-power. Seven years later Parliament was forced to admit that urgent and courageous action must be taken if British industry were not to be outdistanced.

The principle underlying the Electricity (Supply) Act of 1926 provided that the country should be regarded as a single unit and that all the energy required for the nation should be generated in a series of stations of convenient size and situation, interconnected with one another; but the Act maintained the principle of separate distributing

authorities as then existing.[1] The principal results to be expected from the plan, as viewed by the then Minister of Transport, were these: (1) the best existing stations would work at a higher load than is possible under localized conditions, while other selected stations would come in at peak periods to make up the requirements; (2) the less efficient stations would be closed down; (3) a considerable saving in fuel consumption; (4) the over-all reduction in capital expenditure by improving the load factor and the reduction of reserve plant; (5) the establishment of a uniform frequency for the entire country; and (6) the increased efficiency of industry: the adoption of labor-saving devices in the home: and the electrification of farms.

Great Britain has found it difficult to make advances in electrification because, to a greater extent than in any other country, industry has been naturally attached to coal and hence to the steam and gas engines. Many nations turned naturally to electrical power because coal was not plentiful. The transition from coal energy, consumed near the pithead, to electrical power, to be made available throughout the country will probably bring about fundamental changes in the life of the nation. In recent years factories have sprung up by scores around the London area, bringing with the rapid redistribution of population stupendous problems of housing, traffic, and sanitation. The availability of electrical power has unquestionably played a significant part in the silent remoulding of the nation's fundamental alignments.

In 1926 Colonel Ashley pointed out that, compared with its principal competitors, Great Britain stood at the bottom of the list in the *per capita* consumption of

[1] Electricity (Supply) Act, 1926, 16 and 17 Geo. 5, ch. li; the best general treatments of the subject will be found in W. S. Kennedy, *The New Electricity Act*, London, 1927; Hugh Quigley, *Electrical Power and National Progress*, London, 1925; and Orren C. Hormell, "Electricity in Great Britain: a study in administration," (1928) Supplement, 17 *National Municipal Review*, 363–385.

electricity,[1] and this, he said, was an index of Britain's industrial decline in recent years.

In the period before the war coal had been the foundation of Britain's industrial structure. The export market for British coal had declined considerably by 1926. Countries which were formerly large users of coal, like Italy, had developed water power resources. Britain's industrial future, it was argued, depended upon the most effective use of the country's vast coal supplies as the means of intensive electrification. Moreover, a transition to electrified industry held out promise of remedying the serious smoke evil in the populous centers, of utilizing the by-products of coal, of reducing oil imports, and of reviving rural industries with the resultant improvement of social and health conditions in the country as a whole.[2]

Authorities on the subject believe that intensive electrification will play an important part in the efficient utilization of coal, formerly Britain's basic industry. This has been clearly illustrated by Mr. Hugh Quigley, a well-known authority on electricity development. At a time when France was rapidly expanding her generating plant, 1919–24, for example, her coal consumption rose from 45 million tons to more than 60 million tons. In 1924 Great Britain consumed 180 million tons of coal, and of this amount only 7 million tons went to produce electric power. In Great Britain the coal consumption per head of the population was 4·08 tons in 1914, 4·07 tons in 1920, and 3·52 tons in 1922, whereas countries which had speeded up their electrical development had either shown an increased consumption of coal or a less

[1] Consumption of electricity, unit per head of population (1926):

Canada	900	Belgium	230
Switzerland	700	France and Germany	140
U.S.A.	500	Great Britain	118
Sweden and Norway	500		

H.C. Debates, vol. 193, col. 1692, March 29, 1926.

[2] On these aspects of the subject, see particularly *Liberal Party Enquiry, Coal and Power*, London, 1924.

drastic decline. Mr. Quigley concludes that in the higher thermal efficiency of power stations a saving of 50 per cent in coal consumption might be effected, and this linked up with more exact study of fuel economy would save 18 million tons or one-third of the total national saving of 55 million tons mentioned as desirable by the Coal Conservation Report of 1917.[1] The same writer makes the following observation, which has a significant bearing upon the potentialities of the 1926 legislation:

"Twenty million tons of coal consumed under boilers generating steam for electric power purposes would supply energy equivalent to that already derived from fifty-three million tons. We are probably justified in stating that over sixty million tons of coal would be saved annually in this country through electrification of industry, transport, agriculture, and domestic heating and cooking methods."

The low average consumption of electrical power naturally contributes to higher prices than are found in more developed countries. The following comparison of the price of electricity, pence per unit sold, reveals the serious handicap borne by the British industry and indicates the urgency of the reform which was initiated in 1926:

	Year	Pence
Great Britain	1922–23	2·07
U.S.A.	1923	1·05
Canada	1923	·72
Switzerland	1923	·60
Italy[2]	1924	·46

Although international experience had clearly revealed the uneconomic character of small generating units, Great Britain was covered by a maze of small, unconnected generating plants—presenting a striking contrast to any other leading nation. In 1926 there were 592 public generating stations, of which 494 belonged to authorized undertakers, mostly very small ones. Thirty-two stations were responsible for 50 per cent of the output, while no less than 462 small

[1] *Electrical Power and National Progress*, 28–44.
[2] Edison group of companies.

enterprises were required to produce the other half. The result was that the load factor was unreasonably low. Since electricity cannot be economically stored it must be generated as required. In the course of the 1926 debate the Minister of Transport stated,

> "The demand of a station varies from hour to hour, rising from small loads to peak loads, and, as long as a station is working in isolation, it must have sufficient plant for the peak load, and for long periods most of the plant must be idle. The average load factor is no higher than 25 per cent, which means that only one-quarter of our plant is working at full capacity, and the other three-quarters of the plant is idle. To improve this load factor is really the great object of this Bill, and it should be the object of all electrical reform. In truth, it may be said that only about one-third of Great Britain is reasonably supplied with electricity. Over practically all the rest of the country there are small undertakings with territorial rights strong enough to prevent large enterprises being established in their areas, but incapable themselves of generating electricity on a sufficiently large scale and at a price low enough to encourage large-scale consumption. In our rural areas only about one-tenth are afforded even the semblance of a supply."

