91/92 ANNUAL REPORT

Ministry of Energy, Mines
and Petroleum Resources

REVIEW

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199 1/92 Annual Report

Ministry of Energy, Mines and Petroleum Resources

MISSION

The Ministry, acting on behalf of present and future British Columbians, ensures that the Province's energy and mineral resources are developed and used in a safe, efficient and environmentally sound manner for the economic benefit of the Province.

CORE VALUES

In pursuit of its mission, the ministry adheres to the following core values:

Efficiency and Effectiveness

We strive to ensure that the taxpayers' money is used carefully and that the public receives the maximum benefit from our programs and activities.

Service Quality and Excellence

We strive to achieve the best possible performance in the delivery of our services to the general public, industry, elected officials and Cabinet.

Open Communications

We deal openly with our clients in a courteous, responsive and helpful manner.

Staff Commitment

Our achievements depend on our people. We are committed to employment equity and will continue to develop the knowledge and expertise of our staff to enhance service to our industry clients and to members of the public.

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To the Honourable Anne Edwards
Minister of Energy. Mines and Petroleum Resources
Parliament Buildings
Victoria, British Columbia

Minister:

I have the honour to submit the Annual Report of the Ministry of Energy, Mines and Petroleum Resources for the period of April 1, 1991 to March 31, 1992.

John Allan
Deputy Minister

The Honourable David C. Lam
Lieutenant-Governor of British Columbia

May it Please Your Honour:

I respectfully submit the Annual Report of the Ministry of Energy, Mines and Petroleum Resources for the period of April 1, 1991 to March 31. 1992.

Anne Edwards
Minister

THE YEAR IN REVIEW

This past year was one of continuing challenges and accomplishments for British Columbia's energy and mineral sectors. Our energy sector witnessed a strong growth in natural gas exports, tempered by lower prices and profitability facing oil and gas produce-s. In the minerals area. our mining companies continued to struggle against depressed commodity prices, a high Canadian dollar, reduced profits, and declining explorat on activity.

Despite these challenges, some major achievements were made, both within and outride government, during 1991/92. Highlights include:

ENERGY

- The Vancouver Island Natural Gas Pipeline (VIGAS) was completed, bringing cleaner-burning natural gas for the first time to Vancouver Island. Squamish, and the Sunshine Coast.
- New regulations for oil and gas drilling and production were introduced, to improve efficiency, environmental protection, and worker and public safety.
- The ministry implemented a new data management system ("GAMS") to better monitor and review natural gas reserves and export volumes.
- Developmental work was carried out on a new agency, the British Columbia Energy Council, to advise government on specific energy issues and planning.
- Under the ministry's RideShare program, a pilot project on carpooling was held at Simon Fraser University.
- Regulations were enacted, under the province's Energy Efficiency Act, to set minimum energy-efficiency standards for major appliances.
- The government began a review of B.C. Hydro's Power Exchange Operation, a form of futures market to facilitate short-term electricity sales and purchases.
- Work continued on ways for managing greenhouse gas emissions, towards a provincial Clean Air Strategy to be developed by government, industry, and the general public.

MINERALS

A new Aboriginal Affairs unit was added to the ministry, which will take part in land claims initiatives, promote Aboriginal participation in mining, and address other government policy regarding First Nations.

The Mine Development Assessment Act was proclaimed, formalizing the province's longstanding process for reviewing and approve new mine developments.

Work began on a Mineral Strategy and separate Coal Strategy to combat the mining industry's current economic problems.

A new system for reporting mine accidents ("MINACC") was developed and implemented at provincial minesites and the ministry's regional offices.

Various assessments and field studies of mineral potential were conducted during the year, as part of the province's ongoing land use planning processes (e.g., Parks and Wilderness for the 90s).

A ministry study of coalbed methane potential was completed, identifying resources in southeastern British Columbia.

Environmental research projects were undertaken in acid mine drainage, waste rock dumps, and other areas.

Within the ministry, we also continued to improve our services to industry, the public, and government clients, and to refine our organization and administrative functions. An internal Employment Equity Program was launched in 1991/92, with the appointment of an Employment Equity Advisor. In addition, our women's programs and staff training initiatives were enhanced during the year, and construction began on a new ministry head office to consolidate our Victoria staff.

My ministry is committed to promoting viable, competitive energy and mineral industries, while ensuring that the public interest is served through environmental protection, resource revenues, and the pursuit of other social objectives. We will work to balance economic, environmental, and social values in decision-making by adopting policies and programs that stimulate the economy, expand our resource base, and encourage efficiency and conservation.

Realizing these goals cannot be done without the full cooperation of industry, government, and private British Columbians. Therefore, I commend the efforts of all individuals and groups who contributed to the energy and mineral sectors over the last year. We count on their ongoing dedication and commitment to ensure a healthy, sustainable resource sector into the next century.

Anne Edwards
Minister

ENERGY AND MINERALS IN BRITISH COLUMBIA

British Columbia has abundant resources of energy and minerals. which serve the needs of its citizens and prwide major opportunities for trade. The province has large domestic supplies of natural gas. hydroelectric power, and forest industry wastes used to produce energy. We are also a world-class producer and exporter of coal, copper, gold, zinc. silver, molybdenum. and lead.

A Historical *View*

Energy and minerals have served as cornerstones in the development of our provincial economy and social structure. Mining in British Columbia dates back some 150 years, to the first coal mines on Vancouver Island and the placer gold camps of the Cariboo. But the geological forces that gave us such a rich and varied resource endowment are much more ancient.

Since the second world war, government economic policies have supported growth in the energy and mineral sectors. During the 1960s and early 1970s, large hydroelectric dams were built on the Columbia and Peace Rivers, in part as engines of economic development. Historically, British Columbia's advantage in energy and mineral production has come not only from our resource endowment, but also from a skilled labour force, good transportation and other infrastructure, and proximity to Pacific Rim markets.

Where the Resources Are

Our indigenous oil and natural gas resources are clustered in northeastern British Columbia, part of the extensive Western Canadian Sedimentary Basin. Resources for generating electric power are spread throughout the province, with major hydro dams in the Columbia and Peace River Basins. Usable forest residues, such as bark, sawdust, and pulping liquors, are also dispersed, found at industry operations in the Interior and coastal regions. In total, the province has over 1,600 operating oil and gas wells, 88 electric power plants, and 14 energy-from-biomass facilities in production today.

Our coal resources are concentrated in the Rocky Mountains of the Southeast and the Peace River area of the Northeast. Base metals (e.g., copper, lead, zinc. and molybdenum) and precious metals (gold and silver) are distributed throughout the province in complex deposits of varying geology. At the end of 1991, 23 metal and coal mines were operating in the province: 6 of these mines produced metallurgical coal, 2 produced thermal coal, 11 produced base metals, and 6 produced precious metals. Another 40 operations mined a variety of industrial minerals and structural materials, ranging from asbestos to limestone. This total excludes several thousand sand and gravel pits also in operation.

The Extent of our Energy and Minerals

At today's levels of energy production, British Columbia is expected to have about 10 years of proven domestic oil reserves. Proven natural gas reserves indicate approximately 16 years of remaining supply, with

a further 40 years of undiscovered gas potential believed to exist. To date, the province has developed roughly half (10,850 megawatts) of its total hydroelectric resources; however, much of our undeveloped potential occurs at more remote, environmentally sensitive and expensive hydro sites. Wood residue disposed of at provincial sawmills-in the order of 5 million bone dry tonnes annually-could technically generate about 900 megawatts of electricity. Thermal coal reserves at Hat Creek and in the East Kootenays could produce around 1,400 megawatts of power.

We have large, high-quality reserves of both metallurgical and thermal coal sufficient to support mining well into the next century. Proven gold reserves at producing and committed deposits could sustain current production levels to the year 2000, providing soon-t-b-permitted mine projects come on stream. Base metal reserves are in serious decline, as major copper operations near the end of their productive lives. Known mineral reserves are a direct function of exploration activity, which itself depends on commodity prices, access to land, and other economic and policy-related factors. Vast areas of the province are as yet under-explored and there is excellent potential for further major discoveries of our key base metals and other minerals.

Getting Resources Out

There are a number of stages involved in extracting our energy and mineral resources and getting them to market. Crude oil produced in Alberta and northeastern British Columbia is brought by pipeline to Prince George and Vancouver-area refineries, where it is processed to produce usable gasoline and light and heavy fuel oils. Natural gas is processed in the field, to *remove* contaminants, and is then piped to market distribution systems. Electricity is generated at dispersed hydro and thermal power plants and carried through a complex network of high-voltage transmission and distribution lines to consumers.

Mineral ore is extracted from the ground using either open pit or underground mining methods. The ore is crushed, ground, and processed before transportation to markets. Concentrate ore is then smelted and refined to produce the metal from which final products can be made. Currently, most of the concentrates produced in British Columbia are sent to smelters outside of the province.

The Resource Industry

Oil, natural gas, and forest wastes are all produced, transported, and distributed by private sector companies. B.C. Hydro, a Crown Corporation, supplies about 75 percent of the province's electric power. The remainder of our electricity is provided by private utilities and industry, such as

Alcan, Cominco, and pulp mills, which serve their own needs and sell surplus power to others.

The mineral industry is a private-sector domain, consisting of several key segments. A large number of individual prospectors and junior mining companies are engaged in mineral exploration. Production is handled mainly by senior mining companies with major operating mines, and by small to medium-scale producers of placer minerals, sand and gravel, and industrial minerals. Two major smelters and refineries undertake further processing of minerals, Cominco's lead-zinc facility at Trail and Alcan's aluminum smelter at Kitimat. Overall, the provincial mining industry is estimated to be between 65 and 75 percent domestically-owned.

How Much We Produce

In 1991, British Columbia produced about 1,000 petajoules of energy. Natural gas made up the biggest share (56 percent) of energy produced in-province, followed by electricity (20 percent). wood waste and other fuels (17 percent), and oil (7 percent). Over one-third of our total production came from renewable energy sources (hydroelectricity and biomass), more than twice the national average.

Coal and copper vie with each other as the province's most important mineral measured in value of output. By individual product, metallurgical coal and copper accounted for approximately the same share of total mineral value in 1991 (31 percent each), followed by gold (9 percent), zinc (6 percent), thermal coal (3 percent), silver (3 percent), and molybdenum (2 percent). Overall, metals made up just over half of mineral value produced, with coal accounting for about one-third and the remainder falling to industrial minerals and structural materials.

One gigajoule (GJ)
- 278 kilowatt-hours
- 0.16 barrels of oil
- 915 cubic feet of natural gas
- 29 litres of gasoline
- 940,000 British Thermal Units (Btus)

. The average B.C. household uses about 200 GJ each year for heat. light, hot water, and gasoline.

• One GJ will:
- light your house for three months
- give you hot water for three weeks
- power your car for 250 kilometres

One petajoule (PJ)
- 1 million gigajoules
- 278 gigawatt-hours
- 163.500 barrels of oil
- 915 million cubic feet of natural gas
- 940 billion Btus

. The City of Vancouver user about one PJ of energy every day.

Markets and Uses

British Columbians use slightly more energy (1,024 petajoules in 1991) than they produce domestically, so that on balance the province is a net importer of energy. The reason is a heavy consumption of oil products, most (about 80 percent) of which must be brought in from Alberta. We also export substantial amounts of natural gas and electricity. with gas exports currently running around one-half of annual production. Within the province, industry and transportation account for the biggest shares of total energy use.

Over 90 percent of provincial mineral production is exported, primarily to Pacific Rim markets. Most of our base metals are exported as mineral concentrates, the major exceptions being lead, zinc, and by-product metals from Cominco's smelting and refining complex in Trail. Today, British Columbia ranks as the world's third leading exporter of copper concentrates and the fifth leading coal exporter. Aside from Japan,

Korea, and other Asian countries, the United States is also a key market, especially for lead, zinc. and molybdenum.

Energy and Mineral Prices

Energy prices are determined through a combination of market competition and regulation to protect final consumers. The pricing of oil products, such as gasoline and home heating oil, is set through competitive forces, strongly influenced by events in world oil markets. While natural gas prices are also competitively-determined at the wellhead, the cost of delivering gas by distribution utilities (e.g., BC Gas and Centra Gas) is regulated to ensure fair rates and long-term security of supply. Pricing for electricity supplied by provincial utilities (e.g., B.C. Hydro and West Kootenay Power) is extensively regulated; private power producers, on the other hand, may now negotiate prices with new large industrial consumers.

The pricing of our mineral products is established in global markets, so that the B.C. mining industry is essentially a "pricetaker." Commodity prices can be highly volatile, fluctuating with changes in demand, world inventory levels, substitution by new materials, major labour disruptions. and other variables. Recently, both coal and base metal prices have been depressed in world markets, largely due to the impact of the economic recession. Given the cyclical nature of mining, B.C. mineral producers must struggle to control their costs of production and maintain competitiveness.

Impacts on the Environment

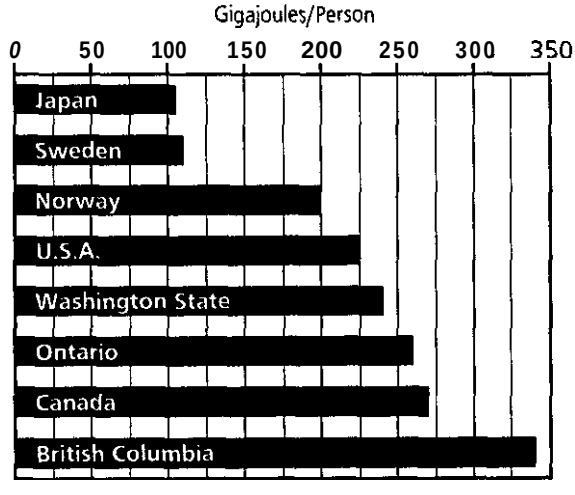
All resource development carries potentially harmful effects on the environment and human health and safety, which must be weighed against the economic and social benefits of that development. Burning fossil fuels for energy contributes to urban smog, acid rain, and a buildup of greenhouse gases in the atmosphere. Hydroelectric dams can flood large tracts of land. affecting wildlife and natural habitats. Marine oil spills and land-based dumping of oil products impact our oceans and inland water supplies. These and other effects call for strict regulation and mitigation to keep environmental damage to a minimum.

The environmental impacts of mining range from the visual effects of land disturbance to the acidic run-off from metal mines ("acid mine drainage") that can contaminate groundwater. Large open-pit mines create huge waste rock piles, which can lead to rock slides and risk to both human life and the natural environment. Environmental regulation is required at all phases of mine development, from the earliest stages of exploration through to reclamation of the minesite after production has ceased.

Energy Intensity *and* Efficiency

Compared to other industrialized regions, British Columbia uses a lot of energy for its population and the size of its economy. A major reason is that our economic structure includes a relatively high share of energy-intensive, resource-based industries such as pulp and paper. mining, and aluminum production. Since 1980, energy consumed per dollar of total provincial output has fallen by about 20 percent. Part of this trend can be attributed to more efficient energy use in various sectors of the economy.

Some strategic actions are underway to improve energy efficiency in British Columbia. For example, B.C. Hydro and West Kootenay Power operate their ongoing Power Smart and Power Sense programs, designed to encourage customers to use electricity wisely. The provincial government has launched several energy management initiatives including minimum efficiency standards For new appliances and the Fuel Smart program to cut oil consumption.



Energy Intensity, 799 1

Largely due to our energy-intensive industry. B.C. consumer more energy per capita than other regions.

RESOURCES IN THE ECONOMY

British Columbia's energy and mineral sectors play an important role in the provincial economy. Together, these sectors generate industry and government revenues in the billions of dollars annually. Our energy and minerals also contribute significantly to international trade. employment. regional economies. and the development of human skills.

Industry and Provincial Revenues

Sales by the B.C. energy industry totalled $5 billion in 1991. For the same period, the mineral sector produced output valued, at $2.8 billion at the minesite. In total, energy, mining, and primary metals account for about 4 percent of the province's Gross Domestic Product. As a source of natural resource revenue, minerals, gas and oil are second only to forestry revenues.

During 1991/92, the supply and use of energy and minerals contributed approximately $1.3 billion in direct revenues to the provincial government. (Note that this figure excludes personal income taxes paid by workers employed in the industries.) Overall, more than $1 out of every $10 collected by the provincial Treasury comes from the energy and mineral sectors. These revenues help to support health care, education, and other government programs to the benefit of all British Columbians.

International Trade

Direct exports of energy generated some $600 million in sales revenue in 1991. Since 1985, when deregulation was first introduced for natural gas markets, gas exports have grown substantially, with annual revenues now in the order of $400 million. Electricity exports typically fluctuate from year to year, varying with precipitation as well as market conditions. but have averaged about $135 million annually over the past five years. In addition to these direct exports, energy is also exported in an embodied form in energy-intensive goods including aluminum, pulp and paper, and chemicals.

With external sales of $2.3 billion, minerals comprise more than 20 percent of British Columbia's total exports. second only to forest products. The sector's growth since the 1960s can be traced largely to the rapid expansion of resource-hungry Japan and, later, Korea, Taiwan, and other Pacific Rim economies. Today, Japan accounts for 52 percent of the value of mineral products shipped from B.C. mines, while other Asian countries take a 12 percent share. The remainder of shipments are divided among Canada (22 percent), the United States (4 percent), Europe (8 percent), and other countries (2 percent).

