industrial and domestic purposes. Since it is in a form more available for the generation of power than any solid fuel, it is advantageous to use it for this purpose whenever possible instead of coal.

Peat contributes practically nothing to our energy requirement. Yet it exists in large quantities throughout the Dominion, and in view of its success as a fuel in other countries, and the information obtained from its manufacture and use here, its availability for the generation of power and heat is known. It is impossible to believe that there is no field for its exploitation and it must be expected soon to find a position as a source of heat and power.

This faint outline of our requirements and sources of energy does not afford information sufficient for proceeding with an inquiry which will lead to the connection of the user of power and heat with the most available form of energy. Here the possibilities of increasing the availability of our supplies of energy will be considered with reference to special methods. They will refer only to the establishment of central stations for the use of the solid fuels, and to the possibility of using hydro-electric energy for house heating.

Central Stations

The central station may be designed to supply electrical energy, gas, steam, liquid fuel, solid fuel, and various by-products, many of which have no connection with the generation of energy. The economy of operation depends upon many factors; one of the most important of which is a large system in which there is more complete utilization of the full capacity of the plant. This is due to non-coincidence of the maximum loads of the various consumers, better thermal efficiency of conversion due to the use of larger units, more complete and intelligent supervision and design, and to the possibility of operating for longer periods at the more economical rated load. The limit of the central station's sphere is reached, when it is cheaper to haul the fuel to the consumer than to deliver energy through pipes or along a wire. It varies with local conditions and the type and price of the fuel. It will be greater for low-grade than high-grade raw fuel, since costs of transportation vary with quantity and are independent of energy content.

The largest field for the central station will be in the generation and distribution of electrical energy. The rough estimate of the mean present power load now met by coal showed the very large requirement of locomotives. To replace the uneconomical steam locomotive with the electric locomotive seems at first sight a rational project. Where the substitution has taken place the coal consumption in the central steam electric stations is one-half of the former consumption on the locomotive. There could be no objection to its substitution for oil in forest areas, and the present damage from locomotive soot and sparks would cease. An examination of the roads electrified shows that they are confined for the most part to suburban and mountain traffic. But the electrically equipped mileage is increasing, and the continuous increase in the price of coal brings the day of general electrification nearer.

The remaining power, which is used for general industrial purposes, is in itself of magnitude sufficient to warrant the consideration of central station supply. Whenever external electric supply takes the place of energy generated at the plant itself, economy results. In many districts this change has resulted in reducing the coal consumption to one-quarter of its previous magnitude.

Central stations distributing gas have not so promising a field as those distributing electrical energy. The costs of transmission, and the relatively high efficiency of conversion of coal into heat energy in the plant itself reduces the possible gain to the buyer. Nor is it likely that the substitution of this type of plant would save fuel. Nevertheless, the cleanliness and improved availability of gas as compared with coal would frequently lead to its preference by consumers.

Types of Central Stations

Central stations may be of the following four types:—

(*a*) Those in which the fuel is completely gasified by partial combustion, and the energy distributed either as gas or electrical power.

(*b*) Those in which the fuel is carbonized and energy distributed in the form of solid fuel, and gas or electricity.

(*c*) Those in which the fuel is completely burned and electrical energy and steam distributed.

(*d*) Those in which fuel is completely burned and electrical energy only distributed.

A consideration of these stations follows:—

(*a*) The by-product recovery producer plant is the most promising means of totally converting solid fuel into gas. Its economic importance lies largely in the high returns possible by the recovery of from 60 to 70 per cent. of the nitrogen in the fuel in the form of sulphate of ammonia. It is of great value for the exploitation of low-grade fuels, particularly peat, whose nitrogen content is high compared with its calorific value. The gas produced has a heat content of about one-fourth that of coal gas. It may be distributed to consumers, or partially converted into electrical energy by use of gas engines or boilers and steam turbines.

In south Staffordshire, a plant has been in operation for some years, and supplies gas over an area of 123 square miles. The price paid for the gas varies from 3 to 5½ cents per thousand cubic feet. The fuel used is slack coal of a fairly low calorific value. This is the only plant which distributes producer gas on a large scale, and it is noteworthy as a possible reason for its unique position, that no dividends have been paid for some years.

In Italy two by-product plants, using peat, are in operation. The energy is distributed electrically.

(*b*) The two outstanding objects of carbonizing coal are to obtain a maximum yield of either coke suitable for metallurgical purposes or of gas suitable for domestic purposes.

The first method of carbonizing is carried out in coke ovens, wherein the long time of carbonization, large size of charge and compression give a coke of the requisite great density and hardness. It is possible with modern coke ovens to obtain a yield of gas more than sufficient for heating the charge, about 20 per cent. of the nitrogen in the coal as ammonia in addition to light oils and tar. The surplus gas is usually of only slightly lower calorific value than town gas, and is eminently suited for distribution for general use, or may be used as a fuel at the plant for the generation of electrical energy.

The second method of carbonization differs from the first in that smaller charges are used in order to obtain the necessary quality and quantity of gas, none of which is used for heating the retorts. As with coke ovens, coke, ammonia, benzol, and tar are recovered as by-products from retorting coal. The yield of coke, however, is less and some of it is used for heating the retorts, while the ammonia yield is greater, due to the smaller contact with the smaller charge.