Because of the small units in which commercial power was supplied and the high prices charged by public supply companies, industrialists were virtually compelled to establish their own generating plants. In 1932 there were more than 4,400 privately operated generating stations in use by industry, coal mines, public utilities, and other forms of enterprise. This development aggravated the uneconomic character of the country's electrical development. The change to public supply will take several years, but the transition has begun. In 1924 public supply undertakings were responsible for about 58·6 per cent of all generating plant in great Britain, but in 1931 this figure had risen to 65·4 per cent, while private generating plant in industry, as apart from the railways, declined from 37·4 per cent to 30·2 per cent.

The Government estimated that by means of the national electricity plan inaugurated in 1926, the saving to the public would amount to £44,000,000 a year by 1940. Critics of the bill were justified in saying that this sanguine expectation

will not be carried out automatically. If substantial savings are to be passed on to commercial and domestic users, the plan of development alone will not only need to prove successful, but adequate provision must be made to lower rates whenever the economies of large-scale operation make it possible. Whether the existing machinery of control may be expected to pass on the expected benefits to the community will require careful examination.

The new electricity scheme has had an important bearing upon the development of governmental and social policy. A precedent (so potent in British life) has been established for national planning in other fields of economic enterprise, and the fact that the Act was the creation of a Conservative Government makes its significance all the more striking. Moreover, the C.E.B., a public utility trust which the Act created to put the plan into operation, has since been considered the model example of the public board type of development. This is particularly evident in the debates regarding the B.B.C. and the London Passenger Transport Board. It is not too much to say that the popularity of the public utility trust in recent years owes its origin primarily to the satisfaction which has attended the creation of the C.E.B. The extension or restriction of the public utility trust will undoubtedly depend, therefore, upon the ultimate judgment regarding the success or failure of the present form of control over national electricity planning.

PUBLIC POLICY PRIOR TO 1926

Only three periods of Parliamentary policy relative to electricity development need to be distinguished. In the early stage, 1882–1919, Parliament treated public and private electricity undertakings in much the same way as it did water and gas supply: maximum rates were established and general provisions concerning service were laid down in General and Special Acts, but effective control was negli-

gible. Municipalities obtained an early lead in the field. In 1919 the Electricity (Supply) Act was passed which established Electricity Commissioners who were instructed to draw up plans for the regional generation and transmission of electrical energy; but when the bill emerged from the House of Lords all provision of compulsory powers whereby the scheme might be made effective had been eliminated, and as a result very little was accomplished. The current era began with the passing of the Electricity (Supply) Act, 1926. The Electricity Commission was preserved as the planning and controlling agency, while the C.E.B. was created as the operating agency which would carry the scheme into effect. Profiting by experience, compulsory power has been provided in order that coercion may be used if negotiation fails.

In the early stages of electrical development in Great Britain there were many obstacles to encounter which were not found in new countries like Canada and the United States. Concerning the modest beginnings of the electrical industry in Great Britain C. R. Fay has written,

> "Great Britain entered the age of electricity through the telegraph and submarine cable. She already had cheap power in the form of steam power generated by coal. Towards the end of the nineteenth century electricity was applied to lighting and local communications. During the last twenty years electricity has risen to be the rival of the steam engine as the motive power of the workshop. In 1905 in engineering workshops there was an electrically driven tool only here and there. Now they are in the majority; and the trend is towards ever smaller units of electrically driven machines."

The Minister of Transport said, during the course of the 1926 debate, "It is doubtful whether more than 34 per cent of the industrial equipment engaged in production in this country, and supplied from public systems, is operated by electricity." However, it will be generally agreed that only in comparatively recent times has electricity come to be regarded predominantly in terms of industrial power, rather than merely for lighting purposes. A statement made by

Colonel Ashley in 1926 throws a great deal of light on the situation:

> "When electricity was first discovered, it could only be transmitted a few miles and it could only be used for lighting in congested or thickly populated urban areas, because that was the only place where it would pay. Therefore, any undertaking, whether municipal or that of a private company, normally took the municipal area as the jurisdiction over which it was to range. Consequently, there sprung up, under legislative sanction, up and down this country, hundreds of these generating stations, and, as the radius for transmitting energy became greater, as it is today, these stations did not disappear as they naturally would have done, because, again, of our conservative nature, and also, as the House will understand, because of the very obvious difficulty of overstepping the municipal boundaries."

The municipalities obtained an early lead in the supply of local electricity, with the result that by 1926 public bodies owned and operated 335 supply undertakings and 248 generating stations, representing a capital investment of £103,480,000, while private companies accounted for only 209 supply services and 190 generating stations, with a total investment of £58,270,000.[1] There were several reasons for the greater number of municipal undertakings. In the first place, private capital was not willing to take the risks at certain times and places, particularly, so it is said, when the municipalities were guaranteed the right to expropriate the companies at fixed periods. Municipalities were guaranteed the right to purchase private supply companies in their areas —a right which was frequently exercised. Moreover, the municipalities frequently demanded the electricity concession in their areas in order to protect their investments in gas undertakings. Electricity supply companies were confined to corporate limits, with the result that when large-scale operations had been proved the most economical form of electricity supply, the parochial limitations forestalled the interconnection and consolidation of generating plants. The contrasting result, a small number of super-power zones, has

[1] *Report of the Weir Committee on National Electricity Supply*, 4 Stationery Office, 1927.

occurred in France and the United States, where companies are free from geographical restrictions. But perhaps the principal reason for municipal enterprise in the electricity field is that other forms of municipal service had established public confidence, and electricity undertakings themselves have proved conspicuously successful.[1] Cities like Birmingham, Leeds, Sheffield, and Manchester have for years operated some of the most progressive public services in the country, and eminent Conservatives, such as the Chamberlain family, have played a prominent part in extending the commercial services of the local authorities.

The most important Acts regulating electricity, prior to 1926, were the Electric Lighting Acts of 1882, 1888, and 1909, the Electricity Clauses Act of 1899, and the Electricity (Supply) Acts of 1919 and 1922. Many of the provisions of these early Acts have been superseded, but others are of great importance today. Prior to the legislation of 1919, the licensing and issuing of Provisional Orders to both private companies and local authorities was exercised by the Board of Trade, subject of course to a confirming Act of Parliament. In 1919 all electricity powers were transferred either to the Ministry of Transport or to the Electricity Commission.

