Hydroelectric power generation 13.9.3

Hydroelectric generation forms a significant though decreasing part in Canada's electrical development. By the end of 1976, the hydro portion of the country's total generating capacity had fallen to 58% from over 90% 20 years earlier.

In view of Canada's extensive water resources, many undeveloped sites would seem to be potential sources of hydroelectric power, but all are not economically viable. Only a fraction of the sites with a theoretical power potential can actually be developed competitively. Before a site can be termed a source of potential power, a detailed analysis of such factors as cost, geography, geology and ecology must be performed. Until such a study is completed on a national scale, estimates of Canada's undeveloped hydropower resources (estimated to exceed 60 000 megawatts), may be misleading.

The maximum economic installation at a power site can be determined only by careful consideration of all conditions and circumstances pertinent to its individual development. For a number of reasons, it is normal practice to install units with a combined capacity in excess of the available continuous power at the flow available 50% of the time, and frequently in excess of the power available at the arithmetical mean flow. Excess capacity may be installed for use at peak-load periods, to take advantage of periods of high flow, or to facilitate plant or system maintenance. In some instances, storage dams have been built after initial development to smooth out fluctuations in river flows. In other cases, deficiencies in power output during periods of low flow have been offset by auxiliary power supplied from thermal plants or by interconnection with other plants operating under different load conditions or located on rivers with different flow characteristics. The extent to which installed capacity exceeds available continuous power at various rates of flow depends on factors that govern the system or plant operation, and this varies widely from one area to another.

Distribution of installed hydroelectric generating capacity given in Table 13.13 shows that substantial amounts of water power have been developed in all provinces and territories except Prince Edward Island. As natural-resource development proceeds, the fortunate incidence of water power near mineral, forest and other resources becomes increasingly apparent. The vast hydro potential of northern rivers may well prove to be a prime factor in the eventual realization of the natural wealth of the Canadian North.

Water-power resources of Nova Scotia and New Brunswick, although small compared to other provinces, are a valuable source of energy and make a substantial contribution to the economies of the two provinces. Numerous rivers provide moderate size power sites within economic transmission distance of principal cities and towns. Others are advantageously situated for development of timber and mineral resources. These provinces have, however, turned to thermal generation, initially coal-fired, with a subsequent shift to oil. Construction of a nuclear power plant in New Brunswick is under way and there are indications of a possible return to coal as a fuel source for new installations.

Thermal power generation 13.9.4

Immense water-power resources and the rapid pace of development have tended to overshadow the contribution being made by thermal energy to Canada's power economy. From a modest 133 megawatts of generating capacity installed at the end of 1900, Canada's installed hydro capacity rose to 39 475 MW by the end of 1976 and thermal capacity to 28 613 MW (Table 13.13).

The same table shows that thermal generation is predominant in Prince Edward Island and Nova Scotia. By the end of 1971, the Yukon Territory had joined the Northwest Territories, Alberta, Saskatchewan and Ontario in having more than half their total capacity thermal-electric. Thermal generation is expected to become increasingly predominant in Ontario.

Over 90% of all thermal power generating equipment in Canada is driven by steam turbines fired by coal, oil, gas or, in the case of nuclear equipment, uranium. The magnitude of loads carried by steam plants combined with the economies of scale has led to the installation of steam units with capacities as high as 540 MW, and units in the 800-MW size range were committed for as early as 1976. Additions of these larger units