

A limited subdivision of generating-capacity with interconnected transmission is also preferable to the single generating-station, because it gives greater security of supply by ensuring that no industry is wholly dependent on one power-station or transmission from one direction for its energy, but may get its supply from a general system which has more than one source of supply. This is particularly desirable in the case of railway electrification and metallurgical and chemical processes involving large amounts of power, where the cost and disorganization caused by a stoppage of supply even for a short time may be so considerable.

The country has also been divided up into districts, and the load centre of each considered separately with relation to possible sources of power, and the scheme of supply shown on the drawing E 116 is submitted as best suiting all the circumstances.

ESTIMATE OF AMOUNT OF POWER TO BE PROVIDED.

In considering the design of a power-supply system it is first of all necessary to determine the total amount of power that will be required. This, of course, bears some relation to the population that will be served when the power-supply is available, and can be estimated in that way. The Lake Coleridge plant, with its present capacity of 8,000 h.p., is supplying an area with a population of 100,000—or, roughly, 0·083 h.p. per unit of population. The demand for power is growing rapidly, and if the plant were available to supply it there is no doubt but the horse-power per unit of population would very considerably increase. Owing to the impossibility of securing extra plant, the supply of power for ordinary cooking and heating has had to be severely curtailed, but there is no doubt that the demand for power for these purposes will increase enormously as soon as we are in a position to supply and its value becomes more generally known. During the last financial year applications for 3,500 h.p. for smelting purposes were refused on account of the insufficiency of the plant at Lake Coleridge. Some of the best-supplied of the smaller towns in the North Island, such as Tauranga, New Plymouth, Hawera, Te Aroha, have from 0·14 to 0·09 h.p. per inhabitant of area served. The three latter are working under severe restriction, due to the limitation as regards the source of supply and high prices, and the figures given are in consequence very much less than would result from an unrestricted supply at cheaper prices. The power supplied by the Dunedin Corporation from Waipori is equivalent to about 0·125 h.p. per head of the population served, but the growth of the load has been checked by the impossibility of getting any more power from the present source. There is evidently a demand for more power in Dunedin, as this Department has received application from a Dunedin firm for 1,000 h.p. at Christchurch.

In other countries the use of electric power *per capita* is considerably greater. In a table appearing in the *Electrical World* of the 11th May, 1918, on the use of water-power for electric-power generation the following figures are given: Norway, 0·468 per unit of population; Canada, 0·216 per unit of population; United States, 0·071 per unit of population. These refer to electricity generated by water-power alone; but, particularly in the United States, there is considerably more generated by steam than by water-power. The proportion has been stated as four to one in favour of steam, so that the consumption per head in the United States would be nearer 0·35. In Canada also the consumption per unit of population would be increased if the steam-generating plants were included.

In California, which is one of the States using water-power to a large extent, the Pacific Gas and Electric Company has a plant capacity of 270,643 h.p., equivalent to 0·235 h.p. per inhabitant in the area served by it—about 35,000 square miles. When we consider that there are seven other companies with an additional aggregate plant of 266,500 h.p. operating in almost the same area, and all interconnected, the peak load of the combined systems is about 0·46 h.p. *per capita*.

The Ontario Power Commission supplies power to an area of about 51,000 square miles in Canada, and, although as yet large portions of this area are not reticulated, they have a peak load on their system of 157,048 h.p., equivalent to about 0·136 h.p. per inhabitant. These figures are the more remarkable when we consider that the average price charged in California and Ontario is more than is the case in the Government undertaking at Lake Coleridge.

The statistics kept by the Inspection of Machinery Department show that, excluding the railways, there are 68,716 h.p. in boilers and 78,513 h.p. in machinery other than that driven by steam in use in the North Island for power purposes. Careful records have been taken over a considerable portion of the Wellington district, and from records of the fuel-consumption, &c., a relation between machinery rating and continuous power-output has been ascertained. Applying this relation to the recorded power above indicates that if the existing machinery were connected into a general system it could all be supplied from a common source of 68,100 h.p. capacity, after allowing for losses in transmission, transformation, and distribution.

The scheme outlined below for the supply of the North Island, 44,000 square miles in area, provides for a maximum demand of 0·2 h.p. per inhabitant on the present population. During the period of construction, however, the population will in all probability increase by at least 2½ per cent. per annum, or 25 per cent. in ten years, which would be about the time necessary to completely carry out the proposals suggested. The electrification of the railways as the present lines become taxed to the limit of steam locomotives, and the development of special metallurgical and chemical industries when cheap power is generally available, may increase this load as the scheme develops. The development in Tasmania is very interesting in showing the way the provision of power brings its load. The Great Lake scheme there was started with a plant capacity of 10,000 h.p., and commenced supply in 1916, but by the end of the same year the Tasmanian Government had entered into contracts for the supply of 42,000 h.p., and had under consideration other contracts for a further 50,000 h.p., nearly all for special metallurgical processes which were made possible by the creation of this cheap power-supply. The scheme of generation and transmission herein described does not