



Hydro-Quebec
Annual Report 1969

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Hydro-Quebec Annual Report 1969

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Department of Natural Resources
Province of Quebec
Office of the Minister

The Honourable Lieutenant-Colonel
Hugues Lapointe, Q.C.
Lieutenant-Governor of
the Province of Quebec

May it please Your Honour,

The undersigned has the honour
to present the report of the
Quebec Hydro-Electric Commission
for the year ended
December 31, 1969

Respectfully submitted,

Minister of Natural Resources,

Quebec, April 10, 1970

commission

management

Head office:

75 Dorchester Boulevard West
Montreal

President

Roland Giroux

Commissioners

Georges Gauvreau, N.P.

Yvon DeGuise, Eng.

Robert-A. Boyd, Eng.

Paul Dozois

Joint Secretaries:

Bernard Lacasse, Q.C.

William E. Johnson

General Auditor:

Marcel Jean, C.A.

Directors:

Jean Boulanger, Q.C.

Law

Jean Lespérance

Organization and Methods

Lionel Boulet, Eng.

Institute of Research

Marcel Couture

Public Relations

General Managers:

J.J. Villeneuve, Eng.

Production and Transmission

Guy Monty, Eng.

Construction

Lionel Cahill, Eng.

Engineering

Edmond-A. Lemieux, C.A.

Finance and Accounting

Alexandre Beauvais, Eng.

Personnel

Maurice Saint-Jacques, Eng.

Distribution and Sales

Léo Roy, Eng.

Supply

Members of the Commission:
(from l. to r.) Messrs. Georges Gauvreau, Yvon
DeGuise, Roland Giroux (president), Robert-A.
Boyd and Paul Dozois.



Photo: Marcel Bourassa

president's report

Last year was one of the most successful in Hydro-Quebec's 25-year history.

The following pages indicate that, aside from the pressures of the tight money market which affected our enterprise as well as others, 1969 was a year of great accomplishment in many fields.

Public utilities such as ours have had to face difficult financial problems. The need to meet the ever-increasing demand from customers obliges electrical utilities to make extremely heavy investments. However, the policy of restricting credit to combat inflation has made it even more difficult and costly to raise capital.

Like most other public utilities, Hydro-Quebec has had to increase its rates in order to maintain its credit position in the face of continuing increases in interest rates and rising labour and material costs.

The commissioning of Outardes 3 and Outardes 4 powerhouses during the year added nearly 1,400,000 kW of generating capacity to the system. We were thus able to get through the critical period of annual peak-load (which occurred in December) without difficulty and at the same time supply appreciable amounts of power to neighboring systems.

An abundant run-off, together with the output of the new powerhouses, enabled us to increase our water reserves and minimize our consumption of fuel oil.

The demand for firm power continued to increase sharply. Provincial sales of electricity were up by 7.7%, exceeding the annual average rate of 7.3% recorded since 1965.

The increasing number of remote-control installations, the studies undertaken to further develop system automation, and other measures are expected to result in greater operating efficiency and safety. This technical progress necessitates new training and development methods to increase the productivity of our human resources.

In the marketing field, we have assumed one of the traditional roles of electrical utilities by establishing an industrial development department which was already functioning by the year-end.

The contract signed with Churchill Falls (Labrador) Corporation Limited is summarized in this report. In addition to the inherent advantages of the contract itself, there is the fact that in 1969 we increased our financial participation in CFLCo. to 34.2% of the company's shares.

The negotiation and signature of this important agreement between CFLCo. and Hydro-Quebec has given rise to a particularly frank and useful type of cooperation between the private and public sectors. We were thus greatly affected by the tragic deaths of several of CFLCo's executives and directors in a plane accident during the year. We especially regret the death of Mr. Donald J. McParland, president and chief executive officer of Brinco and CFLCo., who had become well known to Hydro-Quebec officers and was greatly liked and esteemed by them.

During the year, important changes occurred within the ranks of the Commission. Having directed the affairs of Hydro-Quebec during the nine most difficult years of its history, especially the period following nationalization of the private companies in 1963, Jean-Claude Lessard decided to avail himself of statutory retirement. We also regretted the departure of Jean-Paul Gignac, who shared in the task of integrating the nationalized companies and who felt it his duty to leave the Commission to devote all his time to the affairs of SIDBEC, of which he is president.

The vacancies created by these departures were filled by the appointment of two new Commissioners, Robert-A. Boyd and Paul Dozois. The Commission will benefit by Mr. Boyd's intimate knowledge of the structures and operations of Hydro-Quebec acquired throughout his long career, especially as general manager of the enterprise, and by Mr. Dozois' experience in the conduct of provincial and municipal affairs.

The rapid evolution of our management and operating techniques requires considerable understanding and adaptation on the part of our staff. The year 1969 bore testimony to an awareness of this need and the personal enrichment to be derived from it. On behalf of the Commission, I take this opportunity of thanking all members of the staff for their contributions to the progress of the enterprise.



President

Montreal, April 8, 1970

Daniel Johnson dam:
The usable reserve began to accumulate
in the spring of 1970.



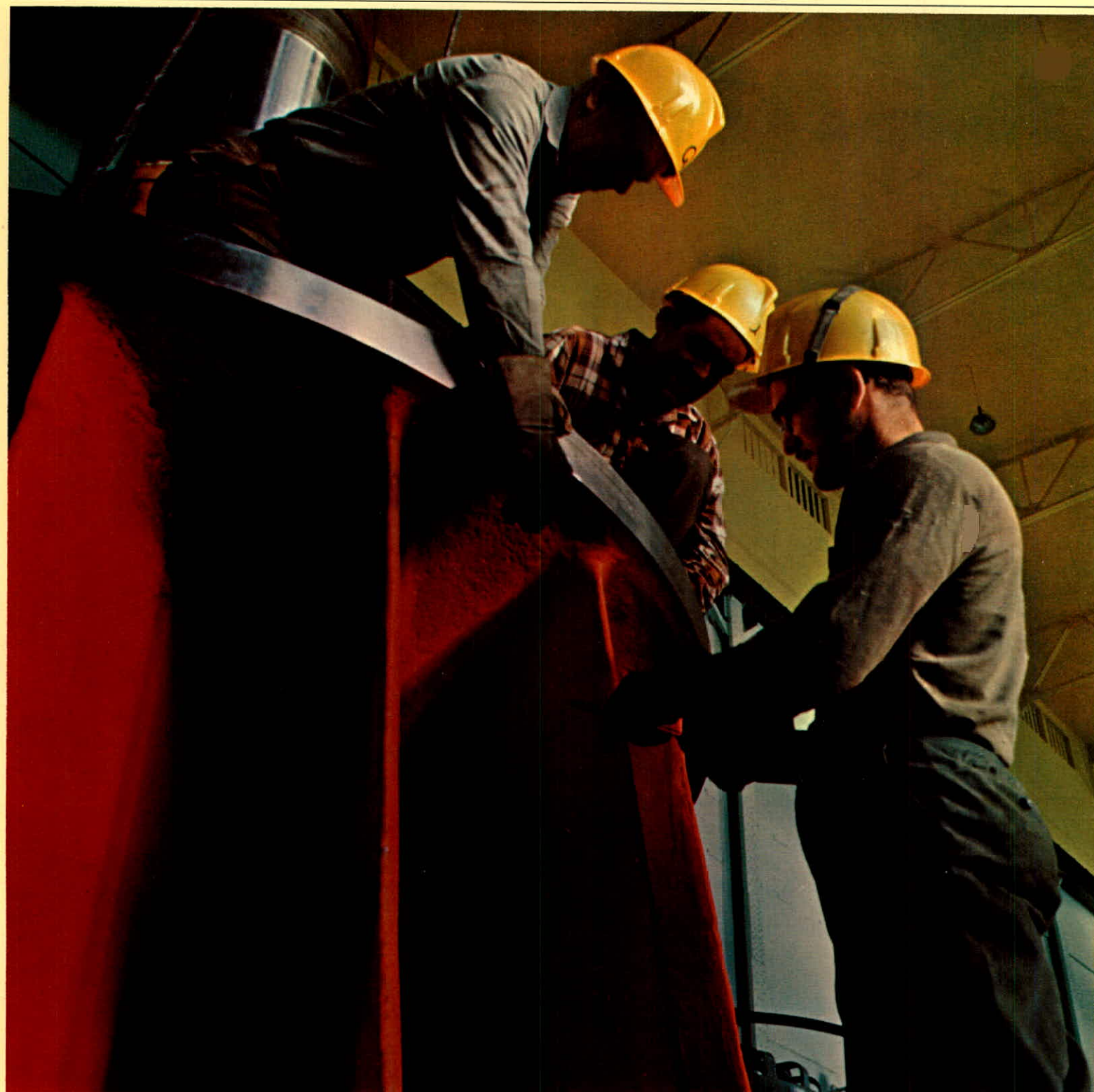


Photo: Marcel Bourassa

highlights

1969

1968

Installed capacity (kilowatts)	9,808,921	8,364,673
Consolidated system normal peak load (kilowatts)	8,594,000	8,193,000
Available energy (millions of kilowatthours)	51,079	47,728
Total electricity sales	\$ 416,012,000	\$ 386,942,000
Total number of customers at December 31	1,761,052	1,707,773
Gross plant additions	\$ 244,846,000	\$ 268,922,000
Properties and plant at cost	\$ 4,012,801,000	\$ 3,782,646,000
Long-term debt (net)	\$ 2,553,867,000	\$ 2,347,479,000
Reserves	\$ 796,439,000	\$ 711,674,000

financial results

Gross revenue for the year was \$431,108,000, an increase of \$33,280,000 or 8.4% over 1968. *Sales of electricity** accounted for nine-tenths (\$29,070,000) of the gain and the balance was made up of *unbilled revenue* and *other operating income*. The increase in unbilled revenue, which is the increase in the amount of energy recorded "in the meters" at the year-end was \$4,315,000, or \$1,266,000 more than the preceding year.

Other operating income increased by \$2,944,000, or 37.6% largely because of sales of surplus assets and revenue from rentals, which together showed an increase of \$2,066,000.

Expenditures

Operating expenditures for the year totalled \$254,563,000, an increase of \$19,925,000 or 8.5% over 1968, as compared with an increase of 11.5% for 1968 over 1967.

The main item under this heading, *operating, maintenance, administration and other expenses*, was \$143,704,000 compared

with \$130,050,000 the preceding year, an increase of \$13,654,000 or 10.5%.

Provision for renewals, always a substantial amount for an electric utility, rose from \$45,751,000 to \$51,488,000. This increase of 12.5% over 1968 is mainly attributable to the commissioning of Outardes 3 and Outardes 4 powerhouses, which together cost \$325,657,000.

The *provincial levy on energy generated*, together with *school and municipal taxes*, amounted to \$41,835,000, as against \$40,087,000 in 1968. *Power purchased*, which is determined in part by hydraulic conditions and generating capacity, decreased by 6.5% and amounted to \$17,536,000.

Net operating income was \$176,545,000, up \$13,355,000 or 8.2% over 1968.

In the 1969 *Financial Statements*, the \$6,736,000 profit resulting from the purchase, at a discount, of Hydro-Quebec debentures for sinking fund purposes

has been shown separately from interest chargeable to operations. The substantial amount of this item is a reflection of current high interest rates which reduce the market value of debentures bearing low-interest coupons.

Total net interest charged to operations increased 10.5% to \$98,516,000.

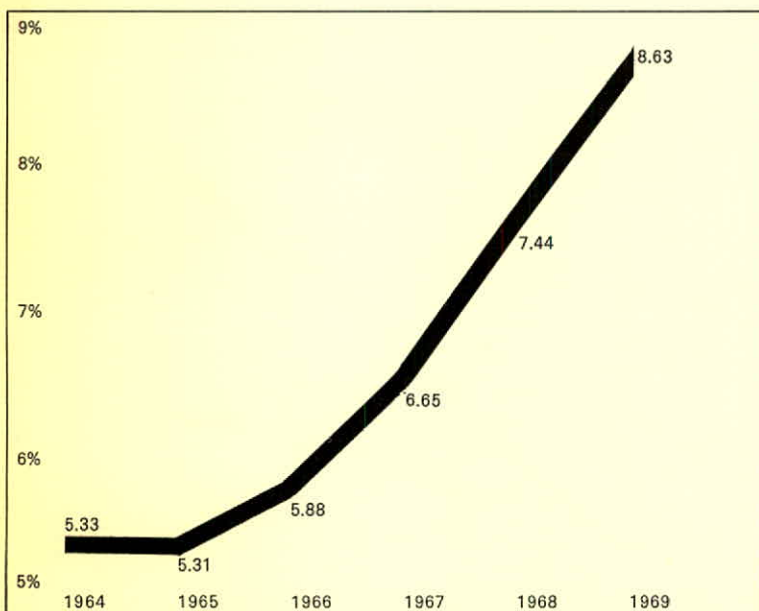
Reserves

After providing for *interest on reserves* (\$39,284,000), the balance available for reserves from 1969 operations amounted to \$45,481,000, bringing total reserves, in effect the Commission's net worth, to \$796,439,000, which represents 22.5% of the Commission's invested capital as measured by total assets less *current liabilities* and *deferred liabilities*.