The original Act of 1882 gave the Board of Trade power to require annual accounts from electricity undertakings, but the only other provision with reference to efficiency and profits stipulated that the companies and the municipalities might make "such charges for the supply of electricity as may be agreed upon, not exceeding the limits of price imposed by or in pursuance of their license, order, or special Act." The system of maximum prices has not worked well, and electricity is no exception. The maximum price plan encourages inefficiency. There is little wonder that the Minister of Transport stated in 1926, "The bill is necessary because only a small percentage of stations of this country are in an efficient state."

[1] Hormell, op. cit., (1928) 17 *National Municipal Review*, 368.

With reference to the revision of prices, Section 22 of the Electricity (Supply) Act of 1922 provided that the prices or methods of charge of both private and public undertakings may be reviewed every three years in case of complaint to the Minister of Transport by not less than twenty consumers, a private company, a municipality, or the L.C.C. This power, as we shall see, is exercised in conjunction with the Electricity Commissioners.

Two provisions in earlier laws afford an explanation of the parochial character of British electricity development prior to 1926—the vice that national planning primarily aims to cure. Parliament provided in the Electric Lighting Clauses Act of 1899 that companies shall not purchase or acquire the undertaking of, or associate themselves with, any company or person supplying energy unless authorized by Parliament to do so, and in case of contravention of this provision the Board of Trade might revoke the offender's license. In the Act of 1909, however, Parliament made lawful the taking of a supply of electricity in bulk. Not only was freedom of consolidation denied to private companies, but the municipalities' powers were, as it later appeared, uneconomically circumscribed.[1] In the Clauses Act (Sect. 4) Parliament prohibited the giving of supply and the laying of electric lines and works outside the prescribed area of the undertakers in the absence of express authorization. This provision has had a particularly adverse affect upon municipalities, who were often forbidden to sell power to "fringe" areas.[2]

[1] The fault was partly the municipalities', as William A. Robson has pointed out. "It was, no doubt, the reluctance of local authorities to combine voluntarily on a large scale for electrical supply purposes—despite notable exceptions such as the Manchester City Council—which led to the far-reaching measures for joint action introduced by the coercive legislation of 1919 and 1926." *Development of Local Government*, 117, London, 1931.

[2] Sir Charles Wilson, referring to the experience of Leeds, stated: "We could have supplied large areas by including them within our city boundary, but this House threw out the bill after the Department had reported in favor of our having the power to extend our boundary. Having spent £4,000,000 on our electricity enterprise, we were not allowed to sell the product of our great station to people about us, as we were desirous of doing." *H.C. Debates*, col. 1733, March 29, 1926.

The Member of Parliament who referred to this policy as "the dead hand of the State" really had reference to the parochialism and conservatism which have been the characteristics of governments dominated by the landed gentry. However, the 1909 Electricity Act permitted two adjacent municipalities to give a bulk supply from one to the other; and under the 1919 Act, any two local authorities—wherever situated within a power company's area—may be authorized to give a bulk supply one to another.

Joint electricity authorities are one of the most important aspects of national electricity planning. The Electric Lighting Act of 1909 first provided for the creation of joint committees or boards composed of two or more local authorities as regards any area of supply consisting of the whole or parts of the districts concerned. Here at last Parliament showed an inclination to permit coordination. This power, which was originally entrusted to the Local Government Board (later the Ministry of Health), is now a prerogative of the Electricity Commissioners. Although only three joint electricity authorities are now in existence, and only one had been created prior to 1926, some observers believe that this movement is the most promising aspect of future development.

The eventual planning of electricity supply was facilitated by Parliamentary provision for electric power companies in 1898 and 1899. These companies were vested with authority to supply large areas, generally as large as counties and sometimes larger. Their powers were strictly circumscribed, but most of the limitations were removed when large generating stations were made the central feature of the Electricity (Supply) Act of 1926.

In short, the period of regulation prior to 1919 was characterized by parochialism in distribution and very small beginnings toward large units of generation and transmission. Parliament's policy aimed at protecting vested interests and historical regions rather than at the greatest efficiency to be obtained from the coordination of regional power zones into

a national plan. The maximum price system failed to stimulate efficiency, to lower prices to the consumer, or to prevent greatly variant prices in closely contiguous sections. The machinery of inspection and control was negligible and impotent. "In the past," stated the Minister of Transport in 1926, "legislation affecting electricity supply has had all the defects of State interference without effective control." The existence of varying frequencies in different sections of the country or even in the same city, worked a hardship on industry and on domestic users, and militated against interconnection. On the other hand, after 1909 a few large generating stations had been established; the way had been cleared for the development of joint electricity boards; and, in a few cases, interlocking directorates and the amalgamation of generating and distributing companies had already emerged amid the welter of private enterprise. Although rationalization and coordination were not really effective before 1926, the Electricity (Supply) Act of 1919 inaugurated a new era by the creation of a permanent planning body, the Electricity Commissioners.

THE ELECTRICITY COMMISSION

The Electricity (Supply) Act of 1919[1] was based upon the Report of the Williamson Committee,[2] which sought a method of reorganizing the electricity supply industry. Although the Act as passed by the House of Commons substantially incorporated the recommendations of the Committee, the opposition of the private companies in the House of Lords succeeded in eliminating the most vital aspect to the Bill, namely the Electricity Commissioners' compulsory powers. This fatal omission was rectified by the 1926 Act. Although not a single plan was put into operation in six

[1] 9 and 10 Geo. 5, ch. c; Keen, op. cit., 257–282; Hormell, 17 *National Municipal Review*, op. cit., 373–375.

[2] Cmd. 9062, Stationery Office, 1918.

years, it should not be concluded that the Act of 1919 was wholly unavailing: the Electricity Commission began to operate and to gain experience and a wealth of information.

The 1919 Act provided that Electricity Commissioners, not more than five in number, were to be appointed by the Minister of Transport, with the concurrence of the Board of Trade. Three were to be full-time officers, and three also were to be selected for practical, commercial, and scientific knowledge, including that of electrical supply. No member may be personally interested in any undertaking for the supply of electricity. The personnel of the Commission is generally admitted to be creditable. Sir John Snell, an engineer, is Chairman, and Sir John Brooke, formerly permanent Secretary to the Ministry of Transport, was recently appointed Vice-Chairman of the Commission. The remaining members are engineers. The term of members is seven years, but provision is made for reappointment.

