Water Power and Electricity.

Electric Water Power of the Dominion.

Electro-chemical Industries.

(From the report of Mr. Birks.)

The introduction of cheap electric power will open up possibilities in the direction of electro-chemical industries which can only be realised by considering what has been done in other countries under similar circumstances. For instance, in Norway and Sweden nearly 1,000,000 electric horse-power has been installed, the greater part of which is used for the manufacture of nitrate fertilizers, calcium-carbide, and for iron-smelting. As this industry is not more than a few years old, and as the circumstances for its development are generally as favourable in New Zealand as elsewhere, it is impossible to foretell what its future may be here; but every water-power development must be made with the possibility of its full power-capacity being required in the early future for such industries. Small electro-chemical factories will be quite worth establishing at once in connection with each power scheme, with the object of utilizing the power at periods of light load, and thus raising the load-factor up to 80 or 90 per cent. This power could, of course, be used without increasing the operating costs at all, and might therefore be debited at a very low figure indeed, quite apart from the cost of operation—say, £2 per horse-power per annum at the power-station, and £4 per horse-power per annum at the seacoast. These prices could, in the meanwhile, only be quoted for a comparatively small plant of, say, 3,000 to 5,000 horse-power capacity, on condition the current were cut off for four to eight hours per day, when the more remunerative load is at its maximum.

Apart from the establishment of comparatively small electro-chemical factories with the object of raising the load-factor of a general power-station, it is only a matter of a few years before electro-chemical works supplied from special hydro-electric power-stations will be remunerative on a large scale in New Zealand. The main industries of this nature which have been developed hitherto are the manufacture of nitrate fertilizers (including nitrolim or calcium-cyanamide), calcium-carbide (for the production of acetylene gas), carborundum (to take the place of emery), and also for aluminium and iron smelting.

In his famous address before the British Association for the Advancement of Science in 1898, Sir William Crookes calculated how long the existing supplies of nitrates in the soil would last in the wheat-producing countries; and the results were very striking, emphasizing the necessity for systematic fertilization on an extensive scale if we are to continue our present dietary. The most important element to be supplied is combined nitrogen in the form of nitrates; and, apart from the quantities contained in decaying vegetable matter, coal-gas by-products, and mineral nitrate-beds, the main source of nitrogen in the future will be from the atmosphere, and the only means of fixation to render it serviceable for agricultural purposes is by means of electric power. Already enormous installations have been erected, particularly in Norway, for this purpose. The Anilin Soda Company, for instance, will shortly have 400,000 horse-power in operation in Scandinavia for this purpose, and will be manufacturing 100,000 tons of nitrates per annum. In addition to the demand without our own Dominion, which is not yet very large, it will be possible to open up very large markets for these fertilisers in Australia.

The manufacture of calcium-carbide will also form an important outlet for electric power. The imports of this material into New Zealand, and value, for the past three years have been as follows:—

Year.	Quantity Tons.	Value. £
1907	898	14,826
1908	932	14,966
1909	1,667	22,603

And the demand will no doubt grow more rapidly in the future. The market in Australia will probably be four or five times that in New Zealand. Being classed as a dangerous material by the shipping companies, the freight from Europe is very heavy, and this will give a natural protection which, with the cheap water-power available, should make the industry very remunerative in the Dominion. Such industries have resulted in other lands in building up whole cities, as at Niagara (U.S.A.), Rheinfelden (Switzerland), Nottoden and Odda (Norway). Probably the Odda works, established by an English company—the Albion United Carbide factory—at Sondre Fiord, in Norway, is one of the best examples of the growth of such a city. The spot has no attractions whatever as a manufacturing centre—in fact, it is inaccessible, distant from the markets, hemmed in by mountains, the surface is sterile, and a couple of years ago the valley was practically uninhabited. It has now enormous carbide-factories and nitrate-factories, around which a large town, almost a city, has already grown up, owing entirely to the existence of some 80,000 horse-power in the immediate neighbourhood. Of this, 23,000 horse-power has been utilized and is now used, producing 32,000 tons of carbide and 12,500 tons of nitrate fertilizer per annum.

Probably of still greater importance to New Zealand is the possibility of electric smelting of iron and steel, as we are fortunate in having iron-deposits and the necessary limestone flux within easy distance of extensive water-power. The electric iron-smelting furnace at Tumfos, Christiania, is now producing iron at £3 per ton to compare with the best Swedish charcoal iron, which costs £5 per ton, and their plant is being largely increased. At Trolhatten and Donnarfvet, steel is being smelted at a cost of under £5 per ton, to compare in grade with steel previously costing £10 per ton, and the British Consul at Stockholm reports that "the economic problem of dealing with iron-ore by the electric furnace to supersede the blast furnace is definitely solved." In Savoy 10,000 tons of high-class special steels are now produced by means of electric furnace per annum, worth £360,000, and the business is rapidly growing.

These developments indicate possibilities far beyond anything dealt with in this report, but which must be kept carefully in view in the immediate development of our water powers.

In considering the whole question, it should be noted that each average horse-power per annum of steam-power consumes about 10 tons of coal. This, if sold for shipping or other purposes outside the Dominion, would bring in a revenue of from £3 to £4 per annum, which is at present lost, and, while the same power is available from our water-powers, is wasted as far as any permanent increase in the wealth of the Dominion is concerned.

Professor Stillwell, President of the American Institute of Electrical Engineers, in discussing hydro-electric plants, states that "true conservation demands the most prompt possible utilisation of our water-powers consistent with a due regard for the rights of the people as a whole in this property, which belongs to them, and should be safeguarded in their interests." In the same discussion Mr. Deane points out that "every undeveloped water-power represents a constant source of unnecessary fuel-consumption. The mild language used in stating the importance of the speedy development of our water-power as a means of conserving our national resources is entirely inadequate. Nitrogen is the most important element in maintaining the fertility of the soil, and we largely depend on the nitrogen in our coal for our present supply from the gas-works. The nitrogen of the coal burned in steam-boilers is entirely wasted; and, in addition, the spare water-power may be used for the manufacture of nitrogenous fertilisers."

The Hutt Scheme.

(Report of Mr. Birks.)

The headworks for a final development of 17,000 horse-power, including dam, conduit, tail-race, buildings, and minor engineering-works, are estimated by the late Mr. Hay at £286,000. In view of the demand immediately in sight—a maximum of 9150 kilowatts (12,200 horse-power), with an average load of 3416 kilowatts (4600 horse-power)—the power available in the Hutt scheme would be ample for many years to come. The average flow necessary to supply this load, allowing for all losses, is only 236 cubic feet per second. To deal with this demand I would recommend the installation of four generating-sets, each of 2500 kilowatts capacity, giving a total power-house capacity of 13,300 horse-power. The details of the power-house plant would be very similar to those proposed for the Lake Coleridge