*Words in italics correspond to terms used in the Financial and Statistical Statements.

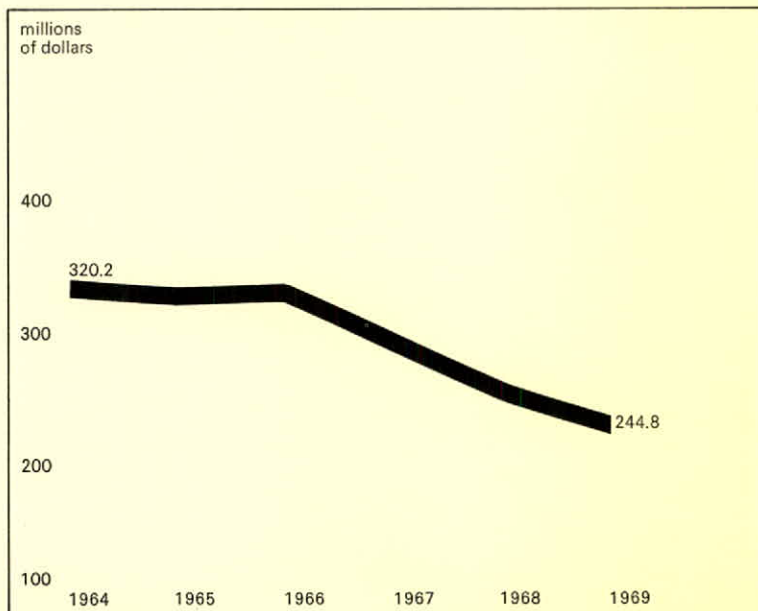
Growth in interest rates

Growth of average effective interest rate on yearly borrowings since 1964.



Annual capital investments

The Churchill Falls contract has resulted in a temporary reduction in investment for new production capacity.



Internally generated funds

Funds generated internally by the year's operations totalled \$135,734,000. This figure includes the amount *available for reserves*, plus *interest on reserves* and other charges not requiring cash outlays. The *profit on investments purchased for sinking funds* does not represent an inflow of funds and has been excluded when calculating the amount of funds available from the year's operations.

These available funds provided more than a third of Hydro-Quebec's cash requirements. During 1969, the Commission repaid \$39,549,000 of its long-term debt, met sinking fund requirements of \$29,001,000, purchased \$75,000,000 worth of common stock and bonds of Churchill Falls (Labrador) Corporation Limited and financed capital investments amounting to \$244,846,000, as against \$268,922,000 in 1968.

To meet these requirements, the Commission borrowed a total of \$273,848,000

in Canadian funds or equivalent by the issue of long-term debentures. The average effective interest rate on long-term borrowings in 1969 was 8.63%, compared with 7.44% in 1968 and 6.65% in 1967. The capital market continued to deteriorate during the year. In February, the effective rate on the first long-term issue of 1969 was 7.44% and on the last issue, in December, it reached 9.99%, a new peak.

As in preceding years, the search for capital on the best possible terms brought the Commission to the European markets where it borrowed 250 million Deutsche Marks (\$67,261,000) and \$20 million U.S. (Eurodollars). A further \$100,000,000 U.S. was borrowed on the American market, and the Quebec Deposit and Investment Fund purchased a significant amount of Hydro-Quebec debentures—\$22,000,000 of a \$50,000,000 issue in February and the full amount of a \$25,000,000 issue in October.

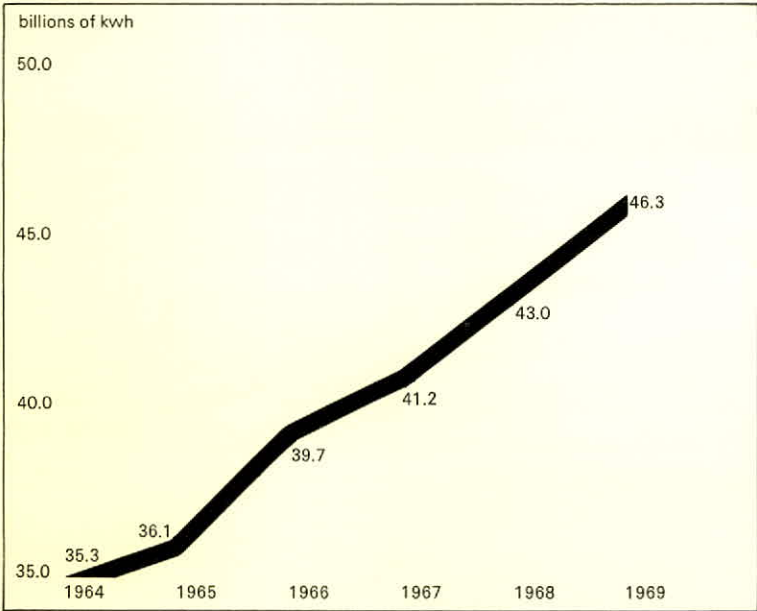
Despite the tight money situation, the

Commission's short term *notes payable* were reduced from \$198,568,000 at December 31, 1968 to \$183,892,000 at December 31, 1969 and the working capital increased by \$13,095,000 during the same period.

At December 31, 1969, the net amount of long-term debt was \$2,553,867,000, as against \$2,347,479,000 one year before. Slightly more than 50% of this debt, \$1,318,270,000, is payable in U.S. funds.

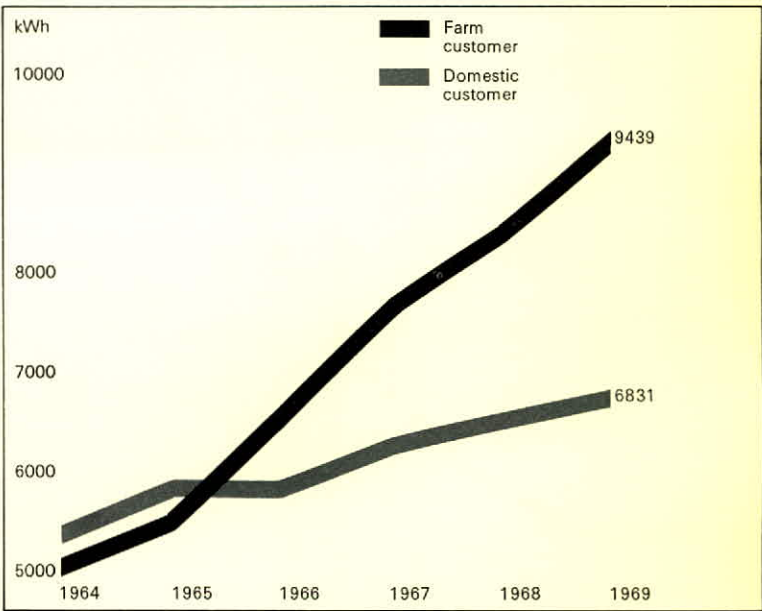
Total sales of electrical energy

Increase in total energy sales since 1964.



Average annual consumption

Growth of average annual consumption per domestic customer and per farm since 1964.



Expos baseball stadium at Jarry Park, Montreal.



Photo: Marcel Côté

sales revenue

Total sales of energy amounted to \$416,012,000 for 46.3 billion kWh, an increase of 7.5% in both revenue and energy over 1968. In 1968, the corresponding increases over 1967 were 4.6% in energy and 9.5% in revenue.

All major categories of customers contributed to the sales increase in 1969, except that deliveries of firm power outside the province decreased by 126 million kWh. However, this reduction resulted from the exercise of withholding rights and can therefore be attributed to increased electricity needs in the province.

Provincial sales

Sales of firm power in the service area amounted to \$404,027,000 for almost 42 billion kWh, an increase of 7.7% in energy and 7.6% in revenue compared with 1968. The 7.7% increase recorded in 1969 exceeds the average rate for the past few years. In 1965, provincial sales of firm

power were close to 31.7 billion kWh and have since increased at an average rate of 7.3% per year. If this rate is maintained, sales will double in approximately 10 years.

Sales of surplus power, which had been greatly curtailed during the preceding two years, amounted to \$4,801,000 for 1.6 billion kWh, an increase of 36.6% in revenue and 28.3% in energy compared with 1968.

Commercial and industrial customers

The 193,000 commercial, industrial and other customers, who together comprise the general and industrial categories, consumed a total of 28.8 billion kWh for \$234,515,000, an increase of 8.7% in both energy and revenue over 1968. The corresponding increase in 1968 over 1967 was 6.4% in energy and 8.2% in revenue.

The 1969 increase in sales was particularly marked in the Richelieu, Laurentides and Matapedia regions.

Residential customers

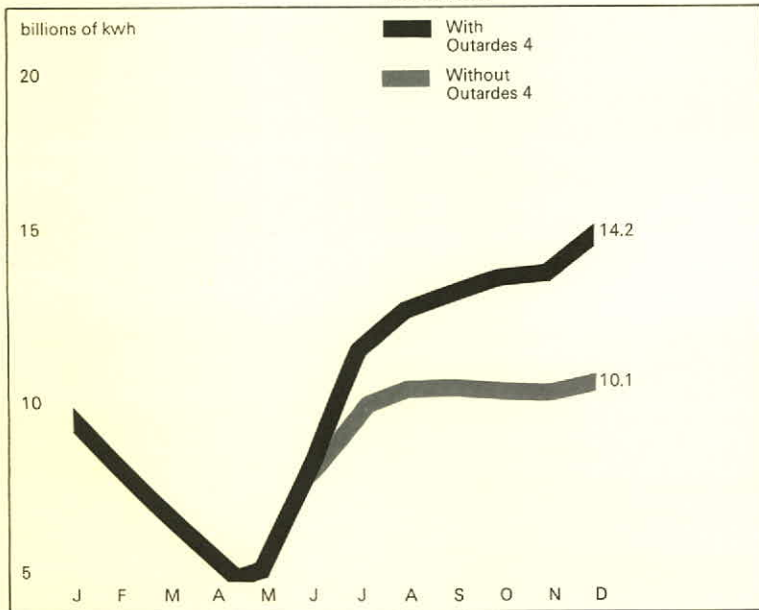
Sales to residential customers reached \$138,090,000 for 10.1 billion kWh, an increase of 6.5% in revenue and 7.4% in energy over 1968. At the year-end, the number of residential customers was 1,477,395 compared with 1,432,649 the preceding year. Average annual consumption per residential customer was 6,831 kWh, compared with 6,562 in 1968 and 6,332 in 1967.

Farm customers

Consumption by farm customers increased 9.1% from 724 million to 790 million kWh, which is particularly significant in that the number of such customers decreased from 85,469 to 83,726. Average annual consumption per farm was 9,439 kWh in 1969, compared with 8,470 in 1968 and 7,693 in 1967. Revenue from the agricultural sector increased 6.2% from \$9,950,000 to \$10,571,000.

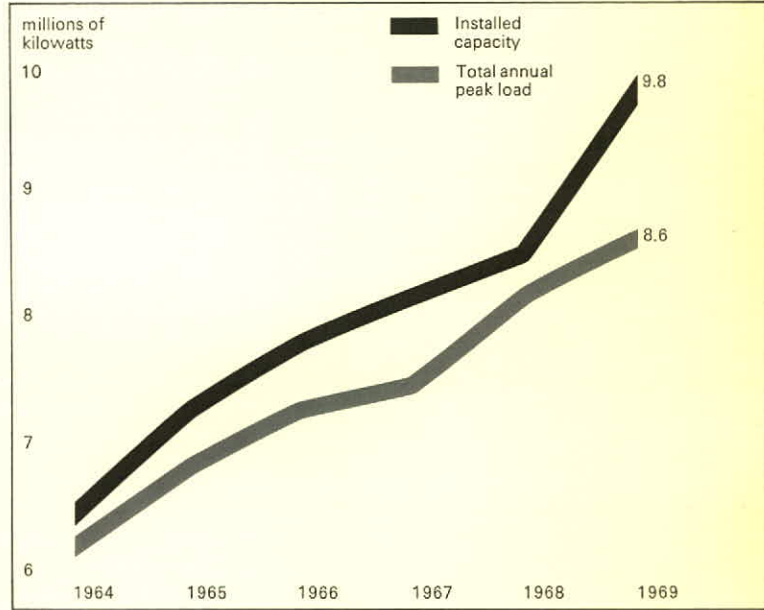
Water reserves in 1969

Accumulation of usable reserves, expressed in billions of kWh, in all reservoirs during the year. The commissioning of Outardes 4 reservoir has increased total energy capacity of all reservoirs from 13.3 to 20.2 billion kWh.



