

CHAPTER VII

ELECTRICAL PROGRESS AND THE NATIONAL ECONOMY

THE CENTRAL ELECTRICITY BOARD

The dynamics of national electricity planning are represented by the Central Electricity Board or the C.E.B. as it is usually called. During the first five years of its existence the Board has evidenced definite objectives, aggressive action, and highly satisfactory results. Progress on the national electricity scheme has surpassed the expectations even of its most ardent supporters. Those who prophesied that the Board would be merely the "child" of the Electricity Commission have been proved mistaken, or at any rate the precocious youngster bears no close resemblance to the older generation.

The Act of 1926 provided for the creation of a national organization, the C.E.B. The primary duty of this body was to carry out the work of concentrating energy in certain selected power stations and to erect a high-tension main transmission line which would interconnect these stations and link up the existing regional systems into a national "Grid." The Board does not own the generating stations and has no control over distribution. Its function is to make production more efficient through concentration and co-ordination, the instrument of coordination being represented by the main transmission system. It has power to obtain land compulsorily for wayleave purposes in common with any other public authority.

The C.E.B. is a new type of public coordinating board with distinct differences from organizations like the Port of London Authority and the Metropolitan Water Board. As has been stated, it is generally regarded as the model type

of public utility trust. Parliamentary control over the activities of the Board is not much greater than it is in the case of the ordinary electricity supply undertaking, which, under present legislation, must obtain the approval of the Electricity Commission for raising capital for the construction of generating stations and for the erection of transmission lines. The C.E.B. is a public body created by statute, financed by the issue of stock which bears with it no voting rights. Therefore the stockholders exercise no control over policy. Principal and interest on the stock may be, but have not been, guaranteed by the Treasury; but such guarantee does not carry with it any additional supervision of the work carried out by the Central Board. The C.E.B. is forbidden to earn profits. The Board can make its own arrangements with supply undertakings, fix its own tariffs, and control absolutely its own administrative organization. It is, consequently, a singular type which combines public control and the elimination of profit-making with a very large measure of independence in operation.

The Board itself is nominated by the Minister of Transport, who, in selection, has paid attention to special qualities such as knowledge of industrial organization, finance, and the control of large manufacturing establishments. Some attention has been given to interests involved in or affected by the national power scheme, such as the railways, labor, local authorities, and electrical supply companies, but ability has been considered the principal test of selection. The membership of the Board has been criticized because it is not as representative as the Act of 1926 contemplated. Following the appointment of the Board in 1927, a writer in the *Economist* observed that "The success of the new legislation depends above all on the strength of the executive ability of the Board, since the latter has before it the difficult task of conciliating many interests and pushing through at the same time the national coordination of electricity supply. At first sight the Board would promise

such ability since its members are well known in industry and trade; but closer examination does much to weaken the first impression. In the first place, it cannot be considered as genuinely representative within the meaning of Clause 1 of the Act," since electricity supply with three members bears too high a proportion, while shipbuilding with two members, including the Chairman, Sir Andrew Duncan, is also too heavily weighted. Local government, commerce, industry, transport, and labor are crowded into the two remaining positions.¹ The members of the Board have been appointed for terms varying between five and ten years. The above criticism undoubtedly possesses merit, because it is important for many reasons that the unequivocal policy of broad representation should be respected. Nevertheless, the auspicious launching of the plan seems to have justified the original selections, and now that five years have elapsed opportunities to broaden the personnel of the Board will arise.

The Board has made considerable use of the committee system, the most important ones being those which deal with the authorization of all acquisitions of land required for sub-station sites and other purposes of the Board, and to deal with all questions in relation to the obtaining of wayleaves not coming within certain guiding principles laid down by the Board. The organization at Headquarters consists of the Engineering Department, the Accounting Department, and the Secretariat, including the Solicitor's Branch. The Engineering Department is subdivided into the construction, the operating, the research, and the supply sections. Each district has its engineering and wayleave officials, who are responsible to the appropriate Headquarters Department. The coordination of the organization as a whole is performed by the Chairman and the General Manager. Most of the costs incurred by the Board are paid to consultants, manufacturers, and contractors, the latter of whom do

¹ "The Central Electricity Board," (1927) 104 *Economist*, 317.

the actual construction work. The Board's expenses will eventually be absorbed by the sale of power from the grid.

A special branch of the Central Board carries on a very intensive but unobtrusive campaign of education and publicity. The popular interest manifested in national electricity planning and the conciliation of diverse interests have been primarily attributable to the remarkable success of this department. Several tomes of signed articles have been produced since 1931, educational motion pictures are being circulated, and the active support of the highly organized electrical manufacturing industry has been enlisted. This liaison has had a great deal to do with the fact that since the depression there has been greater activity in the British electrical industry as a whole than in any other country in the world.

The work of the C.E.B. may be conveniently considered under three main heads: the establishment of the main transmission system, the standardization of frequency, and the development of power areas.

THE NATIONAL GRID

The principal accomplishment of the C.E.B. has been the virtual completion of the 4,000 miles of transmission lines which are required for the national electricity scheme.¹ The progress of the work has been attended by more popular interest than any construction program since the war. Broadcasts have been arranged on the spot and films have been taken when important units of the transmission system were completed. Some of these engineering feats have been truly inspiring, and naturally appeal to national pride. For example, the Roding Tower near Barking reaches a height of 362 feet, and the Thames Crossing Tower

¹ A large part of the information in this section was supplied by Mr. Hugh Quigley in the form of a special memorandum. The present development of the grid has been described in (1932) *Fifth Annual Report of the C.E.B.*

further east a height of 487 feet. The latter tower is the highest erection in England, exceeding Salisbury Cathedral, the tallest building, by 84 feet.

The completion of the high-tension transmission lines has been carried out a year in advance of original expectations. When the C.E.B. began to function in 1927 it was confronted by the following main problems :

- (1) To concentrate the output of electricity into a number of generating stations selected for their efficiency and low operating costs, to construct a transmission system which would interconnect these stations and in this way improve the load factor and general operating conditions.
- (2) To standardize frequency of generation at A.C. 50 cycles throughout the whole of Great Britain so that interconnection could be carried out and a national power system be created capable of functioning smoothly from one district to another.
- (3) To take over the entire output of selected generating stations and sell the power to authorized distributors, the selling price to be composed of a fixed charge based on the kilowatts of maximum load and a running charge covering the costs of production.

