1919.

VICTORIA.

REPORT

BY

C. H. MERZ, Esq.,

ON THE

SCHEME FOR THE GENERATION OF ELECTRICITY,

SUBMITTED BY THE

ELECTRICITY COMMISSIONERS,

AND

COMMENTS THEREON BY THE ELECTRICITY COMMISSIONERS.

PRESENTED TO BOTH HOUSES OF PARLIAMENT PURSUANT TO THE PROVISIONS OF ACT No. 2996.

By Authority:
ALBERT J. MULLETT, GOVERNMENT PRINTER, MELBOURNE.

No. 29.—19062.—Price 6d.

MERZ AND MCLELLAN,
32 Victoria-street,
Westminster, London, S.W.,
12th November, 1919.

The Hon. Arthur Robinson, M.L.C.,
" Collins House,"
Collins-street,
Melbourne.

STATE OF VICTORIA—ELECTRIC POWER SUPPLY.

SIR,

I have received from the Electricity Commissioners a copy of the Report prepared in connexion with the Morwell Power Scheme, and, in accordance with the instructions received from you, on behalf of the Government of Victoria, I have examined same, and beg to report generally upon it for the information of the Government, in accordance with the arrangement made with me and covered by your letter of the 3rd November, and *seq.*

The scheme submitted to me is of a preliminary nature, and is not based upon detailed technical plans or tenders from manufacturers for the plant proposed. It has not been possible, the Report submitted to me states, to do more than this in the time available.

In the Report which I was asked by a previous Government to prepare in 1907 (presented in 1908, and entitled " The Production and Use of Electric Power "—*see* page 34, paragraph 3) I recommended—" That as the demand (for power) for purposes other than the railways increases and the ' load factor ' improves it would pay, assuming that a reliable supply of brown coal is available at a sufficiently low price, to put down a station in the Latrobe Valley (*i.e.*), Morwell and to transmit to Melbourne that portion of the load which is required continuously."

I understand from the Electricity Commissioners (and the Report submitted to me) that they estimate that brown coal can be delivered to the proposed power station for 2s. 3d. per ton. This, having in view the present price of black coal, may be considered a " sufficiently low price."

I further understand from the Report that the Commissioners are satisfied with regard to the water supply for condensing purposes at Morwell, and the suitability of the proposed site for the power station as regards foundations, &c.

On these assumptions, and as the demand for electric power undoubtedly now exists and is growing, the proposal to generate electric power at Morwell ought, in my opinion, certainly to be proceeded with.

I have also considered the general lines of the engineering scheme proposed, and have the following observations and recommendations to make with regard thereto :—

(1) Present-day fluctuations in the cost of labour and material render all prices tentative, but, in my opinion, the estimate for the cost of the power station (including, as it does, the step-up transformers and high-tension switchgear) is insufficient, and for the plant proposed must be increased by at least 25 per cent.

(2) Having in view the importance of Melbourne and district, both as a city and from a manufacturing point of view, the success of the scheme depends very largely upon the reliability of the supply of electric power. I therefore recommend :—

(*a*) That the transmission system should be in duplicate on separate lines of steel towers, each line of steel towers being taken by a different route.

(*b*) That the capacity of the generating sets to be installed in the power station at Morwell should be about 18,000 kilowatts each (instead of 25,000 kilowatts), and that at least four should be installed to commence with. This will be a more reliable subdivision of the plant ; and, having in view the speed of revolution for which it will be possible to build such sets, they will be more economical and more suitable for transport, the importance of which is rightly called attention to in the Report.

(3) Further, it must be remembered, in discussing the question of how much generating plant should be erected at Morwell and how much (if any) further plant should be erected near Melbourne, that it is not entirely a question of the cost of brown coal *versus* black coal, but that the question may also be influenced largely by the relative cost of brown coal delivered at power stations at Morwell and Melbourne respectively.

This was gone into in my 1908 Report (page 25), and it was shown that, "assuming that the total load has a load factor considerably less than 100 per cent.—which will always be the case in practice (Mr. Harper has estimated it at 42 per cent.)—it will pay to consider it as divided into two parts, one of a high load factor and one of a much lower load factor, and to have a centrally situated plant for dealing with the latter."

No special consideration seems to have been given, in the Report submitted to me, to this principle, nor does it appear that advantage is proposed to be taken of the suitability, both of the site and plant at the Newport Power Station for dealing with the "lower load factor" portions of the load.