Installed capacity and annual peak demand

Growth of installed capacity and annual peak demand since 1964.



During 1969, the Rates and Metering directorate conducted studies and analyses preparatory to establishing new electricity rates. These rates, approved by the Lieutenant-Governor in Council on December 17, apply to meter readings after March 15, 1970, and will result in an average monthly increase of \$1.07 for residential customers and an average 10% increase for customers in practically all other categories.

In the fall, Hydro-Quebec opened a central electrical-measurement laboratory in Montreal. One of the most advanced of its kind in North America, this new metering-standards laboratory will calibrate Hydro-Quebec meters according to stable primary standards checked by the National Research Council. The behavior of meters and other electrical measuring instruments will be checked under all possible operating conditions. A training school has also been established for personnel engaged in verifying measuring equipment.

In all sectors of the electricity market, sales promotion required the use of an increasing number of techniques to maintain our position and invade new markets. Reorganization of structures in the Marketing Directorate coincided with the creation of a new service, Industrial Development. Results show that in 1969 there were notable gains in the use of electricity in new construction, but at the same time competition made marked inroads in the sizeable water-heating market.

Industrial development

To enlist the aid of all organizations concerned with the industrial expansion of the province, the newly created Industrial Development service spent the latter part of 1969 establishing contacts. At the year-end, negotiations were under way with several major developers to interest them in the installation of large-scale plants in the province.

During the year, 35 contracts for the supply of electricity were renewed at higher rates with industrial customers whose firm demand is 3,000 kW or more. These contracts totalled 388,000 kW and included 5,600 kW of new firm power. In addition, three new industrial contracts were signed for a total of 28,000 kW.

"All-electric" concept

Electricity was chosen as the sole source of energy in almost a third of new dwelling units constructed in the province during the year.

This achievement can be ascribed in large part to the new methods of direct participation by Hydro-Quebec representatives in the design and financing of new construction. As the result of certain incentives offered to builders, agreements were reached covering nearly 7,000 new "all-electric" dwellings, more than 4,000 of which were completed in 1969.

The computer service to evaluate the cost of installing and using electric heating in the new buildings (CALMEC) has produced good results. Furthermore, in cooperation with the Quebec Electrical League, Hydro-Quebec has familiarized electrical manufacturers, builders, developers, architects and consulting engineers with the new NOVELEC symbol launched early in 1970.

Water heaters

During the year, 13,473 water heaters were installed on a rental basis in customers' premises (compared with 15,501 in 1968), bringing the total number of rented water heaters to 135,160. Steps have been taken to extend the water-heater rental plan to almost all parts of the province in 1970.

The number of loans granted by Hydro-Quebec for the purchase of Cascade water heaters was down to 1,455 compared with 1,838 in 1968. Furthermore, official figures concerning deliveries of electric and other types of water heaters in the province confirm that Hydro-Quebec's share of the annual water-heating market is decreasing. Efforts undertaken during the year to reverse this tendency will be redoubled in 1970.

The number of loans for renovation of electrical wiring systems in dwellings was 4,550 for a total of \$1,441,285. In 1968 there were 6,011 such loans, totalling \$1,862,315.

Household appliances

Various sales campaigns to promote special applications of electricity were launched or extended during the year. In cooperation with the Canadian Electrical Association, the Marketing Directorate participated in a national campaign to promote automatic washers and dryers. A total of 13,500 sales were recorded in Quebec compared with 7,500 in Ontario. The results of a survey conducted in 1968 on the use of electricity in the home have been published in booklet form and are being used to direct future marketing activity in the household appliance field.

Electric vehicles

In cooperation with the Institute of Research and the Supply department, the Marketing Directorate has presented a report to the Commission on the prospects for electrically-driven vehicles. The report recommends that Hydro-Quebec closely follow and participate in the research being carried out, stimulate the interest of Quebec manufacturers and start using electric vehicles as soon as possible.

Farms

The regrouping and specialization taking place in farming operations have had the effect of transforming Quebec agriculture and encouraging the use of electricity. During the year, the "Well-Electrified Farm" emblem was awarded to 189 farms, bringing the number of such farms in the province to 758. Electrical capacity of "well-electrified farms" varies from 200 to 600 amperes and their average annual consumption in 1969 was 29,540 kWh. The average consumption by all farms was 9,439 kWh.

In 1969, the installed capacity of the system increased by the largest annual amount ever recorded in the province. From January 1 to December 31, total production capability rose from 8,364,673 kW to 9,808,921 kW, a gain of 1,444,248 kW or 17.3%.

Commissioning of Outardes 4 (632,000 kW) and Outardes 3 (756,200 kW) powerhouses, two additional units in the Première-Chute powerhouse (62,100 kW) and a 10,000-kW unit at Hull added 1,460,300 kW of new capacity. This figure was reduced by 16,052 kW as a net result of transfers, additions, and withdrawals carried out at various locations during the year.

Maximum demand

The maximum power demand occurred on December 23 at 5.30 p.m. when the temperature was well below normal for that date (-3°F). At that moment, the firm power demand in the service area (system demand) reached 8,100,000 kW, an increase of 5.7% compared with 1968. Total demand, which includes secondary energy and deliveries outside the system, was 8,594,000 kW, an increase of 4.9% over 1968.

At the same moment, however, because the system had power reserves available, it supplied an additional 175,000 kW of exceptional and temporary support to neighboring systems, bringing to 8,769,000 kW the total amount of energy delivered by the system at the moment of peak demand.

Average increase

In the four years from 1965 to 1969, the average rate of annual increase in maximum demand within the service area was 7.5%, and if this rate continues, the system peak will be doubled every 9 years and 7 months.

Exported energy

At the time of maximum demand on December 23, power supplied by Hydro-Quebec's own stations was 8,124,000 kW. The surplus of 24,000 kW above the system peak constituted the net "exported" energy in exchanges with neighboring systems. During the system peak the year before, a net amount of 286,000 kW was "imported" from neighboring systems.

Power reserves

The power attainable from the entire system allowed for a spinning reserve greater than the minimum reserve required and it was not necessary to shed any interruptible load, even at the moment of peak demand (except for one day as a safety measure).

This favorable situation was the result of new units placed in service and also the fact that the maximum production capacity of the Beauharnois powerhouse was reduced by the formation of ice on the canal for only a few days at the year-end, during the holiday period of low load.

hydraulic conditions

Churchill Falls.

Unlike the preceding year, total run-off was 5% higher than average during 1969. This surplus became apparent during the months of May (110%), June (120%) and November (128%). During the rest of the year, run-off was about average.

This increase in run-off was equivalent to 1.75 billion kWh, or roughly 2,765,000 barrels of fuel oil.

A record at Beauharnois

The St. Lawrence River, in particular, had a higher than average flow (122%). As a result, the Beauharnois powerhouse attained a new production record of 11.7 billion kWh, surpassing the previous maximum of 11.3 billion kWh in 1968. Beauharnois alone supplied 24.7% of total generation.

Usable reserves

Usable reserves in the reservoirs (not counting Outardes 4 and Manic 5) were the equivalent of 9.9 billion kWh on January 1, and decreased to 5.1 billion kWh on April 14 after the winter withdrawals. But owing to the higher than average precipitation, these reserves were subsequently restored and increased to 10 billion 57 million kWh by December 31.

Outardes 4 reservoir

Outardes 4 reservoir which has been impounding water since April 1, 1968, began accumulating its usable reserve on June 4, 1969. The eight generating units in the two powerhouses fed by this reservoir, Outardes 4 and Outardes 3, were put in service successively from July 8 to December 15, 1969. By the year-end, these two stations had supplied a total of 1 billion 324 million kWh to the system, leaving usable storage in the reservoir at 59% of full capacity. When full, the Outardes 4 reservoir will have a capacity equivalent to 6.9 billion kWh, bringing the total capacity of the reservoirs operated by Hydro-Quebec to 20.2 billion kWh. When Manic 5 powerhouse is commissioned, its reservoir will bring the total to 41.4 billion kWh (not counting Manic 3).



churchill falls

Manic 5 reservoir

The amount of water withdrawn from Manic 5 reservoir to increase production in Manic 2 and Manic 1 powerhouses was much less than in 1968 owing to the increased generation made possible by the larger reserves in the other basins and the commissioning of Outardes 4 and Outardes 3 powerhouses.

Withdrawals from Manic 5 reservoir accounted for 29% of run-off accumulated during 1969, and produced 1.76 billion kWh of electricity. In contrast, withdrawals during 1968 were 48% of run-off and produced 2.6 billion kWh. By December 31, the water level in the reservoir had reached elevation 1114.9, almost the minimum production level of 1115. This means that the usable reserve will begin to accumulate in the spring of 1970. The reservoir has a total capacity of 4,900 billion cubic feet; impounding began in the spring of 1964.

Tracy thermal plant

As a direct consequence of the surplus water reserves and the commissioning of Outardes 4 and Outardes 3 powerhouses, it was possible to progressively reduce production at Tracy thermal station, starting in October. Nevertheless, Tracy's total 1969 production of 3.6 billion kWh was 10% higher than its 1968 production of 3.3 billion kWh, owing to the high output demanded between January and October.

A good year

The situation with regard to production reserves indicates that 1969 was a good year.

1. To illustrate this, the increased thermal production (312 million kWh) and part of the production from Outardes 4 and Outardes 3 (512 million kWh) can be said to have reduced the withdrawals from Manic 5 reservoir by 824 million kWh. This represents a considerable saving. After the Manic 5 powerhouse comes into service in 1970, the value of this quantity of water will actually increase from 824 million kWh to 1 billion 970 million kWh.
2. The remainder of the production from Outardes 3 and Outardes 4 powerhouses (812 million kWh), together with the increased production from other hydro-electric stations (2 billion 837 million kWh) totalled 3 billion 649 million kWh of additional energy, which *supplied all the increase* in the Quebec demand for electricity (3 billion 316 million kWh) and, in addition, *enabled energy purchases to be reduced* by 333 million kWh.

On May 12, a long-term contract was signed with Churchill Falls (Labrador) Corporation Limited (CFLCo.) whereby Hydro-Quebec will obtain virtually all the production from the 5,225,000-kW generating station under construction at Churchill Falls, Labrador, 700 miles north-east of Montreal.

Deliveries

Power deliveries are to start on May 1, 1972 (when the first two of 11 generating units come into service) and will reach an average rate of 31.5 billion kWh a year when the last generating unit is installed in 1976. The contract is for a period of 40 years from 1976 (or the completion date of the powerhouse) and will be automatically renewed for a further period of 25 years.

Firm power

Firm power at the delivery point will be 4,163,500 kW from June to September and 4,382,600 kW the rest of the year. CFLCo. has reserved the right to withhold 300,000 kW on three years' prior notice. If this option is exercised, firm power will be reduced by that amount and the average annual delivery will drop from 31.5 to 29.1 billion kWh. Transmission losses before power is tapped at Sept-Iles, Quebec and Montreal will take about 1.1 billion kWh.

Favorable price

Taking into account transmission costs and line losses, as well as the responsibilities assumed, the financial terms of the contract are such that Hydro-Quebec will pay a lower price for this energy than for the same quantity of energy obtained from any other source.

The average annual payments that the Commission will make to CFLCo. for energy will gradually drop from \$93,000,000 to \$80,000,000 during the first 40 years of the contract and will be approximately \$63,000,000 during the remaining 25 years.

In addition, the Commission is obligated to pay a part of CFLCo.'s interest charges; this payment will not exceed \$15,000,000 a year and will decline as the company's bonds and other indebtedness are retired, ending in the year 2010. Hydro-Quebec will also assume, within certain limits, at least half of any exchange losses resulting from the purchase of U.S. dollars for principal and interest payments by CFLCo. Inversely, Hydro-Quebec will be entitled to half of any exchange benefit resulting from these payments.

Future dividends

Hydro-Quebec has increased its financial interest in the company and in 1969 held 34.2% of CFLCo. shares (see note 10 in the Financial Statements), with the result that its share of all future dividends will help to reduce the cost of energy purchased. The other shareholders are British Newfoundland Corporation, Limited (Brinco) and the Government of Newfoundland.

Hydro-Quebec's rights

The contract gives Hydro-Quebec extensive supervisory rights over construction and operating costs, as well as company financing. Moreover, the reservoirs and the powerhouse will be operated in accordance with Hydro-Quebec's wishes. The average flow through the turbines will be 49,000 cubic feet per second under an operating head of 1,060 feet. The usable reserve of the reservoirs supplying the powerhouse could exceed 1,100 billion cubic feet.

co-operation with other networks

Hydro-Quebec will deliver large quantities of power to the two neighboring provinces from 1971 to 1977, using reserves that the system will have available during that period. Early in the year, agreements in principle or letters of intent were signed with the Hydro-Electric Power Commission of Ontario and The New Brunswick Electric Power Commission.

