

domestic markets alone are concerned, would not have been warranted at the time. The initial United States power load has, therefore, made it possible for the domestic market to reap all the benefits of available hydro-electric energy many years sooner than otherwise would have been possible.

While Canada has been receiving far more value in her coal importation than she has given in her power exportation, the advantage is rapidly disappearing. It is reasonable to expect that the tendency will be for hydro-power exportation to increase and for coal importation to decrease. The time may come, and in the near future, when the balance will be against Canada.

It is, therefore, imperative that every proposal for increase in the exportation of power be carefully considered from a broad national standpoint. Such consideration involves the evolution of a formula with regard to power exportations which will have cognizance of Canada's fuel-power needs generally.

We must face the fact that for some time to come we shall require to import United States coal, and that in turn therefor we can, under proper conditions of recovery safely and profitably export some of our surplus hydro-electric energy.

Canada, to Become Self-Sustaining, Must Use All Her Fuel-Power Resources According to Their Particular Adaptability

B. F. Haanel, chief of the fuel testing division, Department of Mines, in his clear and comprehensive paper on the "Fuels of Canada," describes the nature, location and extent of our varied, available fuel resources. Mr. Haanel affirms that, while the problems associated with the distribution of fuel to the various parts of Canada are exceedingly complex and the strictest conservation must be practiced, the Dominion is endowed with fuel deposits on such a magnificent scale that all that is necessary is their proper exploitation and economic use for the country to be eventually practically independent of foreign sources of fuel. Mr. Haanel is particularly emphatic that Canada need not go abroad for fuel for household use, if her own fuel resources are properly exploited.

The problem of Canada's fuel needs outside of the "acute fuel area" offers little difficulty, owing to an abundance of both coal and water power. It is simply a matter of efficient and effective use of available resources. Within the "acute fuel area," however, the problem is pressing and prodigious. It resolves itself into two parts; first, provision for domestic or household heating consumption, second, provision for industrial requirements.

1—Domestic requirements of "acute fuel area" involves production of suitable substitute for anthracite.

Domestic needs involve the production of a fuel or fuels which will meet the requirements for general household use. At the present time this need is furnished by American anthracite; over 4,000,000 tons were used in 1916. Competent experts declare the anthracite coal fields of the United States are in measurable distance of exhaustion and that the supply will not last a hundred years. Having in mind the ever-increasing demands within their own borders for this fuel and the rapid decrease in quality as the supply becomes exhausted, responsible fuel advisers of the United States government have seriously urged the establishment of an embargo against exportation of anthracite. We in Canada must realize that our supply of this fuel may be gradually restricted. It is, therefore, essential that we, without delay,

consider what can be accomplished in the production of a suitable substitute for United States anthracite.

2—Industrial requirements of "acute fuel area" involve (a) more efficient use of soft coal in central heating stations, (b) construction of super-power plants to serve contiguous industrial areas, (c) substitution of hydro power for steam-produced power wherever possible, (d) use of hydro power for all new industries wherever practicable.

The second part of the "acute fuel area" problem and the one with which water power is most intimately connected is the fuel necessity of the industrial or manufacturing world.

The industrial requirements are now met by Canadian hydro power and United States bituminous coal—about 14,000,000 tons consumed in 1916 for this purpose in the "acute fuel area."

Owing to the large reserves of bituminous coal in Pennsylvania, this class of fuel will probably be available

WATER POWER IN EUROPE AND NORTH AMERICA
Dominion Water Power Branch Estimate 1915 (slightly revised)

Country	Area Sq. miles.	Population latest available figures.	H.P. Available	H.P. Developed	Per cent Utilized	H.P. Available per sq. mi.	H.P. Developed per sq. mi.	H.P. per Capita Available	H.P. per Capita Developed
U.S.A.	2,973,690	98,783,300	28,100,000	7,000,000	24.9	9.4	2.35	0.28	0.071
Canada A	2,000,000	6,203,500	18,801,000	1,735,000	9.2	9.4	0.87	2.34	0.216
Canada B	927,800	8,900,000	8,094,000	1,725,000	21.3	8.7	1.86	1.01	0.216
Austria	261,260	51,173,000	6,400,000	566,000	8.8	24.8	2.17	0.13	0.011
Hungary	207,500	39,601,500	5,507,000	1,100,000	11.6	26.8	3.14	0.14	0.016
Norway	124,130	2,391,750	5,500,000	1,100,000	20.4	44.3	9.02	2.30	0.468
Spain	190,401	19,588,700	5,000,000	440,000	8.8	26.3	2.31	0.26	0.022
Sweden	172,940	5,522,400	4,500,000	704,500	15.6	26.0	4.08	0.81	0.127
Italy	91,400	28,691,600	4,000,000	976,300	24.4	43.5	10.7	0.14	0.034
Switzerland	15,976	3,781,500	2,000,000	511,000	25.5	127.2	32.0	0.53	0.135
Germany	208,800	64,926,000	1,425,000	618,100	43.4	6.8	2.96	0.08	0.010
Great Britain	88,729	40,831,400	963,000	80,000	8.3	10.9	0.91	0.02	0.002

Plate No. 3—Water Power in Europe and North America

to the "acute fuel area" of Canada for many years. Although not immediately necessary, the ultimate substitution of bituminous coals must, nevertheless, be seriously considered. Water power will be the main means of such substitution. The industrial fuel problem, therefore, in the "acute fuel area" becomes largely a matter of substitution of hydro power for fuel power.

Electrification of railways, especially terminals with adjacent engine divisions, would save enormous consumption of bituminous coal and relieve our transportation systems of their greatest burden.

It is estimated that something like 9,000,000 tons of coal was consumed by our railroads in the year 1917. Judging from the results obtained from the electrical operation of railroads in the United States, it would be possible to save at least two-thirds of this coal if electric locomotives were substituted for the present steam locomotives. This would be a saving of 6,000,000 tons of coal in one year, and would require about 900,000 water horse-power.

Electrification of steam roads at this juncture is not advocated. Under normal conditions, however, and in certain districts, as in western Ontario, electrification will become an economic necessity in a few years.

In districts that cannot be served by water power, the location of modern, efficient, super-power stations at strategic points, with a resultant elimination, or combination, of many inefficient, small stations, would cause a very large saving in the consumption of soft coal, with a concurrent increased production of power.

The substitution in industry generally of hydro power for steam fuel power, would also result in a tremendous relief. There are many plants where such an exchange would be possible now. Future manufacturing plants