On March 31, 1932, the staff of the Electricity Commission numbered eighty-one in all and consisted of thirty-seven established officers and forty-six unestablished and temporary officers. The Commission retains the professional services of certain consulting electrical engineers and employs chartered accountants whenever the necessity arises.

The Act made the Commission solely responsible to the Minister of Transport. Most of the electricity powers previously exercised by government departments were vested in the Electricity Commissioners. Yet, prior to 1926, the Commission had only a shadow of real power. W. S. Kennedy did not exaggerate when he wrote, following the passage of the 1926 Act,

"If the Act of 1919 had not been emasculated in its passage through Parliament, or if the wolves of the municipalities and the lambs of the private companies had fed together amicably under the aegis of the Commissioners in 1920 and the following years, the present Act would in all probability never have been introduced. It would still have been necessary to remove many of the legislative restrictions which have too long hampered electrical development in this country, but there would

have been much less need to recast the whole system, as has now been done."

The Commission conducted some valuable studies during the first six years of its existence and issued several illuminating Reports, but prior to 1926 the work of the Commissioners never got beyond the stage of paper plans. The formation of electricity districts was undertaken immediately by the Commissioners, but it is conclusive evidence of the insufficient powers possessed by the Commission that, after six years, only seven of the sixteen areas originally contemplated had been tentatively delimited. This meant that only four of the great industrial centers of the country had been incorporated in potential electricity districts. Some competent observers believe that the Commission could have accomplished a great deal more if there had been a strong enough incentive to do so.

The difference between what was originally contemplated by the 1919 Bill and what finally became law may be shown by comparison. The Bill proposed to create Electricity Districts with District Boards composed of representatives of the supply companies, local authorities, and large power consumers in the districts delimited. They were to have powers to fix maximum prices, to compel service and extensions of electrical facilities to new territory, to take over generating stations in the area, to build generating stations if required, and to centralize the supply and distribution of electricity in large stations feeding out to small undertakers who would abandon generation of electricity and undertake distribution only. In other words, the Act of 1919 proposed to substitute effective regional control under a central body of Electricity Commissioners for the complexity then existing and to create a system by which the large generating station might come into existence and the work of effective interconnection be carried out. The Act of 1919, as originally drafted, really went further than the law of 1926, because it made more adequate provision for coordi-

nated distribution and made obstructionist tactics less likely. Instead of this, Electricity Districts with Central Advisory Boards or Joint Electricity Authorities, and the Electricity Commission were created, but with no powers to compel any fundamental changes. The Commission had power to fix maximum prices and to arrange the generation and distribution of electricity in the Electricity Districts finally determined (but only in agreement with representatives of the undertakings in the several areas), to determine additions to generating plant, to approve of new power stations and extensions, to collect statistics, and to examine new projects dealing with electrical development. The Commission had no powers to overcome the system of local self-sufficiency, to effect interconnection of existing systems, to compel an undertaking generating electricity in a small station at excessive cost to obtain its power requirement in bulk from a more efficient station, and it had no effective sanctions in the matter of maximum prices or of service. "The situation was, therefore, scarcely affected by the Supply Act of 1919 and the additional financial clauses which allowed the Joint Electricity Authority as constituted to borrow money for the establishment of new capital stations became inoperative owing to the fact that no Joint Electricity Authority had yet entered into operation."

In certain sections of the country, however, large power companies and interlocking directorates began to assume dominant positions. The power companies then occupied and continue to hold the most advantageous position in the entire electrical field. They were created for the purpose of generating electricity and of selling it either to distributing companies or directly to great industrial concerns.[1] From

[1] If established industries (except railways, tramways, canals, and water companies) are located in the area served by distributing companies, the power company must secure permission from the latter before a supply may be furnished. Power companies are also prohibited from selling a supply for lighting purposes, except to authorized undertakers or when purely incidental, as in the case of a factory buying bulk power. Quigley, op. cit., 127; Keen, op. cit., 253, 254.

the very outset the franchises of power companies have been perpetual in tenure; they were not subject to the purchase clause of the Act of 1888. Another great advantage power companies possess is that they are protected from loss due to unprofitable extensions. This is made possible by a binding contract relative to the minimum period of supply, and a minimum return on the actual investment incurred in the extension. For example, the power companies require authorized undertakers before receiving a supply in bulk to agree to continue the supply for a period of at least seven years and to pay annually for the energy an amount equalling not less than 20 per cent on the outlay incurred by the company in making provision for the supply. Finally, through stock ownership and interlocking directorates some of the large power companies have been able to control not only the supply of power in bulk but also the distributing side of the industry as well. The most familiar example of this is the North-Eastern Electric Supply Company (formerly known as the Newcastle-upon-Tyne Electric Supply Company), which through stock ownership of a large number of distributing companies controls and actually operates the generation and distribution "throughout an area of over 2,400 square miles embracing practically the whole of the industrial area of the north-east coast." By the end of the war there were about thirty power companies in operation, but they were definitely limited by the retention of local monopolies in most of the large towns.

By 1926 the concentration of control was assuming a national complexion, as illustrated by the fact that a single Member of Parliament, Mr. George Balfour, was said to be a director of not less than thirty-three electricity companies. It is interesting to note that he was one of the principal opponents of the 1919 and 1926 Acts.

This was the situation which obtained at the time the Electricity (Supply) Act of 1926 was passed and when a second administrative agency, the C.E.B., was created. The

complication of the administrative machinery caused a good deal of comment and criticism in the House of Commons, and it is still a debated subject today. "I am by no means satisfied that the relationship of the Central Board and the Commissioners are the right relationships," was the gist of several speakers' criticisms in 1926. Naturally, the multiplication of bureaucracy brought forth sharp protests. Opposite views were held regarding the likely result of the relationship between the Commission and the Board: either they would form a close partnership, removing all criticism and protection of the public interest, or else, so some said, the two bodies would disagree and cause obstructions and embarrassment. It must be admitted that in several instances the Act of 1926 left the division of functions and authority quite vague and confused. The administrative juxtaposition leaves a great deal to be desired, but the general outlines of control may be distinguished with a fair degree of definiteness.