These agreements, covering a total revenue of about \$120,000,000, will be followed by definite contracts not only for the sale of power but also for the establishment of mutual aid between Hydro-Quebec and the two neighboring networks. Preliminary drafts of these agreements were submitted to the parties concerned at the end of the year.

The letter of intent with Ontario Hydro provides for delivery of a total of 28 billion kWh during the six years of the agreement, in addition to any surplus energy that may be agreed upon by the two parties. The maximum power covered by the new agreement will be 750,000 kW. Hydro-Quebec reserves the right to interrupt supplies at peak load hours, except during the last two years of the agreement when a continuous supply of 500,000 kW is guaranteed.

The new agreement with Ontario Hydro will replace various supply contracts that have already expired or are due to expire shortly. At the year-end, negotiations were in progress with other parties concerned: MacLaren-Quebec Power Company and the Ottawa Valley Power Company.

In the case of New Brunswick, the letter of intent provides for deliveries of power up to a maximum of 320,000 kW between 1971 and 1976. The two networks are already taking the necessary steps to establish the type of inter-connection that will handle the required power while obviating parallel operation. (See Transmission Lines.) It is expected that Hydro-Quebec will deliver a total of about 5 billion KWh to New Brunswick during the contract period.

major power projects

During the second half of the year, Outardes 3 and Outardes 4 power stations were commissioned, adding a total of 1,388,000 kW to system capacity. The four units at Outardes 4 (158,000 kW each) were put on line successively from July 15 to December 15, and the four units at Outardes 3 (189,050 kW each), from July 8 to November 25.

The Outardes River is regulated by a 252-square-mile reservoir receiving run-off from a 6,800-square-mile catchment area that constitutes more than 93% of the river basin. This reservoir was created by eight dams, two of which are large earth and rockfill dams and one a concrete spillway-dam. Reservoir capacity is 858 billion cubic feet, 403 billion of which are usable.

No date has yet been fixed for the restart of work at the Outardes 2 site, where a 454,000-kW powerhouse will eventually replace the 50,000-kW plant operated since 1937 by a private company.

Outardes 4

Outardes 4 powerhouse was built into the west bank of the river at the foot of the main dam and is located 58 miles upstream from the river-mouth. Average flow through the turbines is 12,600 cubic feet per second under a head of 405 feet of water. The powerhouse operates at a load factor of 61.1% and its annual production is 3.4 billion kWh. Power is sent to the Micoua collector substation on a 9-mile, double-circuit, 315-kV transmission line.

Outardes 3

Fifteen miles downstream from Outardes 4 is the Outardes 3 underground power station. At this site, it was possible to create a head of 478 feet of water by building a single concrete dam only 275 feet high which backs up the river into nearby Lac Tirebouchon. Water is taken from one end of the lake through a 7,200-foot-long canal leading to the powerhouse intake. The powerhouse operates at a load factor of 63.6%, with an annual production of 4.2 billion kWh from an average flow through the turbines of 13,060 cubic feet of water per second. Power is sent to the Manicouagan collector substation on a 29-mile, double-circuit, 315-kV transmission line.

Première-Chute

The Première-Chute powerhouse has been built on the river Des Quinze which is a part of the upper reaches of the Ottawa River. The powerhouse's second and third units, rated 31,050 kW each, were put in service in February and in May, the first unit having

Outardes 4 (top):
the main dam and intake.

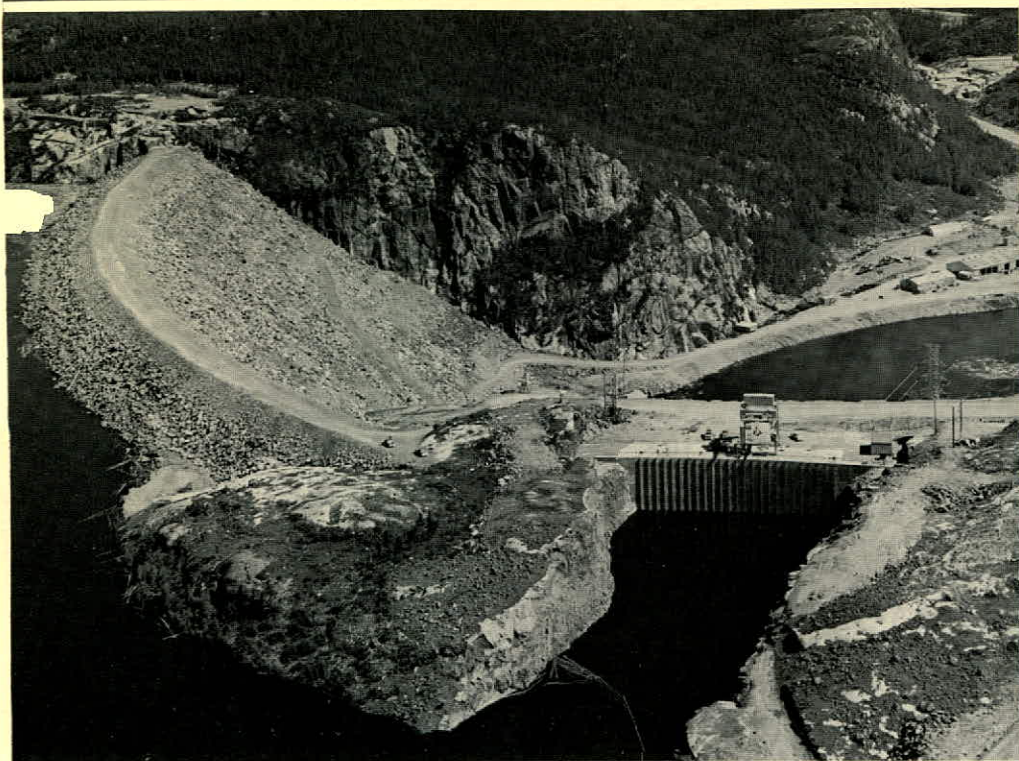


Photo: Jacques Lambert

Outardes 3 (bottom):
the spillway, headrace canal and intake.



Photo: Marcel Côté

been commissioned in November, 1968. At the Rapide-des-Iles powerhouse several miles upstream from Première-Chute, three 36,630-kW units were put in service in 1966 and 1967. There is provision at both powerhouses for the future installation of a fourth unit.

Première-Chute is a run-of-river power station operating under a 73-foot head of water, with an average flow of 13,300 cubic feet per second. It is connected to Rouyn by a 55-mile, 120-kV transmission line, and to the Rapide-des-Iles plant by another 120-kV line, 5½ miles long.

Manic 5

At Manic 5, finishing work continued throughout the year on the Daniel Johnson Dam. At both ends of the crest, 93 cubic yards of concrete were placed, bringing the total volume of concrete in the dam to 2,948,412 cubic yards. By October, the lighting installation along the top of the dam was completed. Additional measuring instruments such as reversed pendulums, extensometers and piezometers have been installed to improve surveillance of the dam's behavior.

During the year, the water level in the reservoir rose above the threshold of the intake, and by December 31 was near the operating level, which is 1,115 feet above sea level. The travelling crane for the intake gates will be completed early in May, 1970, and the gates in the spillway-dam will also be completed in 1970.

At the year-end, construction of the two surge tanks was well advanced. They will have expansion chambers 80 feet in diameter and will project 164 feet above ground level. Erection and finishing work will be completed in 1970.

In the powerhouse, located on the east bank of the river downstream from the dam, spherical valves have been installed at the ends of the eight penstocks. Erection of the turbines and generators began in March, and the first three units, rated 162,000 kW each, will be commissioned on August 1, September 15 and November 1, 1970; the remaining five units will be commissioned in 1971.

Manic 5 powerhouse will operate under a head of 491 feet of water, with an average flow of 22,345 cubic feet per second, an annual production of 7.4 billion kWh, and a load factor of 66.3%. Power will be sent to the Micoua collector substation via four 315-kV transmission lines.

gentilly nuclear station

Première-Chute (top):
powerhouse-dam-spillway.

Manic 5 (bottom):
the powerhouse and surge tanks.

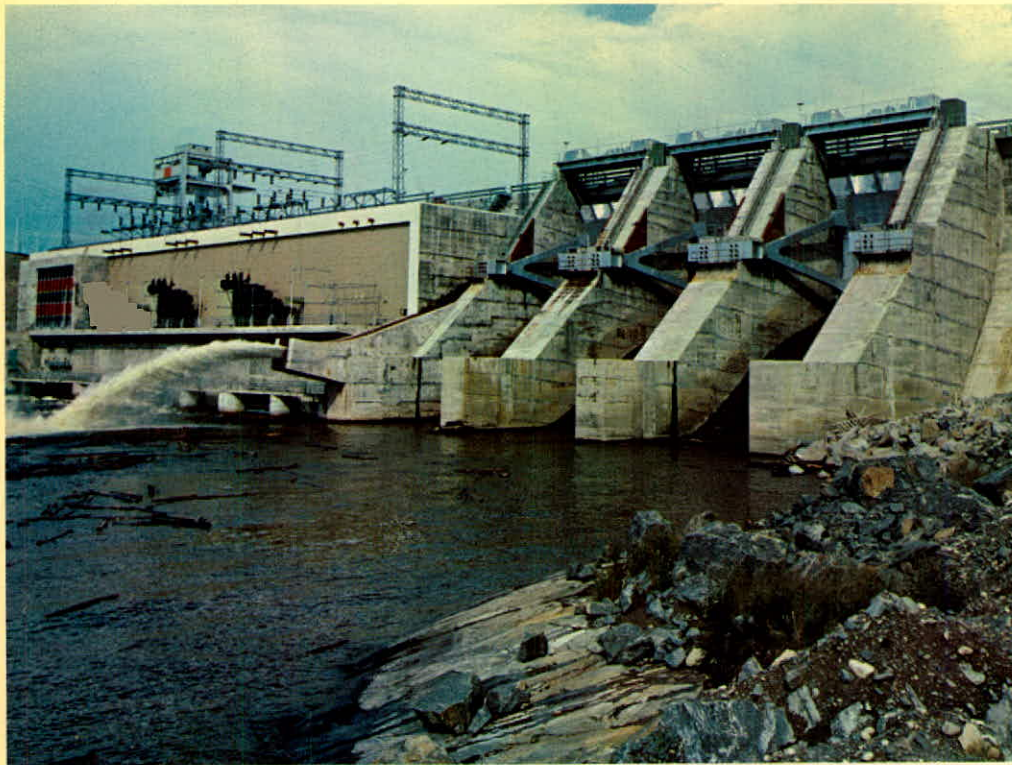


Photo: Marcel Bourassa

During the year, the commissioning staff began to take possession of the various installations in the 250,000-kW Gentilly nuclear power station, and by the year-end the first of 308 pressure tubes were being installed in the reactor core; the tubes will later receive the initial fuel charge consisting of 3,080 bundles of natural uranium dioxide rods.

Barring delivery delays or unforeseen difficulties, the reactor will go critical towards the end of 1970 and should reach full capacity in 1971.

This first nuclear power station in the province is a prototype and will use natural uranium as fuel, heavy water as the moderator and ordinary demineralized water as the heat transport medium that will also provide steam to drive the turbine. Construction is being carried out by Hydro-Quebec for Atomic Energy of Canada Limited, and Hydro-Quebec will buy the station after performance has been proven. The substation for raising the voltage is already connected to the 230-kV network.

The commissioning staff has taken over the substation, several auxiliary services and most sections of the service building and the administration wing. During the critical start-up period, they will number up to 240, consisting mainly of Hydro-Quebec engineers, technicians, operators and maintenance personnel but including engineers from Atomic Energy of Canada and the consulting engineers, as well as Ontario Hydro and Electricité de France.

Inside the reactor building, the two drums for the steam circuit were in place by the year-end and, in addition to the fuel channels, welding had started on the multitude of inlet and outlet pipes for the heat transport system. In the turbine building, the high-pressure stage and the three low-pressure stages of the turbine were in place. The turbine casing, with its biological shield, was being installed and should be completed by the middle of 1970. The stator of the generator was already in place and the rotor had just been delivered. The generator will be cooled by hydrogen and demineralized water.

Hydro-Quebec engineers and technicians who are already working at Gentilly and those undergoing training elsewhere will form the nucleus of the specialized staff required to operate not only the Gentilly station but all the other nuclear plants that will be built in the years to come.



Photo: Jacques Lambert

Outardes 4:
the powerhouse.



Photo : Alain Rinfret

The last power station to be built on the Manicouagan River will be Manic 3 which will have a capacity of 1,176,000 kW. Construction will start in April, 1970 and commissioning will take place from December, 1975 to November, 1976.

The Manic 3 development will comprise an 11,000,000-cubic-yard earth and rockfill dam, an underground powerhouse, and a concrete auxiliary dam closing off a side valley to the east of the main dam. This auxiliary dam will contain the intake, spillway and a log-chute.

