

Fossil fuels. The Canada Centre for Mineral and Energy Technology (CANMET) in the energy, mines and resources department speeded up development of a hydrocracking process for heavy oils as found in the oilsands in Alberta. A coal combustion program demonstrated the benefits of substituting coal for oil in heat and electricity generation, particularly in industries and utilities in the Atlantic provinces.

Nuclear energy. R&D by Atomic Energy of Canada Ltd. to provide technological support to the CANDU nuclear system accounted for more than 93% of expenditures in this area. Other programs focused on fusion research, the uranium fuel resource base and regulatory activities.

Renewable energy resources. Section 13.1.3 in Chapter 13, Energy, summarizes government activity in developing renewable energy research. NRC had major responsibility for the S&T to support programs for the purchase and use of solar heating in response to initiatives from the private sector, and for assistance to solar energy manufacturers. Results suggested that passive solar technology can be cost effective and that solar hot water is more economic than solar space heating. Cost effectiveness of active solar systems seemed to be several years away and would require a major cost decrease in conversion systems. For wind-generated energy the main technological focus was on the verticle-axis wind turbine, chiefly at the 50 kW level. Research was under way on developing technology for obtaining energy from forest biomass and from other biomass energy sources such as farm, animal and food processing wastes. Test drilling to determine possible geothermal sources of energy is described in Chapter 13.

Energy has been the area slated for the largest amount of federal spending on scientific activities in recent years. Food was second and health third. Table 14.5 gives an overview for three years of actual, forecast and estimated expenditures.

Transportation and transmission. Two programs are involved, the transportation of oil, gas and coal and the transmission of electricity. In northern transportation of oil and gas, the government's work in Arctic vessel technology has been primarily in support of regulations. Large powerful ships capable of year-round operation in ice-covered waters are required. In transmission of electricity the program consisted of electrical research at NRC and government support for S&T projects in industry and the utilities, co-ordinated by the Canadian Electrical Association.

14.1.5 Environmental issues

Various components of environmental sciences include the atmosphere, water, land and wildlife. Research on environmental issues helps develop policies, regulations and guidelines to ensure the continued availability and productivity of Canada's renewable resources. It also helps to develop an information base required to formulate environmentally-sound industrial development plans.

Air. In 1980-81 the government's expenditure on air-related research was expected to be \$3.7 million. The environment department monitors and collects air data on common contaminants through an extensive surveillance network. Air monitoring surveys provide information on specific problem areas. Proposals are assessed for the development and demonstration of new air pollution control technology.

Air pollution research is concerned with improving process and control technologies for industries that emit air pollutants. Federal departments of health and welfare and environment were studying the potentially harmful effects of acid rain on human health.

Water. Government expenditures on water-related environmental issues and resource management were expected to be \$38.4 million, with \$33.4 million allotted to the environment department. Studies were to include potential water shortages on the