element in economic competitiveness. Energy distribution for industry can be subdivided roughly as follows: mineral industry (including smelting and refining), one-third, pulp and paper industry, one-quarter, chemical manufacturing, one-tenth, and the rest to all other industrial categories.

The growth among non-industrial consumers results from greater reliance on facilities powered by electricity. Increasing quantities of electricity are required to meet rapidly escalating demands for heating, cooling, lighting, transportation, elevators, electrical appliances and farm machinery. The shift of population from rural areas to cities and towns, where electrical demand is greatest, has contributed to this growth.

Details of the regional pattern of electric energy use can be seen in Table 13.16. In 1976 more than two-thirds of total available electric power was consumed in Ontario and Quebec with all other regions accounting for the remaining one-third. The share of total consumption by these other regions has, however, been rising (combined total of 26% in 1960 but 33% in 1976).

Among the more significant percentage increases in total energy demand were a 15.5% rise in Newfoundland because of higher consumption in the residential and commercial sector; a 12.4% gain in New Brunswick, where residential and commercial load increases offset a decline in industrial consumption; and an 11.9% gain in British Columbia reflecting higher demand in all sectors, including an 18.9% increase in industrial use.

13.9.7 Electric power transmission

Loads handled by small, widely scattered generating systems in the early days of the electric power industry did not warrant the expense of interconnecting power systems. However, increased demand for dependable electric power and improved techniques resulting in lower power transmission costs have led to a reappraisal of the benefits of integrating power systems for better reliability of service and greater flexibility of operation. Most of Canada's generating stations today are components of large, integrated, and often interconnected, power systems operated by power utilities.

Research has developed techniques enabling power producers to use hydroelectric sites once considered as beyond economic transmission distances. Most noticeable is the progressive stepping up of transmission line voltages. A number of transmission lines are designed for operation at 500 kilovolts (kV) and 735 kV. A 924-kilometre 500-kV line carries power from the Peace River to the lower mainland of British Columbia. In Ontario, a 700-km 500-kV line brings power from hydro plants in the James Bay watershed to Toronto. In 1965 Hydro-Québec became the first utility in the world to transmit electric power at 735 kV over the 604-km line linking Quebec's Manicouagan–Outardes hydro complex with urban demand centres at Quebec City and Montreal. By the end of 1971, the initial program for 1 976 km of the 735-kV line was completed, and three 735-kV circuits connecting the Churchill Falls generation station to the Hydro-Québec grid have also been added.

Most power is transmitted as alternating current but there are three applications of high-voltage direct-current (HVDC). A 260-kV HVDC line links the BC mainland and Vancouver Island. It has a capacity of 312 MW and includes 34 km of undersea cable; it is a monopolar system using the ground as a return path for current. Capacity was doubled in 1976 to 624 MW. A 450-kV HVDC system was placed in service in 1973 linking the Kettle generation station on the Nelson River to Winnipeg where two 893-km lines have been completed and converter equipment with a capacity of 1 620 MW is in service. 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 at Eel River, NB, using solid state thyristor valves instead of the mercury arc valves used for the earlier HVDC systems in BC and Manitoba.

Interconnections of 66 kV and 138 kV already 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 systems in the northeastern US. Quebec, New Brunswick and