Jobs in the Resource Sector

The provincial energy industry directly employs around 25,000 people. This total includes all workers involved in the production, transportation, and delivery of oil and natural gas, electric utilities, Alcan's hydroelectric

plant, and government. It excludes energy generated by the forest products sector.

Direct employment in the mineral sector was about 18.000 people in 1991. it is roughly estimated that another 25,000 owe their jobs indirectly to mining. Mineral exploration, on its own, is a major employer, engaging over 3,000 people at times.

People and Skills

People employed in the energy and mineral sectors tend to be highly-skilled, productive, and well-paid. For example, the average mineworker earns $22 an hour, some 70 percent more than the average industrial employee in British Columbia.

Vancouver has become a centre of expertise in mining and related fields including geoscience, environmental engineering, mine safety. and metallurgy. Recently, opportunities have been opening up in energy to develop advanced technologies such as hydrogen fuel cells, energy-from-waste, and *cogeneration* of industrial heat *and* electric power. The high-technology skills required for these resource fields are an exportable commodity in and of themselves.

Regional Development

Our energy and mineral resources stimulate activity in all of the province's regional economies-from the Lower Mainland, home to corporate head offices and supporting services, to remote northern areas where resources are explored for and developed. Oil and gas development is important to the Northeast, coal mining to the Kootenays and the Northeast, and precious metal mining to the North Coast and Nechako regions. The B.C. Interior benefits from copper production and has an energy opportunity in its ample supplies of wood waste. Industrial minerals and small power generation offer potential for future development in southeastern British Columbia, given proximity to Infrastructure and markets.

Resource development is the mainstay of many B.C. communities. Towns such as Fernie, Sparwood, Elkford, Stewart, Tumbler Ridge, and Trail-Rossland were basically founded on local energy or mineral resources. Others, including Kamloops, Princeton, Dawson Creek, Fort St. John, and Port Hardy, receive an economic boost from their resource sectors.

The Economic Linkages

The contribution of energy and minerals to the provincial economy (4 percent of GDP) may seem small compared to industries such as forestry (8 percent), construction (8 percent), or business services (15 *percent).* However, it is the linkages between these resource industries

and other sectors of the economy that make them key economic drivers. Our abundant and reasonably-priced energy supplies have helped to attract other resource-based industry, in particular, pulp and paper, aluminum. and petrochemical manufacture. Energy continues to provide a source of comparative advantage in the production and export of our leading commodities.

Mining depends closely on a variety of services ranging from transportation to financial and legal services. Many of the companies that serve mining-for example, equipment suppliers, geological and engineering firms, chemical laboratories, law firms, and financial institutions-are located in Vancouver and the Lower Mainland. Province-wide, around 60 percent (by weight) of all rail and water transportation is tied to the mineral sector.

ENERGY

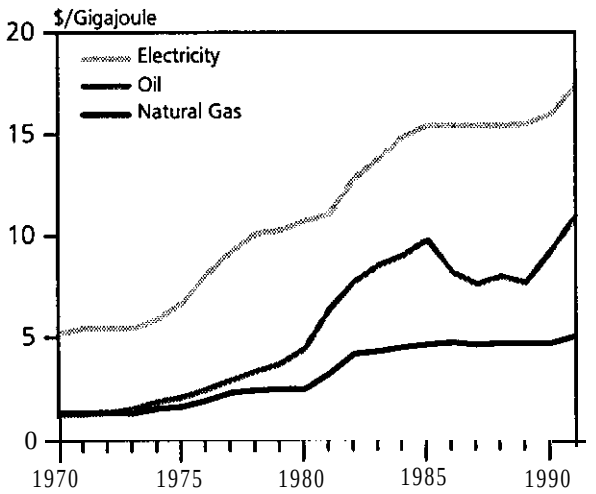
THE ENERGY INDUSTRY IN 1991/92

For British Columbia's energy industry. 1991/92 war a year of increased activity, particularly in the natural gas sector. Gas exports rose markedly during the year, although both oil and gas producers faced lower prices and declining profitability. The electricity industry remained robust. with continuing efforts in the areas of energy efficiency. rate design. and electricity trade.

Production and Use

Total production of energy in the province rose by seven percent to approximately 1000 petajoules in 1991. This total encompasses oil, natural gas, electricity, wood waste, and other fuels. The value of petroleum (crude oil and raw natural gas) and electricity produced, measured at the point of production, increased by five percent to roughly $2.6 billion.

Domestic energy use was up very slightly compared to its 1990 level, to some 1024 petajoules. Together, exports of natural gas and electricity rose by 27 percent to about 300 petajoules.



Residential Energy Prices
(Prices are in 1992 dollars, adjusted for inflation but not adjusted for efficiencies, include GST)

Natural gas has consistently been the lowest cost fuel for home heating purposes.

Retail Prices

The federal Goods and Services Tax (GST), which took effect in January 1991, led to a seven percent increase in the retail price of residential electricity, heating oil, and natural gas. In 1991, residential electricity prices rose by 8.5 percent on average, with the combined effect of the GST and the second of two 1.5 percent B.C. Hydro rate increases effective in early April. On average, prices for home heating (light fuel) oil were up

by 13 percent in the city of Vancouver. These increases reflect the GST and a delayed response to declining crude oil prices after the Persian Gulf conflict.

Gasoline prices, which tend to be more responsive to changes in the cost of crude, fell by eight percent on average for Vancouver. Residential natural gas prices rose by the amount of the GST, with no additional rate hikes over the period. On the basis of retail prices. natural gas remains the fuel of choice for residential heating requirements in British Columbia.

Resource Revenues

The government collects substantial revenues from the energy sector in the form of royalties, bonuses, fees, and rentals. Petroleum royalties were up marginally to $43 million in 1991. as new volumes from the Brassey oilfield compensated for the effect of falling oil prices. Despite higher natural gas volumes, gas and by-product royalties fell slightly to $74 million, due to strong downward pressure on prices. B.C. Hydro's annual dividend to the province was $23 million in 1991/92, down from $145 million in 1990/91.

Tender bonuses from the acquisition of oil and gas rights were also down by eight percent to $55 million. Lower prices, and resulting rationalization by the oil and gas industry, were the main reasons for the decline. Elsewhere, water rentals charged on the generation of hydroelectric power were $286 million in 1991/92, up 15 percent from the previous year's level.

Projects in Review

As of March 1992, over twenty electricity generation, natural gas, and power transmission projects were at various stages in the province's Energy Project Review Process (EPRP). Government review activity continued at a heavy pace from 1990/91. This was primarily the result of private power proposals submitted in response to B.C. Hydro's earlier calls for electricity to serve the domestic and export markets. Of the 24 projects in the EPRP at fiscal year-end, eight were for Independent power producers (IPPs) to serve domestic requirements and seven were for IPPs to serve export markets.

Six projects were approved for Energy Project Certificates (EPCs) during the year. These included four domestic IPP proposals, consisting of two thermal cogeneration plants and two small hydroelectric projects. In addition, approval was given for natural gas distribution facilities in the Squamish area and a new MBTE (a gas additive) transhipment terminal in Kitimat. Also in 1991, B.C. Hydro submitted an EPC application for a second high-voltage transmission line between its Kelly Lake (Clinton) and Cheekye (Squamish) substations.

Energy Management

Initiatives to encourage energy conservation and efficiency continued throughout 1991/92. B.C. Hydro and West Kootenay Power spent $59 million and $2.4 million, respectively, on their Power Smart strategic conservation programs. Provincial gas utilities (BC Gas, Pacific Northern Gas, and Centra Gas) contributed a total of $370,000 towards electric-to-gas fuel switching programs. As of the end of March 1992, B.C. Hydro reported annual electricity savings of over 450 gigawatt-hours from Power Smart, more than double the amount of estimated savings from 1990/91.

During the year, the ministry also expanded its energy management activities. Specific initiatives, including a carpooling project, were launched under the Fuel Smart program first introduced in February 1991. The province also brought in regulatory standards governing the energy-efficiency levels of major new appliances.

New Energy Sources

British Columbia has some new and emerging opportunities in the area of alternative energy sources-for example, energy-from-waste and energy carriers, such as hydrogen, which can be used in fuel cells. Progress was made on two fronts during 1991/92: geothermal energy, or energy from hot water and steam trapped beneath the ground; and coalbed methane, or natural gas found in coal seams. In January 1992, one eight-year permit was issued for geothermal exploration in the Upper Lillooet River area near Pemberton. The exploration site is close to three geothermal wells drilled by B.C. Hydro during the 1980s.

Recent ministry research estimates the province's coalbed methane potential at over 4.2 trillion cubic metres, some six times our total (discovered and remaining) reserves of conventional natural gas. In early 1992, an exploration permit and drilling licence were awarded for two coalbed methane parcels in the East Kootenays. The tenure awards to Norcen Energy Resources Limited and Fording Coal Limited yielded $5 million in bonus bid revenue to the province. ,

OIL AND GAS

Exploration and Drilling

Oil and natural gas drilling activity declined about 17 percent in 1991, with a total of 236 wells drilled during the year. Of these wells, 58 percent were successful (i.e., were' not abandoned as unproductive), compared to a success rate of-63 percent for 1990. As of March 1992, the total land area held under petroleum tenure was down by 10 percent from the previous fiscal year-end, to 5.3 million hectares. These declines in drilling activity

Since 1985, the continental trend towards deregulation of oil and natural gas supply has resulted in a surge of industry activity and gas production. In British Columbia. exploration activity reached an historic high during 1990. with annual industry expenditures in the order of $1 billion. In 1991, however, lower gas pricer and declining profitability led to gas producers undertaking severe cost-cutting measurer. including hundreds of staff lay-offs at Calgary head officer and reductions in exploration and development budgets.

and tenure holdings reflect industry rationalization, in which tighter exploration dollars were focussed on certain key properties. rather then acquiring and maintaining a diverse portfolio of tenures.

There were 13 discoveries of major oil and gas pools in 1991. A discovery in the Brazion area by BP/Amoco Canada resulted in one of the highest Flow rates ever tested in Canada (75 million cubic Feet per day). In aggregate, approximately 2 million cubic metres of newly-discovered oil and 25 billion cubic metres of raw gas were drilled during the year.

Production

B.C. natural gas production was up by 12 percent to 16 billion cubic metres (raw gas) in 1991. At the same time, the value of this production, measured at the plant inlet, rose by only Four percent to $561 million. Essentially, lower gas prices were more than offset by higher export volumes. The downward pressure on prices is linked to a continuing oversupply of natural gas and increased competition For markets.

Crude oil production in the province remained basically unchanged From its 1990 level, at 2 million cubic metres. The value of crude oil at the wellhead, however, declined by 18 percent to $263 million. This translates into a drop in B.C. wellhead prices From an average $162 per cubic metre ($25.82/barrel) in 1990 to $132 per cubic metre ($21.04/barrel) in 1991. Lower B.C. prices, in turn, reflect the decline in world oil prices that Followed resolution of the Gulf War in February 1991.

Domestic Use

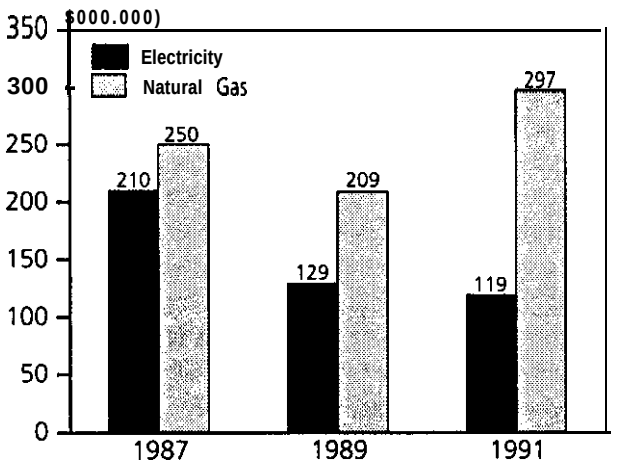
Natural gas use within British Columbia increased marginally to 258 petajoules in 1991. The rise in domestic consumption reflects, in part, the start-up of gas delivery to Vancouver Island. A moderating influence on demand was the warmer winter in 1991, which meant lower requirements For both space heating and electricity generation (i.e., For the Burrard gas-Fired power plant). In terms of consuming sectors, industrial (39 percent) and residential (31 percent) use make up the majority of natural gas demand in-province.

Domestic oil use, which has remained Fairly constant since 1981, Fell For the second year in a row, to 387 petajoules (includes Feedstock requirements). This decline can be attributed to reduced industrial demand as a result of the recession, as well as to an increase in cross-border gasoline purchases. The transportation sector accounted For 68 percent of oil products consumed in 1991. of which about one-half was motor gasoline. Our large requirements. combined with relatively small domestic production, mean that the majority of the province's supplies of crude oil and oil products must be imported, primarily From Alberta.

Natural Gas Exports

Exports of natural gas rose by 29 percent in 1991, to 269 petajoules-the first time in a decade that exports actually exceeded domestic gas requirements. The number of Energy Removal Certificates (ERCs) issued by the Province also peaked at a total of 82, comprising 55 firm and 27 interruptible ERCs. These ERCs cover sales to Eastern Canada and the Pacific Northwest, Northeast, and Midwest regions of the United States. In 1991. they authorized the export of up to 29 billion cubic metres of B.C. gas.

British Columbia's activity in the export arena has grown substantially since the start of deregulation in October 1985. The Pacific Northwest takes most of our export sales (69 percent in 1991). While sales volumes are up. aggressive competition for markets has resulted in lower prices. The average border price for interruptible gas sales to the United States fell from $1.65 per gigajoule in 1990 to $1.42 per gigajoule in 1991.



Natural *Gas and Electricity* Exports

B.C.'s energy exports are a source of substantal revenues.

Vancouver Island ***Natural Gas Pipeline***

In September 1991, natural gas began flowing on the new Vancouver Island Natural Gas (VIGAS) pipeline to serve customers on Vancouver Island and the Sunshine Coast. Completion of the VIGAS project follows three decades of planning and public discussion and two years of construction. The 531-kilometre pipeline was built by Pacific Coast Energy Corporation (PCEC), with funding assistance from the federal and provincial governments. As owner and operator of the pipeline, PCEC delivers natural gas directly to seven pulp mills and to some 28 communities.

Community gas distribution is handled by Centra Gas British Columbia Inc. and Squamish Gas Company Ltd.

Other New Facilities

Major production projects in 1991/92 included the tie-in of several new natural gas fields and commissioning of three new gas processing plants:

Amerada Hess Canada Ltd. opened its Boundary Lake sour gas plant just east of Fort St. John, capable of processing 46 million cubic feet per day of sour, raw gas;

Canadian Hunter Exploration Ltd. started up its Ring/Border gas plant northeast of Fort St. John, with processing capacity of 85 million cubic feet per day of sweet, raw gas; and,

BP completed its West Sukunka gas plant south of Chetwynd, with processing capacity of 130 million cubic feet per day of sour gas.

ELECTRICITY

The B.C. electric power industry has been buoyed by steady demand growth over the past decade. Following on the trend of oil and gas deregulation, there have been efforts across North America to open up the power market to competition and to "unbundle" electricity services such as generation. storage. and transmission. B.C. Hydm has been pursuing these objectives through its calls for privately-produced power, the Power Exchange Operation. and other Initiatives.

Production

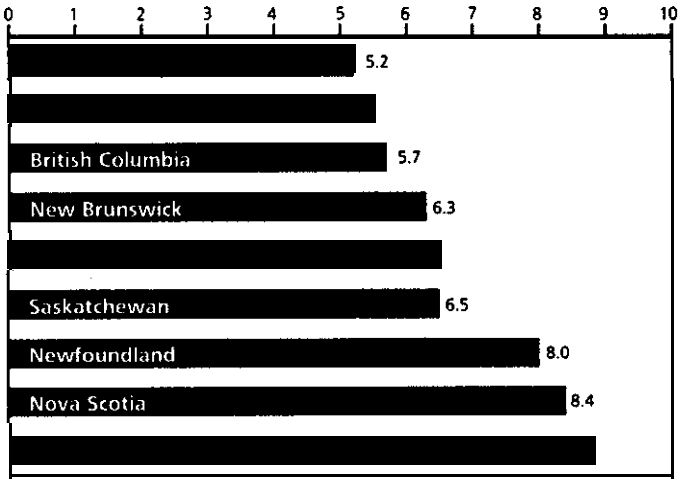
Total production of electricity in British Columbia rose by four percent to 63,000 gigawatt-hours in 1991. This total encompasses hydroelectric and thermal power generated by B.C. utilities and industry, for both domestic and export use. Hydro generation made up 96 percent of the electric energy produced, with oil, natural gas, and other thermal sources accounting for the remainder. Electric utilities produced 79 percent of the province's power, and industry 21 percent.

The value, at net production cost, of all electricity generated during the year was $1.6 billion, up nine percent from 1990. This value. measured at the point of generation, is estimated by examining production costs for the two major provincial utilities. B.C. Hydro and West Kootenay Power. For power produced and consumed by industry (e.g., mines, pulp mills, and smelters), where no sales transaction takes place. imputed values are calculated.