THE PLANNING POWERS

The functions of the Electricity Commission may conveniently be divided into the planning, judicial, and regulatory aspects of its work, whereas the C.E.B. is primarily the executive agency by means of which the scheme of interconnection and bulk transmission will be carried into effect.

Under the terms of the Electricity (Supply) Act of 1926 (Sect. 4) the Electricity Commissioners were instructed to prepare and transmit to the Board, as soon as practicable, a scheme relating to each of the electricity zones into which the country has been divided. The plans to be determined by the Commission dealt with three chief matters:

(*a*) to determine what generating stations (whether existing stations or new stations) shall be the "selected" stations at which electricity shall be generated for the purposes of the Board;

(*b*) to provide for the interconnection of selected stations and also for the connections with the systems of authorized undertakers. The main transmission connecting lines are to be constructed or,

if they exist in any cases, and are suitable, are to be acquired by the Board;

(*c*) to provide (subject to the conditions explained later) for such standardization of frequency as is necessary for carrying out the interconnection referred to in (*b*).

Obviously these technical matters are the proper concern of electrical engineers—and that is what four of the five members of the Commission actually are. The members of the C.E.B., on the other hand, were not chosen for their professional proficiency, but for their practical experience in a variety of pursuits.

The Commission has decided upon ten electricity areas, instead of the sixteen originally contemplated in 1919. Nine of these units have been finally delimited and cover more than nine-tenths of the country. A small section in the north of Scotland will be further investigated and development is meantime deferred. The details of the several plans and the progress that has been made in carrying out the actual work of establishing selected stations, constructing the high-tension lines, effecting interconnections, and standardizing frequencies may best be discussed in the next chapter. At this point it will be desirable to consider the principles which have influenced the Commission in planning the several power zones.

The consensus of professional opinion in Great Britain has favored the view that centralization is wholly justified in a densely populated industrial area, while interconnection applies with equal force to a widely scattered area. World experience has demonstrated that the scientific development of electricity supply can take place in one large generating station or through interconnection of a number of fairly large stations in order to pool the demand for power over a wider area and hence relieve the pressure on any one station. Prior to 1926 the super-power station and the super-power zone could scarcely be said to exist in Great Britain since the largest power station did not exceed 150,000 h.p. and the largest power zone had an output of not more than 800 million units.

The most remarkable example of the advantages of interconnection has been supplied by Germany, and the British have been primarily influenced by this experience. For example, three super-power stations now feed into a network supplying Berlin. In 1924 these stations had an output of 1,770 million units compared with 400 million units in 1918, an increase of 340 per cent.

The super-power zone has presented the British with a more difficult and a more urgent problem than the super-power station. Investigations which have been made make it "fairly obvious that the heart of the problem of electricity supply on a national scale lies in transmission, and the future of the super-power zone is tied up with it." Mr. Quigley has pointed out that of the capital cost of generation and transmission in twenty British undertakings, 1922–23, generation accounted for 23·4 per cent of the average cost, while transmission and distribution represented 27·6 per cent of the total capital outlay. He therefore concluded that in almost every case the capital cost of transmission and distribution is greater than the cost of generating plant, and that it is only in exceptional cases, where overhead transmission can be carried out, that this item is definitely less. On the basis of the 1922–23 figures, an addition of seven million kilowatts of generating plant would cost £163,800,000, but the transmission and distribution to correspond to this would amount to a charge of £193,200,000; in other words, out of a total of £357,000,000, transmission and distribution would account for 54 per cent. At the end of 1930, out of a total capital expenditure of £354,000,000, £218,000,000 or 61·6 per cent was devoted to transmission and distribution.

In the determination of the proper electricity areas the Commissioners have been influenced by many factors, among which are the recognition of existing groupings, the supply of industrial and populous areas, the avoidance of transmission beyond the point at which it becomes uneconomical,

equalization of the load on generating stations, ease of technical administration, and population and industrial trends. As the Electricity Commissioners stated in their First Annual Report,

> "it is not a question of starting *ab initio*, to develop a comprehensive and standardized system of generation, transmission, and distribution on the basis of present-day knowledge and technical practice, as there already exists an extensive and heterogeneous development representing the uncoordinated growth of many years. It is obvious that, in many circumstances, the problem of reorganization resolves itself into the determination of the best method of adapting, modifying, and expanding the existing development with the view of ensuring as speedily as possible an improvement in the supply of electricity for the numerous and growing needs of the community."

The choosing of "selected" generating stations is fraught with difficulties, because vested interests must be placated and suspicions arising from political differences cannot be completely obviated. So far as concerns the technical criteria whereby generating stations are selected, the factors to be considered are quite clear, but the application of these standards in given instances is a subject of some difficulty. The basis of selection of generating stations, stated the C.E.B. in their First (1928) Annual Report, involves consideration of the cost of coal delivered to the station, the abundance of water for condensing purposes, technical characteristics of the station such as type and size of the plant units, steam pressure, etc., proximity to the load, and the possibilities of the site for the further expansion of the station. All electricity generated at selected stations is to be sold by the owners to the Board. The price at which it is to be sold is specified by the Second Schedule of the 1926 Act. Owners of selected stations must run them as regards total output, times, and rate of output, and with due regard to economy and efficiency, under the direction of the Board. Owners of other stations in the area may, subject to the provisions according to which generating stations may be closed, continue to manage their plants as they think best.

Certain selected stations will naturally have to be altered and extended as the scheme develops, and the Commission, on the application of the Board, has power to deal with these cases. In such circumstances the judicial as well as the technical competence of the Commission is involved. These extensions and alterations are divided into two categories: (*a*) such as are required by the scheme, and (*b*) additional extensions and alterations required from time to time by the Board with the Commission's approval.[1] The two cases are subject to different procedures. The former will be dealt with at this point, but the latter is a proper question for consideration under the judicial powers arising under the Act.

An effective refusal to enter into agreement with the Board as regards the original selection of stations and their operation under the Board's direction would soon make the Act a dead letter. Consequently Section 5 of the 1926 Act provides that in case the Board, subject to the Commission's oversight, fails to reach an agreement with the owners of a selected station, the station in question may be purchased by the Board and "transferred to a Joint Authority, if there be one in the district, or, failing the Joint Authority, to any authorized undertaker or company approved by the Board." As a last resort, the Board itself may acquire and operate the station. The same principles apply to main transmission lines.