In the preliminary discussion of the grid itself it was generally agreed that the scheme could not be expected to be in full operation much before 1934. The program for the grid's construction was not drawn up in absolute detail, as provision had to be made for changes and modifications dependent upon local conditions and unexpected difficulties. The Act of 1926 provided that after the Commission had prepared a plan for each area the Board should publish the scheme and give an opportunity to all interested parties to place objections to it before the Board. As a result of these representations some considerable modifications have been made in the plans originally drawn up by the Commission. In certain cases the routes have been shortened to link up more directly main grid points and in other cases, largely owing to wayleave negotiations, alternative methods of approach have been developed.

The first scheme prepared by the Electricity Commis-

sioners was adopted by the Board in June 1927, and other plans followed at the rate of two each year. The last one was adopted for Southern Scotland in August 1931. The Commissioners listed the stations to be selected and to a certain extent planned the interconnecting transmission system for each area, leaving the construction to the Board.

In legal matters, negotiations have been protracted in connection with certain wayleaves where local opposition developed. The Board has been very successful, however, in avoiding expensive and protracted government inquiries and litigation. Only 2·36 per cent of all wayleaves secured in 1931, for example, were obtained compulsorily, although 10,000 wayleaves were obtained in that year. There appears to be no question that alterations of plan made necessary by wayleave difficulties have been, in some cases at least, a factor accounting for the fact that the grid has cost slightly more than anticipated.

The technical details regarding the transmission system are inappropriate in this discussion, but a few of the facts may be of interest. The transmission lines are steel-cored aluminium, capable of taking 50,000 kw. These lines are borne principally on transmission towers ranging in height from 70 feet to 487 feet. The largest river towers weigh as much as 290 tons, and the Thames Crossing towers near Dagenham have a span length of 3,060 feet. For primary lines operating at 132,000 volts, about six towers are required per mile and for secondary lines operating at 33,000 volts about eight towers. Thus for the purpose of the national scheme about 17,275 towers are required for primary lines and about 9,000 towers for secondary lines, making a grand total of 26,275. The total estimated tonnage of steel which has gone into the construction of the grid, inclusive of sub-stations and river crossing towers, is about 150,000 tons, while aluminium required for the complete system will probably be in excess of 12,000 tons.

The relation between overhead transmission and the

amenity question has raised local agitations which have occupied a good deal of space in the press, but which have not seriously retarded the progress of the plan. The Board has followed the policy of working in close contact with bodies interested in these matters, such as the local rural preservation societies, and has preferred to use the method of negotiation in preference to the method of compulsion. The areas in which agitation has been most marked have been the Lake District, the South Downs, Oxford, the New Forest, and parts of the line from Malton to Whitby. Certain negotiations have not been entirely completed, and, as has been said, in other instances some deviation of the proposed line has been necessary. For the most part, however, the country has been educated to the fact that the whole weight of engineering knowledge and experience in the United States, Germany, France, Italy, and Switzerland has been on the side of overhead transmission over large areas, and that the cost of underground transmission is from twice to ten times as great, depending upon the character of the country.

In practically every case the grid, either through primary or secondary lines, has established points of contact and supply, and wide areas are served by authorized undertakers with existing transmission and distribution systems, so that immediate advantage can be taken of the national power supply when it is available. The Board commenced trading in two areas, Central Scotland and Mid-East England, in January 1933, when 1,360 miles of primary transmission lines, 596 miles of secondary lines, and 94 miles of underground cables had been energized. In the completed scheme there will be more than 273 grid points from which authorized distributors will be able to obtain supplies of electricity. Switching stations are intended to link up different areas without transformation of electricity. At each selected generating station a transforming station will raise the voltage of generation to the transmission voltage of

132,000 volts, while at the other end of the circuit a second transforming station will reduce it to 33,000 volts, or lower pressures, to make it available to authorized distributors. A further stage in the process will be represented by distribution sub-stations transforming from 33,000 volts to the voltage required for supply direct to the consumer. The grid, therefore, carries out about half of the process from the production of electricity to its consumption by the public, the remaining half being performed by distributing companies, local authorities, and municipalities.

The national transmission system may at the outset prove in excess of existing requirements, but in the view of the C.E.B. it is certain to be fully loaded in a few years' time. In 1924 the total capacity of all generating plant in Great Britain (inclusive of private industry) was about 6,351,800 kw., whereas in 1931 it had risen to 10,744,200 kw. This means that the country had "increased its industrial capacity over the seven years by as much as the total increment from the beginning of industrial electrification to the end of 1914." The Board's plans have predicated a volume of electricity equivalent to about 500 units per head of population, this figure to be reached, it is hoped, about 1940. At that point the whole transmission line will be fully loaded; but the entire power scheme will not be completed much before 1935, when it is assumed that the output of electricity will not be less than 17,000,000 units compared with the estimated figure of 25,000,000 in 1940. The grid should be loaded, even in 1935, to the extent of 70 per cent, which is regarded as an economic load. The areas in which there is already standard frequency may be expected to develop more rapidly than those in which large-scale conversion of frequency must be brought about.

In making grid calculations for future electrification, the Electricity Commissioners and the Board have carefully avoided any supposition that railway electrification would take place. Railway electrification would undoubt-

edly be advantageous to the supply industry, however, because the railway load factor is very high, between 40 and 50 per cent. Financially it would make little difference to the Board, because the price quoted to the railways has been cut close to cost. The Southern Railway has already electrified its suburban lines, and judging from its increased passenger traffic and superior financial showing since that time, it will be difficult for the other railways to resist electrification on parts of their lines at least. As a matter of fact, it seems almost certain that the electrification of suburban services will take place as a result of the adoption of the London transport scheme.

THE STANDARDIZATION OF FREQUENCY

The second function of the C.E.B. is to establish a standard frequency for the national electricity scheme. The Weir Committee advocated this policy very strongly, since they believed that without it, interconnection on a national scale would not be entirely effective. The Commission and the Board have accepted the same view and are determined to carry through the necessary reforms. On the other hand, the policy has met with strenuous opposition in certain quarters because the cost, roughly £19,000,000, will be spread over the supply industry as a whole for a number of years, and because the incidence of the transformation falls mostly upon certain areas rather than upon all districts equally. About £9,000,000 of the expense has been incurred in the North-East England area alone. The national view and the long look ahead justify the program of standardization which has been promulgated. Moreover, the advantages of uniformity to the manufacturers of electrical equipment and the resulting benefit to the export trade are important factors properly deserving consideration. The convenience to the retail buyer will also be a great advantage.