The powerhouse, which will contain six generating units operating under a head of 312 feet of water, will have a load factor of 53%, a total average flow of 26,000 cubic feet of water per second, and an annual production of close to 5.5 billion kWh. The reservoir created by the dam will have a capacity of 388 billion cubic feet of water, 25 billion of which will constitute the usable reserve. The reservoir surface will be at the same level as the Manic 5 tailrace and, as a result, the site of the river's fourth set of rapids, Manic 4, will be permanently inundated.

At the site of the Manic 3 dam, an alluvium-filled gorge extends about 400 feet beneath the riverbed. The gorge has to be sealed off and made water-tight so as to prevent seepage under the dam. To accomplish this, a concrete cut-off wall will be poured in place; it will consist of a double row of concrete piles and panels extending down through the alluvium and two feet into the bedrock. This remarkable wall will be the deepest cut-off wall of its kind in the world. It will enable the dam to be built without first excavating the riverbed down to bedrock—a task that would have been costly and time-consuming in this case.

Tests carried out at the site in 1969 established that it would be possible to drill to the required depths with sufficient accuracy. A concrete inspection gallery will be built into the base of the dam on top of the cut-off wall. The main dam will be 1,280 feet long and 40 feet wide at the crest, 2,400 feet wide at the base, and will have a maximum height of 353 feet. Comprehensive simulation studies that have been carried out with the aid of a computer will determine the most economical procedure for transporting construction material and thus reduce construction time and costs.

During the year, exploration proceeded for the deposits of natural materials such as glacial till, sand, gravel and rock that will be needed to build the dam. All occur within a radius of two or three miles from the construction site.

During 1969, hundreds of studies were conducted for new projects, additions or repairs to existing installations and major maintenance work. The principal projects under study were power developments that could be built at Lac Saint-Joachim, the James Bay drainage basin and in the Temiscamingue area.

Lac Saint-Joachim

The Hydroelectric Power Development Projects Directorate gathered additional data on the terrain for a proposed pumped-storage plant at Lac Saint-Joachim on the north shore of the St. Lawrence, about 35 miles downstream from Quebec City. Study of the project continued, and by the year-end the preliminary design report was almost finished for presentation in January, 1970.

The preliminary design envisages three groups of reversible motor-generator, pump-turbine units. Each group would contain three 400,000-kW units, making a total capacity of 3,600,000 kW. Each group could be considered as a separate powerhouse in itself, connected to the reservoir by a tunnel supplying the penstocks of the three units.

Lac Saint-Joachim would be transformed into a large storage basin by constructing four dikes. Another basin joining the river, and at river level, would supply water to the pump-turbines or receive water from them.

James Bay

During the year, studies continued on the various possibilities for developing the Nottaway, Rupert and Broadback Rivers which flow into Rupert Bay at the southern end of James Bay. Up to 5,230,000 kW could be developed on these rivers. The studies for a proposed hydroelectric complex have been divided into four stages of development, and with the aid of a computer, the best economic solutions have been sought.

The first stage consists in studying the development of the Rupert River alone with no regulation, and the last stage consists in designing the optimum development of this river with the Nottaway and Broadback Rivers diverted into it, assuming complete regulation of all three rivers.

An interim report on the first two stages was completed during the year, and a preliminary design report on the last two stages will be prepared during 1970. About 60 men took part in on-site work during the year, but in 1970 only office work will be done.

Manic 3:
the site of the future dam is outlined by snow.



Photo: Jacques Lambert

Gentilly:
Quebec's first nuclear power station.



Photo: Atomic Energy of Canada Ltd.

Chute Rouge

Construction of a powerhouse of between 190,000 kW and 300,000 kW at Chute Rouge, 30 miles northwest of Matagami and 145 miles from Amos, is still being studied independently of the Rupert Bay complex. The additional data gathered in the region during the year will be of help in choosing the best site for the powerhouse and also the best practicable combination of reservoirs (Lakes Olga and Matagami.) A preliminary design report will be finished in 1970.

Temiscamingue Powerhouse

Detailed plans were made during the year for a 195,000-kW underground powerhouse between Lac Beauchesne and the Ottawa River, 9 miles downstream from the town of Temiscamingue. It would replace the 17,000-kW. Kipawa powerhouse which had been operating at Lac Temiscamingue since 1920 but was recently taken out of service.

The preliminary design, drawn up by the Hydroelectric Power Development Projects Directorate in collaboration with its consulting engineers, envisages two reservoirs. The first would be made by joining Lac du Moine to Lac des Loups, and the second by joining Lac Kipawa to Lac Beauchesne. Altogether, they would contain a usable reserve of 196 billion cubic feet of water.

The underground powerhouse, located in the right bank of the Ottawa River, would be designed for an average regulated flow of 4,655 cubic feet of water per second, a head of 296 feet, annual production of 932 million kWh, and a load factor of 55%. It would contain three 65,000-kW generating units, each fed by three 400-foot long penstocks having a maximum diameter of 16 feet.

The Temiscamingue powerhouse would be located 150 miles south of Rouyn and 380 miles northwest of Montreal. It would supply power to Hydro-Quebec's 120-kV northwest system and construction would take about five years.

The vast network of 735-kV lines designed to transmit power from Churchill Falls and the Manic-Outardes complex to Quebec City and Montreal comprised a total of 795 miles of circuits in service at the year-end.

Manicouagan-Boucherville

The second link between the Manicouagan and Boucherville substations, a distance of 370 miles, was completed in September when the Lévis-Boucherville section of this link was put in service. From the Manicouagan substation, the two lines travel along the north of the St. Lawrence as far as Ile d'Orléans where they cross the river, connect into the Lévis substation and then continue along the south shore to Boucherville substation near Montreal.

In July, the Manicouagan and Micoua collector stations, situated between the Manicouagan and Outardes Rivers, were connected by a 37-mile, 735-kV tie line.

Micoua-Duvernay

The third 735-kV line between the Manic-Outardes complex and the Montreal area should be in service between Micoua substation and Laurentides substation (near Quebec City) by October, 1970, and between Laurentides substation and Duvernay substation (near Montreal) by August, 1971.

At the beginning of November, the 247-mile Micoua-Laurentides section of this line was three-quarters complete when a disastrous ice-storm caused the collapse of all the conductors and 28 towers on a 10-mile stretch of the line. At the year-end, steps were being taken to ensure that this section of line would nevertheless be in service close to the scheduled date.

Boucherville-Duvernay

Boucherville and Duvernay, the two 735-kV terminal stations in the Montreal area, will be connected by a 20-mile, 735-kV tie line which will cross the St. Lawrence River near the existing 315-kV line linking the Boucherville and Bout-de-l'Île substations. The river crossing will cover a total distance of 3 miles between anchor towers; foundations for the four intermediate suspension towers were completed during the year. Two of the towers will be 378 feet high and the other two, 486.5 feet high. They will be erected in 1970 and the conductors strung in 1971. The line is expected to be in service by August, 1971.

Power from Churchill Falls

Energy from the Churchill Falls powerhouse, presently under construction, will be received by Hydro-Quebec at the delivery point located about 150 miles north of Sept-Îles. It will be received via three 735-kV transmission lines, two of which will continue from the delivery point to the Manicouagan substation, a distance of 255 miles, while the third will travel 265 miles from the delivery point to the Micoua substation.

By the end of the year, more than half the tree-felling had been completed on the rights-of-way for these lines, and construction was about to begin on the first of the two lines to Manicouagan substation. This line is scheduled to become operational in November, 1971, the line to Micoua substation in 1972, and the second line to Manicouagan substation in 1973 or 1974.

Churchill Falls (Labrador) Corporation Limited is going ahead with construction of three 735-kV lines, each 125 miles long, from the powerhouse to the delivery point.

Micoua-Jacques Cartier line

The additional energy supplied from Churchill Falls will necessitate considerable expansion of the 735-kV network, which was designed originally to take power from the Manic-Outardes complex to the Montreal and Quebec City regions.

At the year-end, tree-felling had started on the right-of-way for a fourth 735-kV line between the complex and the Quebec City area. This line will be 265 miles long; it will start at Micoua substation, run inland north of Arvida and terminate at the new Jacques Cartier substation to be built near Quebec City. Commissioning of the line is planned for the fall of 1972.

315-kV lines

The only 315-kV lines put in service during the year were two double-circuit lines, one connecting Outardes 3 powerhouse to Manicouagan substation (26 miles), the other connecting Outardes 4 powerhouse to Micoua substation (9 miles).

By the year-end, right-of-way clearing was almost completed for two double-circuit, 315-kV lines that will link Manic 5 powerhouse to Micoua substation, a distance of 67.5 miles. The first of these two lines will be finished by the time the first generators are put in service at Manic 5 in 1970.

Line to New Brunswick

During the year, right-of-way clearing began for a 263-mile, 315-kV line that will be built from Lévis to Matapédia in order to deliver about 5 billion kWh to New Brunswick between 1971 and 1976, after which it will continue as an interconnection. On the section between Lévis and Rivière-du-Loup (114 miles), surveying was completed and tree-felling started; line construction will start in the fall of 1970. On the Rimouski-Matapédia section (83 miles), surveying was completed. Commissioning of the entire line is scheduled for October, 1971.

From Matapédia, it is planned to deliver energy to New Brunswick by a 230-kV line terminating near Dalhousie at a converter station which will provide a direct-current link between the Hydro-Quebec system and the Maritime Provinces' system. The purpose of the converter station is to avoid parallel operation of the two systems so as to maintain their stability.

230, 120 and 69 kV

The Gentilly nuclear power station has been connected to the system since March by a 13-mile, 230-kV line terminating at Larochelle substation, near Sainte-Angele.

In September, a 63-mile double-circuit, 230-kV line was completed between Chandler and New Richmond in Gaspé. One circuit on this line is being operated at 161 kV in order to close a 406-mile loop which starts at Les Boules and returns there via Copper Mountain, Chandler, New Richmond and Matapédia. The entire loop will eventually be modified to operate at 230 kV.

During the year, 57 miles of 120-kV lines and 46 miles of 69-kV circuits were put in service.

In Montreal, 5.3 miles of new 120-kV underground circuits were completed between Berri and Jeanne d'Arc substations and between Berri and Delorimier substations. Work started on conduits for two other miles of 120-kV underground circuits.

Because of the expansion of the system, a total of approximately 4,300,000 kVA in new transformer capacity was installed during 1969 at existing substations and in about a dozen new substations. (This figure is the maximum capacity with fan-cooling, during any season.)

The 735-kV system alone received an additional 2,343,000 kVA. Two transformer banks rated 571,500 kVA each were put in service at Micoua substation, located between the Manicouagan and Outardes Rivers. At this substation, power is presently received from Outardes 4 powerhouse and will soon be received from Manic 5 powerhouse as well; transformers at the substation raise the power voltage from 315 kV to 735 kV. At Boucherville substation, completion of the second 735-kV line from Lévis has necessitated the installation of two more 600,000 kVA transformer banks, raising the substation's transformer capacity to 3,600,000 kVA.

Hauterive substation near Baie-Comeau received an additional 150,000 kVA, bringing its capacity to 450,000 kVA. Capacity was increased at two of the Montreal-area substations supplied at 315 kV: Laprairie substation, from 300,000 kVA to 800,000 kVA and Saraguay substation, from 500,000 kVA to 600,000 kVA.

Transformer capacity was considerably increased at several of the substations supplied at 230 kV and 120 kV, including Sorel Terminal Station, South Cable House, and the Beaumont, Cleveland, Delson, Hemmings Falls, Laurent, Longue Pointe, Mondelet and Rockfield substations.

At Cap-de-la-Madeleine, a new 200,000-kVA, 230-kV substation was put in service. In the heart of Montreal, the new Berri substation was put in service in January 1970 with an initial capacity of 120,000 kVA. New substations supplied at 120 kV were put in service at Sainte-Agathe, Calumet, Landry, Maniwaki and Plouffe.

Capital expenditures for the whole of the distribution system amounted to \$51,000,000 in 1969, \$2,332,000 less than in the preceding year.

The cost of extensions and additions to supply new customers was \$21,274,000, which includes 800 miles of new medium-voltage circuits. At December 31, the total length of distribution lines in the eight regions was approximately 44,500 miles.

Underground lines

Underground distribution work carried out in the province for both technical and esthetic reasons cost \$4,630,000. This figure includes a number of underground circuits laid in new housing developments where customers are directly or indirectly called on to pay the difference between the cost of underground and overhead distribution. In Montreal, Hydro-Quebec's share of the cost of putting 3 miles of overhead lines underground was \$900,000.

Standardization of distribution material and supplies continued during the year. Most stocks are now renewed by bulk purchases, which result in savings of about 15%.