Domestic Use

Domestic electricity use increased slightly to 57,300 gigawatt-hours in 1991. Since the early 1980s, in-province requirements have been growing steadily at an average three percent per year, largely due to electrification of the residential sector (e.g., homes using more and bigger electrical appliances). By sector, industry still accounts for the largest share (48 percent) of domestic consumption, followed by the residential (23 percent) and commercial sectors (20 percent).

During 1991, B.C. Hydro served some 1.3 million customers in the province. Domestic sales by the utility totalled 40.600 gigawatt-hours. Annual peak (one-hour) demand for the year occurred in January, at 7.5 gigawatts. Warmer temperatures in late 1991 contributed to a lower maximum demand than had been recorded in 1990. B.C. Hydro's highest peak demand ever at 6.1 gigawatts.



B.C.'s electricity prices are amongst the lowest in Canada.

Residential Electricity Price Survey, January 1992
(Based on 1000 kWh/month consumption, prices exclude GST and PST)

Nectricity Exports

B.C. Hydro's electricity exports increased by 12 percent, from 1990 levels, to 5,100 gigawatt-hours. Short-term firm exports, 21 percent of the total, fell by four percent, while interruptible exports, 79 percent of total exports, rose by almost 18 percent. Total sales revenues were up substantially to $170 million. Reasons for the increase in exports included generating plant shutdowns and the water-flow requirements of the United States.

Both the volumes and prices of power exports are highly variable. dependent on factors such as stream flow conditions, transmission availability in the U.S. Pacific Northwest, and the cost and amount of alternative U.S. generation. Over the past five years, B.C. Hydro's exports have ranged from a low of 3,500 gigawatt-hours in 1991 to a high of 9,500 gigawatt-hours in 1966.

B.C. Hydro Reporting Relationship

In November 1991, B.C. Hydro's reporting relationship to government was transferred from the Ministry of Energy, Mines and Petroleum Resources to the Ministry of Labour and Consumer Services. The change was made to

allow for a more "arms-length" relationship between the utility and its regulators. In particular, this ministry's role in the review and approval of power projects suggested that it should be removed from the oversight of B.C. Hydro's day-t-day operations.

Also in November, the Crown Corporations Secretariat was created, with a broad mandate to review the plans and policies of Crown corporations and to monitor their performance. The Secretariat will examine a range of issues that concern B.C. Hydro, from criteria for evaluating capital programs to policies for the purchase of privately-generated power.

Rate Design

in January and February 1992. the B.C. Utilities Commission held a hearing into an application by B.C. Hydro to restructure customer rate schedules. The goal of the rate design application was to structure residential. commercial, and industrial rates so as to promote the efficient use of energy. Under the existing rate design for residential and commercial customers, the average price of a kilowatt-hour of electricity falls as consumption rises (a so-called "declining block" structure), tending to discourage energy efficiency. B.C. Hydro proposed gradually to increase its rates for successive "trailing blocks" of electricity to levels that more closely reflect the cost of developing new power resources.

In April 1992, the Utilities Commission issued a decision in support of the application, ordering B.C. Hydro to flatten out its rates for residential and commercial customers. (Note that rates for industrial customers are already flat.) At the same time, the Commission denied the utility's industrial rate proposal and directed B.C. Hydro to work with industrial customers to tailor Power Smart and demand management programs aimed at ensuring cost-effective energy savings.

Columbia River Treaty

Under the Columbia River Treaty of 1964, three large storage dams were built in British Columbia, resulting in the generation of additional power downstream in the United States. Canada's half-share of the additional generation, known as the Canadian Entitlement, was sold to a group of *U.S.* utilities for a 30-year period. The Canadian Entitlement, which belongs to British Columbia, will return to the international border starting in 1998. It represents a relatively low-cost, environmentally-clean power resource worth in the order of $1.0 billion ($1990).

During 1991/92, discussions continued between the province, B.C. Hydro, and the U.S. Bonneville Power Administration on technical issues related to the return of the Entitlement. The government is considering options for disposition of the power, including its sale within British Columbia and resale of a portion or all of the power to export markets.

Power Exchange Operation

POWEREX, a subsidiary of B.C. Hydro, currently operates a Power Exchange Operation (PEO) to conduct short-term (less than one year) electricity trade transactions with parties outside the province. In September 1991, B.C. Hydro and POWEREX applied to the government for an Energy Project Certificate to expand the PEO to include domestic electricity exchanges. In its expanded form, the exchange would be open to utilities, private power producers, and industrial customers in British Columbia, Alberta, and the United States. Interconnected utility power systems and reservoirs would be used to buy, sell, transmit, and store electricity. The PEO application remains under government review at the present time.

OUTLOOK

Oil

Both the immediate and longer-term outlooks for energy in British Columbia are relatively favourable, although certain sectors (i.e., oil production) are expected to decline. Natural gas and electricity are forecast to increase their shares of provincial energy supply, at the expense of oil and other fuels.

The province's oil producers will continue to face market price uncertainty and rising costs over the next year. Rationalization is also hitting the petroleum refining industry, which witnessed the closure of one B.C. refinery, Petro-Canada's Taylor plant, in 1991. As current crude oil reserves decline, and are likely not replaced by any major new finds, provincial production will decline. This decline will mean increased imports from Alberta and offshore, since domestic oil demand will be sustained by modest growth in road transportation requirements.

Natural Gas

The natural gas industry will also experience reduced prices and earnings again in 1992/93. While oversupply and increased competition could keep prices low for several years, over the longer term both natural gas volumes and prices are forecast to rise. Steady growth in demand is expected to come from export markets, Vancouver Island, and new construction in the Lower Mainland. Despite anticipated price increases, natural gas will remain the least expensive fuel in all domestic heating markets.

Electricity

Provincial electricity demand, too, is expected to show steady growth, with electrification of the commercial and industrial sectors and, in particular, the pulp and paper industry. Electricity prices are forecast to fall relative to other fuels over the long term. Private power production will increase its share of total provincial supply. Overall, British Columbia has a diverse mix of resource options for the future, including increased conservation

and energy efficiency, greater coordination and trade with neighbouring power systems, and new utility and non-utility power plants.

New Opportunities

There are some strategic opportunities for further development of the B.C. energy sector. Given our resource base and expanding U.S. markets, increased natural gas and electricity exports could help to create employment, as well as adding to industry and government revenues. More highly-skilled jobs could also be created by the domestic processing of raw energy into petrochemicals, liquified natural gas, and privately-generated thermal power. The province has abundant potential in a number of alternative energy sources. including coalbed methane and geothermal energy, which may become economically feasible as the prices of conventional fuels rise through time.

MINERALS

THE MINING INDUSTRY IN 1991/92

The past year saw continuing challenges for the prwince's mineral sector in the form of depressed prices, a high Canadian dollar, and reduced company profits. Exploration activity, so critical to the sustained growth of the rector, made a sharp decline in 1991/92. Nevertheless, there were some bright spots during the year in terms of exploration successes, particularly at producing mines. and new mining developments on the horizon.

Production

The total value of minerals produced in British Columbia was $2.8 billion in 1991. down seven percent from the 1990 value of $3.0 billion. Declining metal and coal prices, as well as a drop in asbestos and sulphur production, contributed to the lower value of output. Coal was the single most important mineral commodity, valued at $980 million. Copper production, with revenue of $847 million, accounted for the biggest share of total metal value.

Weakening commodity prices, the high Canadian dollar, and reduced demand as a result of the recession continued to hound mineral producers during 1991/92. Base metal prices fell for a second consecutive year. after recovering in the late 1980s. Coal prices have experienced a prolonged period of weakness, with the average minehead value of coal to south-eastern B.C. producers down 40 percent between 1982 and 1991. Overall, the provincial mining industry lost almost $500 million in 1991.

Mine Openings

Three mining operations started up over the course of the fiscal year. In May 1991, Bethlehem Resources completed a $4.5-million rehabilitation of the Goldstream copper-zinc mine near Revelstoke. At full production, the reopened mine has an expected life of five years. In July, Westmin Resources opened the small SB project, with a workforce of 30 employees. Located next to the Premier gold mine near Stewart, this operation used the Premier mine's milling facilities to process its ore.

The third operation to begin production during the fiscal year was the Dome Mountain gold mine near Smithers. Opened in January 1992, Dome Mountain employs about 15 workers and will produce an estimated 400,000 grams of gold through the end of 1992.

Mine Closures

Three operations also closed during 1991/92. In August 1991, Teck Corporation closed the Afton copper mine. The newly-opened SB project closed in November, as its deposit had been exhausted.

The McDame asbestos mine at Cassiar ceased production in February 1992, when Cassiar Mining Corporation went into receivership. Asbestos valued at $35 million was shipped during 1991, but only $4.5 million was sold in 1992.

Strikes *and Shutdowns*

Strikes occurred at three companies, Cassiar, island Copper, and Similco. The Similco copper mine was on strike the longest, with production shut down between June and October 1991. Workers at the giant Highland Valley copper mine near Kamloops carried out some production slowdowns while negotiating a new labour agreement in the fall. These slowdowns led to a drop in output and the need to draw on inventories.

Treminco downsized the Silvana lead-zinc operation in July. The company halved its production rate and reduced its workforce by 15 people. In November, Sable Resources had to shut down its recently opened Multinational B-Zone gold property, after an underground mine collapse. The company is hoping to reopen Multinational in early 1992/93. Because of economic conditions and downsizing, a large number of mineworkers were laid off during the year, including some 280 employees in total at the Lawyers. Golden Bear. Similco. and Myra Falls mines.

Projects in Review

Prominent in the province's Mine Development Assessment Process (MDAP) during 1991/92 were the Mount Polley copper-gold project, Stronsay lead-zinc project, and Crystal Peak Garnet project. all at an advanced stage in the MDAP. Review of the Telkwa coal project, located in northwestern British Columbia, was put on hold by Shell Canada Ltd. in late 1991. The Windy Craggy copper-gold project review was delayed in late 1991, in order to allow resolution of water and land use issues. This proposed $600-million project is located in the Tatshenshini-Alsek region of the Northwest of British Columbia.

The following projects received approval-in-principle to proceed to permitting during the year: the Fording Coal Henretta Dragline project, Cheni Gold BV Deposit, Line Creek Coal MSAN Stage I, and International Shasta Multinational B-Zone Development. In total, some 25 proposed projects were at various stages in the MDAP at the end of 1991/92.

Eskay Creek

Significant progress was made on the $210-million Eskay Creek gold-silver project northwest of Stewart. This project, jointly owned by Placer Dome Inc. and International Corona Corp., is one of the richest undeveloped mineral properties in Canada. Probable gold reserves in the Eskay Creek deposit are estimated at 3.4 million ounces.

During 1991/92, engineering and environmental studies continued on the project. A major underground drill and development program produced excellent drilling results. Perhaps most importantly. construction was completed on a 37-kilometre access road from Highway 37 at Bob

Quinn Lake to the confluence of Volcano Creek and Iskut River. The new Iskut Road will help Eskay Creek and other projects In the region, and will generally make the Northwest more accessible for mineral exploration and development.

Other Developments

A number of other developments of note occurred at mining projects and existing mines. For the Mt. Milligan project In north-central British Columbia, work continued on large-diameter drilling to delineate ore reserves, preparation of mill and dump sites, metallurgical research, and a feasibility study. The Golden Bear gold mine near Telegraph Creek solved most of its production and milling problems. after underground operations were shut down in March 1991. Underground development started at the Samatosum (lead. zinc, silver, gold) open pit mine near Barriere, and underground drilling discovered a new gold zone.

Successes with geological modelling and drill programs at other B.C. mines may help to extend their productive lives, for example:

Westmin Resources Ltd. discovered the Gap Zone at its Myra Falls mine (copper, lead, zinc, silver, gold) on Vancouver Island;

Gibraltar Mines discovered the Gibraltar North Zone at its operations in the Cariboo; and,

a major drilling program completed at Noranda Inc.'s Bell copper mine indicated significant new reserves.

Exploration Activity

Mineral exploration expenditures decreased markedly from over $200 million in 1990 to approximately $150 million in 1991. Especially hard-hit were individual prospectors and junior mining companies, which have been proven "mine finders' over the years. The decline in exploration activity reflects the combined effect of weakening metal prices, rising costs, and industry concerns about land access. In addition, exploration dollars are being effectively lured elsewhere, as other countries, such as Chile, have eased their legislative restrictions on investment and mineral tenure.

New mineral claims staked in 1991/92 were 6,392, a drop of 20 percent from the 10,496 staked in 1990. Likewise, notices of work to develop exploration properties were down 23 percent, from 2,438 to 1,675.

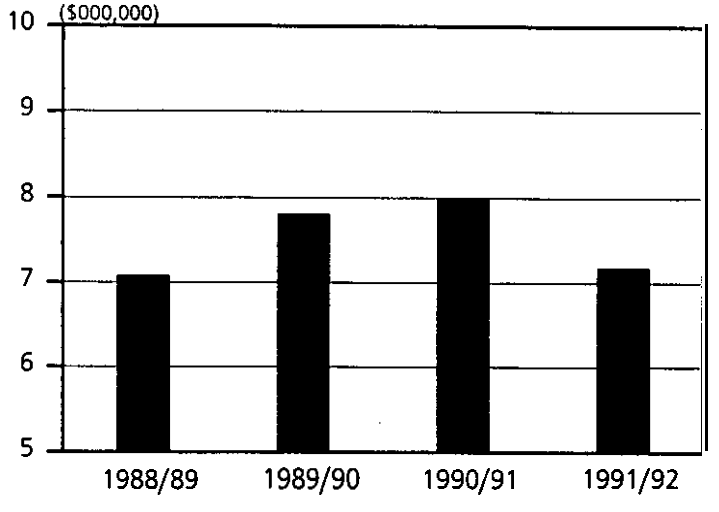
Exploration *Highlights*

Despite reduced spending, British Columbia witnessed the highest level of exploration activity in Canada in 1991. This activity was focussed mainly in the central and northern parts of the province, In pursuit of precious

and base metal targets. Following the trend that began in 1988/89, exploration interest continued for multi-element deposits of large sire. such as copper-gold porphyry deposits, or ones with high unit values. such as volcanogenic massive sulphide and high-quality precious metal deposits.

Copper-gold porphyry deposits under exploration included Galore Creek, Copper Canyon, Copper Penny, Sulphurets, Kemess, Lorraine, Dorothy, Cat, Klawli, Chuchi Lake, Col, Fish Lake, Hushamu, Red Dog, and Katie. Volcanogenic and sediment-hosted massive sulphide deposits under exploration included Tulsequah Chief, Sib, Unuk River. Rock and Roll, Seneca, Darlin, and Horn. Among the vein and transitional deposits of interest were Polaris Taku, Spectrum, Red Mountain, Dome Mountain. Clisbako, J&L, Elk, and Taseko.

Mineral titles revenue fell by 10 percent in 1991/92.



Mineral Titles Revenue

Mineral Revenues

Revenues from mineral fees and royalties amounted to almost $42 million in 1991/92, compared to $45 million in 1990/91. Mineral titles revenue alone was down from $8.0 million to $7.2 million. These declines reflect continued slow demand and weak coal and metal prices.

SECTORAL HIGHLIGHTS

Coal

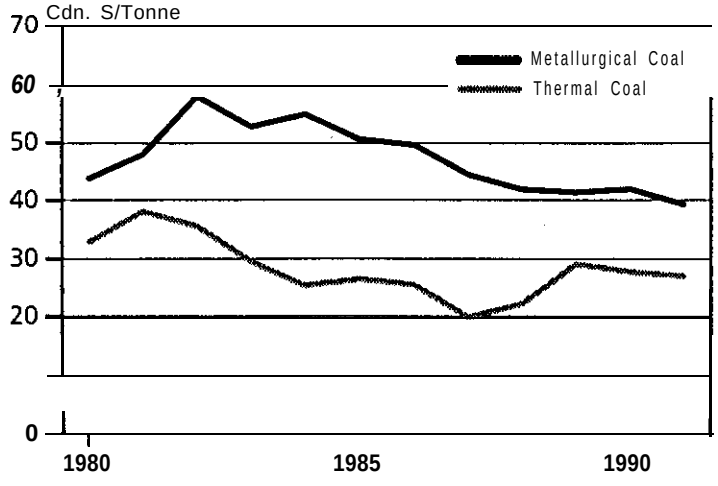
After a strong year in 1990, Japanese demand for metallurgical coal in steelmaking began to weaken in late 1991, reflecting a general economic slowdown and reduced automobile exports in particular. Shipments by

B.C. mines actually increased slightly in 1991 to 21.7 million tonnes; however. the value of coal production declined by five percent to $055 million. Contract prices fell again this year, with the 'world' price of coking coal down one U.S. dollar to U.S. $51.80 per tonne on average for 1991.

Demand for thermal coal in electricity generation remained firm over the year. Both the quantity and value of B.C. shipments were basically unchanged at three million tonnes and $83 million, respectively. The 1991 benchmark price for thermal coal was U.S. $39.85 per tonne, also down one U.S. dollar from its 1990 level.

