

13.5.4 Thermal power generation

The incidence of immense water-power resources in Canada and the brisk pace of their development has tended to overshadow the very considerable contribution being made by thermal energy in the nation's power economy. For a modest 133 MW of generating capacity installed at the end of 1900, Canada's installed hydro capacity rose to 36,512 MW by the end of 1974 and thermal capacity to 20,637 MW (Table 13.10).

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. Although coal is still the most important fossil fuel for thermal plants in Nova Scotia, oil is the preferred choice for new thermal power generation in the other Atlantic provinces.

Over 90% of all thermal power generating equipment in Canada is driven by steam turbines fired by coal, oil or gas. 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 have been committed for as early as 1976. Additions of these larger units are, however, only possible where systems are large enough to accommodate them. Additional types of thermal generation are provided by gas turbine and internal combustion equipment. The flexibility of internal combustion engines makes this type of equipment particularly suitable for meeting power loads in smaller centres, especially in the more isolated areas. Gas turbines are frequently used for peak loads where their rapid start-up ability and minimal capital cost are manifest advantages.

After World War II, industrial expansion and rapidly growing residential and agricultural development placed extremely heavy demands on power generating facilities. Since hydro sources alone could not possibly satisfy this demand an extensive program of thermal plant construction began in the early 1950s; by 1956 thermal capacity represented 15% of the total. Since then, the annual installed capacity has averaged 56% hydro-electric with the remainder in thermal generation. At the end of 1974 thermal capacity accounted for 36.1% of Canada's installed capacity.

Thermal plants accounted for only 24.7% of total generation in 1974 because much of the capacity installed is operated for peak load duty only, with hydro-electric capacity providing base-load generation. This pattern will change with the introduction of additional nuclear-fuelled thermal generation plants which can operate economically at high capacity for base-load purposes.

Nuclear thermal power. Commercial electric power generated from the heat of nuclear reaction became a reality in Canada in 1962 when the 20-MW Nuclear Power Demonstration (NPD) station at Rolphton, Ont., fed power for the first time into a distribution system in Ontario. The NPD station was a forerunner of a series of large nuclear stations that will shoulder more and more of Canada's rapidly growing power loads.

Atomic Energy of Canada Limited, a federal Crown company incorporated in 1952, has concentrated its efforts on the development of the CANDU reactor. The Canadian CANDU (CANada-Deuterium-Uranium) power reactor uses heavy water (deuterium oxide) as a moderator for slowing or "moderating" the neutrons released by nuclear fission. The high neutron economy obtained by using this moderator with neutron-transparent core materials (zirconium alloys) means that Canada's abundant resources of natural uranium may be used as fuel. The CANDU system is however, sufficiently flexible that enriched uranium, plutonium recovered from spent fuel, or thorium may be incorporated into its fuel system.

The production of heavy water has been a critical item in the Canadian nuclear power program. The first 800-ton-a-year heavy water production plant at Ontario Hydro's Bruce Nuclear Power Development on Lake Huron went into operation in 1973 and is producing at over 80% of its design capacity. Ontario Hydro is now building the first of three additional plants at the Bruce site which it announced in 1973. In Nova Scotia rehabilitation of the Glace Bay plant continued with start-up scheduled for 1975, and operation of the Canadian General Electric Port Hawkesbury plant was considerably improved after modifications. AECL negotiated the purchase of this plant from CGE in 1974. Construction is continuing on the new 800-ton-a-year plant of AECL at the Gentilly site in Quebec.