The Weir Committee expressed the opinion that the change-over to standardized frequency could be completed by 1929, but in this they were badly mistaken. The conversion of the North-East England area alone will probably not be completed much before 1935. In the meantime, the policy has made work for large numbers of electrical workers at a time when employment was very much needed. In every case of conversion to a standardized frequency the owner must obtain the authorization of the Board, and the actual work is carefully supervised by engineers and auditors employed by the Board.

The areas most affected by the standardization of frequency are North-East England, Central England, and Central Scotland. The consequent installation of new or altered electrical plant in consumers' premises will contribute to the work of modernization and reequipment of many of the most important industrial establishments in the country. It is hoped that the reduction in price of electricity supplied from the grid will more than offset the capital charges incurred by standardization of frequency. If all elements of the national plan are properly administered there is every reason to suppose that this expectation will be fulfilled.

THE FINANCE OF NATIONAL ELECTRICITY DEVELOPMENT

When the Electricity Bill was before Parliament in 1926 more attention was given to the financial powers of the C.E.B. than to any other feature of the legislation. Since the passage of the Act criticism of the financial provisions of the electricity scheme has continued, but in decreasing volume.

The Weir Committee estimated that £25,000,000 would be needed to construct the transmission system and that the cost of standardization of frequency would be about £8,000,000. Parliament provided that the "maximum" sum which the Board might borrow is £33,500,000, but that

this amount might be increased by the Board obtaining a Special Order under the Act of 1919. The Special Order must be approved by the Electricity Commissioners and by the Minister of Transport. Experience has demonstrated that the "maximum" is not a maximum at all, because a stock issue of £50,000,000 has already been authorized. The engineering computations of the Weir Committee did not take into account all factors and were therefore not wholly reliable.

The Board may borrow specifically for the following purposes: (*a*) the construction or acquisition of main transmission lines or generating stations; (*b*) any other payment or any permanent work which the Board is authorized to assume and which the Commissioners decide should be spread over a term of years.¹ The cost of standardizing frequency, amounting to £19,000,000 instead of £8,000,000 in the Commission's judgment, falls within the latter category. The Board may borrow to pay interest on capital for the period during which it remains unremunerative. What that period is, the Commissioners, after consulting the Treasury, are to determine. An elastic clause further stipulates that the Board may borrow to provide working capital and for any other purpose which the Act provides that they may borrow.

In the last analysis, the Treasury exercises a fairly complete control over the general purposes for which borrowing may take place. A blanket provision, of very great importance, expressly stipulates that any borrowing must receive the consent of the Commissioners and that it is to be carried out subject only to regulations as to repayment and the like laid down by the Minister of Transport and approved by the Treasury. All sums are to be repaid within such period as the Commissioners may determine, and that period is not to exceed sixty years. Here again the Treasury must be consulted. Treasury supervision is a fitting and necessary

¹ Electricity (Supply) Act of 1926, Sects. 26-30; Kennedy, *op. cit.*, 54-59.

form of control over public utility trusts so long as the impetus to free initiative is not stifled. These conditions appear to be fulfilled.

The money borrowed by the Board is to be raised by the issue of stock to the public. Section 29 of the 1926 Act provides for a Treasury guarantee to the Board. It is in form permissive, the words of the section being, "Subject to the provisions of this section, the Treasury may guarantee—the payment of the interest and principal of any loan proposed to be raised by the Board, or of either the interest or the principal." This provision raised a storm of protest from the individualists, but its inclusion was undoubtedly salutary. The mere possibility of a Treasury guarantee unquestionably makes it possible to raise money at a lower rate of interest, and it recognizes a *prima facie* right of public oversight of the finances of the Board. The Treasury guarantee has never been used and it seems unlikely that it will be. The outstanding stock of the C.E.B. bears interest at the rate of 4, $4\frac{1}{2}$, and 5 per cent. Inasmuch as recent issues of stock have not been as readily subscribed as some earlier ones and have hence borne a higher rate of interest, the criticism may properly be made that the Board might have used the Treasury guarantee provision to the advantage of all except the investing public, naturally desirous of higher rates of interest. With money as cheap as it has been, and with the synchronous lowering of Treasury interest rates, it appears unwarranted to pay 5 per cent on stock invested in an enterprise of the character of the C.E.B.

In keeping with the usual provision, the Board may suspend interest and sinking fund payments for a period not exceeding five years, subject to the consent of the Commissioners, who must consult the Treasury before deciding. The latter part of this provision was utilized in 1931.

All sums received by the Board must be paid into a separate account with the Bank of England. The Act of 1926 expressly states the current expenses which must be paid out of

receipts. These include: salaries and fees to members, officers, and employees of the Board; pensions and gratuities; repayment to the Commissioners of expenses incurred in preparing schemes under the Act; and repayment to the Minister of Transport of any expenses—roughly £30,000—incurred before the Act came into operation. The Board's accounts must be audited and published once a year and offered for sale at a price not exceeding one shilling.

Thus far, the Board's stock has, on the whole, had a favorable reception by the investing public. Out of £36,000,000 nominal capital raised in the market to July 31, 1932, £16,000,000 was definitely oversubscribed, £3,000,000 was raised privately, and about £17,000,000 was not fully subscribed. Every issue of the Board was standing at a high premium at the end of 1932.

The Electricity Commissioners have established regulations prescribing the period within which provision must be made for repayment. In respect of money borrowed for the purpose of standardization of frequency the period stipulated is 40 years; in respect of borrowings for other purposes various periods have been fixed for the respective classes of expenditure, e.g. freehold land, 60 years; buildings, 30 years; overhead lines, 25 years; underground mains, 40 years; plant and machinery, 20 years.¹

Preliminary figures indicating the total cost of the national grid as apart from standardization of frequency, are now available, and it appears that both the estimates of the Weir Committee and also the original estimates of the Electricity Commission have been exceeded. The Weir Committee's computations applied to the year 1924 and did not visualize so comprehensive a program as has actually been undertaken. The Commission's analysis of the total expenditure required for the purposes of the scheme lay between £45,000,000 and £50,000,000, standardization of frequency, according to the latest estimates, accounting

¹ (1929) *Second Annual Report of the C.E.B.*, 24.

for about £19,000,000 and the construction of the main transmission system for roughly £25,000,000. Capitalization of interest on the latter during the first five years, and the cost of carrying out and operating the national power scheme account for the remaining sum.