(4) The Act under which the Electricity Commissioners were appointed (clause 11) calls for a report as to the steps to be taken to secure the ultimate co-ordination or unification of all States or other electrical undertakings in Victoria, and, in my opinion, the cheapest possible supply of electric power will only be secured both for manufacturing purposes and for the railways if such co-ordination takes place, and the requirements of the State as a whole for electric power be considered together. All of which points to the desirability of taking into consideration the great asset that the State has in the Newport Power Station, constructed as it was at a time when prices of plant were very much lower, and the suitability of that plant for dealing with the lower load factor portion of the load, even if this necessitates some extension thereof.

(5) If this be done and the fundamental principles referred to in my previous Reports are taken full advantage of, then I consider that the prices at which power can be profitably sold by the State in Melbourne will be within those set out in the Report sent me by the Electricity Commissioners; but, if these principles are not taken advantage of, then I do not consider that, at to-day's cost of apparatus, the prices at which power can be profitably supplied to Melbourne will be as low as estimated, if the scheme is designed with such regard to continuity of supply and reliability as, in my opinion, is required.

(6) I approve of the proposal to use brown coal direct for steam raising in the initial installation, leaving over the question of abstracting the by-products for the time being.

(7) I approve of the adoption of a periodicity of 50 complete cycles per second for the Morwell scheme and for the State as a whole, reserving the 25 cycle system for railway and other special purposes in the central area. Frequency changers will be required for tying the two systems together, but these will, to a large extent—if not entirely—take the place of the synchronous condensers referred to in the Report.

(8) The voltages for transmission and distribution require most careful consideration before final adoption, because whatever is decided for this scheme should be standardized for the State as a whole, and a correct decision thereon will have a most important bearing upon future capital expenditure throughout the State, and upon the feasibility of extending the Electric Power System into the country districts.

I do not enter further into technical questions, though a correct decision in regard thereto, when the plans and specifications come to be prepared, is, of course, essential to the success of the scheme. These, as already stated, have not yet been prepared.

As, during the last few years, I have been largely concerned with considering the general question of electric power supply for the British Government, it may be worth while, in conclusion, briefly stating my general views of the situation:—

In my Report of 1908 I referred, at considerable length, to the importance to the State of Victoria of a reliable and cheap supply of electric power. This is now generally admitted, and the increasing cost of commodities throughout the world has placed it in the forefront of national

problems in all countries. The experience of the war has proved, conclusively, the advantages of the electric motor for all manufacturing purposes, and it is now recognised that it is only by the use of more power in industry that the average output per head, and, as a consequence, the earning capacity of the individual, can be increased.

It is, therefore, in my opinion, most important that this whole question of electric power supply should be looked at from the point of view of the State as a whole. The Report submitted to me briefly refers to the extension of the system to outlying districts, and I would urge the importance of a cheap supply of power, not only for Melbourne and district, but throughout the State for agricultural as well as for manufacturing purposes.

If the scheme be properly engineered and advantage taken of the possibility of using transmission lines not only for power and light, but also for railway purposes, a cheap supply of electric power can be rapidly brought within reach of a much greater proportion of the State of Victoria than is apparently at present realized.

In my 1908 Report I also showed how, just as there was a proper time for proceeding with the Morwell scheme, so, in my opinion, at a later date the water power resources of the State ought to be developed. The increasing cost of fuel and the time that has elapsed since 1908, makes this matter really urgent. This is no reason for delaying the Morwell scheme, but rather the reverse as the works for any water power scheme take considerably longer to carry out than for a coal fired power station, and it is clear that, unless the Morwell scheme can be proceeded with at once, some other steps will have to be taken to deal with the demand two or three years hence. Specifications for the plant have not yet been prepared, and, in my opinion, it will take at least two years from the placing of contracts before Melbourne will obtain a supply from the Morwell Power Station.

The principles upon which electric power supply should be dealt with were thus fully and clearly set out in 1908. In 1912 they were confirmed in a further report and explained fully to Parliament, which then determined that the State should itself deal with the whole question of the supply of electric power. All the investigations and reports since have but re-confirmed the correctness of the principles originally laid down.

I concur, therefore, in what I take it is the recommendation of the Electricity Commissioners, that it is incumbent upon your Government to come to an immediate decision in the matter of the further supply of electric power, not only for Melbourne, but for the State generally, and that, unless the State is either to suffer serious loss or commit either itself or the existing suppliers of electricity to wasteful expenditure, it is not possible to postpone a decision on this question until the next session of Parliament.

I am, Sir,

Yours faithfully,

(Signed) CHARLES H. MERZ.

2nd December, 1919.

MORWELL POWER SCHEME.

SIR,

In reply to your letter of 27th November asking for the Commissioners' comments on the Report received from Mr. C. H. Merz on the scheme for the generation of electricity, we desire at the outset to state that we are glad to find Mr. Merz is in agreement with the main recommendations in our Report. As to the several instances in which there appears to be a difference of opinion, we desire to make the following remarks thereon :—

Mr. Merz is of the opinion that the estimate for the cost of the power house, viz., £1,442,927, is insufficient, and for the plant proposed must be increased by at least 25 per cent.

