USES FOR POWER FROM IRRIGATION DAMS.*

THE question may be asked, What is the best use to make of electric power which is developed by water for irrigation? Irrigation dams are usuolly situated at considerable distances from cities and other centres where electric current is wanted for lighting, tramways, and motive power. Although electric transmission of power is efficient, a long distance transmission line is expensive to construct and maintain, and even in countries where there is no trouble with ice and snow, there are the risks of stoppage due to wind and dust storms, bush fires, etc.

When estimating the supply available from a given source for domestic purposes, only the minimum flow can be reckoned upon, if risk of shortage is to be obviated. Therefore, for a domestic supply of electricity all surplus between the minimum and the maximum flow is wasted, so far as power is concerned, and expensive spill-weirs and channels have to be provided.

Clearly, it is wise to make use of the electric power as near to where it is generated as possible, also for operations which use the same power right through the 24 hours, but which can be temporarily suspended if need be.

When the Assuan dam comes to be harnessed a part of the power is to be transmitted about 30 miles and used for pumping. Assuan presents considerable difficulties, because, in the first place, it is not easy to select an industry to be pursued which could utilize power that varies between 100,000 h.p. and 10,000 h.p.; also during the greater part of the year the climate at Assuan is extremely hot, and it is, therefore, difficult to develop large manufacturing industries in such a climate.

When the Trawool dam scheme was being considered a suitable use for the power appeared to be to transmit it to the cities of Ballarat, Bendigo, and Melbourne for a domestic supply. The great advances of the last few years of electro-chemistry and metallurgy have, however, changed the situation considerably. During this period of eight years many new industries which utilize large quantities of cheap electrical power have safely passed the experimental stage, and a single factory making fertilizers could now easily utilize the entire output of the water power, and with an absolute certainty of selling the product without disturbing prices. The tendency is now to establish electro-chemical and metallurgical factories close to the power, and to dispense with transmission lines; also to work the water power and the factory together, arranging the output of the one to meet the demand of the other so that the utmost use can be made of the water available. When that is done surplus water need not be wasted, and under certain conditions the whole mean annual rainfall may be reckoned upon after allowing for evaporation.

The following are some of the new electrical industries which require large quantities of electrical power at low cost: (1) Manufacture of nitric acid from atmospheric nitrogen in electric furnace by the direct method. (2) Making nitrogenous and phosphate nitrogenous fertilizers by the direct process. (3) Manufacture of calcium carbide for acetylene lighting. (4) Manufacture of calcium cyanamide fertilizer from calcium carbide. (5) Electric reduction of iron and steel. (6) Making alkali from salt by the electrolysis. (7) Making aluminum from bauxite. (8) Making carborundum for use as an abrasive. (9) Making graphite in the electric furnace. (10) Melting concentrates. (11) Treating refractory zinc ores, etc.

Some of these industries have to be carried on continuously, as, for example, the manufacture of calcium carbide and calcium cyanamide, the reduction of iron and steel, and the making of aluminum, etc. The cost of stoppage and restarting is excessive in all smelting and allied operations. On the other hand, some of the industries, such as fixation of atmospheric nitrogen by the direct process, can be worked intermittently. The manufacture of graphite can also be carried on intermittently.

Where the water can only be used for a portion of the year, the problem is to fix upon some particular industry which can utilize power intermittently, and will permit of changes in the amount of labor employed, without undue additional expense. Also, the product must be such that it has a widespread market, so that when it is turned out in considerable quantities it does not upset prices. At the same time it should be capable of being conveniently stored at times when the output may temporarily exceed the demand. The manufacture of fertilizers from atmospheric nitrogen by the direct furnace process meets all these conditions, and is, therefore, ideal. Not only can the process be carried out intermittently, but the demand is practically unlimited, for to be continuously productive all soil requires plant foods. The most direct and simple method to make fertilizer is to blow air through an electric arc flame so as to form nitric oxide gas. In the presence of oxygen this changes to nitrogen peroxide, which, when brought into contact with water, produces nitric acid. If lime is acted on by this dilute nitric acid a nitrogenous fertilizer called calcium nitrate, containing 12¾ per cent. of nitrogen, is produced. Large quantities of this fertilizer are made in Norway, and it is finding its way to the fruit lands of California and to other parts of the Pacific in competition with sodium nitrate and sulphate of ammonia.

A valuable fertilizer can be made by grinding up phosphate rock and mixing it with water to the consistency of cream. When the gas from the furnace is passed through this it changes the phosphate into the citric soluble state, so making it valuable as phosphate fertilizer. At the same time the lime is acted upon and takes up nitrogen, so that the fertilizer contains two out of the three principal plant foods. The phosphate of basic Bessemer slag is in the soluble condition, and is very largely used as a phosphate fertilizer, but the slag from some open-hearth steel furnaces is largely insoluble, and so the phosphate is not in a form in which it is immediately available for agriculture. This waste basic slag is being produced in Middlesborough alone at the rate of 150,000 tons a year. With the aid of the electric furnace it may be possible in the future to turn it to good account. The direct method of making fertilizers has reached enormous proportions in Norway. One factory utilizes 140,000 h.p., which is generated by a water-power at Rjukan, while another factory to utilize 120,000 h.p. is being equipped. About $40,000,000 is invested in the business in Norway alone.

* Abstracted from a paper by E. Kilburn Scott before the British Association, Australian meeting, August, 1914.

Mayor H. C. Hocken, of Toronto, and several of the officials of the works department will represent the city at the fifth American Good Roads Congress in Chicago this week.

The MacArthur Concrete Pile and Foundation Company has appointed the Douglas Milligan Company as their sales agents for Eastern Canada, with main office in the New Birks Building, Montreal, and branch office at 95 King Street East, Toronto.