In the case of disagreement with a municipality as a result of which its generating station or transmission line may be taken over or transferred, a great injustice is possible. Acquisition in the case of a power company will involve payment of the total capital expenditure on the generating station or main transmission line less depreciation on a scale to be fixed by the Electricity Commission; in the case of a local authority or joint electricity authority it means merely the transfer to the Board of the responsibility for meeting annual interest and sinking fund charges on the capital

[1] Electricity (Supply) Act of 1926, Sects. 5, 6, 7. Kennedy, op. cit., 19, 20.

borrowed, without repayment of those sums. The only proviso against this lies in the possibility of the C.E.B.'s refunding any capital expenditure raised directly by the municipality without recourse to loans. The writer agrees that "In any case, such a discrimination against the local authority is scarcely justified since the latter has been forced to expend considerable sums on development in the early stages without return, and the value of the electricity department as an asset in the accounts of any municipality for general purposes is very great indeed."[1] If these provisions should be used against the municipalities, and in some cases they are certain to be, the resulting resentment would undoubtedly be very great. Parliament assiduously protects private property in the case of compulsory purchase, but this recent instance and the provisions regarding municipal tramways in the London Transport Bill, prove that the rights of community property (the ratepayer's asset) are treated with little respect when they can be used to increase the earnings of the investing public.

The provisions of the 1926 Act relating to the closing down of generating stations are of great potential importance. In case the owners of a generating station, not being a selected station, are notified by the Board that the latter can supply the same quantity of electricity as then required at a lower rate, the generating station will be given a period of three months in which to accept or reject the Board's offer. If during the subsequent year the cost of generation remains higher than the rate offered by the Board, the Commission is empowered to close down the station within a period of not less than six months and to order the undertaker to receive his supply from the Board for a period of not less than seven years, on specified terms ascertained in accordance with the provisions of the 1926 Act. If the owners of the generating station are not satisfied with the decision regarding the relative costs of production, the matter may be referred to an

[1] "Financial aspects of the Electricity Bill," (1926) 102 *Economist*, 671.

arbitrator and assessors appointed by the Minister of Transport from a panel set up under the Act. "In calculating for the purposes of this section the cost of production of electricity generated by the authorized undertakers," reads an important provision of Section 14 of the 1926 Act, "no account shall be taken of the capital charges in respect of capital expended on the generating station."

The Act contemplates, as the normal procedure in the future, the erection of new generating stations under the auspices of the Board. Here again the Board may neither erect nor operate the new station unless the Commissioners are satisfied that no existing body can be found with whom satisfactory arrangements can be made. This is the only case in which the Joint Authority is not given preference. In case no other arrangement seems possible, the Commissioners may authorize the Board itself to provide the station by a Special Order under Section 26 of the Act of 1919.

The remaining technical powers of the Electricity Commission may be dismissed with brief reference. The only other planning power of importance is the establishment of a standard frequency. At the end of the year 1926 no less than 77 per cent of the total installed capacity in the generating stations of authorized undertakers was 50-cycle plant and most of it was designed for 3-phase working. Furthermore, the systems adopted throughout Europe, with the exception of Italy, are uniformly 3-phase 50 cycles. This is the frequency that has been adopted by the Electricity Commission.

The provisions of the 1926 Act (Sect. 9) relative to "Standardization of Frequency" are of such great importance that the exact wording should be given. The establishment of a standardized frequency, it will be observed, is a necessary concomitant of interconnection, and hence the Act provides that

"The Board may require any authorized undertakers or owners of any selected station to amend or alter the frequency employed in their

undertaking or station, if and so far as such amendment or alteration is required to effect the standardization of frequency as the Board with the approval of the Electricity Commissioners may think expedient, subject to the payment to the authorized undertakers or owners of any expenses which they may properly incur in carrying into effect (including the cost of altering or replacing plant belonging to consumers), and the Board shall if required advance free of interest such sums as may be necessary to enable the said authorized undertakers or owners to comply with such requirements and they are hereby authorized to do so notwithstanding anything in any special Act or Order relating to their undertaking."

If the Board and the undertakers do not agree as to the sum necessary to carry out the work, the matter is to be determined by reference to the Commissioners, or at the option of the owners, by arbitration before a barrister selected by the Minister of Transport.

The Weir Committee estimated that the net cost of converting the stations of selected and authorized undertakers alone would amount to £8,000,000, but the Commission has stated that the net cost for the country as a whole will be double this amount. One of the aims of the Commission is to establish alternating current (A.C.) instead of direct current (D.C.) and common voltages throughout the country. In 1929–30, 145 undertakings were supplying D.C. only, while many were giving both A.C. and D.C. Most of the enterprises were operating within a field of about nine different voltages, but there were still forty-six declared voltages in operation between 100 and 480. The Act of 1926 provides that the cost will eventually be repaid by the electricity industry as a whole. The Electricity Commissioners act as the collecting agency through which the money is turned over to the Board. The necessary annual charges for interest and sinking fund are spread over the whole of the revenue received from the sale of electricity and apportioned between the suppliers in proportion to the revenue from all sales. The Commission has determined that forty years will be required to liquidate the necessary outlay for standardization.

The powers granted to the Electricity Commission and to the C.E.B. should be sufficient to guarantee national uniformity of frequency as expeditiously as possible. Standardization affects utilization as well as generation, and the inducement to the industrial firm to carry out conversion through the substitution of new motors must be sufficient to break down a feeling of natural reluctance and opposition. A policy of regionalism and of gradualness would have proved impotent, whereas a national policy vigorously pursued will make of Britain "one scientifically coordinated power zone."

THE COMMISSION'S JUDICIAL FUNCTIONS

The Electricity Commission combines the power to issue orders and establish policies with the duty to hold hearings and to decide controversies. At one time it acts as a planning body, at another it serves in a judicial capacity. True, no words of any Act refer to the Commission as a "court," but the powers provided by legislation, the attitude of the Commissioners themselves, and the nature and method of their procedure on certain occasions definitely establish the judicial character of an important part of the Commission's work. Whether hearings held before the Commissioners, and open to the public, are "judicial" or "quasi-judicial" is sheer sophistry.