New agreements

After three years of negotiations, a new contract was signed with Bell Canada covering the joint use of poles. This contract, for a period of five years from December 1, 1968, resulted in an increase in net revenues of more than \$500,000 during 1969. At the year-end, similar agreements were being negotiated with other public utilities.

A new agreement for the supply of electricity to educational establishments was signed with the Quebec Department of Education. Both parties will realize substantial savings for initial outlays and operating costs of electrical installations in new schools.

In the fall, a study group from Electricité de France visited Hydro-Quebec to obtain information on live-line maintenance methods, administrative structures, work organization, accident prevention and various other matters of mutual interest.

Diesel stations

The village of Lac-Edouard, located about 40 miles northeast of La Tuque, which had been supplied by a 350-kW diesel power station, was connected to the system by a line that already existed in part. An amount of \$300,000 was spent to renovate and extend this line, which was put in service towards the end of the year. Several new generating units were added to the diesel stations supplying localities on the lower north shore, including two 1,000-kW units at Havre Saint-Pierre.

At December 31, total capacity of all the small diesel stations operated by Hydro-Quebec was 20,030 kW. Those serving localities on the lower north shore are spread over a distance of 400 miles between Havre Saint-Pierre and Blanc-Sablon; the latter village is located some 900 miles northeast of Quebec City.

During the year, three more powerhouses in the province's northwest were brought under remote control: Rapide-des-Iles and Première-Chute are now controlled from the Rapide-des-Quinze powerhouse, and Rapide 2 from the Rouyn dispatching centre. Rapide 7 powerhouse has been remotely controlled from Rouyn since 1968, and the only powerhouse in the northwest not yet under remote control is Rapide-des-Quinze, itself a remote-control centre at present.

The other powerhouses on the provincial system already under remote control are Shawinigan 3 and St. Narcisse (remotely controlled from Shawinigan 2), and Manic 1 powerhouse, which is controlled from the Manicouagan substation.

The new Outardes 4 and Outardes 3 powerhouses will be controlled from the Manic substation in 1970, as will Manic 5, where the first generating unit is scheduled to be placed in service in August, 1970. La Trenche and Rapide Blanc powerhouses on the upper St. Maurice will be remotely controlled from La Tuque powerhouse in 1971, bringing to 3,800,000 kW the total amount of remotely-controlled generating capacity.

Substations

Throughout the province, seven new remotely-controlled substations were placed in service and four existing substations were brought under remote control, bringing to 118 the number of substations of all types being operated this way.

On the Island of Montreal, the new Berri substation is controlled from Notre-Dame substation and remote-control equipment has been installed in the Guy, Baie-d'Urfé, Laurent and Delorimier substations. On the Island, the number of major substations that are remotely controlled is now 19 out of a total of 28. A year ago the number was 14 out of 27. Several of the remaining nine substations are themselves remote-control centres.

The present remote-control installations use telephone cables, carrier waves (on transmission lines), radio or microwave links for transmitting signals.

Training of personnel

As a trial measure and to facilitate personnel training, the Control Service has been authorized to install computers in the future 735-kV Duvernay substation near Montreal and in the new Manic powerhouse. These computers will be provided with print-outs for automatic recording of data and alarm signals. Moreover, during the year, 38 engineers and 20 technicians started following courses on the application of transistorized logic circuits to control. These courses are being given by a professor from Ecole Polytechnique of Montreal.

Berri substation, Montreal, commissioned in 1969.

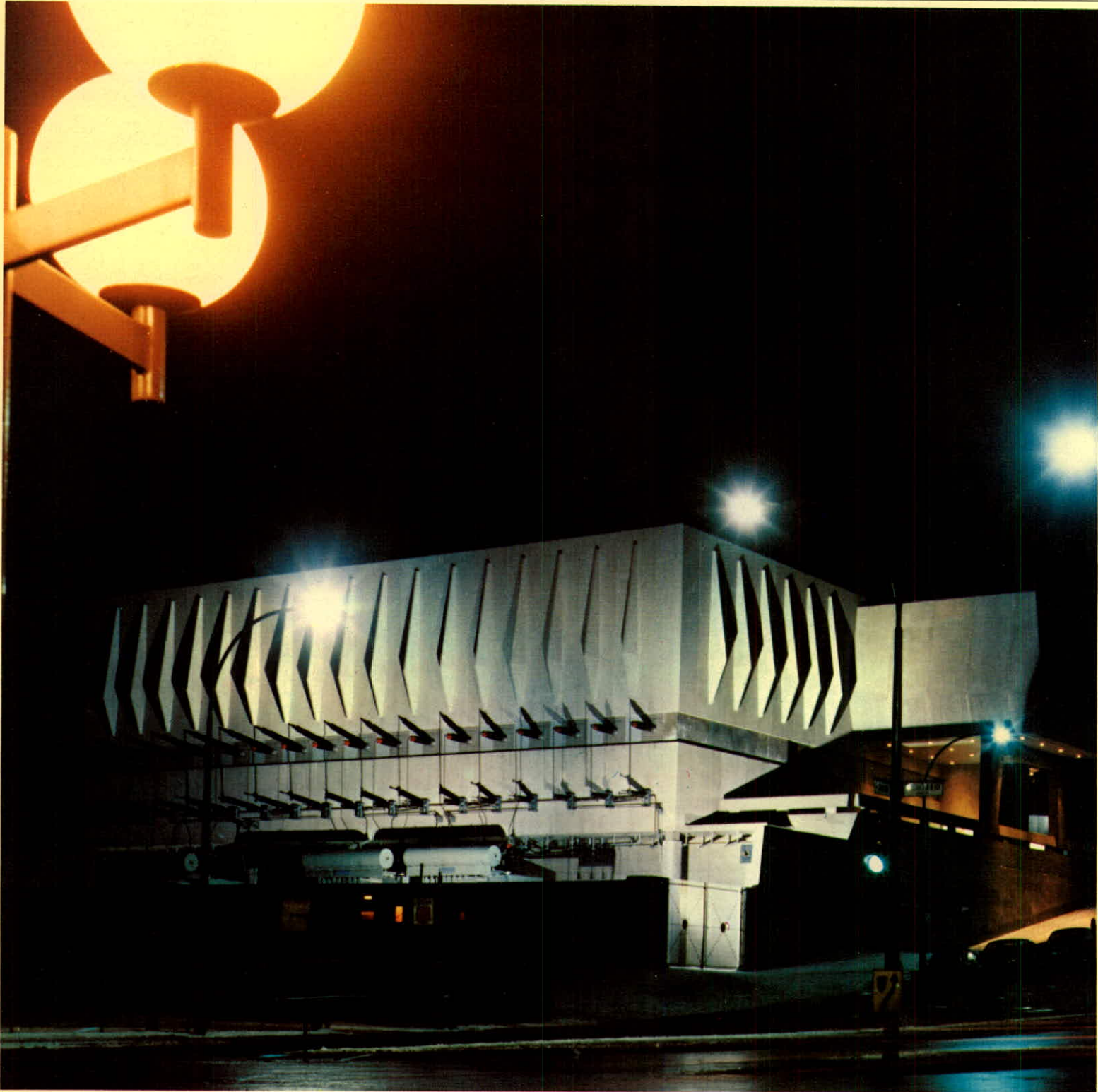


Photo: Alain Rinfret

In the fall of 1969, a contract was awarded for the establishment of a microwave link between the Hydro-Quebec system and Churchill Falls powerhouse.

Between Hauterive substation near Baie-Comeau and Arnaud substation near Sept-Iles (118 miles), the link will operate via six ordinary relay stations. But, because of the absence of access roads and local electricity supplies, the remaining distance (256 miles) will be covered by two hops using transmission by tropospheric scatter. For this section of the link, reflectors with a diameter of 60 feet will be used.

It will be the first time that this type of transmission has been used for the protection of extra-high-voltage lines. The whole of this new link will be ready to operate by August, 1971. It will provide the same services as the rest of the Hydro-Quebec microwave system, namely protection, remote-control, telemetering, verbal communication, and so forth.

During the year, the Micoua 735-kV substation and the Gentilly nuclear power station were linked to the microwave system. In addition, major telephone links were installed at Rouyn, Rimouski and Thetford.

In August, 1969, the Commission set up a task force to define the entirely new methods of supervision and operation that are becoming increasingly necessary to guarantee safe operation of the system as the number, length and loading of the transmission and distribution lines increase.

The task force, whose report will be presented during 1970, was also authorized to examine all aspects of a system of supervision and operation employing computers, with all the combinations possible, in order to recommend the best formula for future growth. A comparative study will be made of initial costs and the savings that can be realized, and recommendations will be made concerning the retraining of personnel.

The task force has been asked to determine, within the framework of these general studies, the particular degree of automation that will be essential to the system after completion of the planned new sources of electric power such as Churchill Falls, nuclear power stations and pumped-storage stations.

The group began by making a survey of Hydro-Quebec's present installations and operating methods. They also examined the steps taken or envisaged by other large power systems faced with the same problems, so as to combat the formidable problem of blackouts.

During 1969, more specialists of international renown joined the Institute. Several young research workers who were already on the staff returned from training in European laboratories, including those of Electricité de France and Italy's national electricity system, CESI. By the year-end, the staff numbered about 100, including 45 research workers, and was preparing to occupy the administrative offices and the general research laboratory building early in January, 1970.

Construction of the high-voltage laboratory will begin in March, 1970, and end in May, 1971. Towards the end of August, 1970, construction of the high-power laboratory will begin. It should be completed by May, 1972, when the laboratory will take delivery of six short-circuit transformers ordered in 1969. These transformers will be rated 1,200,000 kVA each and will enable tests to be carried out at voltages up to 1,500 kV.

Through cooperation with universities in the Montreal area, the Institute's researchers were able in 1969 to obtain useful results on the following subjects: fuel cells, direct-current voltages, and direct-current circuit breakers.

The Institute is located on a square-mile tract of land near the Boucherville 735-kV substation, 20 miles from downtown Montreal.

economic research

Early in the year, a new directorate, Economic Research, was created to carry out or coordinate studies so as to advise the Commission on the economic aspect of technical, administrative or financial problems of concern to Hydro-Quebec.

Besides acting as consultants to the Commission, the new directorate will advise other departments on economic questions relating to their functions, supply economic data and analyses when required, and undertake development and management-efficiency studies.

During the year, the new directorate carried out several studies, including a forecast of the future evolution of costs, interest rates and prices of fossil fuels.

oil exploration

The Société acadienne de Recherches pétrolières (SAREP), a subsidiary of the Texaco Exploration Company, continued the oil-exploration work begun in 1967 in the Gulf of St. Lawrence, in accordance with an agreement concluded with Hydro-Quebec, which holds the oil-exploration permits for this area.

During the year, some 1,280 linear miles of seismic soundings were carried out in several quadrilaterals determined from data gathered in previous studies. A survey was also made of the geological structure of the sea-bed around the Magdalen Islands and Anticosti Island.

Hydro-Quebec's share of the on-site cost incurred in 1969 amounted to \$250,000. Results of investigations are encouraging and, at the year-end, initial exploratory drilling was being planned for 1970.

The oil-exploration permits granted to Hydro-Quebec by the Quebec Minister of Natural Resources cover an area of about 36 million acres in the St. Lawrence estuary and gulf, but the agreement with SAREP is restricted to an area of 3,300,000 acres in and around the Magdalen Islands.

supplies

The total value of material, equipment and services purchased by the Supply department in 1969 amounted to \$241,147,000, an increase of \$70,919,000 or 41.7% over 1968. (It should be noted that even though an order is placed in one particular year, delivery dates and payments may be spread over several years.) This rise is attributable to the continuing expansion of the system and especially construction of the 735-kV lines. The policy of bulk purchasing resulted in estimated total savings of \$1,200,000 for the year.

Revenue from the sale of real estate totalled \$1,389,000, up by \$341,000 over the preceding year. The acquisition of real rights or properties needed for major projects throughout the province involved negotiation of 4,351 purchases, servitudes and agreements amounting to \$1,755,000, compared with \$3,057,000 in 1968.

New buildings

During the year, two new administrative centres were inaugurated, one at Rimouski for the Matapedia region and the other at Lévis in the Montmorency region. At Alma, in the Saguenay region, a building was acquired for a new district service centre.

The task of providing suitable premises for the staff of the regions and zones was affected by leases already in force and by the need to restrict capital investments to the most essential.

Standardization of material

In July, the Commission created a standardization committee, under the chairmanship of the general manager of Supply, to standardize stocks of material and equipment kept in Hydro-Quebec stores throughout the province.

The 300,000 different items now carried in stores represent an investment of \$30,000,000 that can be considerably reduced through standardization. The private companies and cooperatives nationalized in 1963 used a great variety of items destined for the same use; since then, efforts were concentrated mainly on codifying and standardizing distribution equipment, but from now on standardization will be extended to stock of all kinds.

