

raising the pressure at the power-house and stepping down again at the substation would be 4 per cent. additional at full load, making a total loss of 17 per cent. at a total load of 13,200-horse power; at a total load of 10,000-horse power the total loss would be 15 per cent.; and at 6,000-horse power 13 per cent. In working out fuller details a lighter line may prove sufficient, but the above is a safe estimate. A telephone circuit would be required following each transmission-line, with small exchange-boards in the power-house and substations.

The maintenance of the transmission will involve patrolling its whole length at frequent intervals; and for this purpose two linesmen's cottages would be required along each route, dividing it into suitable lengths for regular patrol service. Telephone instruments in each house connected with the telephone circuit would enable the linemen to be concentrated rapidly in the case of an emergency.

The two transmission-lines should terminate in independent substations, one towards the northern and the other on the southern side of the city, in order to give a good lay-out of the distributing-mains. These two substations would be cross-connected by a cable, again providing for continuity of service in case it is necessary to cut out either of the transmission-lines at any time. The main transmission-lines should not be brought farther into the city than is necessary to obtain good centres for distribution, and on this account the southern substation would be situated in Addington, near the Railway Workshops, and the northern one near the Exhibition Grounds. These substations would be provided with lightning-arresters, step-down transformers reducing the pressure from 40,000 volts to 6,600 for distribution in bulk, and switchboards controlling the various circuits. From the Addington substation distributors would be run to the Railway Workshops, the tramway power-house, the Sydenham, Cashmere Hills, and Heathcote pumping-stations, the factories and mills in Woolston, Addington, Islington, and Hornby, the Halswell and Redcliffs quarries, and the Lyttelton Harbour. From the Exhibition substation distributors would be run to the City Council Electric-power Station, the Drainage Board pumping-station, the Belfast, Kaiapoi, and Rangiora mills and factories. Provision would be made in the distributors from the substations to supply each suburb or section of the city not already supplied by the City Council mains, and each town, village, group of houses, mill, or factory within fifteen miles of the substations that offers sufficient inducement.

In addition to the two main substations, a number of transformer and distributing huts would be required for supplying current to smaller centres in which there is no authority to take the power in bulk, and in which the Government might have to undertake the retail distribution. The exact positions of these would be fixed as the demand arose, but I have allowed for twenty-five, with an average capacity of 100 kilowatts. The following would be the approximate length of main distributors :—

	Miles.
Christchurch to Rangiora, <i>via</i> Belfast and Kaiapoi .. .. .	20
Addington to Lyttelton .. .. .	8
Branches from main lines to Halswell, Islington, Hornby, and Lincoln .. .. .	15
Branches from substations to various distributing centres .. .. .	25
Total .. .. .	68

In addition, low-tension 220-volt distributors would be necessary for retail distribution in smaller centres, requiring about forty miles circuit with meters and services.

I attach complete estimates for these works, amounting to £291,500, exclusive of the purchase of any land or way-leaves that may be necessary, the construction of main roads, interest during construction, and preliminary departmental expenses. For four years hence—that is, for the first two years of operation—the load would be considerably less than the maximum of 13,300-horse power provided above, and one of the generating units might be omitted in the meanwhile, reducing the power-station capacity to 10,000-horse power and reducing the outlay by £17,000. Similarly, one of the two transmission-lines would have ample capacity for the first few years of operation, and the £34,000 on the above outlay might thus be held over in the meanwhile. If it were decided at first to supply current only from the main distributors or the transformer-huts, leaving the local bodies or groups of consumers to make their own arrangements for distribution, a reduction of £25,000 would be effected in the capital outlay. The costs of the full development of 10,000 kilowatts or 13,300-horse power thus work out as follows :—

	Total.	Per Kilowatt.	Per Horse-power.
	£	£	£
Headworks .. .. .	60,000	6	4.5
Power-house .. .. .	110,600	11.1	8.3
Transmission-line .. .. .	44,300	4.4	3.4
Substations .. .. .	18,800	1.9	1.4
High-tension distribution .. .. .	29,200	2.9	2.2
Low-tension distribution .. .. .	28,600	2.9	2.1
Total .. .. .	£291,500	£29.2	£21.9

Compared with the costs of other power plants of similar output, the cost of headworks is low, owing to the exceptionally favourable circumstances of Lake Coleridge for partial development. The other items show a fair margin above the cost of similar works in the older countries, which would more than cover the necessary allowance for higher freight and wages.