The Electricity Commission does not by any means possess a monopoly of the judicial functions which arise under the provisions of the several electricity Acts. It was a matter of common comment at the time the Electricity (Supply) Act of 1926 was passed that no matter what else happened, the legal profession had been well taken care of and, if many disputes should arise, stood to profit generously. This is due to the fact that the principle of arbitration, as one writer has stated, "is sunk right into the Bill." In several cases an

authorized undertaker may appeal against the findings of the C.E.B. or the Electricity Commissioners, or both, to the arbitration of a barrister appointed by the Minister of Transport. This barrister may call in the aid of one or more qualified assessors in the consideration of the appeal, and his decision, with certain modifications, is final. In several cases the Commission and the barrister have supplementary or alternative jurisdictions.

The principal cases in which the Commission may be called upon to act judicially are these: disagreement regarding the price to be paid for the acquisition of generating stations and main transmission lines; any dispute relative to the obligations and rights of owners of selected stations except those involving the cost of production, in which case the matter is referred to an arbitrator; questions regarding the cost, etc., of altering frequency; the relative cost of electricity in cases where an owner objects to the requirement that his station should take an exclusive supply from the Board; disputes regarding the closing of generating stations; applications for Special Orders by gas companies supplying electricity under the Act of 1925; and whether, in an application for wage compensation, a given station shall be deemed closed or restricted within the meaning of the 1926 Act.

At these hearings the parties concerned are frequently represented by counsel and the whole proceeding is similar to that of the Railway Rates Tribunal or the Traffic Commissioners. The procedure is more informal than in the case of the other two bodies, however, because the Commissioners are not legally trained and members of the public rarely attend the hearings.

The provision for appeals to the Electricity Commission received unfavorable criticism when the Electricity Bill of 1926 was before the House of Commons. Sir Charles Wilson stated that the Electricity Commissioners had been given powers of dictators and that appeals from the Board to the

Commission would never be properly heard.[1] Mr. Lloyd George said, "I hope there will not be these appeals to the Electricity Commissioners"; and Mr. Trevelyan Thomas concluded that "It is not much good saying that one can appeal to the Electricity Commissioners because the Board is the child of the Commissioners, and one does not get the independent judgment necessary when appeals are made. I hope that something may be done to establish a judicial authority to which appeals can be made from the judgment of the Board."

The suggestion that a special judicial tribunal should be created to hear disputes regarding the electricity plan is very interesting, but on balance it appears that the existing method of appeals to the Electricity Commission is preferable. Appeals to a court would involve delay, invite litigation, and transfer questions which are primarily technical into the legal domain. Moreover, as a result of seven years' experience with the Electricity Commission, it is the consensus of informed opinion that the Commission has discharged its judicial functions with scrupulous fairness and good judgment. However, it must be observed that the "argumentative" or coercive stage of the development has just arrived, so that the Commission has never been severely tested. So long as men like Sir John Brooke, who has had many years of experience hearing appeals as the former chief administrative official of the Ministry of Transport, are members of the Commission, it is doubtful if any strictly judicial body could command the confidence enjoyed by the skilled Electricity Commissioners. It is significant that the electricity industry and the municipalities have shown a preference for appeals to the Electricity Commission, rather than the alternative method of arbitrations before barristers

[1] *H.C. Debates*, vol. 193, col. 1731, March 29, 1926. "Then as to appeals," said the same speaker, "will anyone tell me the difference between the new Board and the Electricity Commissioners? It is true that they are different in name, but I say unhesitatingly that appeals from one to the other will never be considered satisfactory by anyone."

and assessors. Since 1926 many quasi-judicial hearings have been held by the Electricity Commission, but not a single arbitration has taken place. This situation may possibly be altered when additional generating stations have been closed or restricted.

The 1926 Act provides for several cases in which arbitrations by barristers are allowed. These relate to the scheme for interconnection, the selection, extension, and closing of generating stations, the cost of supply to main transmission lines and generating stations, the determination of expenses incurred through standardization of frequency and alteration of transmission lines, the price to be paid for generating stations and main transmission lines, and the adjustment of wage compensation when stations are closed or restricted. These are important powers, but it will be observed that in several instances the Commissioners possess an alternative, original, or complementary jurisdiction.

The law relating to the compulsory alteration and extension of selected stations may be taken as an example of the important duties imposed upon the arbitrator. It is provided under Section 5 of the 1926 Act that a selected station may be made the principal source of energy for a much larger area than was originally supplied, or it may be required to deal with a greatly increased load in the same area. The owners may feel in such cases that they are not in a position to accept the financial burdens made necessary by the Board's requirements, and they may then appeal to an arbitrator appointed by the Minister of Transport on the ground that to carry out the extensions and alterations would impose an "unreasonable financial burden" on them.

In the view of W. S. Kennedy, an authority on electricity law, the Act is not clear as to the result of the arbitrator's inquiry, and consequently a complete deadlock may occur.[1] If the arbitrator should find in favor of the owners, concludes Mr. Kennedy, "the appeal to the arbitrator in this case is of

[1] *The New Electricity Act*, 21, 22.

very little use," because the Board is empowered to take over the station or authorize some other undertaker to acquire and operate it. On the other hand, if the arbitrator finds in favor of the Board, it will be impossible to compel the complainant to carry out the extensions. No provision has been made in the Act whereby the Board may render financial assistance to the owners when extensions have been found necessary. It appears, therefore, that the provisions regarding compulsory extensions provide no real protection to owners, but fortunately these stipulations, like the utilization of the services of an arbitrator, are not likely to be employed in many instances.

If we add up all the cases in which arbitration machinery may be set up, the *Economist* has pointed out[1] that there is little of fundamental importance left apart, and the business of coordinating electricity supply depends almost entirely upon the ability of the Board to preserve "the goodwill of the authorized undertakers, or failing that, a barrister assisted by one or more assessors will virtually take over their duties." Moreover, in two important cases special orders made by the Minister of Transport must lie before each House of Parliament for thirty days, during which time there is opportunity for either House to take steps to prevent the orders coming into operation. In the first case, the right of the Board to acquire a generating station owned by an authorized undertaker where the latter is unwilling to carry out the arrangements considered necessary by the Board, and in the second case the determination of the tariff to be paid for the supply to and by the Board are at stake. Hence, on careful examination it appears that

"practically every feature of real importance for the successful realization of a nationally coordinated scheme of electricity supply lies at the mercy of a barrister or of a party sufficiently strong to carry either House of Parliament with it against the provisions, in certain instances, of the bill. It is obvious that, in the desire to avoid victimization the

[1] "The Electricity Bill in Committee," (1926) 103 *Economist*, 456.