Major restructuring of the B.C. coal industry continued through 1991/92. In July 1991, Shell Canada Ltd. sold its Line Creek mine in the Kootenays to Calgary-based Manalta Coal. Also in July, Consolidated Brinco, owner of the Quinsam mine, merged with Hillsborough Resources. A debt restructuring plan was prepared for the Quintette mine in north-eastern British Columbia, with Teck Corp. now acting as mine operator and one-half owner. The Byron Creek mine in the Southeast remained up for sale by Esso Resources Canada Ltd.

All of British Columbia's major mineral products. except for lead and zinc. experienced declines in their value of output during 1991/92. This was due largely to lower commodity prices and the high Canadian dollar. While coal did not face the same declines as certain other commodities (e.g., copper and sulphur), a prolonged period of weak pricer and reduced profit margins has especially hurt this industry. In 1991, B.C. coal producers sustained financial losses of $62 million in aggregate. before extraordinary losses.



Average Price Per Tonne for B.C. Clean Coal (minehead value)

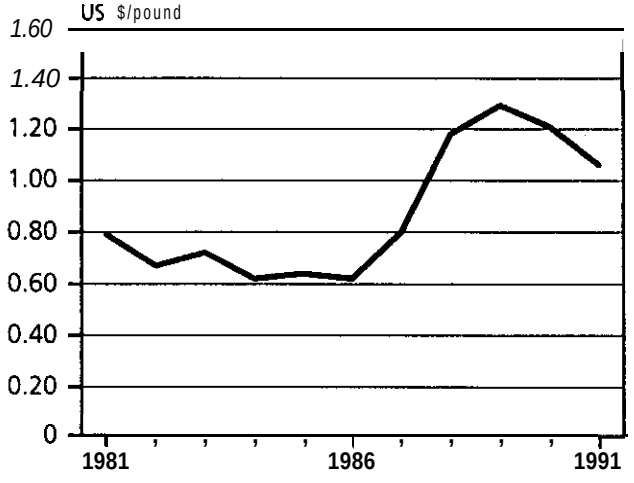
B.C. coal prices have declined over the part decade.

Copper

Copper shipments managed to increase marginally to 331 million kilograms in 1991, despite closure of the Afton mine and production slowdowns at Highland Valley Copper. In value terms, however, output fell by 14 percent, with the combined effect of exchange rates and reduced copper prices. The average price of copper declined from U.S. $1.21 per pound in 1990 to U.S. $1.06 in 1991.

British Columbia has several large producing copper mines, including Highland Valley which is the world's second largest producer in terms of ore milled. We also have significant undeveloped deposits, such as Mount Polley, Mt. Milligan, and Fish Lake near Williams Lake. The Windy Craggy deposit in the northwestern comer of the province contains an estimated nine billion pounds of copper.

After recovering in the late 1980s, B.C. copper pricer have fallen in the last few years.



Average Price per Pound for B. C. Copper

Lead and Zinc

Lead and zinc prices also fell during 1991—the average lead price from U.S. $0.46 per pound to U.S. $0.34 per pound, and the average zinc price from U.S. $0.75 per pound to U.S. $0.53 per pound. Production, on the other hand, increased substantially over 1990 levels. The value of lead output more than doubled to $33 million, while zinc output rose by almost one-half to $152 million. These increases reflect the return to production of Cominco's large Sullivan mine near Kimberley, which had been closed for nine months in 1990.

Cominco experienced financial difficulties during the year, due to lower prices and technical problems with the start-up of its new QSL lead smelter. In January 1992. the company announced across-the-board job cuts to reduce the workforce at its Trail lead-zinc smelter by 500 people. The QSL lead smelter remained out of service throughout 1991/92, while Cominco conducted an assessment of alternatives for the facility.

Molybdenum

Molybdenum prices continued their decline, falling From an average U.S. $2.81 per pound in 1990 to U.S. $2.35 per pound in 1991. Weak prices are the result of excessive world inventories, created in large part by copper mines that produce molybdenum as a by-product. Output at B.C. mines declined by 10 percent in 1991, due mainly to the closure of the Brenda copper-molybdenum mine near Peachland in June 1990.

In 1991, Placer Dome's Endako mine celebrated its 25th year of operation. Endako is Canada's only primary molydenum producer, with production levels currently running about 14 million pounds Per year.

Gold

Gold production increased by eight percent to 17.4 million grams in 1991. Cominco's Snip mine, which began operating in January 1991, added 2.4 million grams to the provincial total. Higher production levels at the Nickel Plate and Golden Bear mines also contributed to the increase.

In value terms, gold output fell marginally to $238 million, as lower prices and the high Canadian dollar more than offset our increased production. The London Metals Exchange price for gold averaged U.S. $362.18 per troy ounce in 1991, compared to U.S. $383.47 per ounce in 1990. Weak prices can be attributed to a variety of factors including record world production levels, reduced demand due to the recession, and unrealized fears about Soviet gold reserves being dumped on the market.

Silver

Silver output was down by 20 percent to 505 million grams in 1991. The main reason was declining ore grades and lower production rates at Placer Dome's Equity Silver mine near Houston, the source of about one-third of provincial output. The value of silver production fell even further, by 35 percent, to $74 million. High world inventories continued to influence silver prices, which declined from an average U.S. $4.82 per troy ounce in 1990 to U.S. $4.04 per ounce in 1991.

Other Minerals

Production of industrial minerals. such as asbestos, sulphur, limestone, and gypsum, totalled $86 million, down 28 percent from their 1990 value. Asbestos output mad; the largest (34 percent) decline to 63 thousand tonnes, reflecting a shutdown in March 1991. as well as technical problems associated with the shift to underground mining at the Cassiar McDame mine.

While sulphur production rose by 19 percent in physical terms, the value of output was down by one-quarter to $42 million in 1991. Sulphur prices made a sharp decline during the year, due to reduced industrial demand, an excess supply of sulphur from natural gas production, and increased competition in key world markets. The value of structural materials, including cement, sand and gravel, remained essentially unchanged from 1990 levels, at a total $312 million.

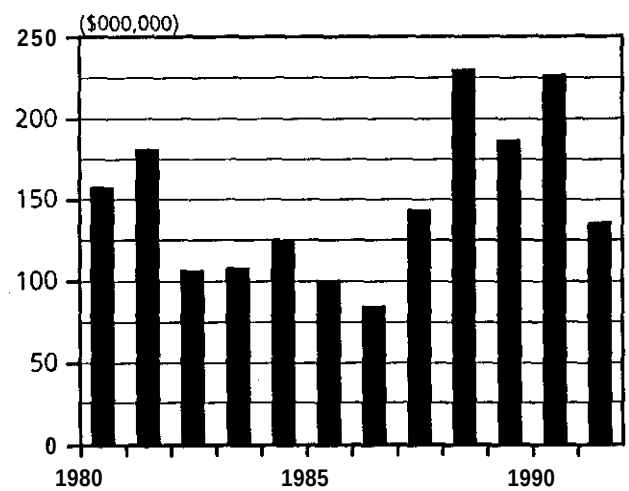
OUTLOOK

Although the outlook for 1992/93 does not suggest much improvement over the part year, in the longer term there are opportunities for B.C. minerals in the discovery of new deposits, new mine development, and expanding markets.

Declining Exploration

Exploration activity is expected to fall again in 1992, as a result of continuing low prices and the limited availability of investment capital. However, the province has a number of promising areas where further work will likely occur. In particular, northwestern British Columbia remains a target of key exploration interest, and with the completion of the Iskut Road, access to this region is much improved. Also, there is potential for exploration successes at existing mines, as demonstrated by recent results at the Gibraltar and Myra Falls operations.

Mineral exploration spending fell sharply in 1991.



Exploration Expenditures
(excludes corporate overheads)

Continuing Mine Closures

Several producing mines are scheduled to close during the next few years: Bell (1992), Lawyers (1992), Samatosum (1992). Premier (1992), and Equity Silver (1993). This trend will continue for the 1990s. Some sched-

uled mine closures, such as Equity Silver, are expected to be permanent, due to depleted ore reserves; others, such as the premier gold mine, may be temporary, depending on commodity prices and costs.

New Development

The impact of mine closures and reduced exploration activity may be offset, to a certain extent, by new mine development. Major projects such as Mount Polley, Stronsay, Mt. Milligan, and Eskay Creek, as well as some smaller projects, could advance to the permitting stage of the *Mine* Development Assessment Process in the next several years. Whether these projects would then be developed depends on company financing, market prices, and other economic considerations.

New Technologies and Markets

Over the longer term, the B.C. mineral sector has some strategic opportunities in the pursuit of innovative technologies in exploration, mining, and mineral processing, as well as the development of new markets and products. Efforts to increase the provincial "value-added" to our mineral products-for example, through domestic copper smelting or coke manufacturing-could become important in the coming years. There is significant growth potential in the fields of structural materials, industrial, and "space-age" minerals including dimension stone, refractory minerals, rare earths, titanium, and ceramic materials.

Metals

Base and precious metal prices are expected to remain weak through 1992/93. A compensating influence on further weakening prices will be the lower value of the Canadian dollar in 1992. Output at B.C. mines will be affected by some of the scheduled mine closures noted above. With more mines closing than are expected to open during the decade, exploration is sorely needed to address our declining metal reserves, especially reserves of key base metals (e.g.. copper and zinc).

Coal

The B.C. coal industry will continue to experience low prices and earnings. As of early 1992/93, certain companies were already facing reduced prices of U.S. $0.50 per tonne, arising out of production cutbacks at Japanese steel mills. In the long term, metallurgical coal demand will be hit by technological change in Japanese steelmaking, requiring less and less coal per tonne of output. Thermal coal demand, on the other hand, is forecast to grow considerably, with increased requirements for electricity

generation in Japan, South Korea, Taiwan, Europe, and other markets. If prices for thermal coal improve, British Columbia will be well positioned to supply these markets.

MANAGING OUR RESOURCES

RESOURCE EVALUATION

A pivotal ministry function is the collection and processing of data on energy resources and mineral deposits and occurrences, for use by government, industry, and the public. Resource inventories and evaluations are important inputs into provincial regulation, management of resource rights, land use planning, revenue collection, and policy-making. High-quality. comprehensive, and timely information helps to promote efficient exploration and development by the province's mineral and oil and gas industries.

The ministry's mandate is t ensure that British Columbia's energy and mineral resources are developed and used in a safe. efficient. and environmentally-round manner for the sustained economic and social benefit of the province. its regions, and communities. To meet that mandate, we have a number of enduring responsibilities in resource management. These responsibilities are outlined here. along with a description of major ministry accomplishments during 1991/92. Later, some more activities from the past year are examined under areas of key concern to the government: planning. jobs and regional development. people and skills. energy efficiency, the environment. and ministry services.

ENERGY HIGHLIGHTS

Oil *and* Gas Evaluations

In 1991/92, the ministry's petroleum geologists evaluated over 275 oil and gas wells, to map their subsurface geology and quantify hydrocarbon reserves. The results of this work, which include over 300 new or revised maps, will be used to estimate reserves, make decisions on petroleum tenures, and evaluate proposals for Improving the conservation and recovery of oil and gas resources.

Two new gas fields (Tupper Creek and Stone Creek) were designated during the year, and one new oil field (Sunset Prairie). Major geological evaluations were completed in the Bullmoose Sukunka, Buick Creek-Rigel, Jedney-Bubbles. and Tommy Lakes field areas.

Coalbed Methane Potential

A paper entitled *Coalbed Methane in Southeast British Columbia was* completed in April 1991. The paper identified potential resources of 493 to 600 billion cubic metres in the Crowsnest, Elk Valley, and Flathead coalfields. For comparison purposes, the province's total reserves of conventional gas are estimated at 680 billion cubic metres. Together with findings from earlier ministry studies, this recent research places our coalbed methane potential at some 4.2 trillion cubic metres in nine major coalfields evaluated so far.

Energy Resource Maps

The ministry contributed to the publication of a map, *Energy Resources of British Columbia, a joint* project with B.C. Hydro, BC Gas, and Canadian Cartographics Ltd. Contributions were also made to the Geothermal

Inventory Resources Map of British *Columbia,* prepared in cooperation with the Geological Survey of Canada.

MINERAL HIGHLIGHTS

Regional Geological Mapping

The ministry's Geological Survey Branch (GSB) continued its multi-year regional mapping program in 1991/92. Despite British Columbia's mineral endowment, less than 10 percent of the province is currently mapped at the 1:50 000 scale most useful for exploration.

Regional surveying occurred at a moderate pace again this year. with several projects funded by the ministry and the federal-provincial Mineral Development Agreement (MDA). Among the major activities were:

- two mapping projects in the Northern Quesnel Trough of north-central B.C., north and west of the giant Mount Milligan copper-gold deposit, where heavy claim staking activity has occurred recently—the main geologic targets are coppergold porphyries and carbonate-hosted lead-zinc mineralization;
  in the Iskut region of the Northwest. a project in the More Creek area, part of the province's Golden Triangle between the Galore Creek and Eskay Creek gold camps-targets include gold veins, high-tonnage copper-gold porphyries. gold skarns, and stratabound massive sulphides;
  mapping in the Stikine region, just north of the Golden Triangle—with high potential for copper-gold porphyries and epithermal gold deposits; and,
  a project completed in the Atlin area, north of the Stikine. where two distinct tectonic belts converge-with potential for massive sulphides and gold.

Regional *Geochemical Surveys*

Since 1976. the GSB has carried out regional stream sediment and water sampling in areas of high base and precious metal potential. The geochemical data produced by these surveys is used in mineral exploration, environmental studies, and land use planning.

The 1991 Regional Geochemical Survey (RGS) program featured the release of geochemical data For areas covering *more* than 100,000 square kilometres of the Southeast. Increased claim staking activity In the eastern Rocky Mountains resulted from the release of new analytical data for gold and more than 30 other metals. Also in 1991, an extensive stream sediment survey was conducted of the Mount Waddington area in south-central British Columbia.

District Geologists

The GSB's five district geologists continued to maintain an up-to-date inventory of the geology, exploration trends, and mining developments throughout the province. While exploration activity declined considerably in 1991. mineral deposits studies continued in "hot" areas such as the Omineca and Quesnel Trough copper-gold porphyry belts, the Iskut-Stikine precious-base metal belts, and parts of the Kootenay and Okanagan regions. The district geologists have a broad resource management function that includes participation in the ministry's Mine Development Assessment Process and provincial land use planning initiatives.

Other Geoscience

Highlights of other geoscience activity during the year include:

- A three-year field project on gold and base metal skarns was completed. with a provincial reconnaissance program.
- A drift prospecting program was carried out at the Mount Milligan, Island Copper, and Kemess copper-gold deposits, to develop mineral exploration guidelines for glaciated areas with thick surficial cover.
- In the Northwest, a new placer gold study was started, and a field conference was held in Atlin.

Geographic Information Systems

A successful pilot study was carried out in 1991 to test the feasibility of using Geographic Information Systems (GIS) to gather, manage, and analyze complex geoscience data. GIS technology allows users to combine large amounts of diverse data in a desktop computer environment, producing simple thematic maps and clear answers to queries. The pilot project, focussed on the Smithers area, "layered" a variety of databases including ones related to local topography, geology, geochemistry, location of mineral claims, designated land use areas. and archaeological sites.

RESOURCE RIGHTS

The ministry is responsible for the management of Crown mineral, coal, petroleum, natural gas, underground storage, and geothermal rights in the province. It administers title to Crown resources in an efficient manner to promote industry exploration and development. At the same time, in the interest of the public and other government agencies, it ensures the orderly disposition of tenure, with due regard to other land and resource uses, impacts on the environment, and economic benefit to British Columbians.

ENERGY HIGHLIGHT

Oil and Gas Tenure Referral Process

In 1991/92, the ministry began work on an inter-agency referral system for granting rights to Crown oil and natural gas. Effective in the next fiscal year, other provincial agencies will have the opportunity to comment during the disposition of oil and gas tenures. In particular, these agencies will be able to identify areas where exploration access will infringe on other land uses, and to request conditions on that access. The new tenure referral process will benefit industry by allowing companies to plan their exploration activities more effectively; the public will benefit to the extent that impacts on the environment and other land uses are better controlled.

MINERAL HIGHLIGHTS

TITLES 2000

The ministry completed the final stages of its three-year Titles 2000 project, designed to modernize information systems for recording mineral titles and mapping claims. Under this initiative, British Columbia's 24 mining divisions (Gold Commissioner offices) were streamlined into six regional offices. In addition, each of the approximately 60 Government Agent offices were linked to the new automated Mineral Titles Data Administration System (MiDA) containing information on all B.C. mineral tenures. The central MiDA system will improve service to government and industry clients in all areas of the province, by making tenure information available within one business day of recording.

Claim Staking Inspections

Ministry surveillance of mineral claim staking increased during the year, to improve the enforcement of staking regulations and reduce the number of title disputes. The three regional Mineral Titles inspectors carried out a number of inspections where mineral tenures were being used for non-mining purposes. They were also on hand For several large staking rushes, resulting in some cancellations of title For various reasons. On September 9, 1991. the inspectors were mobilized for a four-hour rush involving approximately 60 claim stakers, when the Eskay Creek no-staking reserve was lifted.