In the *Fifth Annual Report of the C.E.B.* a significant statement was made relative to grid cost. It reads as follows :

“The cost of constructing the grid is now ascertainable within narrow limits, although some small degree of estimation is still necessary. . . . The cost will amount to about £26,700,000. In comparing this figure with the estimates made by the Electricity Commissioners in formulating the Schemes, it is necessary to note that the Schemes, as adopted by the Board, differed in some important respects from those prepared by the Commissioners ; putting the two sets of figures on a comparable basis, the cost will come out within 2½ per cent in excess of the Commissioners’ estimates, despite substantial expenditure on experimental lengths of 132,000-volt cable and on the undergrounding of some sections of secondary lines for the preservation of the amenities.”

Criticisms of the cost of the national electricity development have been heard, but it is impossible to tell how much importance should be attached to them. Critics frequently base their suppositions on the Weir Committee estimates, an unwarranted procedure. The price paid for wayleaves is also mentioned, and it is alleged that in its haste the Board has been extravagant. This argument cannot be answered with certainty, but it may be observed that in the long run higher prices for land are probably more economical than long delays which would tie up capital and impede the progress of the national plan.

The criticism which does deserve frank consideration, because it is capable of constructive treatment, is the privileged position which the electrical manufacturing industry holds in relation to the contracts and construction work of the C.E.B. The British electrical manufacturing industry has one of the most closely organized and highly developed associations in the country. Moreover, the principal costs incurred by the Board involve wants which are filled by

this and allied trade associations. Although Continental firms have been able to supply a small percentage of the Board's contracts, the time is not distant when the British manufacturers may (and many would say should) have a monopoly of the Board's business. That point has practically arrived now. Under such circumstances it has been suggested that Parliament should, by some means never definitely analyzed, take action to regulate the electric manufacturing industry, in order that the capital costs of the national electricity scheme may be properly safeguarded in the public interest. Tariff policies are bound to make the question of public utility status arise more frequently and acutely.

The interest and sinking fund charges represented by capital expenditure on the national transmission scheme will be recovered from the sales of electricity in bulk from selected generating stations to authorized undertakers. According to the Act of 1926, the Board was empowered to purchase from the owners of selected generating stations the total output of such stations and sell back to them what is required for their own purposes plus a certain charge to meet the Board's expenses. In a few years the Board will become the largest wholesaler of power in the country, and when that time comes the financial responsibilities of the Board should be considerably lightened. However, the Board is prevented by law from making a profit. The real problem lies in the proper integration and the maintenance at high efficiency of the generating stations and supply undertakings forming the backbone of the power areas.

POWER AREAS

Nine of the schemes which will eventually form the national power system have been completely planned, while actual development of the tenth, Northern Scotland, will probably be deferred for several years due to the

sparsely developed nature of the country. The nine schemes comprising the present network, and the dates of their adoption, are as follows: Central Scotland, 1927; South-East England, 1927; Central England, 1928; North-West England and North Wales, 1928; North-East England, 1929; Mid-East England, 1929; South Scotland, 1931; East England, 1930; and South-West England and South Wales, 1930. The smallest schemes, East England and South Scotland, cover areas which are predominantly agricultural and may really be considered part of the neighboring schemes—South-East England in the one case and Central Scotland in the other.

The importance of the other areas arises predominantly from their industrial character, which played an important part in the basis of selection. An economic analysis of the several zones may be of interest. "North-East England covers the shipbuilding, iron and steel, chemical and coal-mining industries of the North-East coast and hinterland. The North-West England scheme covers Lancashire with its textile industries, its coal mines, iron and steel plants, and engineering works in the vicinity of Manchester, as well as Cheshire, with its great chemical works concentrated round Runcorn and Widnes, while the Mersey estuary with its grain-milling and seed-crushing industries, shipbuilding and soap works also is included. Mid-East England covers the three main industries of woollen textiles, coal-mining, iron and steel; Central England, great engineering and electrical manufacturing industries, metal-working generally and automobile construction. The South-West England and South Wales scheme covers the coal mines, iron and steel plants of South Wales, confectionery, tobacco, and paper-making works in and around Bristol and wide stretches of agricultural territory. It covers also the great port of Southampton and runs as far north as Oxford with its automobile industries. South-East England, which has been one of the most recently industrialized sections of Great Britain, is

notable for an enormous number of small industries supplying articles in general consumption or materials required for building construction of all kinds. It has, however, three important industries, notably paper, cement, and electrical cable manufacture, as well as the Port of London. Scotland as a whole has very large shipbuilding yards, iron and steel plants, coal mines, while it has a number of less important industries devoted to chemicals, oil-refining, cotton and woollen textiles, paper, and printing."

A power map, contained in the Board's reports, will indicate the exact division of the country. Reference to the map will suggest the strategic importance of the Central England area. As one writer has stated, "The Central Midlands will probably be the most important section in the whole national scheme, owing to territorial considerations, and the power center located in Birmingham may well become one of the most active and economically operated of any such centers in the country."

Each area should be ultimately in a position to meet costs of operation and capital charges without subsidy from other areas. In the meantime, agricultural areas lying between industrial centers will be assured of a supply sufficiently cheap and available to develop their resources. The main transmission lines are connected at certain points in each scheme area with the trunk lines which run north and south throughout the country. From those points radiation rings radiate to link up a series of towns which are distributing points.

In the selection of the most efficient generating stations to supply each area the Board has departed from the Weir Committee proposals on finding that the best results would be obtained by a rather broader selection and greater number of stations than the Weir Committee contemplated. The total number of selected stations under the nine schemes adopted is 135, new stations to the number of 16 being built. Some of these stations, notably Clarence Dock and Iron-

bridge, are in operation, while, in the London area, two of the principal new stations, at Battersea and Fulham, have, in the one case, been completed, and in the other been placed on contract.

The total number of generating stations closed down between 1927 and 1933 was 146. Of this total, 39 stations can be traced to the operations of the Board. It is interesting to note that the grid as constructed links up twelve water power stations in North Scotland, Central Scotland, South Scotland, and North Wales—these being the only sections with effective water power resources.