Government has gone to the opposite extreme and placed the bill in danger of obstructionist tactics as adopted by an authorized undertaker determined to reduce the bill to nullity. The opposition to the bill in 1926 shows this probability is by no means an impossibility."

The real test of the compulsory powers of the Act appears to lie immediately ahead. The grid has been practically completed, and many additional generating stations must be closed. Objectors and obstructors have made their presence known. How will the Commission and the arbitral system withstand the baptism of fire? Litigation in the law courts would be unfortunate, but this is the ultimate sanction, as early experience has already demonstrated.[1] In the long run, however, the statesmanship and aggressiveness of the C.E.B. must be relied upon primarily if obstacles are to be successfully surmounted.

LABOR POLICIES

The closing down of generating plants and the concentration of production in selected stations will ultimately mean the dislocation of a considerable number of employees. Rationalization always throws men out of work. Realizing that national benefits would involve inevitable personal hardships,

[1] In the course of correspondence between the Commissioners and the Corporation of Ealing during 1923 it transpired that the municipality had removed from its generating station certain obsolete units having a total capacity of 300 kw., and had substituted therefor a unit having a capacity of 2,000 kw., and that it was proposed to defray the cost of the alterations out of the accumulated profits of the undertaking. The Corporation contended that the alterations did not constitute an extension of an existing generating station within the meaning of the Act of 1919, and that the proposed manner of payment was expressly sanctioned by Section 52 of the Ealing Electric Lighting Order of 1891. The Electricity Commission held otherwise, and the case was referred to the High Court by the Attorney-General. The court decided that the expression "generating station" where used in the Act of 1919 means any buildings and plant used for generating electricity as well as the site of such buildings, and that the prohibition of Section 11 of the Act against extending the plant used for generating electricity covered an extension of the plant's capacity, and that the cost of providing an entirely new generating set was an expense properly chargeable to capital. Liberty was granted to the Attorney-General to apply for an injunction in the event of its being considered necessary. Attorney-General *v.* Ealing Corporation, (1924) 131 L.T. 467; 88 J.P. 153; *Fourth Annual Report of the Electricity Commissioners*, 44.

the framers of the 1926 Act adopted the policy of assisting employees who will be adversely affected by the national plan to adjust themselves after their employment has been automatically taken away.

Compensation is guaranteed to regularly employed officers and employees of electricity enterprises when, in consequence of the changes in the electricity industry brought about by the Act, they have been deprived of their employment or have suffered diminution in salary and have not been given "equivalent employment under like conditions." The guarantee extends over a period of five years from the date when a generating station has been closed or a main transmission line has been acquired. The employees affected are required to prove to a referee appointed by the Minister of Labor that their loss of employment or diminution of salary has not been on the grounds of misconduct, incapacity, or superannuation, and that the case otherwise comes within the law granting compensation. The amount of compensation is to be paid by the owners of the station or the main transmission line. These are policies which should have been more widely followed in recent years.

The Whitley Council system has been adopted in the electrical industry. The problems of fixing wages and of settling disputes relating to hours and conditions of service are handled almost entirely in the electrical industry by a framework of regional conciliation boards leading to a national council.

District Councils have been established in the principal industrial areas, approximately coterminous with the power areas. For example, District Council No. 1 has jurisdiction within the North-East Coast area. The board is composed of twenty-eight members, employers and employees having fourteen members each. In this area eight of the employers' representatives are appointed by company undertakings and six are chosen by municipal services. The employees' representatives are chosen by the trade unions in the several

branches of the industry. These unions are strongly organized and are national in scope.

Appeals may be taken from the district councils to the Joint Industrial Council for the Electrical Supply Industry—the national tribunal in the Whitley system. Here again representation is equal, and practical results depend upon reason, goodwill, and patience rather than upon a decision having coercive force. Questions affecting the industry as a whole are also considered by the national council.

The relations between employers and employees in the electrical industry appear to be satisfactory, due largely no doubt to the beneficial effect of the Whitley regime. Collective bargaining seems to have proved successful in settling the wage disputes and in creating more uniform standards of service throughout the country. However, the electrical unions have not succeeded in preventing wage cuts as well as have the railway unions. Like the railway unions, though, the official policy of the electrical unions favors State management of the electrical industry and workers' cooperation in management.

SUMMARY

Great Britain has begun to plan. The first step in the direction of planned basic industries has been auspiciously taken because throughout the world it is generally recognized that intensive electrical development is the key to almost limitless industrial and social advantages. The first serious effort to coordinate national electricity generation was made in 1919 and if the bill had been passed without alteration the electricity scheme would have been superior in some respects to the compromise Act of 1926. The 1919 Act made room for local initiative and provided for the problem of distribution as well as for the organization of power production. The present Act is only the first step in a thoroughly integrated electrical network, but it is an important one.

Electricity Commissioners, created by the Act of 1919,

have powers to plan the generation scheme and to decide important controversies arising from the carrying out of the actual work by the C.E.B. The Commission also has certain regulatory powers which will be considered in the next chapter.

The entire country has been divided into ten electricity areas, but only nine of these will be intensively developed for the time being. All areas will, by means of interconnections and the construction of high-tension transmission lines, form a single network from which power will be sold to authorized distributors by the C.E.B. Selected generating stations, which will supply most of the bulk power, have been chosen. The Commission has established a standard frequency of A.C. 50 cycles for the entire country.

The time has just arrived when the judicial powers of the Commission may be put to a severe test, but experience to date has indicated that this function has been well administered. The Act of 1926 also made provision for the determination of disputes by means of arbitrations before a barrister selected by the Minister of Transport, but it is thought that these provisions were mere gestures and that they will prove to be of little importance.

In order to safeguard the interests of the workers who will be displaced as a result of the national plan, a policy of financial compensation has been devised. This provision, combined with the Whitley Council system for settling wage and employment disputes, has created a foundation for amicable labor relations.

The real test of any plan is what transpires in actual practice. In the case of the national electricity development this result may be learned by studying the record of the C.E.B.