Dispute Resolution

Under the Mineral Tenure Act, the ministry is charged with reviewing and resolving complaints against free miners and with taking action against them, where necessary. In 1991/92, a total of 174 new complaints were

made relating to staking abuses and false statements of work. A total of 223 complaints were resolved. with almost all decisions favouring the complainant. The ministry found 76 statements of work that did not have required technical reports accompanying them, 65 of which were resolved. In total, 13 actions were initiated against free miners, resulting in the suspension of 12 certificates, with suspension terms of six months to 10 years.

Reverted Mineral Claims

In June 1991, the ministry disposed of 452 reverted Crown granted mineral claims (RCGs) by opening the land for staking. Under former mining legislation, RCGs were available by application only. Claim staking over these lands is now allowed, subject to compliance with the Mineral Tenure Act and regulations. The ministry will continue this policy of disposing of RCGs, as they arise.

RESOURCE DEVELOPMENT AND USE

The ministry has a critical regulatory role to ensure that resources are developed and used in an efficient, orderly manner, balancing the interests of industry, *government,* and society at large. As part of this role, the ministry conducts referral and approval processes for new energy and mining developments. It reviews and approves energy removals (exports), making sure that domestic energy needs are met first. The ministry also sets and enforces environmental, health, and safety standards governing resource development.

ENERGY HIGHLIGHTS

Small Power Project Review Process

Throughout 1991/92, the ministry worked on the development of a new review process for small power projects. This process will apply to all projects of less than 20 megawatts proposed by independent power producers (IPPs), where power is to be sold to B.C. Hydro or another buyer, or is to be used for the producer's own needs (greater than 500 kilowatts). A main feature of the new review process is that proponents will have to demonstrate the environmental and so&-economic impacts of their projects, as part of en initial screening proposal to government.

Oil and Gas Regulations

After extensive public and industry consultation. new oil and gas drilling and production regulations were Introduced, taking effect in December 1991. With over 400 changes, the new regulations reduce environmental

impacts, improve worker and public safety, and enhance resource conservation in the province's oil and gas fields. They also make oil and gas operations more flexible for producers, and allow industry to take advantage of new technology. Changes include: improvements to blow-out preventor standards; increased size of the target areas for gas wells; better on-site posting of potential hazards and fencing requirements for public safety: emergency planning zones for sour gas wells; and reordering of the regulations to make them more logical and user-friendly.

Fraser Valley Drilling

During 1991/92, the government reaffirmed an earlier policy decision not to allow natural gas drilling for underground storage in the Fraser Valley. Permission was given for the drilling of one natural gas exploration well in East Delta, which was subsequently abandoned as unproductive. Stringent conditions were placed on the drilling activity to control environmental, noise, and other impacts on the local community.

Gas Administration Management System

In an environment of natural gas market deregulation, ministry staff are required to review gas reserves and deliverability for individual export and domestic contracts. This calls for a computerized approach, given the large numbers of producers and gas pools in the province. During 1991, the ministry implemented the first phase of its new Gas Administration Management System ("GAMS"), using sophisticated GIS software technology. The new system allows for easier review of energy removal applications and ongoing monitoring of gas export volumes.

Orphan Well Policy

Orphan wells refer to abandoned oil and gas wells for which no owners exist (e.g., due to company bankruptcy), and which have not been properly sealed and reclaimed. It is estimated that current and future orphan wells could cost the government more than $15 million to restore, if preventative measures and action on funding are not taken. The ministry is preparing recommendations on how to manage orphan wells and limit the province's financial exposure, with work underway on the funding issues and legislative changes required.

Coalbed Methane Policy

In July 1991, a paper was published describing the administrative framework under which coalbed methane could be explored for and developed. The paper lays out policy in such areas as the disposition of tenures,

licensing and drilling requirements, data reporting, and public consultation. Essentially, where coalbed methane resources are found on Crown lands. for administrative and regulatory purposes they will be treated in the same manner es conventional natural gas resources. Case-specific management rules, on the other hand, will apply to resources which involve private lands.

Core Market Policy

The province's Core Market Policy, In place since 1988, requires natural gas producers to have under contract gas supplies adequate to meet their "core market" (residential, commercial, and small industrial) customer demands for 10 to 15 years. This policy, designed to guarantee domestic energy security, is administered by the B.C. Utilities Commission through its rules for reviewing energy supply contracts. In the spring of 1991, the major provincial gas distributor. BC Gas Inc., submitted 21 supply contracts for approval to the Commission. To support the Commission's review, ministry staff undertook a study of gas reserves and deliverability commitments associated with each contract.

MINERAL HIGHLIGHTS

Mine Development Assessment Act

In August 1991, the province proclaimed the Mine Development Assessment Act, thereby formalizing the longstanding Mine Development Review Process. There were two principal reasons for this legislation: to demonstrate the province's commitment to thorough environmental assessment for all significant mine developments in British Columbia; and to establish a legal basis for consultation in the review process, by upgrading the provisions for public and Aboriginal consultation. Developments that may be subject to the Act include new coal end hardrock mineral mines capable of producing over 10,000 tonnes of ore per year, plus any other mine (e.g., placer, sand and gravel, or quarrying operations) so designated by the Chief Inspector of Mines. The key approval under the Act is now the mine development certificate, replacing the former approval-in-principle.

Mine Development Assessment Process (MDAP)

During 1991/92, 10 submissions were made to the MDAP, with eight new projects enteringthe preapplication stage of the process. As well. 12 projects not yet under construction, which had received an approval-in-principle under the former Mine Development Review Process and were still in good standing, were required to convert to mine development

certificates (MDCs). Of these, the Fording Coal Henretta Dragline project and the Dome Mountain gold-silver project approvals were successfully converted to MDCs in early 1992. Further consultation with Aboriginal groups is underway to complete the conversion of the remaining 10 projects in the process.

Inspections

During 1991/92, 2,845 inspections of mineral and coal mines, exploration sites, placer mines, rock quarries, and sand and gravel operations were performed. These inspections covered all aspects of health. and safety, environmental, and mine reclamation concerns. Health and safety inspections are undertaken by specialists in mining, mechanical and electrical engineering; and occupational hygiene.

Mine Type	Number of Inspections
Coal – Surface	256
Coal – Underground	19
Exploration – Surface	582
Exploration – Underground	22
Industrial Minerals – Surface	24
Industrial Minerals – Underground	16
Metal – Surface	180
Metal – Underground	118
Placer – Surface	686
Placer – Underground	6
Sand and Gravel	795
Quarries	94
Abandoned	26
Other	21
Total	2,845

Table 1 – Volumes of Inspections during *the 1991/92* Fiscal Year

Health and Safety Code

British Columbia's Health, Safety and Reclamation Code, proclaimed in 1990, is viewed as a model for health and safety standards worldwide. The Mines Act requires that a committee review the Code annually, to ensure that it keeps up with changes in technology, workplace hazards, and public environmental concerns. The first annual review, completed in early 1992, was undertaken by a tripartite committee of labour, Industry, and academic representatives, chaired by the ministry's Chief Inspector of Mines. As part of its review, the committee was asked to investigate the

application of systems for making mines more internally responsible for their health and safety.

Extended Workday Research

A unique study on extended hours of work, conducted in collaboration with the U.S. Bureau of Mines and Simon Fraser University, was completed in 1991. The study has been described as the most extensive and ambitious piece of research of its kind ever attempted for the industrial sector. Evidence from the three-year project indicates that the new scheduling provides greater harmonization of work and social life, with no apparent safety or health impacts.

Mine Accident Reporting System

The ministry completed development of the Mine Accident Reporting System (MINACC), an innovative software package designed to capture mining-related accidents and dangerous occurrences in a format acceptable to the Chief Inspector of Mines. In addition to meeting ministry in-depth reporting requirements, the system produces comprehensive reports for mine managers to help in designing accident prevention strategies. Between October and March, MINACC was installed at 27 minesites and the ministry's six regional offices, supported by on-site staff training and a help-desk in Victoria.

Mine Rescue/Emergency Preparedness

Mine rescue and emergency preparedness at mining operations continue to be a high priority in maintaining the B.C. industry's excellent safety record. During 1991/92, the ministry finalized emergency preparedness plans to detail effective channels of communication for providing additional aid and assistance to mines in an emergency. The plans also include important information on the responsibilities of on-site mine staff and organizational procedures required, to combat any emergency situation that could arise. Documents detailing the plans are under development.

Mine Rescue Competitions

The ministry also sponsored the Regional and Provincial Mine Rescue and First Aid Competitions, with industry personnel participating as both competitors and officials. These competitions simulate actual emergencies in open pit and underground mines. A total of 17 highly trained teams advanced to the provincial competition held in Nanaimo in June 1991. Gibraltar Mines Ltd. and the Cominco Sullivan Mine were winners in the competition.

Health and Safety Awards

In 1991, the ministry initiated an award to recognize the joint occupational health and safety committee at a mining operation which has demonstrated excellence. innovative approaches to enhance worker safety awareness, and/or significant improvements in cooperative internal responsibility for safety at a mine. Mine managers, supervisors, and workers were encouraged to nominate their safety committee and to submit evidence of achievement. The first awards were presented by the Honourable Anne Edwards at the March 1992 Annual Mine Safety Awards Banquet, to BHP Utah's Island Copper mine and Westar Mining's Greenhills mine.

Runaway Trucks

Most provincial mines are surface operations involving the use of large haul trucks to move millions of tonnes of ore on a daily basis. British Columbia has developed the world's most stringent braking test requirements. In addition, for some time the ministry has been researching methods to arrest runaway haul trucks. In 1991/92, in cooperation with a surface mine that kindly donated a truck, field tests were successfully conducted to prove the capability of a crash barrier made from used haul truck tires.

Fire Hazards

Preparatory work was begun on the use of a computer program to simulate a fire in an underground mine. Such a simulation could predict likely fire hazards. An underground mine has expressed interest in conducting a fire simulation study.

Mine Reclamation

Since 1969, B.C. mining companies have been required by law to reclaim all lands disturbed by mining. Major coal and metal mines now cover a total of 31,560 hectares in the province, compared to less than 200 hectares in the late 1960s. Of this total. 6,633 hectares (27 percent) have been reclaimed, leaving a balance of 23,017 hectares of disturbed land. Most of the remaining disturbance consists of active mining areas that cannot be reclaimed until mining has been completed.

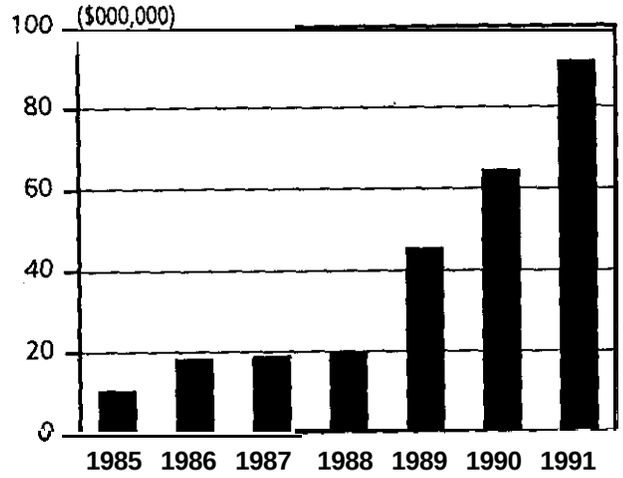
Mine Reclamation Policy

In September 1991, the ministry published *a* **paper,** *Mine Reclamation in British Columbia: Policy Overview,* **which describes the current**

regulatory framework For reclamation in the province and policy initiatives to improve it. The Paper outlines requirements for filing a reclamation plan when a new mine development is proposed. For providing a security (bond) to cover reclamation costs, and for obtaining and keeping a reclamation permit over the operating life of the mine. Areas For improvement in the current Framework include greater public involvement, better environmental research and regulations. and higher security levels.

Reclamation Securities

In the past few years, the value of security deposits required for new mines has increased, to reflect more closely the true costs of reclamation and the province's risk of financial exposure. The total value of securities held by the province rose from about $10 million in 1985 to $91 million at year-end 1991/92. Also in 1991, the ministry and the Ministry of Environment signed a 'protocol agreement to combine their bonding requirements.



Reclamation Security Deposits He/d by B. C.

Mining reclamation securities required by province have grown t over eight times since

Activity at *Specific* Mines

Progress in the reclamation area For specific mines included:

successful agreement on the placement of a $37.5-million security For the Equity Silver mine, scheduled for closure in 1992—consisting of $32 million For long-term treatment of acid mine drainage and $5.5 million for sealing of waste dumps and decommissioning costs; the Formation of a Public Liaison Committee in Kimberley to oversee the decommissioning and reclamation of the Sullivan lead-zinc mine;

continued work with the public surveillance committees set up to review closure plans for the Brenda and Equity Silver mines; and, continued reclamation work *on* the Mount Washington site, achieving cleanup of about 50 percent of the pit area, with the goal of improving the quality of water draining from the site.

Reclamation Awards

Reclamation programs from mines all over the province were recognized at the 15th Annual Mine Reclamation Symposium held in Kamloops in June 1991. The Annual B.C. Mine Reclamation Award was presented to Brenda Mines, a recently-closed copper-gold-silver-molybdenum operation in the Okanagan. Citations were also presented to Polestar Exploration Inc. (exploration). Total Energold Corporation (metal mining), Westar Mining (coal mining), Preido Mines (placer mine), and Butler Bros. Ltd. (sand and gravel).

RESOURCEREVENUES

The ministry assesses and collects various royalties, rentals, fees, and other revenues from the energy and mineral sectors. These revenues are intended to ensure that the people of British Columbia, as owners of the resources, share in the economic benefits, Revenue levels must also be determined with regard to their impact on the financial health and competitiveness of the province's energy and mining industries.

ENERGY HIGHLIGHTS

Oil and *Gas Permits and Drilling Licences*

A review of the annual rental rates for oil and gas exploration permits and drilling licences was carried out during 1991/92. Effective May 1, 1992 rentals for all permits and drilling licences will increase. Permit and drilling licence rentals have remained unchanged since 1982, and the rate adjustments recognize inflationary pressures and recent increases in other jurisdictions. These permits and licences currently generate about $3.6 million per year in provincial *revenues.*

Water Rentals

Water rental charges on hydroelectric power are indexed using a formula linked to B.C. Hydro's average electricity *rates.* A *freeze on* water rental increases, which had been in effect since 1964, was not extended, resulting in a 15.1 percent increase in these charges In January 1992.

The increase means an average rate hike of 1.6 percent for B.C. Hydro customers and 2.1 percent for West Kootenay Power customers.

Petroleum and Natural Gas Act

Changes were made to the Petroleum and Natural Gas Act and the Petroleum and Natural Gas Royalty and Production Tax Regulation to establish tax rates, allowances and administrative procedures for the monthly collection of a production tax on petroleum and natural gas produced from freehold lands. Previously the Mineral Land Tax issued an annual tax notice assessing the previous years production of petroleum and natural gas, produced and sold, from freehold properties. With these changes, petroleum and natural gas produced from either Crown or freehold lands are assessed taxes and royalties under the same legislation and in the same time frame.

Petroleum Audits

The ministry performs audits to ensure that resource royalties and taxes are paid in compliance with legislation. Twelve comprehensive and gas cost allowance audits were completed during the fiscal year. The audits generated additional revenues of $2.9 million, at a cost of $240,000. The payback of the audits to the province was approximately 12 to 1.

Royalties for *Geothermal Energy*

During 1991/92, ministry staff drafted a royalty regulation specifically for geothermal electric power projects, the main use for high-temperature geothermal resources. Over the coming year, this draft regulation will be fine-tuned as a starting point to develop royalty policy for other types of geothermal energy applications.

MINERAL HIGHLIGHTS

Resource Management Fees

A new Resource Management Fee was introduced in 1991 to cover the cost of Increased services (mine inspections) to the mining industry. The fee is based on an assessment of 30 cents per $100 of payroll, with a $300 deductible for each mine. All sectors of the industry are subject to the fee including exploration, placer mines, and sand and gravel pits. In effect. the $300 deductible per mine *means* that most short-term mine exploration programs and small informal placer mines will likely be exempt.

Mineral Tax Act

The Mineral Tax Act was amended to allow for the establishment of a new Mineral Tax Review Board. This board is responsible for hearing appeals from industry with regard to mineral royalties and other taxes. Formerly, the Review Board was under the jurisdiction of the Mineral Land Tax Act. With its legislative move, the Board will have a new membership and will review more tax matters that were previously referred to the Minister.

Mineral Audits

Some 40 desk audits and 12 field audits were completed to verify mineral revenues during 1991/92. An additional $6 million in tax revenue was collected, at a cost of $270,000, for a payback to the province of about 22 to 1.

PLANNING FOR A SUSTAINABLE FUTURE

RESOURCE PLANNING

Comprehensive planning means making decisions about resource development and use in a broader social context, allowing for the needs of future as well as current generations. The ministry is responsible for energy and mineral planning at the provincial level which meets the government's overall socioeconomic goals, and which ensures the long term financial health of the B.C. energy and mining industries.

The ministry is committed to resource management policies that balance the changing economic, environmental. social, and regional priorities of British Columbians over time. Comprehensive strategic planning of the province', energy and mineral resources is critical to ensure that they are sustainable in the long term. An important elem of that planning is effect public consultation and input into the making of resource decisions. The ministry is also committed to meeting o responsibilities with resp to the government's wic land use planning and integrated resource management objectives These responsibilities include providing information on energy a mineral resources need for specific planning processes. The ministry works to see that energ and mineral values are and accurately account for in all provincial, reg and local planning initiatives.