Owing to the limited time available, the estimates of capital expenditure submitted with our Report were prepared without formal tenders having been received. Tenders were not necessary at this stage—not until the comments of the expert (Mr. C. H. Merz) on the general lines of the scheme had been received,

The estimates covering the most important items of the plant required, amounting to nearly 70 per cent. of the total expenditure (£1,442,927) on the power house are based upon information supplied by leading manufacturing firms. The balance of the expenditure will consist mainly of work to be carried out locally, such as the construction of buildings, coal bunkers, water channels, and erection of plant, the greater part of which work will not be undertaken for at least eighteen months, at which time the cost may prove to be less than that estimated, in view of the possible reduction in cost of steel. Any variation from the estimated cost of such works is not likely to appreciably affect the total expenditure as estimated.

Prices of machinery are unstable and have been difficult to procure, particularly in the case of British electrical firms. We were, however, furnished with complete information as to likely prices for the whole of the electrical section of the plant, including the step-up transformers and high-tension switchgear, by an electrical manufacturing company having exceptional experience in the manufacture of such plant in the United States.

Bearing in mind the simple lay-out of the proposed power house at Morwell, including the outdoor arrangement of the step-up transformers and switchgear, we are of the opinion that the amount provided in the estimate for the power house should suffice, provided that prices in the near future do not increase appreciably.

Transmission Line.—Mr. Merz is of the opinion that the transmission system should be in duplicate, on separate lines of steel towers, each line of steel towers being taken by a different route.

It was stated in our Report that for the first stage of the scheme it was proposed to erect only one line of towers, with two sets of conductors, each capable of conveying a normal load of 25,000 kilowatts.

It was also indicated that as soon as the demand exceeded 50,000 kilowatts it would be necessary to duplicate the line. The erection of the second line, therefore, depends upon the growth of the demand. The single transmission line is being so designed that in the event of a failure of one set of conductors, the other, by means of its overload capacity, will be capable of transmitting about 40,000 kilowatts which, in addition to the 10,000 kilowatts to be supplied by Newport, is the estimated demand to be met in the metropolitan area in 1923.

Further, the postponement of the erection of the duplicate line, for even a year, makes it possible that such line will be erected at less cost, owing to reductions in the market price of metals. In our opinion, there is not sufficient need to proceed with the erection of two transmission lines in the first stage of the scheme.

As to the suggestion that each line should proceed by a different route, it will be quite sufficient to provide a reasonable distance between the two lines, which was intended. The second line would take a different route to Melbourne from a point such as Dandenong, and proceed round the north of Melbourne to the vicinity of Footscray and Williamstown. Further reference to the transmission line is made later in this communication.

Capacity of Generating Set.—Mr. Merz is of the opinion that the capacity of the generating sets to be installed in the power station at Morwell should be about 18,000 kilowatts each (instead of 25,000 kilowatts), and that at least four should be installed to commence with.

It has to be pointed out that generator sets of 25,000 kilowatts capacity were taken only for the purpose of an estimate of cost. When calling for tenders it was fully intended to draft the specification in such a manner that manufacturers could offer sets of various capacities and speeds so as to enable the Commissioners to obtain the most economical and suitable arrangement of plant.

Co-ordination of Operations at Newport and Morwell.—Mr. Merz in his Report draws special attention to the importance of co-ordinating the operations at Newport and any other State power house that may be erected in the future.

In our Report (*see* section 14), we have already pointed out that considerable advantages will accrue to the State scheme as a whole if Newport and Morwell power houses should be linked up, amongst which is the reduced reserve plant required to be held in readiness for emergencies, and greater security against cessation of supply through serious breakdown. With these two power houses linked up the reserve plant should be installed at Newport, where with the help of frequency changers it will not only meet the emergency demands of either power house, but act as security in the event of a failure of the transmission line. Such an arrangement would render it still further unnecessary to proceed at once with the erection of the second transmission line.

To effectively carry out this proposal and to obtain the proper co-ordination of operations at the two power houses, it is necessary, as pointed out in our Report, that the control of Newport and Morwell be vested in a single authority. From Mr. Merz's comments on this aspect of the proposed State supply, it would appear that he is in full agreement with us on this matter.

I have the honour to be,

Sir,

Your obedient servant,

THOMAS R. LYLE,

Chairman,

for Electricity Commissioners.

The Hon. Arthur Robinson, M.L.C.,
Minister for Public Works,
Melbourne.

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