735-kV suspension tower near Quebec bridge.





Gentilly:
Pressure tubes being installed in reactor core.

Permanent employees numbered 11,890 at the year-end, 167 more than at December 31, 1968, while construction workers totalled 2,307 at the beginning of October, or 1,981 fewer than a year earlier. Without counting employee benefits, the salaries and wages paid to permanent staff totalled \$109,166,600, compared with \$104,320,000 in 1968, while the amount paid to construction workers was \$21,499,000, compared with \$42,977,000 in 1968.

During the year, 700 persons were hired and assigned permanent positions, including 21 from among the graduating students interviewed at five universities. This was 46 less than last year when new employees numbered 746, including 25 new graduates. However, 38 active employees and 56 pensioners died and 207 members of the permanent staff retired.

The number of group-life insurance claims (covering deaths and total and permanent disability) was 192 and cost \$2,411,185 compared with 250 claims for a total of \$2,701,650 in 1968. At December 31, the Quebec Hospital Service Association (Blue Cross) had reimbursed employees a total of \$1,431,661 in medical, surgical and hospital expenses, as against \$2,247,945 in 1968.

Labor agreements

Important new collective labor agreements affecting permanent staff and construction personnel were concluded during the year, with no work stoppages involved.

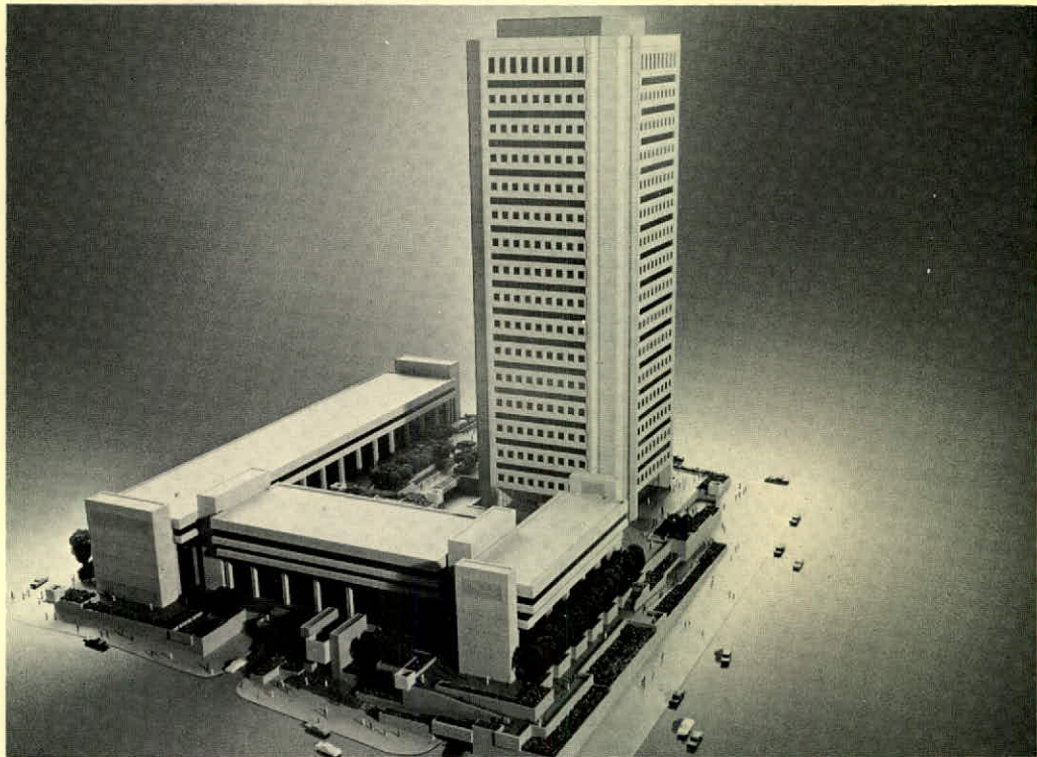
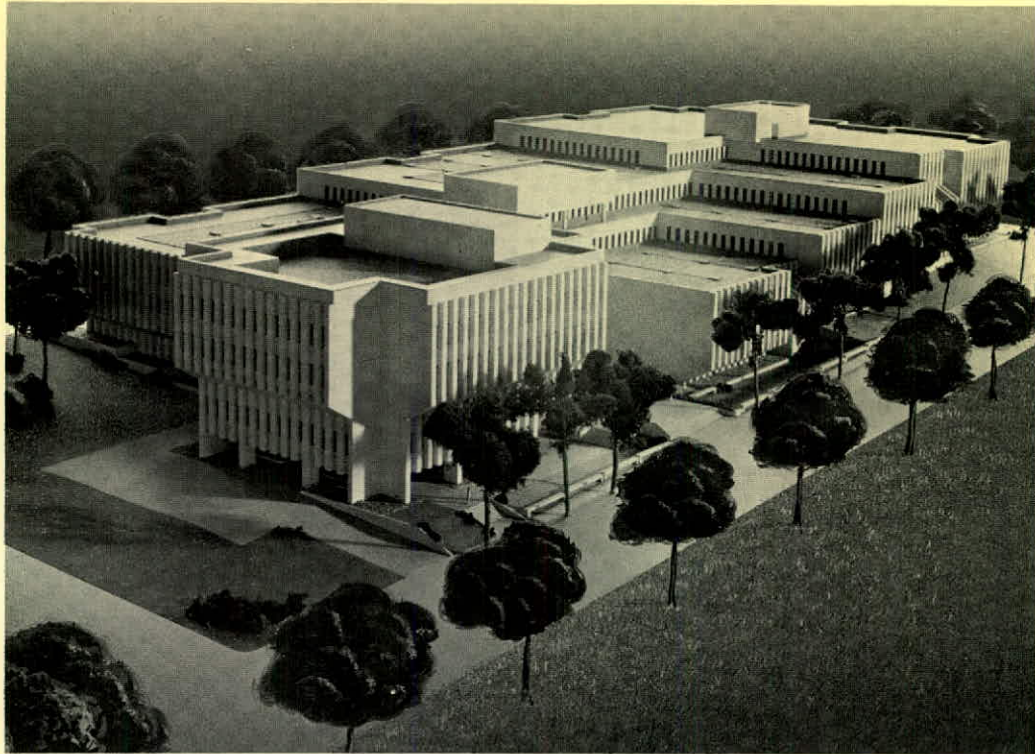
Three agreements for the period from January 1, 1969, to December 31, 1971, were signed with locals 957, 1,500 and 2,000 of the Canadian Union of Public Employees covering more than 8,000 tradesmen, office workers and technicians. The three-year agreements provide for an annual salary increase of 5%, except for the agreement covering tradesmen which stipulates salary increases of 5% in 1969, 9% in 1970 (for certain categories) and 4.7% in 1971.

Two new agreements covering construction personnel at Manicouagan and Outardes were signed with the Syndicat national de la Construction (CNTU) and are due to expire on June 3, 1970. New agreements for various periods were also reached with Local 57 of the International Union of Office and Professional Employees covering 40 employees at the Gentilly nuclear power station; with the Syndicat des Travailleurs de Bécancour covering 64 employees at Gentilly, and with Local 6961 of the United



Photo: Alain Rinfret

All-electric:
Models of future administrative complex for the
Quebec government.



Steelworkers of America covering 70 employees at Rapide-des-Iles and Première-Chute powerhouses.

Training and development

During the year, increased emphasis was placed on employee training and development. As the result of new programs, 383 supervisory personnel took part in study sessions on communications, nearly 400 upper-management staff members followed a course in financial management and close to 350 foremen in the regions and zones participated in a course especially designed for them. About 550 supervisory and professional personnel followed technical courses and another 900 employees took evening courses in a variety of subjects at institutes for adult education.

Job evaluation

Since 1965, the committees responsible for establishing a job-evaluation plan have evaluated 260 upper-management and 800 lower-management posts. At the year-end, another 1,200 supervisory positions were under study. In October, the Commission approved the overall plan and its method of application, as well as the evaluations already completed for upper-management personnel.

Scholarships

Sixteen scholarships, including nine renewals, were awarded to promising employees to enable them to pursue full-time university studies leading to specialized bachelor's degrees, master's degrees or doctorates. The total value of the scholarships is about \$70,000.

In addition, 42 employees, including 13 new recruits for the Institute of Research, were following special training courses in other countries. Hydro-Quebec received 10 trainees from other countries and about 50 Canadian trainees from the academic and business worlds.

The Commission also awarded scholarships worth a total of \$135,000 to 25 Quebec university students, other than employees, for studies leading to a doctorate. Fifteen of these scholarships were renewals.

Accident prevention

Among operating personnel, the accident frequency rate per million manhours of work, which was 9.9 in 1967 and 8.1 in 1968, was 8.3 in 1969. Altogether, there were 192 accidents, three of them fatal, compared with 186, two of which were fatal, in 1968.

At the construction sites, where there was a considerable decrease in the number of manhours worked, the frequency rate dropped slightly, from 21 to 20.8. The actual number of accidents was 174 as against 270 in 1968. However, there were five deaths, compared with two in 1968.

Radioprotection

The radioprotection service established by the Health directorate at the Gentilly nuclear station in 1968 carried out medical examinations on 150 prospective employees in order to detect any specific condition or disease that would be incompatible with work in a nuclear station. A six-week course is given to new employees to teach them means of self-protection against radiation.

The radioprotection service is headed by a doctor of science whose staff at present consists of a nuclear engineer, a radiophysician, a radiobiochemist and a radioprotection engineer-in-training.

In addition to constant radiologic supervision of the staff and station installations, these specialists will also be responsible for preventing any nuclear pollution in the vicinity of the station, including the river water and the atmosphere, so as to protect nearby inhabitants.





Hydro-Quebec Annual Report 1969

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Auditors' Report

We have examined the consolidated balance sheet of the Quebec Hydro-Electric Commission and its subsidiary companies as at December 31, 1969, and the related consolidated statements of revenue and expenditure, reserves, and source and application of funds for the year ended on that date. Our examination included a general review of the accounting procedures and such tests of accounting records and other supporting evidence as we considered necessary in the circumstances.

In our opinion, the operations of the Commission during the year have been carried on in conformity with the law and the accompanying consolidated balance sheet, the related consolidated statements of revenue and expenditure, reserves, and source and application of funds, forming the report of the Commission, present fairly the financial position of the Commission and its subsidiary companies as at December 31, 1969, and the results of their operations and the source and application of funds for the year ended on that date, in accordance with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Montreal, Canada,
April 6, 1970.

Léo Davignon, C.A.
of Davignon, L'Abbé, Verner & Associés
Raymond, Chabot, Martin, Paré & Associés
Chartered Accountants

H. Marcel Caron, C.A.
of Clarkson, Gordon & Co.
Chartered Accountants

QUEBEC HYDRO-ELECTRIC COMMISSION AND ITS SUBSIDIARY COMPANIES

Consolidated Statement of Revenue and Expenditure

(in thousands of dollars)

for the year ended December 31, 1969

		1969	1968
Revenue	Sales of electricity	\$416,012	\$386,942
	Increase in unbilled revenue	4,315	3,049
		420,327	389,991
	Other operating income (net)	10,781	7,837
		431,108	397,828
Expenditure	Operating, maintenance, administration and other expenses	143,704	130,050
	Provision for renewals (depreciation)	51,488	45,751
	Provincial levy on energy generated	23,744	22,088
	School and municipal taxes	18,091	17,999
	Power purchased	17,536	18,750
		254,563	234,638
Net operating income		176,545	163,190
	Less: Interest (net) (note 8)	98,516	89,189
	Profit on purchase for sinking funds (note 5)	(6,736)	(3,738)
	Interest on reserves (note 7)	39,284	33,852
		131,064	119,303
Available for reserves		\$ 45,481	\$ 43,887
Reserve provisions (note 7)	Contingencies	\$ 18,002	\$ 19,328
	Stabilization of rates	8,407	7,800
	Amortization	19,072	16,759
		\$ 45,481	\$ 43,887

The accompanying notes are an integral part of the consolidated financial statements.

