

\$1,090 million compared with a deficit of \$300 million in 1960. The energy industries continue to be major growth industries and in 1973 accounted for almost one fifth of total capital investment in Canada. Their importance in regional development is illustrated by the \$4 billion of oil and gas revenues that accrued to the Alberta government in the period 1947-73 and by the industrial development that has been stimulated throughout western Canada.

The growth and scale of oil supply and demand is shown in Table 13.1. Exports of crude oil grew rapidly during the 10-year period to 1972 but there were indications of a levelling off in 1973 leading to a possible decline throughout the rest of this decade. Domestic demand for oil grew at an average rate of 5.5% during 1962-72. The rate in 1973 was close to 6%.

Domestic demand for natural gas and exports tripled in the 10-year period to 1972 (Table 13.2). Exports have now stabilized as no new export permits have been granted since 1971. The annual increase in domestic demand for natural gas in 1973 was 9.8%, somewhat lower than the 11.5% annual average of the previous 10 years.

Table 13.3 illustrates coal and coke supply and demand trends since 1962. The large increase in coal exports over the 10-year period to 1972, particularly in 1970 and 1971 was almost equivalent to the production growth. Imports increased substantially to meet the requirements of the Ontario market. Total demand growth in 1973 was only slightly lower than the average annual increase in the previous 10 years.

Electric energy supply and demand trends are indicated in Table 13.4. Exports of electric energy have increased more rapidly than imports but both remain comparatively small. Until 1973, exports never exceeded about 4% of generation. Domestic electric energy demand in Canada increased at an average annual rate of 7% in the period 1962-72 but rose to 7.8% in 1973.

13.2 Uranium and nuclear energy

Total western world energy requirements in 1990 are expected to be about 2.7 times those in 1970. The annual growth rate for energy of all kinds is forecast at 5%, for electric energy at 6%, and for energy provided by nuclear plants at rates varying from 32% in the earlier years to 13% in the later years. Nuclear energy's share of total world energy requirements is expected to increase from less than 1% in 1970 to about 21% in 1990, largely at the expense of coal but also partly as a substitute for natural gas in the North American market.

The heavy-water-moderated power reactor concept offers the prospect of abundant, relatively low-cost electric energy to meet this demand. 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 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.

An essential component of the CANDU nuclear reactor system is heavy water, the compound formed from two atoms of deuterium (or heavy hydrogen) and one of oxygen. It is similar to ordinary water both chemically and physically but with a density about 10% greater. It has special nuclear properties, however, which enables a nuclear reactor with heavy water as a moderator to use natural uranium. Reactors using light water must be fuelled with enriched uranium. The production of heavy water has been a critical item in the Canadian nuclear power program. In 1973 the 800-ton-a-year Bruce heavy water production plant went into operation and by the end of the year was producing at about 80% of its design capacity. Ontario Hydro exercised its option to purchase the plant from Atomic Energy of Canada Limited and announced its intention to build three more such plants at the Bruce site. In Nova Scotia the rehabilitation of the Glace Bay plant continued with start-up scheduled for 1975 and the operation of the Canadian General Electric Port Hawkesbury plant improved considerably after modifications. At the end of 1973 the federal government announced that a new 800-ton-a-year plant would be built by Atomic Energy of Canada Limited at the Gentilly site in Quebec.

In August 1973, the Canadian government announced a sale to the Tohoku Electric Power Company of Japan of 1,000 short tons of uranium oxide from the government owned general stockpile and from the government-Denison joint venture stockpile. Delivery of uranium under the agreement will take place over the period 1977 to 1981.