operating continuously. The balance reflects fluctuations in load below peak demand during daily and seasonal cycles together with reserves of generating capacity.

13.7.6 Electric power transmission

The nature of the loads handled by small, widely scattered generating systems in the early days of the electric power industry in Canada did not warrant the expense of interconnecting power systems. However, as the demand for dependable electric power increased and improved techniques reduced power transmission costs, the benefits of integrating power systems to achieve reliability of service and flexibility of operation were re-appraised. Today, most of Canada's generating stations are components of large, integrated, and often interconnected, power systems operated by power utilities in the various provinces.

Research in the field of power transmission has developed techniques that enable power producers to utilize hydro-electric sites previously considered beyond economic transmission distances. Most noticeable, perhaps, is the progressive stepping-up of transmission-line voltages. In Canada, there are a number of transmission lines designed for operation at 500 kilovolts (kV) and 735 kV. A 574-mile, 500-kV line is in service to carry power from the Peace River to the lower mainland of British Columbia. In Ontario, a 435-mile, 500-kV line carries power from hydro-electric plants in the James Bay watershed to Toronto. In 1965 Hydro-Québec achieved world leadership when power was carried for the first time at 735 kV over the 375-mile transmission line between Quebec's Manicouagan—Outardes hydro complex and the cities of Quebec and Montreal. By the end of 1971, the initial program for 1,228 miles of the 735-kV line had been completed. Work has now been completed on the three additional 735-kV circuits to connect the Churchill Falls complex with the Hydro-Québec grid.

Most power is transmitted as alternating current but three applications of high-voltage direct-current (HVDC) are found in Canada. In service in British Columbia is a 260-kV HVDC link from the mainland to Vancouver Island. It has a capacity of 312 MW and includes 21 miles of undersea cable; it is a monopolar system using the ground as the return path for current. This system is being expanded to 624 MW for an in-service date of 1976. A second HVDC system was placed in service in 1973 linking the Kettle generation station on the Nelson River to Winnipeg where two 555-mile lines have been completed and converter equipment with an initial capacity of 810 MW has been installed. The planned ultimate rating of this system is 3,200 MW. Another application designed to provide a non-synchronous tie between the power systems of New Brunswick and Quebec is a 320 MW back-to-back HVDC system located at Eel River, NB. This facility was placed in service in 1972 employing solid state thyristor valves in place of the mercury arc valves used for the earlier HVDC systems.

Interconnections of 66 and 138 kV exist between British Columbia and Alberta and a 230-kV tie is being planned. Saskatchewan, Manitoba, Ontario and portions of the Quebec system are interconnected and, through the Ontario Hydro system, are linked with the north-eastern United States systems. Quebec, New Brunswick and Nova Scotia systems are interconnected. The first major international tie connecting regions of the Maritimes in Canada with the United States became a reality during 1970 on completion of a 345-kV link between the New Brunswick and Maine systems. British Columbia has an international tie with the Pacific Northwest (500 kV) and a 230-kV link between Manitoba and the United States was completed in 1970.

The search for economies in transmission systems has led to changes not only in materials used but also in tower erection and cable-stringing methods. Guyed V-shaped and Y-shaped transmission towers are being used increasingly in place of self-supporting towers where the terrain is suitable, and erection costs are being reduced by the use of helicopters to transport tower sections to the site for assembly. The use of helicopters for spraying for brush control on the right-of-way and for line inspection and maintenance is widespread.

13.7.7 Electric utilities

Federal government regulation of electric utilities with respect to the export of electric power and the construction of lines over which such power is exported falls within the jurisdiction of the National Energy Board.

Power is generated in Canada by publicly and privately operated utilities and by industrial establishments. Over 73% of the total electric power generated in 1972 was produced by publicly operated utilities, 12% by privately operated utilities and 14% by industrial establish-