British Columbia Energy Council

In November 1991, the ministry began work on developing a new advisory agency to government, the British Columbia Energy Council. The Council will be a permanent body, created by statute, to advise the Minister on a range of energy matters in the province. Its two main functions will be to undertake comprehensive provincial energy planning. and to conduct broadly-based public consultation on specific energy issues referred to it by the Minister. New legislation establishing the Council will be introduced early in 1992/93.

Mineral Strategy

The ministry also started work on the preparation of a provincial Mineral Strategy designed to address the difficulties facing the B.C. mining industry today. This strategy will focus on policy options to stimulate exploration investment in the province, given the current trend towards declining metal reserves, mine closures, and reduced exploration activity. It will also look at ways to improve the competitiveness of the mineral sector in an environment of depressed prices and earnings and mounting foreign competition. The strategy is scheduled for completion sometime in 1992/93.

INTEGRATED RESOURCE MANAGEMENT

Increased public demands for an overall land use strategy and for more effective resource management in British Columbia have led to a number of planning initiatives. Specific processes, such as the Old Growth Strategy, Parks and Wilderness for the 90s, and regional and local planning by the ministry of Forests, are now being integrated through discussions on a Provincial Land Use Strategy (PLUS). The ministry is taking an active role In these initiatives to ensure that subsurface resource values are properly represented and that access to land for exploration is maintained. To meet the increased requirements for resource assessments,

staff resources have been reassigned to the land use planning area and a greater emphasis is being placed on producing mineral potential maps.

Parks and Wilderness Areas

Throughout 1991/92, ministry staff continued to be actively involved in the government's Parks and Wilderness for the 90s program, whose goal is to confirm proposed areas for conservation, recreation and forest wilderness in the province. In September 1991, the government published a *Summary of Public Responses to Parks and Wilderness for the 90s,* following on the extensive public review process that had occurred earlier in the year. Based on public response, the Ministries of Parks and Forests have reanalyzed their proposals and an action plan is now being devised to coordinate all of British Columbia's protected area programs. The ministry is taking part in this planning process, largely by supplying assessments of energy and mineral values in the affected areas. During the year, ministry petroleum and mineral resource specialists completed subsurface resource assessments on most of the 176 candidate study areas.

Mineral Evaluations

In addition, detailed field studies of mineral potential were carried out for three proposed park areas:

- The largest project mapped the geology and assessed the mineral potential of the Kakwa Recreation Area near the Alberta border east of Prince George, a scenic region with potential for base metals and industrial minerals such as silica and magnesite.
- Another project mapped and sampled in the Babine Recreation Area just west of Smithers, with base and precious metal potential.
- The third project evaluated the Cascade Recreation Area west of Hope, where there is potential for copper-gold-zinc occurrences.

Once these studies have been published. the IO-year period allowed for mineral exploration will commence, prior to government consideration of park status and boundaries.

Chilko Lake Planning Area Study

The Chilko Lake area southwest of Williams Lake is a region of high mineral potential that has been proposed for park status for many years. In June 1991, a Study Team was formed after Chilko Lake was identified as an inter-agency study area in the Parks and Wilderness for the 90s process. Co-chaired by the ministry, the Ministry of Parks, and the Nemiah Valley Indian Band, the Study Team's mandate is to negotiate the resolution of land use issues among the various affected interests, and to make

recommendations to the sponsoring Ministers for decision by Cabinet. Work began in July 1991. and a draft land use proposal is scheduled for public review by late 1992.

Other Planning Initiatives

Currently. the Ministry of Forests has primary responsibility for integrated resource management in areas covering more than 80 percent of the province's land base. The existing system of regional and local planning processes, known as Forest Land Management Plans and Local Resource Use Plans, are in the process of being modified. During the fiscal year, the ministry was extensively involved in assisting in policy development and providing subsurface resource information to these planning initiatives. In addition, the ministry participated in a number of local Community Watershed Planning processes, to demonstrate that responsible exploration and development activity can be undertaken in watershed areas.

JOBS AND REGIONAL DEVELOPMENT

Maintaining a strong, resilient economy, with opportunities for all regions of the province, is one of the government's central goals. The ministry's activities in support of the energy and mineral sectors help to encourage economic and regional development throughout British Columbia.

The ministry provides support to industry in a variety of ways. We develop policies and procedures to ensure the efficient, timely regulation of resource development and use. We supply information on energy and mineral resources, so that industry can target exploration and development activity more effectively. Ministry support also includes the promotion of exports, assistance for infrastructure and research and development, and policies to protect community stability

TRADE OPPORTUNITIES

Exports of energy and minerals are actively promoted by the ministry as a means to create employment, generate revenue, and improve the efficiency with which resources are developed and used. The ministry reviews and approves all energy removals from the province, ensuring that domestic requirements are satisfied and that environmental impacts are fully addressed. During 1991/92, a record number of gas Energy Removal Certificates (ERCs) was issued: 56 firm and 31 interruptible, for a total of 67 ERCs.

ENERGY

Natural Gas Exports

In July 1991, the province approved a major long-term firm gas sale to California. Under the terms of the ERC, five B.C. producers will supply the major export aggregator, Alberta & Southern Gas Co. Ltd. (AGS), with 21 billion cubic metres of natural gas over the next 13 years. This approval was the first under the government's new policy of flexible reserves dedication. The new policy requires that 50 percent or more of the applied-for volumes be supported by "established" natural gas reserves at the time of application.

International Natural Gas Dispute

In November 1991, the California Public Utilities Commission issued a ruling which set new procedures for allocating U.S. pipeline capacity to Canadian gas exporters. The effect of the ruling was to disrupt contractual arrangements between A&S and its Canadian gas suppliers, culminating in a regulatory dispute between Canada and California. Representatives from the two federal governments, British Columbia, Alberta, and California met to attempt to resolve the dispute. A joint agreement was signed in January 1992, laying out general principles for future gas trade. Negotiations among the government and private sector parties are still in process.

B.C. Hydro Energy Removal Certificate

B.C. Hydro applied to the ministry in April 1991 for a new ERC to continue its electricity exports and exchanges until 1997. In September, the application was referred to the B.C. Utilities Commission for a hearing, in view of public concerns centring mainly on the Burrard Thermal Plant. To provide

adequate time for public input, B.C. Hydro's existing ERC approvals were extended for one year, to the end of September 1992. The Commission's hearing began in April 1992.

Power Exchange Operation

In June 1991, the government announced that the Power Exchange Operation (PEO) proposed by B.C. Hydro and its export subsidiary, POWEREX, will undergo a thorough provincial review. This exchange operation was designated as a regulated project, in order to allow the ministry and other agencies to evaluate the concept. In September, POWEREX submitted an application for an Energy Project Certificate. During the remainder of 1991/92, the PEO was under review within government, in consultation with stakeholders.

Columbia River Treaty

A steering committee composed of senior representatives from the ministry, the Crown Corporations Secretariat, and B.C. Hydro are evaluating the technical and economic options for return of the Canadian Entitlement to the Columbia River downstream power benefits. These options include selling the Entitlement to provincial utilities or industry, and entering new agreements to sell some or all of the power to utilities or other customers in the United States. The province's goal is to maximize the return from this valuable power asset.

REGIONAL STABILITY

The ministry has a role in ensuring regional and community stability in cases where the energy or mineral sector makes a critical contribution to the local economy. In recent years, the government has provided targeted financial aid in the form of loans and loan guarantees, equity ownership, and rescheduling of tax payments. Provincial legislation has been introduced to establish the Natural Resource Community Fund, which will finance worker and community adjustment services in communities affected by resource industry downturns. During 1991/92, the ministry's activities in this area have focussed on the struggling coal industry, accounting for some 3,600 direct jobs in southeastern British Columbia.

MINERALS

Marshall Report

In December 1991, the government released a report, *Coal in B.C.: An Assessment of Future Prospects*, prepared by consultant Dick Marshall.

The 100-page report recommends ways to improve the coal industry's international competitiveness and its contribution to the province. Among the report's recommendations are the need to:

- improve labour-management relations, reduce transportation costs, and ease the tax burden in order to enhance industry competitiveness;
- find new markets for B.C. coal in domestic electricity generation and coke manufacturing; and,
- develop a communications strategy to increase public awareness of the importance of the provincial coal industry.

Comments on the Marshall report were received and reviewed early in 1992.

Coal Strategy

The Marshall report was the first step in the ministry's ongoing preparation of a provincial Coal Strategy. In February 1992, a Coal Strategy News Update was released confirming the government's commitment to a policy strategy. Later, public forums to solicit comment in Sparwood and Tumbler Ridge attracted more than 400 people in total from the general public and local stakeholder groups. The government has also indicated that coal will be considered in future energy supply planning for the province, and has taken steps to deal with the financially-troubled Westar Mining Ltd. Development of the coal strategy will continue through 1992/93, with a draft policy expected for 1993/94.

Westar Mining

In February 1992, the province's Job Protection Commissioner appointed a special commissioner to address the financial difficulties facing Westar Mining Ltd. The company's Balmer coal mine is the largest employer in the East Kootenays, with a workforce of 1,300 people. Plagued by depressed prices and high operating costs, Westar has an excessive debt load which it has been unable to service. The special commissioner will prepare a report making recommendations on a restructuring plan for the company.

INFRASTRUCTURE AND RESEARCH

The government also provides financial assistance for the provision of infrastructure and research into the development and application of new technology and information. Support for infrastructure, such as access roads, airports, and pipelines, is typically allocated on a case-by-case basis.

ENERGY

Power and Gas Extensions

The provincial Power and Gas Extension Program (PGEP) provides grants to help expand electricity and natural gas service to rural areas of British Columbia. PGEP is intended to lower heating costs for consumers, promote economic development and clean energy, and reduce reliance on imported oil. During 1991/92, grants amounting to $2.9 million were awarded to 41 separate natural gas extension projects. A total of 3,427 new customers in 29 communities were connected to gas service by fiscal year-end.

Power Discount for Pulp Mill

Under the Economic Development Electricity Rate Act, the province approved incentive electricity rates for a new state-of-the-art pulp mill near Chetwynd in northeastern British Columbia. The $150-million operation, built by Louisiana-Pacific Canada Ltd., will be the first "zero effluent discharge" mill in North America to use an electricity-driven freeze crystallization process. As part of a financial assistance package, the mill will receive a 20 percent discount on about one-quarter of its total power needs until December 1994.

MINERALS

Mineral Development Agreement

The ministry negotiated a new five-year federal-provincial Mineral Development Agreement (MDA) in 1991. This $10-million funding program provides assistance for a range of research projects including geological studies, environmental technology development, infrastructure planning, economic development studies, and public information campaigns. In 1991/92, a total of $540,000 in funding was spent in the following areas:

- geoscience—geological surveys, geochemical surveys, and geographic information systems ($350,000);
- technology—acid mine drainage research ($140,000);
- economic development—a forum on aboriginal opportunities in mining and a study of institutional constraints in the Mine Development Review Process ($30,000); and,
- public information—a teaching package for schools developed by the Mining Association of B.C. ($20,000).

Industrial Minerals

The ministry's Geological Survey Branch continued to monitor all activities in the industrial mineral sector, in pursuit of development opportunities. In May 1991, the GSB co-hosted its first international conference in this field, the 27th Forum on the Geology of Industrial Minerals held in Banff. Also in progress during the year were studies of residual kaolin, rhodomite, and dimension stone, aimed at identifying exploration targets. The Mt. Brussilof magnesite study was expanded to a regional study of magnesite deposits for southeastern British Columbia, with the purpose of evaluating economic potential and developing an exploration model.

Coal Research

Geological research continued through 1991/92 to gather data for the development and marketing of the province's coal and coalbed methane resources. Mapping targets included the Peace River coalfield (Chetwynd area), several of the smaller northwestern coalfields (e.g., Telkwa and Seton), and the Comox and Nanaimo sub-basins on Vancouver Island. In addition, province-wide studies continued on coal quality, including washability, sulphur, and trace elements. Ministry efforts in coalbed methane included a study of resource potential, field tests to measure methane desorption, and sponsorship of the Canadian Coal and Coalbed Methane Geoscience Forum in Parksville in February 1992.

PEOPLE AND SKILLS

FIRST NATIONS

The ministry's emerging responsibilities with respect to First Nations range from representing mineral and energy interests in land claim negotiations to promoting Aboriginal employment and business opportunities in energy and mining.

Aboriginal Affairs Unit

A new Aboriginal Affairs section was added to the Mineral Resources Division in the fall of 1991. The section is responsible for representing the Division in pre-treaty and treaty initiatives, and gives policy direction on issues related to land and resource management and public consultation. While the section provides the ministry's first point of contact on broad-based Aboriginal policy, several branches in the Energy Resources Division also have a policy and implementation function in this area. Internal advice to the ministry regarding First Nations issues and associated staff training requirements is developed jointly by staff in both divisions.

Aboriginal Participation in Mining

In November 1991, the Aboriginal Affairs section hosted a one-day forum in Prince George to discuss the barriers to involving Aboriginal peoples in the B.C. mining industry. This forum was attended by representatives of 20 First Nations organizations from central and northern British Columbia, three mining companies, the College of New Caledonia, the federal Department of Industry, Science, and Technology, and the ministry. The discussion focussed on examples of successful working relationships between industry and Aboriginal communities, Aboriginal expectations about the opportunities in mining, and their educational and training needs. The forum also considered an appropriate role for government in facilitating partnerships between Aboriginal peoples and mining companies.

Federal-Provincial Working Group

Ministry staff also took part in a federal-provincial working group formed to investigate opportunities for Aboriginal participation in mineral exploration and development. A questionnaire designed to identify levels of Aboriginal involvement in the Canadian exploration industry, possible barriers to participation, and the costs and benefits of such participation was distributed to 15 exploration companies. The federal Department of

The ministry is committed to policies and programs that develop human skill and talents, both outside and within government. Through its support for research into new technologies—for example, hydrogen fuel cells and environmental control measures for mining—the ministry promotes the development of exportable, high-technology skills. Recently, our mandate has expanded to include servin First Nations' interests.

Indian and Northern Affairs prepared and circulated a report summarizing the working group's findings.

Aboriginal Participation in Project Reviews

In a March 1991 decision, the Supreme Court ruled that the province had an ongoing "fiduciary" obligation to let Aboriginal peoples use unoccupied Crown Land for traditional sustenance activities, until the land is dedicated to another purpose. To meet its obligation, the government must consult with First Nations groups prior to approving any resource activity that might conflict with these traditional land uses. Ministry staff have begun work on identifying the kinds of energy and mineral projects that should be referred to Aboriginal groups for consultation. The ministry's goal will be to find a consultative process that serves the interests of both the ministry and First Nations.

STAFF DEVELOPMENT

The ministry's ability to deliver effective programs and policies depends on the quality of our staff. We work to build a highly-qualified, diverse workforce through initiatives such as employment equity, and to develop staff knowledge and expertise through ongoing training.

Employment Equity

In July 1991, the ministry launched an employment equity program designed to ensure that all persons have equal access to employment and promotional opportunities in the ministry, regardless of gender, race, or disability. A series of meetings were held to discuss employment equity issues with staff in Victoria and the district offices during the summer and fall. In September, an Employment Equity Advisor was appointed to implement the program. Seminars were held in October 1991 and January 1992 to orient managers to the issues of managing staff in a diverse workforce. Throughout the remainder of the year, a team of ministry staff developed a strategy and business plan that will be finalized in early 1992/93.

Women's Programs

The Women's Program Working Committee, composed of members from throughout the ministry, continued its work to heighten awareness about women's issues. Interested staff attended a Taking Charge of Your Career workshop in June 1991, took part in networking events during the year, and received training on gender-inclusive language. The Committee hosted a speaker on the "Glass Ceiling" for a government-wide audience in February 1992.

Staff Training

The ministry is increasing opportunities for staff development through external training, as well as through instruction from in-house specialists. In 1991/92, appropriate staff were trained internally in the new Office Management System, Petroleum Information Management System, and Gas Administration Management System. A training resource room was set up in Victoria, to help staff assess their training needs. Other new and ongoing ministry initiatives included funding of staff diploma programs, the creation of a formal policy framework for secondments, and courses on leave management and hiring.

TRAINING OF OTHERS

Where funding allows, the ministry may also support training and development of individuals outside the government.

Prospector Training

The Prospector's Training Program, consisting of several basic and intermediate level courses and two advanced training courses, continued during 1991/92. In May 1991, the highly-respected 15th annual Advanced Prospecting Course was delivered to a class of 26 students. The Petrology for Prospectors course was jointly delivered with the Kamloops Exploration Group, in conjunction with the Kamloops field conference held in April 1991. Financial assistance, through the Prospectors Grant program, was suspended for the year due to budget limitations.

University Students

The ministry continues to employ university and college students from a variety of disciplines in co-op work terms and auxiliary positions. Over the course of 1991/92, some students received on-the-job training at our head and regional offices and in the field. In addition, ministry staff manned a booth at the University of Victoria's Career Days in October.