Objections are sure to be heard when further generating stations are closed, but little opposition may be expected from the owners of selected stations. They have a great deal to gain and seemingly little to lose except complete freedom of action. In the Act of 1926 there is a proviso that where the owner of a selected generating station can prove that his cost of production would be less under independent operation than the price charged him by the Board, he can obtain from the Board his energy requirements at his own cost of production with no addition to cover the expenses of the Board. In practice, however, the fact that the national production of electricity will be concentrated in 135 stations instead of spread over 474 and that the demand for electricity is still increasing rapidly in Great Britain, will mean that each selected station will have a much greater output as part of the national system than it would have independent of it, and it will be almost impossible for the supply undertaking to prove conclusively that its costs would be less under independent operation.

The development of the grid and the unification of power areas have reached the stage where the results will soon be apparent. It is only natural, therefore, that attention should begin to be focussed upon the complementary aspects of national electricity planning, namely the improvement of distribution and the price regulation reforms which are

necessary if the advantages of cheap power are to be passed on to the users. Both of these vital questions require careful and candid examination. A great deal of study will be required. Our efforts can only scratch the surface and stress the importance of the next steps.

PRICE REGULATION

The price of electricity in Great Britain is high and varies greatly within neighboring districts. Although the average price of electricity for all purposes has fallen from 2·047d. in 1924 to 1·38d. in 1931, there must be a further reduction of domestic and commercial charges before electrical power will be widely used for household purposes. There is, therefore, a close and inescapable relation between the lowering of retail and commercial electricity rates and the economic use of the national grid. This fact is clearly recognized by the Electricity Commission, the C.E.B., the electrical manufacturing industry, and Chambers of Commerce, from whom the impetus to reform electricity rates may be chiefly expected. The private distributing companies, on the other hand, seem to be content in many cases to supply a low density of consumers at high prices and with correspondingly high profits. As a matter of fact, the view seems to be quite generally taken that the result of the 1926 Act will be to reduce consumers' rates only slightly but to increase profits considerably. If this course of events is permitted to transpire, the electricity scheme will be at best but a partial success, and may create dissatisfaction more serious than that found among consumers prior to 1926. It is only as trustees for the community of users that public utility trusts should continue to receive support.

The present status of price regulation cannot be considered satisfactory, because the official policy is passive, public complaints are not easy to register, and corrective

action is usually slow and disappointing. The regulatory powers of the Electricity Commission are, from the consumer's standpoint, the most important of all; but under existing circumstances they are the least effective part of the Commission's functions. Although the announced object of the 1926 Act was to give a cheap electricity supply to the consumer, Professor Hormell has properly concluded that the present provisions are "hardly stringent enough to bring about a reduction of price in the absence of a will in that direction on the part of the distributor. The machinery for readjusting prices to the consumer was not thoroughly overhauled and brought down to date in 1926. The provisions of the Act do something for the consumer, but it is questionable if they do enough."¹

The existing situation relative to the general control over prices and profits may best be explained by an analysis of the historical evolution which accounts for the relation of the Electricity Commission to the Minister of Transport. Prior to the establishment of the Ministry of Transport in 1919 the electricity powers arising under early Acts, including the regulation of prices, were vested in the Board of Trade. The only important exception to the unified control exercised by the Board of Trade was in the matter of authorizing electricity loans by municipalities, which was originally the responsibility of the Local Government Board and later of the Ministry of Health. In 1919 all powers relating to electricity supply were transferred to the Ministry of Transport, and later when the Electricity Commission was established certain powers were granted to it, subject to the Commission's responsibility to the Minister of Transport. Because of this relationship, the Minister of Transport has chosen to delegate to the Commission all reserved powers relating to electricity except those which directly affect his responsibility to Parliament and to the consumers. The regulation of electricity prices is the most important of the

¹ (1928) 17 *National Municipal Review*, op. cit., 380.

three or four matters in which the Minister has retained the ultimate decision and responsibility. The exercise of the compulsory wayleave powers, the obtaining of consents for overhead lines, and the revocation of electricity licenses are the other reserved powers of great importance.

In the matter of regulating the price of electricity to the consumer, therefore, the Electricity Commission acts in merely an investigatory and advisory capacity to the Minister of Transport. He need not follow their advice, nor that of the electricity inspectors in his own Department. In matters which affect the ballot-box the Minister alone must assume the responsibility. Nevertheless, through their express powers and their advisory powers, the Electricity Commissioners have more practical influence over price regulation than the Minister himself.

When the national electricity scheme has entered into complete operation the C.E.B. will act as a middleman, buying power from generating stations and selling it without profit to the distributing enterprises. The price to be paid for the supply received from selected stations has been defined by the second schedule of the 1926 Act, and the Commission has general responsibility for seeing that there is a compliance with these provisions. The cost of production of electricity, as furnished to the Board by the undertakers owning a station selected under the scheme, is based on the following factors: (*a*) generating costs, (*b*) rents, rates and taxes, (*c*) management and general charges, (*d*) allowance for depreciation, (*e*) interest. The accounts of all authorized undertakers are subject to the periodic scrutiny of the Electricity Commission, and special audits will be made whenever ground for such action arises. In determining financial standards for the factors of cost referred to above, the Commissioners exercise a very broad discretion and their word is final. For example, the Act refers to "the proper proportion of management and general establishment charges attributable to the station," and in the case of depreciation to

“charges properly attributable” and “such amount as the Electricity Commissioners think just.”

The provisions relative to interest charges are of vital importance, and have received more criticism than any other item entering into the price of the bulk supply. Where the owners of the selected station are a joint electricity authority or a municipal body, the rate of interest shall be the average rate payable on the money raised for electricity purposes, and where the owners are a company the allowance shall consist of the average rate of dividends and interest paid on their share and loan capital during the preceding year, so, however, that the rate shall in no case be less than 5 nor more than $6\frac{1}{2}$ per cent per annum. The stipulation regarding the maximum charge for interest has given rise to the most severe criticism, especially in the case of the power companies which have paid more than $6\frac{1}{2}$ per cent on their capital during recent years. However, an impartial consideration of the whole financial picture reveals that the provision in question is just.¹

Although the rates charged by municipalities and local authorities have been on the whole substantially lower than the tariffs of private companies, the law has narrowly limited the amount of the public undertakings' surplus which may be applied in aid of local taxation and provides that the major portion of the surplus shall go to reducing charges and toward paying off capital loans. To the writer this provision appears to be another case of unfair discrimination against the municipal services. Why should the directors of a municipality be limited to an infinitesimal dividend declaration, divisible among all the ratepayers, so long as directors of private companies may distribute dividends amounting, in the case of some companies, to ten or fifteen per cent? It is entirely just and proper that municipalities should provide additional public services and improvements from the earnings derived from vital supply undertakings. The

¹ “Financial aspects of the Electricity Bill,” (1926) 102 *Economist*, 670.

writer hazards the view that Parliament's policy relative to municipal services will meet with wide-spread objection within a relatively short time and that the equal claims of public authorities will have to be recognized. The revolt will be hastened by the fact that since 1926 it has become infinitely more difficult for local authorities to purchase private companies when dissatisfaction has arisen because of the company's service, prices, or profits.

