

obtainable from the source, so as to permit of the overhaul and repair of machinery. The usual method is to install an extra unit of water plant in the power-house. In the present instance I propose that the stand-by unit should be a complete steam set. The advantage of a steam stand-by set in this scheme is that not only does it serve the purpose of a spare unit, but it also provides means of tiding over short periods of exceptional or abnormal low water, thus enabling the available water to be used to a larger extent. The additional cost of the steam unit over a water-power unit is not great, and the cost of running on infrequent occasions would be a negligible proportion of the total operating cost, whilst the additional security and value conferred on the water-power plant is out of all proportion to the added expense.

I would propose further, instead of installing the steam unit at the power-house, to take advantage of the fact that Wellington City has already a steam plant installed which is of the capacity required for the purpose aforesaid, and as they will deem it advisable and prudent to maintain this in running condition to provide against temporary interruptions of the supply, which are inevitable on every transmission system, there should be no difficulty about coming to terms for the use of this plant for relieving the load on the water-power plant in case of necessity. Some modification of the existing Wellington plant may be necessary to fit in with this scheme, but this is a detail about which there should be no difficulty in a matter which is to the advantage of both parties.

The cost of providing headworks, power-station, and plant for 25,000 horse-power would be at normal prices £420,000, which is under the limit of £20 per horse-power specified above. This illustrates the advantage of concentrating the power-supply for a considerable district in one source. If, for instance, we sought to provide for the needs of Wellington City and immediate neighbourhood only from this source the cost of hydraulic works for the power required would be excessive, whereas when developed for the full capacity and for the benefit of a larger area and population it becomes a sound commercial proposition.

As regards the area to be supplied, there is an economic limit to the area over which a given amount of power can be distributed, and one of the obstacles to a satisfactory scheme of power-supply in New Zealand at present is the small amount of power required per square mile of area supplied. Having regard to this principle, and stretching it to the limit, we should be working on economical lines in serving the following districts from this source: the whole of the Wellington Province as far north as Taihape and Wanganui, and the southern portion of Hawke's Bay. I would propose, in the first place, to run trunk lines to Wellington, Palmerston North, Wanganui, and Masterton as chief centres, and from these centres, as well as from intermediate points on the trunk line, to provide the necessary distribution-lines and substations to serve the surrounding districts.

The cost of providing the trunk lines, distribution-lines, substations, and other services to give a supply in bulk to local distributing authorities and to large power-users throughout this area would be £580,000, making a total of £1,000,000, which expenditure is at the rate of £40 per horse-power.

The capital charges on this expenditure at $7\frac{1}{2}$ per cent., to include interest, depreciation, and sinking fund, work out at £3 per horse-power per annum; the annual cost of maintenance and operation would amount to £25,000 per annum, or the equivalent of £1 per horse-power per annum. Both charges require a return of £4 on the average per horse-power per annum in order to provide for all charges with a reasonable provision for depreciation. We know by experience in Christchurch that we can secure this revenue without difficulty, even where economical fuel plants are already installed.

The development of the Mangahao would help Wellington out of a difficulty, and from the Government's point of view Wellington alone would provide an immediate load on the station of about one-third its capacity, and would enable the large area outlined above to be supplied at the same time both economically and advantageously, and the prospective markets in these districts, combined with the natural increase in Wellington, should absorb the balance of the power available in a very short time.

Complete surveys have been made of the Mangahao scheme and plans and estimates prepared. A survey of the transmission-line between Shannon and Wellington is proceeding and will shortly be completed, and the position of the substation to serve Wellington and the Hutt Valley has been located.

Summarizing the foregoing, the scheme of development recommended is that three sources of water-power should be developed in the first place—*i.e.*, Lake Waikaremoana for the Hawke's Bay District; Arapuni Gorge, or some other to be selected, for the Auckland District; and the Mangahao River for the Wellington District. These three sources in a natural course of extension will get linked up together, thereby enhancing the value of each source by adding to the security of supply and enabling a continuous output to be maintained throughout the whole of the Island.

The position in regard to the investigation now is that detailed surveys have been made of the Mangahao River, of Aratiatia Rapids on the Waikato, of the Arapuni Gorge, and the Waikato, Pokaiwhenua, and Waipa Rivers near Horahora, and of Lake Waikaremoana. Further investigations and calculations utilizing existing survey information have been made of the Hutt River, Huka Falls, Kaituna River, and other schemes. Observations of flow made during the recent sequence of dry seasons have necessitated a modification of previous estimates of the power obtainable from the various sources.

A survey staff is at present engaged on the transmission-line between Shannon and Wellington, and will shortly be transferred to the Auckland District in order to survey a route for the trunk line between the Waikato and Auckland.