The efficient development and use of British Columbia's energy resources is the cornerstone of provincial energy policy today. Cutting consumption allows private consumers to save on their energy bills, while lower costs for industry help our competitiveness in world markets. Moreover, energy efficiency is the most cost-effective and immediate answer to the province's energy-related environmental problems. The ministry's efforts to improve energy efficiency are focussed in the areas of transportation programs, standards for products and buildings, leadership, pricing, and support for utility and other external programs.

ENERGY EFFICIENCY

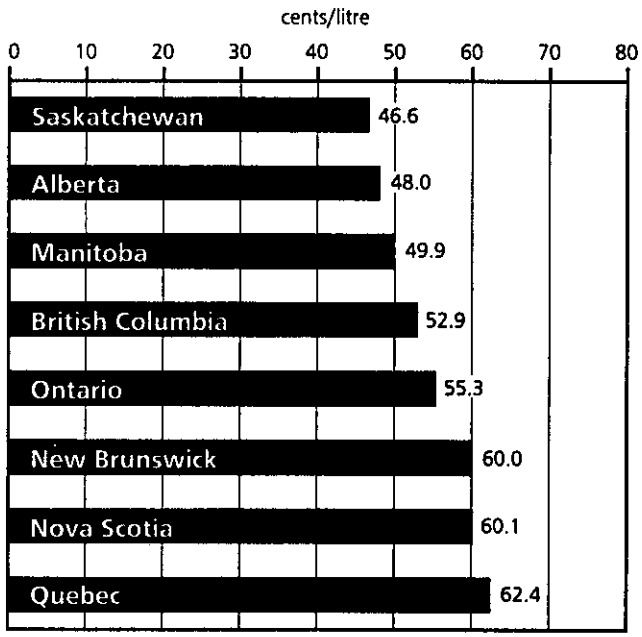
TRANSPORTATION

Energy efficiency in the transportation sector is a priority for several reasons. Vehicles are the province's largest energy consumers, and the source of much of our reliance on imported oil. They also account for the lion's share of our urban air quality problems, especially pressing in the Lower Mainland. In general, energy efficiency programs offer the benefits of lower energy costs, cleaner air, reduced traffic congestion, and enhanced energy security.

Fuel Smart

Fuel Smart is the ministry's long-term program aimed at reducing oil consumption and increasing energy efficiency in the transportation sector. The program was launched in February 1991, partly in response to energy security concerns arising from the Iraqi invasion of Kuwait in August 1990. During 1991/92, progress was made on three initiatives currently under the Fuel Smart umbrella: Fuel Smart Driver, RideShare and Pro-Trucker.

B.C.'s gasoline prices compare favourably to those in other provinces.



Self Serve Regular Unleaded Gasoline Prices, January 1992

Fuel Smart Driver

An advisory committee composed of representatives from driving schools, government agencies, and other groups was struck during the year to develop a Fuel Smart Driver Training Program for teaching new drivers about fuel-efficient driving techniques, maintenance practices, and vehicle purchase decisions. As a first step in developing a Fuel Smart training module, the ministry, along with Energy, Mines and Resources Canada (EMR), prepared terms of reference for a study into the essential elements of fuel-efficient driver training. As well, in March a demonstration of Fuel Smart driving took place in Victoria, in cooperation with Camosun College and B.C. Hydro's Power Smart program. Results of the Fuel Smart-Camosun Challenge indicated fuel savings of up to 40 percent from Fuel Smart driving.

RideShare

The goal of the RideShare program is to promote carpooling, or ride-sharing, through information materials, workshops, and pilot projects. In May 1991, the first pilot project was launched at Simon Fraser University, which led to the signing up of over 300 participants during the fall 1991 term. This project partially funded the development of computer software by STW Communications of North Vancouver to match people who might be suitable carpool partners. Also during the year, ministry staff began work on a RideShare Toolkit that will provide a step-by-step guide on how to set up a carpooling program.

Pro-Trucker

Pro-Trucker teaches fuel-efficient driving techniques to professional truck drivers, using a format of intensive two- to three-hour seminars. The program is being co-funded by the ministry and EMR, with delivery through the B.C. Safety Council. In 1991/92, seminars were offered free of charge at various locations throughout British Columbia.

BUILDINGS AND EQUIPMENT

Efficiency improvements in buildings and equipment offer the potential for large, economical energy savings which can only be realized from time to time—that is, when the particular building or piece of equipment is replaced. Minimum efficiency standards can be set on new products and buildings to remove the heaviest energy users from the marketplace.

Appliance Efficiency Standards

Under the ministry's Energy Efficiency Act (1990), the province introduced regulations to set minimum energy-efficiency standards for major appliances in 1991. In May, standards were enacted for nine household appliances: ranges, refrigerators, clothes washers and dryers, dishwashers, water heaters, air conditioners, and natural gas furnaces. A September amendment increased the efficiency level required for refrigerators and brought in one of the first North American standards for electric motors. One of four provinces currently with energy-efficiency legislation, British Columbia has set its standards to harmonize with those adopted in other provinces and the United States.

Building Efficiency Standards

The ministry has also been researching building standards and, along with B.C. Hydro, made a proposal to the B.C. Building Code Review Process to incorporate minimum energy-efficiency requirements for new residential and commercial buildings into the 1992 Building Code. The Ministry of Municipal Affairs, Recreation and Housing agreed to set up a technical a dvisory committee to develop recommendations on standards for new low-rise buildings, for inclusion in Part 9 of the Code.

Government Leadership

Construction began in November 1991 on the ministry's new Victoria head office at the corner of Herald and Blanshard Streets. The Jack Davis Building—named for the late Honourable Jack Davis, Minister of Energy, Mines and Petroleum Resources between 1986 and 1991—will serve as a model for energy-efficient office design. Examples of energy-efficiency measures to be incorporated in the design include: tinted, double-glazed windows; high-efficiency lighting with electronic ballasts; variable speed drives on supply fans; and high-efficiency boilers, chiller, and electric motors. Implementing these and other measures is expected to reduce the building's annual energy use by over one-third and to save in the order of $100,000 per year in energy costs.

Cogeneration Projects

In a typical cogeneration system, waste heat from an electricity generating plant provides steam for an industrial process, resulting in the more efficient use of a given energy source. In May 1991, two cogeneration projects were approved for development under the province's Energy Project Review Process. As part of the Celgar pulp mill expansion at Castlegar, a 50-megawatt cogeneration plant fuelled by natural gas and wood waste will

be completed in 1993. In late 1993, a 105-megawatt gas-fired cogeneration facility at Taylor in northeastern British Columbia will begin supplying electricity to B.C. Hydro and steam for Westcoast Energy's natural gas processing plant.

ENERGY PRICING

The ministry promotes energy pricing policies that send the right signals to consumers about how much energy they should use. Furthermore, it is ministry policy that energy prices should reflect the full costs borne by society in the development and use of resources.

B.C. Hydro Rate Design

In 1989, the province directed the B.C. Utilities Commission to raise B.C. Hydro's electricity rates gradually, in keeping with the rising costs of new supply and the need to promote energy efficiency. In January 1992, this pricing policy was affirmed in the course of B.C. Hydro's rate design hearing before the Commission. The ministry submitted a written brief restating the government's commitment to conservation and energy efficiency, and to electricity pricing that serves those goals.

Energy for Heating

In December 1991, the ministry released a consultant report by Marvin Shaffer and Associates (*Economic and Environmental Costs of Electricity and Natural Gas in B.C. Lower Mainland Space and Water Heating Applications*) quantifying the costs to consumers and society of substituting natural gas for electricity in specific residential end-uses. The costs to society, or "social costs," are defined in the analysis to include environmental impacts from air emissions. The report concludes that, for both private consumers and society at large, natural gas is the more economical fuel in space heating uses. These results will be used for further research and policy discussion in the area of social costing of energy resources.

As an essential part of its mandate, the ministry is charged with integrating environmental values with economic and social values when making decisions about the province's energy and mineral resources. Through its review processes for new resource development and ongoing regulation of industry, the ministry sets and enforces environmental, health, safety, and reclamation standards. It funds and undertakes environmental research, develops leadership programs alone and in cooperation with other agencies, promotes the efficient development and use of resources, and supports pricing policies that reflect the true social costs of energy. The ministry's Environmental Affairs Committee, composed of senior executives and staff experts, meets on a regular basis to review policies and procedures for land use, mine reclamation, and project approvals.

A CLEANER ENVIRONMENT

AIR IMPACTS

Environmental impacts on the air we breathe are a particular concern for energy development. For example, gasoline and diesel fuel used in motor vehicles are estimated to produce some 80 percent of harmful air emissions in the Lower Mainland. Vehicle exhaust, the burning of fossil fuels, and other energy-related sources make up almost 70 percent of the anthropogenic carbon dioxide that contributes to atmospheric warming. The ministry has a number of initiatives underway to manage these and other air emission impacts.

ENERGY HIGHLIGHTS

Vancouver Island Natural Gas Pipeline (VIGAS)

The 1991/92 year marked the startup of the VIGAS pipeline to bring natural gas for the first time to Vancouver Island, Howe Sound, and the Sunshine Coast. The pipeline will allow consumers to replace fuel oil with cleaner-burning natural gas. Replacing oil with gas will reduce emissions of sulphur dioxide and carbon dioxide, helping to improve air quality and alleviate acid rain. Access to natural gas will also reduce oil barge and tanker traffic in the Georgia and Juan de Fuca Straits, making oil spills less likely.

Clean Choice Program

Also in 1991, the province launched a $25-million natural gas conversion program called "Clean Choice," targeted at residential and commercial customers in areas served by the new VIGAS pipeline. This program provides grants of up to $700 for households and up to $3,000 for businesses to convert their heating systems from oil or electricity to natural gas. Clean Choice is part of the government's financial commitment to the VIGAS project, which also includes a guaranteed cap on the price of natural gas and a Rate Stabilization Fund to cover project losses during the early years. As of year-end 1991/92, conversion grants amounting to $1.7 million had been paid to 2,026 households and 197 businesses.

Greenhouse Gases/Clean Air Strategy

The government published its first-ever provincial inventory of human-made carbon dioxide emissions in 1990. During 1991/92, the ministry, along with the Ministry of Environment, continued to develop inventories and evaluations of measures for managing greenhouse gases. This work

was completed in March 1992, and will form the basis for a broader Clean Air Strategy to address GHG emissions and urban smog. The Clean Air Strategy will be developed in consultation with industry and the public.

Alternative Transportation Fuels

The use of alternative transportation fuels (ATF)—in particular, natural gas, propane, methanol, ethanol, and, ultimately, electricity and hydrogen—can help to control emissions of specific pollutants, as well as to reduce our dependence on imported oil. To date in British Columbia, propane and natural gas have been promoted through exemptions from the provincial Motor Fuel Tax. In the 1992 Budget, this exemption was extended to alcohol fuel blends containing at least 85 percent methanol or ethanol. The Budget also announced that the Motor Fuel Tax will be phased out on all ATF starting in 1997.

Research and Development

In 1991/92, the government continued to provide support for the development of clean energy technology. This support included ongoing participation in a project by Ballard Power Systems of North Vancouver to demonstrate the use of hydrogen fuel cells for powering transit buses. The Ballard fuel cell offers both environmental and efficiency benefits, since electricity is generated without combustion and with little waste heat. Funds are being provided to develop a small street-ready bus, scheduled for testing by fall 1992, with plans for a large-scale fleet application over the longer term.

MINERAL HIGHLIGHTS

Diesel Emissions

Over the past few years, the ministry has been involved in research into particulate emissions from both underground and surface diesel-powered mining equipment. During 1991/92, presentations were made to various groups on the nature and effect of these emissions, especially in underground mines where diesel soot poses a particular threat to worker health. After extensive study on the practical methods for evaluating emissions from large equipment, apparatus was purchased to determine the degree of opacity in the raw exhaust emanating from high horsepower engines. With the help of one of British Columbia's larger mines, Highland Valley Copper, a test program was set up to study the level of diesel emissions during normal operations at the open pit mine.

Clean Coal Technology

The province has provided support for a $1-million feasibility study currently underway to investigate the use of clean coal technology in electric power generation. This study is examining a new technology called Integrated Gasification Combined Cycle (IGCC), which is expected to reduce the acid gas and carbon dioxide emissions produced by coal combustion. The Coal Association of Canada is undertaking the feasibility study, with funding contributions from the federal government and the provinces of British Columbia, Alberta, and Saskatchewan.

WATER IMPACTS

The environmental impacts of resource development on our oceans, rivers, and other bodies of water range from the effects of marine oil spills to groundwater contamination by the acidic run-off from rock left over at metal mines. Acid mine drainage (AMD), in particular, has been the focus of ministry-supported environmental research in recent years.

Acid Mine Drainage Task Force

The British Columbia Acid Mine Drainage (BCAMD) Task Force, chaired by the ministry, coordinates the province's research into solving AMD problems. During 1991/92, the Task Force spent almost $750,000 on 19 research projects, bringing the total spent since its inception in 1987 to over two million dollars. The Task Force also continued to work closely with the national Mine Environment Neutral Drainage (MEND) program, coordinating provincial projects into the national research plan.

Acid Mine Drainage Research

Among the research projects undertaken through BCAMD sponsorship were:

- prediction—a survey of the acid generation potential of closed and abandoned mine sites in the province;
- prevention—blending of acid generating and acid consuming materials in waste rock dumps at Kutcho Creek in the Northwest, to determine if this approach would produce acceptable water quality in run-off waters;
- treatment—the use of an artificial wetland at Bell Copper mine as a passive treatment system;
- control—an evaluation of remediation methods at the abandoned Mt. Washington site; and
- monitoring—the monitoring of aquatic invertebrates to assess AMD impacts.

Water Quality Survey

In a joint project with the Ministry of Environment, a water quality survey was conducted for the Fernie and Kananaskis Lakes areas (82G and 82J map areas) in southeastern British Columbia. This project, conducted as part of the ministry's 1991 Regional Geochemical Survey program, provided data on copper, lead, zinc, arsenic, cadmium, mercury, and sulphate in waters.

LAND IMPACTS

Many of the land impacts of energy and mineral development have to do with competing land values such as recreation, forestry, and natural habitat. Recently, waste dumps and geologic hazards (earthquakes) have been areas for mineral research by the ministry.

MINERAL HIGHLIGHTS

Waste Dumps and Rock Drains

Waste rock dumps refer to the rock and overburden piles that remain after mining, while rock drains are structures used for diverting stream flow through and under the piles. These waste dumps, sometimes over 400 metres in height, face stability problems that can threaten worker and public safety, as well as cause environmental damage and loss of natural habitat. In 1991/92, the Mine Waste Dump Research Committee, chaired by the ministry, continued to support research towards a common understanding of rock stability problems and their solutions. Three consultant studies were published in 1992 documenting:

- methods of monitoring waste dumps to prevent failures;
- failure runout characteristics of waste dump failures at large open-cut coal mines in the Rockies; and,
- a review and evaluation of the cause and effects of all waste dump failures in the province to date.

Natural Geologic Hazards/Earthquakes

The ministry's Geological Survey Branch conducted a joint study with the Geological Survey of Canada into the neotechtonics of southwestern British Columbia. The study involved offshore coring and the analysis of onshore evidence of earthquakes and tsunamis. A workshop on the geology and management of geologic hazards in the province was held in March 1991, and a public information brochure on earthquakes was later prepared and distributed.

IMPROVING MINISTRY SERVICES

In pursuit of our mandate, the ministry strives to achieve several core service values. We attempt to provide prompt, efficient, and high-quality service to our clients among the general public, industry, and government. We maintain a policy of open and courteous communications with these clients. Furthermore, we are committed to better internal management of the ministry, with an emphasis on staff development and satisfaction.

The ministry's Communications and Public Affairs Branch is the focus for general public inquiries, media relations, issues management, and advertising. Ministry staff, in general, play an important role in the delivery of information. In 1991/92, staff members answered over 1,000 letters to the Minister and prepared some 500 Ministerial briefing notes on a wide variety of issues.

SERVING THE PUBLIC

The ministry's services to the public are wide-ranging—from regulation of public safety and the environment, to revenue collection, to the provision of public information. Some highlights in the public information area are noted below.

Communications and Public Affairs

Ministry communications during 1991/92 included:

- news releases and media alerts (85), industry information letters (25), and advertisements (9);
- press conferences, receptions, and other events (11);
- printed brochures, pamphlets, booklets, Annual Reports, and Business Plans (47); and,
- conferences, exhibits, and trade shows (4).

Freedom of Information and Privacy

The ministry began work in preparation for the government's Freedom of Information and Privacy legislation, to be proclaimed in 1993/94. A strategy will be developed in full compliance with the government-wide initiative. The ministry will also advise associated agencies, including the B.C. Utilities Commission and B.C. Petroleum Corporation, on freedom of information matters.

Earthquake Circular

In October 1991, the Geological Survey Branch released the first of its new generation of public brochures, entitled *Earthquakes in British Columbia.* This small and colourful brochure provides a brief introduction to the phenomenon of earthquakes, including their causes and effects, global and provincial patterns, and a listing of local large events over the past 100 years. The brochure attempts to relay the need for geologic research to minimize the effects of natural hazards on British Columbians.