As a result of changes in the law since 1919, municipalities will find it much more difficult to control the price of electricity in their areas by exercising the right of purchase at stated intervals, as provided in the 1888 Act. The original provisions of the purchase clause making it possible for the local authority to take over a private company at the end of forty-two years and at intervals thereafter, were altered by the Act of 1919. This legislation provided that the purchase of a private company's holdings by a local authority, except in the district of a joint authority, was conditioned upon the consent of the Electricity Commissioners. The Act of 1922 further modified the purchase provisions by a stipulation that the power of purchase might be suspended for such period and on such conditions as the Company and the Municipality agreed upon, subject to the approval of the Electricity Commission. In 1924 the Weir Committee proposed that the municipalities' right of purchase should be completely withdrawn, but an amendment to this effect failed to pass in 1926.

The Act of 1926 made significant changes in the purchase clause. In the case of companies formed after 1926 and whose area extends over the districts of two or more local authorities, only a joint electricity authority or a joint committee of local governments can exercise a right of purchase. Companies have been given a tenure of fifty years. Notice of intent to purchase may be given six months after the expiration of each subsequent ten-year period. The price shall be "a sum equal to the capital properly expended

for the provision of the land, buildings, works, materials, and plant in use or available for use at the time of purchase for the purposes of the undertaking, less depreciation according to a scale as may be determined by special order." Finally, the Act of 1926 provided that local authorities and private companies might, with the permission of the Electricity Commission, amend, vary, or alter the terms of purchase at any time within ten years of the date of purchase. As Professor Hormell has stated, "Under the conditions produced by the new Act probably few occasions will arise where it will seem expedient or advisable for a single municipality to purchase the plant of a private company."

The Electricity Commission has been given a very extensive control over the electricity departments of municipalities. The Commissioners must approve all borrowing by municipal electricity undertakings, and their accounts are subject to the Commission's audit. Furthermore, the amount that may be applied in aid of local rates in any year shall not exceed $\frac{1}{2}$ per cent of the outstanding debt of the undertaking, and since March 31, 1931, "no sum shall be paid in aid of the local rates unless the reserve fund amounts to more than one-twentieth of the aggregate capital expenditure on the undertaking."

One of the most important questions arising from national electricity planning is the ultimate effect of the 1926 Act upon the low prices heretofore found in municipal undertakings and the survival of the electricity undertakings of local authorities. Several speakers in the course of the 1926 debate expressed the view that "in the long run this series of checks and counter-checks will make it extremely difficult for a successful municipality to develop to a still more successful degree the industry for which it is responsible." Was the electricity scheme intended as a blow to municipal electricity undertakings? Municipalities will be well-advised to form joint committees and joint electricity authorities if they wish to protect and extend their interests.

The possibilities of what may be done in this direction may be seen in the development around Manchester. The Ontario (Canada) power scheme may also be studied with great profit.

The Weir Committee found that the average price charged to the consumers for all purposes in 1924 was 2·047d. but at the same time many municipalities, like Leeds, Birmingham, and Huddersfield, had reduced their prices to 1d. or less, while private companies charged as much as 7d. per unit in some cases. The writer has come across a recent instance in which a family living in a section of Greater London served by a large holding company decided to move to a contiguous section in order to come within the area of a municipal electricity service. The price for lighting was 7d. in the first instance and only 3½d. in the latter, while the comparison between power rates was 1¾ and 1. This situation is duplicated in many cases throughout the country. Not long ago the rates charged by a private company near London were investigated by the Electricity Commission. It was found that the company was earning a profit of 16 per cent, so the price of electricity was reduced. The company now earns 11 per cent. These are not isolated instances.

A recent analysis by the financial editor of a London paper reveals the profits which are permitted in electricity supply undertakings. "Electricity shares," he said, "maintain a strong hold on the investors' fancy owing to the good records of the various companies and the increased stability of the industry." He then gave as illustrations two companies that "have maintained their present rates of dividend (15 per cent and 10 per cent) for many years," and another which had just paid the same as last year, 10½ per cent, on a larger capital. The whole situation requires investigation and reform. Public service enterprises should not be permitted to earn profits like these; seven or eight per cent is quite sufficient.

As far back as 1926 Sir John Snell, the Chairman of the Electricity Commission, stated that in a few years the average price of electricity should be .7d. per unit and that the average lighting cost should be 9d. Most consumers will find a considerable discrepancy between this engineering verdict and their present electricity bills.

One factor complicating price regulation is the extension of holding company operations in recent years. The development has not proceeded nearly so far as in the United States and it is not expected that anywhere near the same difficulty will be experienced in dealing with the question of control. There are four centers of the holding company development at the present time, namely London, Central England, North Wales, and Scotland. Fortunately for themselves, the British have no problems of federalism or of judicial review. Hence if it should appear from the accounts of an operating company that a holding company was charging fees or in some other way "skimming the cream off the profits," the Commissioners could simply reduce the prices which the operating company is permitted to charge and automatically eliminate the objectionable features. In British law electricity holding companies have no guaranteed charging powers, because unlike the ordinary distributing companies they are not "statutory undertakers" but simply commercial organizations formed under the Companies Acts. As such they are not subject to direct regulation. However, the problem of regulating large power companies which own distributing companies as well as generating undertakings presents a much more difficult problem of regulation.

The alleged speculation with electricity stocks is another factor complicating the future control of prices and profits. According to the *Economist's* electricity correspondent, "speculation of a dangerous type has entered, and economic values are being shaken. The supply undertakings find their shares quoted at almost fantastic rates on the Stock

Exchange, where returns on such a valuation with dividends paid as at present are not much more than 3 to 4 per cent, and in one case $2\frac{1}{2}$ per cent.”¹ This is unquestionably another evidence of the widely held view that the profits of electricity undertakings will soar as a result of the national power scheme.

