cities and by far the greater number of our towns and villages are supplied with hydro-electric energy, while the electro-chemical industries centred at Niagara, Shawinigan and elsewhere evidence the development in that direction. Nevertheless, with proper direction and encouragement this could be greatly increased. An example of this is given in the electro-chemical field, where, although exact figures are not available, it is safe to say that more hydro-electric energy is exported for this industry than is used in Canada for the same purpose.

Control of Power Export

The question of power export has become very acute, and no export licenses should be granted except when unavoidable. Canada secures little benefit from this exported power, as, once a plant is in operation, the benefit derived from an installation generating the enormous quantity of 100,000 or 200,000 h.p.—exclusive of the small taxation and export charges—would be represented by the earnings of a staff of a dozen attendants.

Industries in which the cost of power is but a small factor in the total cost of production do not benefit greatly from cheap power. While cheap power is an attraction to all industries, other things being equal, those requiring the largest amount, figured on a basis of the value of their product, will naturally be more interested.

Power-using Industries

The following table, prepared from both Canadian and United States census reports and various other sources, is of interest in this connection. It shows the amount of power required, in the industries enumerated, to produce $1,000 worth of product during one year. The larger this amount, the greater need of cheap power for the industry.

Industry.	H.P. required for every $1,000 produced per year.
*Mechanical wood pulp	16.93
*Aluminum	16.00
*Calcium carbide	15.39
†Cement	7.08
†Log products	2.95
†Brick, tile and pottery	2.28
†Iron and steel products	1.98
†Cottons	1.97
‡Cement	5.91
‡Paper and wood pulp	4.87
‡Kaolin and ground earth	4.47
‡Brick and tile	3.67
‡Flax and hemp, dressed	2.46
‡Lumber products	2.46
‡Cottons	2.07

*Data from various sources.
†Data from Canadian census.
‡Data from United States census.

The manufacture of carborundum, of nitric acid, of nitrate fertilizers from the nitrogen of the air, and of graphite in electric furnaces, all require large amounts of power.

Recent papers, read before the American Institute of Electrical Engineers, and dealing with the connection between water-powers and various industries, point out that industrial processes founded upon electro-chemistry have a part in the manufacture of a very wide range of commercial products.

Electro-chemical Processes

Electro-chemical processes have entered into some phase, at least, of nearly every branch of our industrial life. From a small beginning in electroplating two generations ago, much the greater portion of the copper output of the world is now electrolytically refined; zinc and tin so refined are also in the market. Electrolytic refining increases the purity of the metal and also makes possible the recovery of the impurities as by-products, thus greatly cheapening the cost of refining.

Electrolysis of common salt forms the basis of the electrolytic alkali industry, the products of which are caustic soda, the starting point for various chemical industries; metallic sodium, also used as a foundation for other products, such as the cyanide so largely used in the metallurgy of silver and gold, chlorates, used in the manufacture of matches, certain explosives, etc., hypochlorites, of value for bleaching, and chlorine, employed as a sterilizing agent.

Electric Furnace Products

Many new industries have been created by the electric furnace, some of the products of which are abrasives, graphite, silicon, ferro-alloys, refined steel, phosphorus, calcium carbide, used in the generation of acetylene, and in the manufacture of cyanamide; it is also being experimented with in the metallurgy of many metals. Used as an electrolytic furnace, it becomes an important application to the production of aluminum.

Electric furnace processes all consume large quantities of energy; an ordinary melting operation, such as casting an alloy or refining steel, usually requires from 600 to 1,000 kw.h. per ton. In the production of ferro-alloys the power used varies from 3,000 to 8,000 kw.h. per ton of product; the aluminum furnace requires 25,000 kw.h. per ton of product.

The industrial use of electric discharges through gases is still in its infancy, but among the products are ozone and nitric acid, the former used for sterilization and the latter as a base for fertilizers and explosives.

Production of Nitrogen

The production of some of the most highly nitrogenous food products has been steadily declining and Canadian and United States farmers have been producing less per acre than European farmers. In the last analysis, the food supply depends upon the plant food supply. The production of nitrogen, which is one of the three principal fertilizer ingredients, is distinctly a water-power proposition, involving the fixation of atmospheric nitrogen.

Each of the processes under consideration has advantages. The problem is many-sided and far-reaching, and hence it is very desirable that the various government departments concerned should co-operate in determining the most advantageous.

Those not familiar with conditions in the electro-chemical industry commonly put all electro-chemical industries in one class as power consumers. They are, however, extremely diverse, their requirements in power, and the relative importance of the factors of power, labor and other items are also extremely diverse.

The electro-chemical industries have already become of great value to Canada and, in the utilization of water-power resources, will become far more so; they have a fundamental interest in the development of cheap power,