School Programs

Under the Mineral Development Agreement, the province helped to fund the preparation of a teaching package for B.C. schools. Through a cooperative effort involving teachers, the Mining Association of B.C., industry, and government, three separate "Resource Units on Mining" were developed to fit with the provincial curriculum for Grades 5 and 10.

INDUSTRY AND GOVERNMENT CLIENTS

Ministry services to industry and other government agencies range from providing resource evaluations for exploration and land use planning to publishing guides and manuals on provincial regulatory requirements.

ENERGY HIGHLIGHTS

"PIMS"/"GAMS"

In 1991/92, the ministry began work on its Petroleum Information Management System (PIMS), a database to gather, store, and disseminate all information related to oil and natural gas wells in the province. The first phase of the Gas Administration Management System (GAMS), to keep track of gas reserves, was also implemented during the year.

Petroleum Titles Data Base

An electronic tape of the petroleum titles data base was developed during 1991/92, providing detailed information on some 7,000 oil and gas tenures in the province. The tape is now marketed on a monthly basis through the government's Crown Publications Inc., and is available at a cost of $300 per month.

"Toolkit" for Exploration

In June 1991, the ministry prepared a presentation of over 200 slides documenting information on energy in the subject areas of geology, land, production, transmission, and exports. This presentation, called Toolkit for the B.C. Energy Explorer, was delivered to some 120 representatives from oil and gas companies in a one-day seminar held in Calgary.

MINERAL HIGHLIGHTS

"MINFILE"

MINFILE is a PC-based mineral inventory system containing geological and economic information on 11,000 metallic mineral, industrial mineral, and coal occurrences in the province. The system provides a "desktop prospecting" tool for those interested in mineral exploration, and is available from Crown Publications at no additional cost with the purchase of MINFILE data. In July 1991, the ministry released Version 3.0 of the MINFILE software, which includes user-friendly searching, reporting, and data entry modules. Version 3.0 is an improvement over earlier versions in that it allows users to modify ministry data, enter new data, or establish new records for their own discoveries.

"MiDA"

MiDA is the province's new automated system for recording and maintaining data on mineral titles in the province. Industry and government clients can now access tenure information from any one of 60-odd central or regional ministry offices, within one business day of recording. Manual mapping of claims has been replaced by a digitized process, which required the scanning of about 3,000 reference maps. This year's Cordilleran Geology and Exploration Roundup in Vancouver featured a display booth on MiDA, with an operational workstation to demonstrate recording and plotting procedures.

Guide to the Mineral Tenure Act

In March 1991, the ministry published a guide to the Mineral Tenure Act and its regulations. The guide outlines the duties and responsibilities of both free miners and administrators. In practical terms, it lays out the procedures for locating, recording, and maintaining mineral titles in British Columbia.

Claim Staking Guidebook

A new user-friendly guidebook called *George's Guide to Claim Staking in B.C.* was published in March 1991. The guidebook, available at a nominal fee from any government agents office, outlines claim stakers' rights and responsibilities for both placer and mineral claims. It reflects the province's new Mineral Tenure Act and safeguards to ensure that the environmental impacts of mining activity are kept to a minimum.

Guidelines for Exploration

A revised edition of the *British Columbia Guidelines for Mineral Exploration* was published in November 1991. The revisions incorporate recent legislative changes and policy developments. Included in the guidelines are: requirements for obtaining ministry approvals under the new Mines Act; legislative requirements of other government agencies; detailed rules for conducting work on mineral exploration projects; minimum standards for reclaiming exploration sites; and ministry policies on exploration in environmentally-sensitive areas.

INTERNAL MANAGEMENT

Aside from employee training and development (see above under People and Skills), the ministry works to ensure the internal administrative efficiency of its operations and an effective working environment for staff.

Internal Services

The ministry's accomplishments in providing administrative, personnel, and other internal services included the following:

- more than 100 competitions for staff positions, and nearly 200 classification reviews, were held in 1991;
- the central library catalogued over 500 acquisitions, processed over 200 journals, and answered in excess of 2,500 reference requests;
- the ministry dispatched 52 field crews in warehouse services, maintained 115 owned and leased vehicles, and handled 3,800 help desk calls for facility and telecommunication services;
- the Geological Survey Branch was relocated from 756 Fort Street to 553 Superior Street in Victoria; and
- policy, procedures, and training were completed for the ministry's Earthquake Preparedness Plan.

Office Management System

The ministry proceeded with implementation of the Office Management System (OMS), as part of a financial decentralization initiative. The computerized OMS system allows individual managers to enter budget commitments and expenditures, run current financial reports at any time, and make supplier inquiries to determine status of payments. OMS training continued through 1991/92, with a total of 70 staff introduced to the system.

New Office Building

The ministry's new head office building currently under construction will consolidate 10 separate Victoria offices and some 350 employees. This consolidation will create efficiencies both for internal ministry management and for service to outside clients. The building, scheduled for occupancy in 1993/94, will include various features to ensure an efficient and pleasant working environment, for example: opening windows, high indoor air quality standards, security parking access and bicycle lockup, showers, a lab facility, and a private branch exchange telephone system to allow instant relocation of phones within the building.

Occupational Health and Safety

In 1991/92, the ministry took action to upgrade its head office occupational health and safety services. A comprehensive network of safety committees was formed from ministry staff, and training was provided in first aid and safety courses. This training included a First Responders course, with instruction on CPR and resuscitation.

MINISTRY ORGANIZATION

OVERVIEW

The ministry is composed of three Divisions for operating purposes: Energy Resources, Mineral Resources, and Revenue and Operational Services. The three Division heads, along with the Director of Communications and Public Affairs, report directly to the Deputy Minister (see the accompanying organization chart, page 70).

The ministry had a total of 389 full-time equivalent (FTE) staff positions for the 1991/92 fiscal year. The FTEs are primarily used for permanent regular full-time positions, with a small number being used for seasonal geological field work staff.

ORGANIZATIONAL CHANGES IN 1991/92

A number of organizational and staffing changes occurred during the year. Ministry branches, in particular those in the Mineral Resources Division, were restructured to address evolving responsibilities in areas such as environmental regulation, land use planning, Aboriginal affairs, and public information. In total, 14 new FTE positions were created in 1991/92.

ENERGY RESOURCES DIVISION

There were no significant changes to the Division's structure and staffing during 1991/92.

MINERAL RESOURCES DIVISION

Mine Development Assessment Branch

In September 1991, the ministry established the Mine Development Assessment Branch to administer the newly created Mine Development Assessment Process. This branch combined former Mine Development Review Process staff from the Resource Management Branch and additional staff brought on to handle upgraded public and Aboriginal consultation activities. As well, the former Mine Development Steering Committee was replaced by a senior management committee to address policy issues and provide overall process direction. The management committee is chaired by the ministry and is comprised of both ministry and Ministry of Environment senior staff.

Aboriginal Affairs Section

To deal with the ministry's growing involvement with respect to First Nations issues, a new Aboriginal Affairs section was added to the Mineral Policy Branch in Spring 1991. This new section, in cooperation with branches of the Energy Resources Division, represents the ministry's interests in land claim negotiations, provides direction on land and resource management issues, and undertakes consultation with Aboriginal groups. The 1991/92 budget allowed for a staffing complement of two FTEs for the section.

Geological Survey Branch

Following a major independent organizational review by the Canadian Geoscience Council, the Geological Survey Branch was restructured in April 1991. The Branch now consists of five sections. Three of these sections (Mapping and Resource Evaluation, Environmental Geology, and Economic Geology) are focussed primarily on gathering, processing, and analyzing geoscience data. The other two sections (District Geologists and Geoscience Information) are responsible for making this information accessible to clients in the mineral industry, government, and the general public.

Resource Management Branch

In February 1991, the Division's Engineering and Inspection Branch was reorganized and renamed the Resource Management Branch to reflect a broadened mandate. Under its new structure, the branch consists of two units, Occupational Health and Safety and Environmental Impact Management. The 1991/92 budget provided 12 additional staff members to meet all areas of the expanded mandate from mine inspection to the placement of Regional Managers in key district offices, as well as greater resources to support the Mine Development Assessment Process.

REVENUE AND OPERATIONAL SERVICES DIVISION

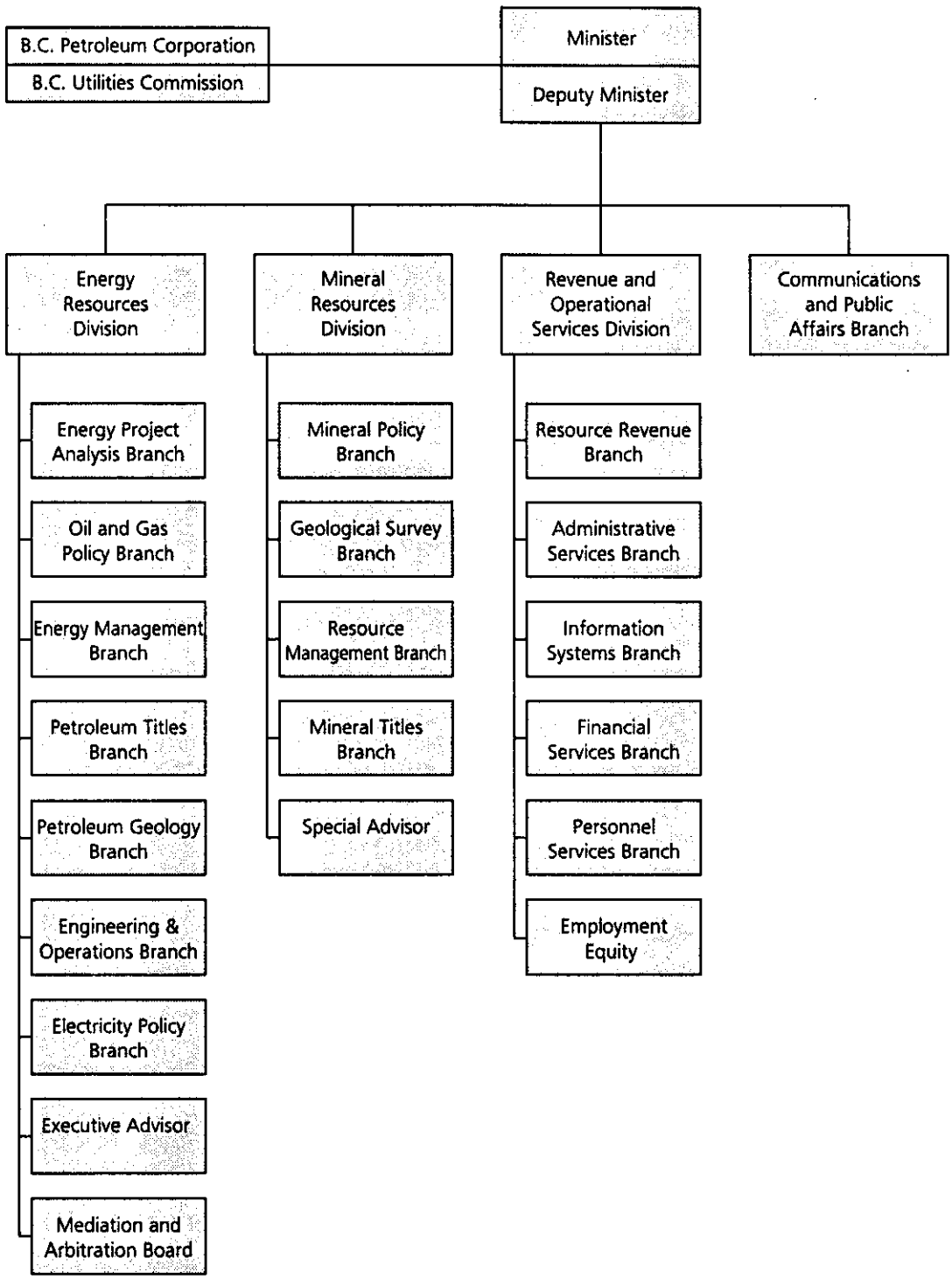
Resource Revenue Branch

The Mineral Revenues Branch and the Petroleum Revenues Branch were amalgamated into the new Resource Revenue Branch in August 1991. This change was made to increase efficiencies, by maximizing staff utilization, in the areas of management, financial, and administrative support.

Employment Equity

In September 1991, an Employment Equity Advisor was appointed to implement the ministry's Employment Equity Program. The position reports to the Executive Director of the Division, and is a member of the ministry's Executive Committee.

MINISTRY OVERVIEW



LEGISLATION

Legislation administered by the ministry includes the following:

- Coal Act
- Economic Development Electricity Rate Act
- Energy Efficiency Act
- Fort Nelson Indian Reserve Minerals Revenue Sharing Act
- Gas Utility Act
- Geothermal Resources Act
- Hydro and Power Authority Act
- Hydro and Power Authority Privatization Act
- Hydro Power Measures Act
- Indian Reserve Mineral Resource Act
- Mine Development Assessment Act
- Mineral Land Tax Act
- Mineral Prospectors Act
- Mineral Tax Act
- Mineral Tenure Act
- Mines Act
- Mining Right of Way Act
- Ministry of Energy, Mines and Petroleum Resources Act
- Natural Gas Price Act
- Petroleum and Natural Gas Act
- Petroleum and Natural Gas (Vancouver Island Railway Lands) Act
- Petroleum Corporation Act
- Pipeline Act: Part 7 (by OIC 468/88)
- Power Act (not in Revised Statutes of B.C. 1979)
- Utilities Commission Act
- Vancouver Island Natural Gas Pipeline Act

New legislation enacted in 1991/92 consisted of:

- Mineral Land Tax Amendment Act and Regulations

EXPENDITURES

MINISTRY EXPENDITURES — STANDARD EXPENDITURE CLASSIFICATIONS

	Fiscal Year 1990/91	Fiscal Year 1991/92
Salaries	$19,535,685	$22,089,045
Supplies and Services	14,030,221	14,149,858
Capital	3,525,652	2,028,626
Other Expenditure (Write Offs)	—	17,225,834
Grant (Includes Fort Nelson Revenue Sharing Agreement)	9,429,921	42,941,899
Recoveries (Mineral Development Agreement)	(3,460,577)	(2,937,586)
TOTALS	**$43,060,902**	**$95,497,676**

DETAILS OF EXPENDITURES BY APPROPRIATION AND ACTIVITIES AND BY STANDARD EXPENDITURE CLASSIFICATION

Summary of Expenditures	Fiscal Year 1990/91	Fiscal Year 1991/92
Minister's Office	$304,810	$306,885
Executive Management	921,551	920,528
Revenue and Operational Services Division	6,266,848	5,883,380
Energy Resources Division	8,369,829	9,322,897
Mineral Resources Division	16,857,282	18,551,265
Power and Gas Line Extensions	1,624,740	—
Fort Nelson Indian Band Revenue Sharing Agreement Statutory	265,818	233,201
Financial Administration Act. Sec. 24 (c) - Interest on Revenue Refunds	279,267	103,386
Mines Act Sec. 17(2) — Mine Improvement	96,359	24,932
Mineral Development Agreement (Net of Recoveries)	543,329	—
Mineral Exploration Incentives Program	484,904	—
Special Account — Vancouver Island Natural Gas Pipeline Assistance	7,046,165	27,964,281
Financing Transaction — Concessionary Loans	—	11,524,624
Valuation Allowance	—	17,217,387
Special Warrant Number 8	—	3,444,910
TOTALS	**$43,060,902**	**$95,497,676**

MINISTRY CONTACTS (As of March 31, 1992)

MINISTER'S OFFICE

Honourable Anne Edwards

DEPUTY MINISTER'S OFFICE

John Allan, Deputy Minister
Irwin Henderson, Communications and Public Affairs Branch

ENERGY RESOURCES DIVISION

Peter Ostergaard, Assistant Deputy Minister
Gordon Douglas, Executive Advisor
Warren Bell, Energy Management Branch
Karen Koncohrada, Director, Oil and Gas Policy Branch
Philip Carter, Director, Electricity Policy Branch
Denise Mullen, Acting Director, Energy Project Analysis Branch
Bruce Hanwell, Director, Engineering and Operations Branch
John MacRae, Director, Petroleum Geology Branch
Gerald German, Commissioner, Petroleum Titles Branch

MINERAL RESOURCES DIVISION

Bruce McRae, Assistant Deputy Minister
John Clancy, Special Advisor
Brian Parrott, Director, Mineral Policy Branch
Denis Lieutard, Director, Mineral Titles Branch
Ralph McGinn, Chief Inspector, Resource Management Branch
Ron Smyth, Chief Geologist, Geological Survey Branch
Ray Crook, Director, Mine Development Assessment Branch

REVENUE AND OPERATIONAL SERVICES DIVISION

Joan Hesketh, Executive Director
Bruce Garrison, Director, Resource Revenue Branch
Timothy Chatton, Director, Administrative Services Branch
Tom Scharien, Director, Information Systems Branch
Jennifer Smith, Director, Financial Services Branch
Barry Turner, Director, Personnel Services Branch
Belinda McLaughlin, Employment Equity

DISTRICT OFFICES

Fernie
Fort St. John
Mediation and Arbitration Board
Nanaimo
Nelson
Prince George
Quesnel
Smithers
Vancouver