Complaints by consumers to the Ministry of Transport should be facilitated. Although the Act of 1922 provides that the Minister may commence an investigation of electricity tariffs where twenty consumers complain, in practice many more than this are usually required. The policy adopted in recent years has had the effect of discouraging unorganized users who might have a very good case. Despite this attitude, judging from newspaper accounts, dissatisfaction with retail electricity prices evidences a tendency to become more wide-spread. In conversation with various sections of the population one finds a deep-rooted conviction that electricity prices require a thorough overhauling. Such a reform is not likely to be effected until steps have been taken to get at the root of the problem, the distribution system. This is the next step in national electricity planning.

THE PROBLEM OF DISTRIBUTION

Generation is only one side of the electricity supply industry, and not necessarily the more important. During the period since 1926 the number of distributing companies has actually increased. On March 31, 1932, there were 661 authorized undertakers in Great Britain—a net gain of 126 since 1921. Of the 661 enterprises 378 were owned by municipalities, 275 by companies and persons, 3 by Joint Electricity Authorities (combinations of companies and local authorities), and 5 were operated by Joint Boards (representative of

¹ “Electricity supply—the influence of speculation,” (1928) 106 *Economist*, 1173.

local authorities). During the interval since 1926, unlike the earlier stages, the number of new company undertakings has rapidly outstripped the municipal expansion.

In their Twelfth Annual Report the Electricity Commissioners dealt primarily with the problems of distribution—an augur of the attention the question is likely to receive in the near future. “It has become increasingly evident,” stated the Report, “that centralization of generation will require to be supplemented by improvement in and coordination of distribution if the opportunities for expansion presenting themselves to the supply industry are to be utilized to the fullest possible extent.”¹

Provision has been made to standardize frequency in the generating side of the industry, but conditions among distributors remain chaotic. The official statistics for 1930-31 showed that 253 undertakings were distributing alternating current only; that 288 enterprises were utilizing both alternating and direct current; that 121 supply services were distributing direct current only; and that there were as many as 45 different declared voltages between the range of 100 to 480 volts at which supplies were being given to consumers in various parts of the country. Standardization of voltage in the distributing side of the industry will require nation-wide action and enforcement machinery to carry it out.

The Commissioners also referred to the fact that there are “considerable differences in various parts of the country in the degree of development attained and in the nature and extent of the facilities and service offered to existing and potential consumers.” An aggressive policy was counselled because “In no case, even among the best developed areas, can it yet be said that the saturation point of economic electrical development is in sight of attainment.”

The lowering of prices for domestic and industrial power depends very largely, as has been said, upon the reorganization

¹ (1932) *Twelfth Annual Report of the Electricity Commissioners*, 8.

of the distribution system. A former Minister of Transport, Herbert Morrison, pointed out recently that "The significant fact stands out that while generation costs are falling and will continue to fall as the grid system develops, distribution costs are practically standing still; in some instances there is actually a tendency for distribution costs to advance." Compulsion on a wide scale must be used if any effective relief is to be obtained.

Finally, certain sections of the country are deprived of a satisfactory electricity supply even where there is an effective demand. Engineering authorities stated in 1928 that only one-fifth of England and Wales could be regarded as "within the range of effective development at that time."¹ This is due to the fact that some areas have not attracted financial development and in others undertakers are content to make a large profit on a small number of consumers, when the potential number of consumers is known to be much greater. At present the owners of concessions cannot be forced to develop their monopolies. The policy of many distributors is inclined to be unprogressive relative to the conditions imposed upon prospective customers in the matter of service connections. Guarantees and installation charges imposed are frequently so heavy that large sections of the population, particularly in rural and suburban communities, cannot afford the service. In addition, concession hunting, speculation in distribution rights, and territorial expansion of electrical service must be dealt with, it is claimed, if the national plan is to be effective.

The whole position may be summarized by the following analysis:

"The danger of the electricity supply industry falling out of balance—between manufacture and sales—is a danger which must be considered. It would be absurd if the C.E.B. were to reduce the national cost of electricity to less than .4d. per unit to find the ultimate consumer paying to the distributor an average of 1½d. per unit or even

¹ "Electricity supply—the distribution problem," (1928) 106 *Economist*, 1068. This article contains many significant statistical observations.

more. Distribution cannot be left to the play of natural economic forces if generation and transmission have already been organized on a scientific basis: the existence of an enormous number of distributors supplying small areas cannot make for efficiency or reduction of waste. Each of these undertakings must obtain a margin of profit on expenditure and a return on capital which through its limited range of application becomes special in character and excessively high when related to total sales."¹

The case for organizing the distributing side of the power industry is convincing, but its accomplishment far more difficult than in the case of generation and transmission. Several possibilities suggest themselves: (a) the extension of power companies over wide areas; (b) the widespread development of Joint Electricity Authorities and Joint Boards; (c) the creation of a National Distribution Board on the order of the C.E.B. The respective suggestions are not exclusive, but complementary. The Electricity (Supply) Act of 1919, as originally drafted, incorporated all of the general principles contained in the above analysis.

Power companies alone are not likely to be a satisfactory solution of the problem, due to the natural resistance of municipal undertakings and the difficulties of regulating them effectively—as illustrated by the experience of the United States. They may well be an important element in a larger scheme, however. Joint Boards and Joint Electricity Authorities are a particularly satisfactory means of integration. The municipalities must act: if they stand still their position is likely to become extremely hazardous. Municipal purchase suffers from the drawback that such action, except through Joint Boards, tends to retard the development of large distributing systems.

The National Distribution Board would be primarily a coordinating agency, although it should be given power to purchase. It would work in conjunction with the C.E.B. The functions of the latter might conceivably be extended

¹ 106 *Economist*, 1068; see also "Electrical supply—capital cost of distribution," (1928) 106 *Ibid.*, 1120.

to cover distribution in addition to generation and transmission. Such a plan would have to be based upon regional foundations and local responsibility if it were to succeed. The success of a national distribution scheme would depend upon "service, on active enterprise, and on selling efficiency; and a national board would not furnish these things and be able to create a scheme capable of dealing with every type of consumer which would be elastic in operation and consistent in principle." National planning, joined to local initiative and responsibility, is likely to produce the formula most congenial to British temperament and tradition.

