R&D on heavy oils and oil sands is directed toward increasing the yield of liquid fuels and ensuring that the products can be incorporated into the conventional oil supply and refining systems without major change in refining practices. Research is under way on combined processing with coal as a future source of liquid fuels. A pilot plant based on EMR's is under construction by Petro-Canada.

The sector operates pilot scale facilities and special research instruments that are beyond the normal requirements of individual companies for full-time use but are used in the sector's R&D and by companies under contract when required for their specific research. These include a rolling mill, experimental foundry, a mineral processing plant, special analytical equipment and the largest rock press in Canada.

Canada centre for remote sensing, a branch of the department, co-ordinates a remote sensing program in co-operation with federal and provincial departments, private industry and universities. The program develops and demonstrates systems, methods and instruments to deal with remote sensing data from satellites and aircraft, to develop an information system for Canada's land and ocean resource managers. It concentrates on satellite remote sensing, airborne remote sensing and an application program. Its analysis facilities are made available to scientists and users of remote sensing data and techniques. A fleet of aircraft carrying a number of state-of-the-art sensors, such as a synthetic aperture radar, is available to users across Canada on a limited charge recovery basis.

CCRS is the federal agency responsible for R&D in remote sensing by optical infra-red, ultra-violet and radar methods, both active and passive. After the branch acquires remotely sensed data from satellites such as Landsat and aircraft, it processes the data to provide information relating to mineral resources, agriculture, forestry, land use and Arctic navigation. CCRS also fosters Canadian industrial capability in ground receiving stations for satellite data reception and the development of remote sensing technology.

10.9.2 Earth Sciences

This sector assists the mineral industry through the Geological Survey of Canada, the earth physics branch, the surveys and mapping branch and the polar continental shelf project.

The **Geological Survey of Canada** maps and studies the geology of Canada. Principal aims are to ascertain mineral and energy resources potential and to assist in resource exploration by providing a systematic geological framework, by defining geological settings favourable to mineral and fuel occurrences, and by conducting magnetic, radiometric and geochemical surveys of interest to the mineral industry. The geological survey provides information on land resources, terrain performance and geological hazards, derived from studies of earth and rock materials, land forms and associated dynamic processes. (See Chapter 1, 1.3 *Geology* and 1.3.3 *Origin of leading minerals.*) Part of the geological investigation deals with Canada's offshore regions, including non-renewable resources and coastal and seabed conditions.

The **earth physics branch** carries out geophysical work of interest to the mineral industry. To provide data to assess earthquake risk and hazard and to study the interior of the earth, the branch operates a network of seismological observatories. To study the structure of the earth's crust, it conducts gravity, seismic and electromagnetic surveys. Together with data from geomagnetic observatories, it provides reference fields and forecasts of geomagnetic disturbance for use in mineral exploration. Geothermal measurement boreholes provide information on underground thermal conditions, including permafrost.

The **surveys and mapping branch** has completed topographical mapping of Canada as described in Chapter 1, Physical setting. Through a basic network of survey control points across Canada, the branch provides precise figures of latitude, longitude and elevation above sea level. The branch also produces multicoloured maps for other government agencies, aeronautical charts and atlases. A national air photo library has on file over 4 million aerial photographs, both black and white and colour, taken over the last half century from aircraft and more recently from space satellites.

The **polar continental shelf project** co-ordinates and provides logistics support for all field work undertaken in the Canadian Arctic by government, and many non-government scientific researchers. It also conducts studies of scientific problems unique to the Arctic.

10.9.3 The energy sector

This is a policy recommending group. Responsibilities relate directly to the mining industry and many other parts of the economy. It assesses individual projects in relation to each energy source and the interrelationships of the several sources. It appraises trends in oil and gas exploration and production, transportation, processing and marketing in Canada and abroad, and informs federal agencies, industry and the public on oil and gas developments. In the uranium field, the sector co-ordinates resource assessment and development, establishment of enrichment facilities and export. It provides coal research and development grants, makes resource assessments and advises on production expansion rates. The sector administers federal interests in offshore mineral resources as well as federally owned mineral rights in the provinces. (See Chapter 11, Energy.)

Summing up. The department controls, under the Canada Explosives Act, the manufacture,