ELECTRICITY PROGRESS AND FUTURE POTENTIALITIES

The national electricity scheme is merely a means to an end—the development of the resources of the country—and an ultimate judgment regarding the soundness of the plan must therefore be suspended until it has been shown that cheap power available to consumers in every part of the country is a reality. The potentialities of national electricity planning, assuming a corresponding overhauling of distribution, are truly inspiring. The strengthening of British industry, the revival of economic activity in the rural township or village, the industrialization of agriculture, and the location of new industries destined to meet the requirements of the consumer in those self-contained power areas, the elimination of the smoke evil, and the provision of labor-saving devices for the housewife, are all benefits which can reasonably be expected if the power resources of the country are completely developed and controlled in the public interest.

Great Britain's world economic position has been considerably bettered as a result of the electricity program of recent years. In 1933 Great Britain ranked third in power production for the first time. Ever since 1927 Great Britain has been making up some part of the deficiency

in electrical consumption which weakened her relative position in world electrical development; and over the first five years, 1927-31, the expansion in the output of electricity from public supply undertakings has been 34.9 per cent in Great Britain compared with 16.3 in the United States of America, 14.6 in Germany, 12.6 in Canada, and 21 per cent in Italy.¹ Great Britain's relative position has improved even more in the past two years, and now that the grid has commenced operation even more gratifying progress should be made.

The benefits of a national plan may be observed in the improvement of the British electrical manufacturing industry in recent years. Although the grid was not erected for the purpose of electrical experimentation, a prominent leader of the electrical industry stated recently, "it has provided a good example of that cooperation which is essential to national economic planning of any kind." He described as follows the tangible gains to the British electrical industry as a whole:

"The competitive strength of the manufacturing industry must have been considerably increased largely through the knowledge gained in fine modifications of plant and equipment to ensure greater reliability of service and more exact operation. In the early years a great part of this experience had to be derived from export contracts and it is notorious that defects in plant shipped overseas are much more widely advertised and used by competitors than defects in plant supplied for the home market. In many ways, therefore, the grid has proved a valuable center of development and experiment, much greater than the most spectacular research organizations could create in the United States or elsewhere."

The national electricity plan has proved a constructive way of dealing with unemployment. An official statement issued in 1933 revealed that including the electrical engineering, cable-making, structural engineering, building and contracting, iron and steel, coal-mining, cement and pottery industries, the total number of workers employed

¹ (1931) *Fourth Annual Report of the C.E.B.*, 3.

directly or indirectly on the construction of the grid and on standardization of frequency, as far as it had progressed, was between 100,000 and 120,000 for one year. In these estimates no allowance was made for employment in industries feeding into those main supplying industries or of the labor used in railway and road transport.

Cheap electricity is a method of speeding up the "back to the farm" movement, a social transition which is likely to take place in many countries during the course of the next few years. The grid renders it possible for the supply undertaking to open up areas with a low density of population because it is in a position to supply electricity in bulk at a price which, joined to the highly simplified distribution networks designed now for rural electrification purposes, can justify the extension of supplies to small villages, townships, farms, hamlets, and even country houses.

Cheap rural power has already encouraged agriculture, local artisanship, and small manufactures in the rural regions of several European countries; it can do the same thing in Great Britain. Examples of what can be done may be seen in the rural industrial centers near London, such as Welwyn Garden City.

In conclusion, the relation of electrical progress to the national economy of Great Britain cannot be better expressed than in the words of Sir John Snell, Chairman of the Electricity Commission, who said in his presidential address to the British Association,

"As Great Britain is essentially dependent on imported foodstuffs to a large degree and on other raw materials for the feeding of her essential industries, it is clear that the most efficient and economic systems of industrial power and transport are necessary parts of the future equipment of the country. If we add to this work of increased power application a notable improvement in the conditions of rural life, we shall help to improve the physical conditions of our people in both urban and rural districts, in addition to providing those engaged in industrial pursuits with better means of competing and holding their own with manufacturers in other countries. In this, electricity must necessarily play a great part."

CONCLUSION

The national grid has commenced operation a year in advance of original expectations. During the five years of its life the C.E.B. has been characterized by initiative and foresight. Now that construction work on the grid has been completed the functions of the Board will be to perfect interconnections, to build additional secondary transmission lines if and as the need arises, to carry through the standardization of frequency schemes, and to act as the national manufacturer of bulk power—the principal purpose for which the Board was created.

It is too soon to form a final judgment concerning the merits and defects of the type of public utility development represented by the C.E.B. The organization and functioning of the Board have not settled down into any hard and fast lines—no doubt to its advantage in many respects. Aggressive action and freedom from burdensome restrictions—the chief virtues which are claimed for the public utility trust—have undoubtedly characterized the work of the Board so far. On the other hand, it may be found that a public utility organization of this sort is less able to protect itself from the demands and pressures of various and sundry interest groups than a public service which is more closely integrated with the machinery of the central government.

The powers and activities of the C.E.B. are subject to more regulation and control by agencies representing the larger interests of the public than many Members of Parliament seemed to think in 1926, or than most people seem to think today. The threads of control running to the Electricity Commission, the Minister of Transport, and the Treasury are not so tightly drawn that they interfere with the initiative and the detailed administration of the Board, but they guarantee the public's representatives a controlling voice in questions relating to major policies such as finance, equal treatment of regional sections, electricity tariffs, and

the amenities of the countryside. However, the responsibility for the actions of the Board itself is so diffused (being divided among eight members), and the agencies of public control are so many and complex that direct responsibility through Parliament to the people is impossible. Press criticism of the Board's policies and practices, except in isolated and unimportant instances, is now virtually out of the question. This situation may be compared with the steady and effective criticism directed through Parliament at the Post Office. Opinions differ widely as to the effect of democratic criticism on monopolies entrusted with important powers and privileges, but it may be suggested that the virtual immunity of the C.E.B. from criticism has gone as far in the opposite direction as critics of Post Office administration complain that it has gone in the direction of Parliamentary interference.

The planning of generation and transmission must be regarded as only the first step in national reform if the real industrial and social benefits of power potentialities are to be obtained. The questions of high electricity prices and of the chaos of distribution require a great deal of study, followed by effective action from Parliament. The Electricity Commission and the C.E.B. are already keenly aware of the direct bearing of effective distribution on the economic use of the national grid. The solution of the distribution problem raises more difficult and important questions than have been dealt with in the planning of generation and transmission. The existing method of regulating electricity prices leaves a great deal to be desired. If cheap power, available equally in all parts of the country, is to revitalize British industry, electrify agriculture, redistribute the population over the countryside, eradicate the smoke curse, and make the latest inventions of science available to all classes of the population, national planning of electricity must be applied to the problem of distribution as well.