QUEBEC HYDRO-ELECTRIC COMMISSION AND ITS SUBSIDIARY COMPANIES

Consolidated Balance Sheet

(in thousands of dollars)

as at December 31, 1969

Assets		1969	1968
Fixed assets	Property and plant, at cost:		
	In service	\$3,404,418	\$2,991,603
	Construction work in progress	608,383	791,043
		4,012,801	3,782,646
	Less reserve for renewals (accumulated depreciation)	705,882	663,420
		3,306,919	3,119,226
	Construction, operating and sundry equipment, at cost less amount amortized	25,486	28,503
		3,332,405	3,147,729
Current assets	Cash and treasury bills, at cost	15,917	15,894
	Accounts receivable	51,135	52,179
	Unbilled revenue	31,644	27,329
	Materials and supplies, at cost	29,594	23,926
	Expenses applicable to future operations	3,415	5,255
		131,705	124,583
Other assets	Investments, at cost (note 1)	132,219	58,296
	Unamortized debenture discount and expenses	44,924	41,184
	Accounts receivable	10,534	10,749
	Employees' mortgage loans	3,993	4,531
	Deferred cost on purchase of energy (note 2)	1,920	—
		193,590	114,760
		\$3,657,700	\$3,387,072

Liabilities		1969	1968
Long-term debt	Bonds and debentures — guaranteed by the Province of Quebec (note 3)	\$2,515,523	\$2,319,585
	Less sinking funds (notes 3 and 5)	53,943	56,278
		2,461,580	2,263,307
	Net exchange premium (note 4)	79,726	71,668
		2,541,306	2,334,975
	Other long-term debt (note 6)	12,561	12,504
		2,553,867	2,347,479
Notes payable			
	Notes payable maturing within three years of which \$154,574 and \$168,806 are due within one year	183,892	198,568
Current liabilities	Bank overdrafts	3,296	9,998
	Bank loans	2,000	9,450
	Accounts payable and accrued liabilities	63,944	61,724
	Accrued interest	43,094	37,136
		112,334	118,308
Deferred liabilities	Workmen's compensation awards	2,546	2,633
	Customers' deposits and advances	8,622	8,410
		11,168	11,043
Reserves (note 7)	Contingencies	310,519	277,215
	Stabilization of rates	147,289	131,617
	Amortization	338,631	302,842
		796,439	711,674
		\$3,657,700	\$3,387,072

On behalf of the Commission :
(signed) Roland Giroux, President
(signed) Georges Gauvreau, Commissioner
Montreal, April 6, 1970.

(signed) E.-A. Lemieux
General Manager
Finance and Accounting

The accompanying notes are an integral part of the consolidated financial statements.

QUEBEC HYDRO-ELECTRIC COMMISSION AND ITS SUBSIDIARY COMPANIES

Consolidated Statement of Reserves

(in thousands of dollars)

for the year ended December 31, 1969

	Total	Contingencies	Stabilization of rates	Amortization
Balance, December 31, 1968	\$711,674	\$277,215	\$131,617	\$302,842
Add:				
Interest on reserves	39,284	15,302	7,265	16,717
Provision from consolidated revenue	45,481	18,002	8,407	19,072
Balance, December 31, 1969	\$796,439	\$310,519	\$147,289	\$338,631

The accompanying notes are an integral part of the consolidated financial statements.

QUEBEC HYDRO-ELECTRIC COMMISSION AND ITS SUBSIDIARY COMPANIES

Consolidated Statement of Source and Application of Funds

(in thousands of dollars)

for the year ended December 31, 1969

	1969	1968
Source of Funds		
Operations of the year —		
Available for reserves	\$ 45,481	\$ 43,887
Less:		
Net profit on investments purchased for the sinking funds	6,736	3,738
	<u>38,745</u>	<u>40,149</u>
Plus:		
Provision for renewals (depreciation)	51,488	45,751
Interest on reserves	39,284	33,852
Amortization of operating equipment	3,318	3,067
Amortization of debenture discount and expenses . . .	2,899	2,526
Issue of debentures (less discount and expenses)	<u>265,789</u>	<u>177,347</u>
Plus exchange premium on debentures issued in		
U.S. funds	8,059	9,783
Sundry items (net)	<u>4,385</u>	<u>9,650</u>
	<u>\$413,967</u>	<u>\$322,125</u>
Application of Funds		
Additions to property and plant (cost)	\$ 244,846	\$ 268,922
Less:		
Amortization of construction equipment	2,200	6,031
Maturities of long-term debt	39,549	27,135
Purchase of sinking fund investments	29,001	27,480
Purchase of shares and bonds from Churchill Falls (Labrador)		
Corporation Limited	75,000	40,000
Decrease (increase) in short-term notes payable	14,676	(12,626)
Increase (decrease) in working capital	13,095	(22,755)
	<u>\$413,967</u>	<u>\$322,125</u>

The accompanying notes are an integral part of the consolidated financial statements.

Les notes ci-jointes font partie intégrante des états financiers consolidés.

QUEBEC HYDRO-ELECTRIC COMMISSION AND ITS SUBSIDIARY COMPANIES

Notes to Consolidated Financial Statements

December 31, 1969

		1969 (\$'000')	1968 (\$'000')
Investments at cost	Note 1		
	Churchill Falls (Labrador) Corporation Limited (see note 10) —		
	Debentures, General Mortgage, 7½%, due 2010 (par value \$100 million at December 31, 1969 and \$25 million at December 31, 1968)	\$ 90,500	\$22,625
	Common shares:		
	Fully paid	34,333	27,208
		<u>124,833</u>	<u>49,833</u>
	Gelco Enterprises Ltd., 4% unsecured note, due 1991	7,250	7,315
	Saint John Realty Co., non-interest bearing note	—	386
	Sundry investments	136	762
		<u>\$132,219</u>	<u>\$58,296</u>

Deferred cost on purchase of energy	Note 2	
	In accordance with the terms of a contract with Churchill Falls (Labrador) Corporation Limited (see note 10), the Commission is obligated to pay to the Corporation an amount equal to a part of the interest charges on the First Mortgage Bonds, General Mortgage Bonds and other indebtedness of the Corporation. These payments will be amortized over the years when power is delivered.	

Note 3		Interest Rate	Year of Issue	Year of Maturity	Bonds and Debentures (\$'000')	Sinking Fund Investments (\$'000')
Series						
(Note 5)						
Bonds and Debentures	Quebec Hydro-Electric Commission					
	"D"	3%	1947	1970-1973	\$ 22,300	
	"K"	3½%	1953	1978	43,306 U.S.	\$13,702
	"L"	3¼%	1954	1974	20,860	170
	"M"	3½%	1955	1975	29,172	
	"N"	3½%	1956	1981	45,801 U.S.	13,556
	"O"	4¼%	1956	1976	19,241	
	"P"	4¼%	1956	1981	30,432 U.S.	6 975
	"Q"	4¾%	1957	1977	41,816 U.S.	5,703
	"S"	5%	1957	1975, 1982	22,783	
	"T"	3¾%	1958	1983	44,813 U.S.	7,624
	"V"	5%	1958	1979	16,714	
	"W"	5%	1959	1980	24,849	
	"X"	5%	1959	1984	42,481 U.S.	2,207
	"Y"	6%	1959	1979	21,212	
	"Z"	5½%	1960	1982	29,418	
	"AA"	5½%	1960	1983	22,042	
	"AB"	5½%	1961	1985	35,502	
	"AC"	5½%	1961	1985	32,848	
	"AD"	5½%	1962	1982	37,090	
	"AF"	5½%, 5¾%	1962	1970, 1984	55,170	659
	"AG"	5%	1963	1988	278,449 U.S.	
	"AH"	4%	1963	1973	20,000	
	"AI"	4½%	1963	1973	7,118	
	"AJ"	5%	1963	1973	12,196	
	"AK"	5½%	1963	1973	5,775	
	"AL"	6%	1963	1973	8,089	
	"AM"	5½%	1963	1986	46,157	
	"AN"	5%, 5½%, 5½%	1964	1971, 1984, 1994	47,856	
	"AO"	4½%	1964	1994	50,000 U.S.	2,917
	"AP"	4¾%	1964	1989	46,830 U.S.	430
	"AQ"	5½%	1964	1988	56,786	
	"AR"	5½%, 5%	1965	1987, 1995	71,086	
	"AS"	4¾%	1965	1985	50,000 U.S.	
	"AT"	5½%	1966	1987	50,000 U.S.	
	"AU"	6%	1966	1991	48,439	
	"AV"	5¾%	1966	1992	60,000 U.S.	
	"AW"	6%	1966	1980, 1990	48,212	
	"AX"	6¼%	1966	1991	40,000 U.S.	
	"AY"	6¼%	1967	1993	60,000 U.S.	
	"AZ"	6½%	1967	1978, 1990	48,861	
	"BA"	6¼%	1967	1993	50,000 U.S.	
	"BB"	6½%	1967	1992	50,000 U.S.	
	"BC"	6¾%, 7%, 6% and 7%	1967	1970-1977, 1980, 1994	57,000	
	"BD"	6¾%	1968	1989	60,000 U.S.	
	"BE"	7½%, 7½%, 7%	1968	1970-1978, 1980, 1994	48,800	
	"BF"	7¾%	1968	1986	25,000 U.S.	
	"BG"	7¼%	1968	1991	50,000 U.S.	
	"VA"	7¼%	1968	1974	10,000 U.S.	
	" —	6¾%	1969	1984 (150 million Deutsche Marks)	40,216	
	" —	7¼%	1969	1984 (100 million Deutsche Marks)	27,045	
	"BH"	7¾%	1969	1974 (1990 at the option of the holders)	50,000	
	"BI"	8¾%	1969	1999	50,000 U.S.	
	"BJ"	8%	1969	1979 (1974 at the option of the holders)	20,000 U.S.	
	"BK"	8½%	1969	1972 (1992 at the option of the holders)	25,000	
	"BL"	9¾%	1969	1995	41,700 U.S.	
					\$2,298,465	\$53,943

*Sinking fund debentures.

QUEBEC HYDRO-ELECTRIC COMMISSION AND ITS SUBSIDIARY COMPANIES

Notes to Consolidated Financial Statements

December 31, 1969

Note 3 - Continued

Series	Interest Rate	Year of Issue	Year of Maturity	Bonds and Debentures (\$'000')	Sinking Fund Investments (\$'000')
(Note 5)					

The Shawinigan Water and Power Company
First Mortgage Sinking Fund Bonds

"H"	3½%	1945	1970	\$ 13,107	
"J"	3½%	1945	1970	6,760	
"M"	3%	1946	1971	25,000 U.S.	
"N"	3%	1946	1971	5,849	
"O"	3¼%	1947	1972	11,833	
"P"	3¼%	1948	1973	19,839	
"Q"	3%	1950	1975	14,650 U.S.	
"R"	4¼%	1956	1976	11,146	
"S"	5¼%	1961	1981	15,414	
				123,598	
Sinking Fund Debentures					
—	5½%	1957	1972	13,347	
				\$ 136,945	

St. Maurice Power Corporation
First Mortgage Sinking Fund Bonds

"A"	3¼%	1946	1970	\$ 6,667	
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Southern Canada Power Company, Limited
First Mortgage Bonds

"B"	3½%	1946	1976	\$ 5,560	
"C"	3½%	1948	1976	2,500	
"D"	3¾%	1951	1981	2,500	
				\$ 10,560	

Quebec Power Company
First Mortgage Sinking Fund Bonds

"F"	3%	1947	1972	\$ 2,623	
"G"	6¼%	1962	1982	12,777	
				\$ 15,400	

Note 3 - Continued

Series	Interest Rate	Year of Issue	Year of Maturity	Bonds and Debentures (\$'000')	Sinking Fund Investments (\$'000')
(Note 5)					
Gatineau Power Company					
First Mortgage Bonds					
"C"	3%	1946	1970	\$ 36,279 U.S.	
"D"	3¼%	1946	1970	1,821	
"E"	3¾%	1948	1973	2,274	
				<u>\$ 40,374</u>	
Lower St. Lawrence Power Company					
First Mortgage Sinking Fund Bonds					
"E"	4½%	1953	1973	\$ 788 U.S.	
"F"	5⅞%	1959	1984	925 U.S.	
				<u>\$ 1,713</u>	
Northern Quebec Power Company, Limited					
First Mortgage Sinking Fund Bonds					
"B"	5⅞%	1954	1974	\$ 499	
Saguenay Electric Company					
First Mortgage Sinking Fund Bonds					
"C"	4⅞%	1953	1973	\$ 1,020	
General Mortgage Sinking Fund Bonds					
"A"	5½%	1962	1982	3,880	
				<u>\$ 4,900</u>	
Total Bonds and Debentures				<u>\$2,515,523</u>	<u>\$53,943</u>

A contract was signed by the Commission before December 31, 1969 for the issue on February 17, 1970, of \$8,300,000 (U.S.) Series "BL", 9¼% debentures. Furthermore, a contract has been signed on January 22, 1970 for the issue, on February 1, 1970, of \$50,000,000 Series "BM", 9¼% debentures and another contract has been signed on March 3, 1970 for an issue, dated March 15, 1970, of \$60,000,000 (U.S.) Series "BN", 9¼% debentures.

Bonds and debentures of subsidiary companies are guaranteed by the Commission, guarantee which is in turn guaranteed by the Province of Quebec. Maturities and sinking fund requirements on bonds and debentures for 1970 total approximately \$112 million.

canadiennes de la série "BM", 9¼% et un autre contrat a été signé le 3 mars 1970 pour une émission datée du 15 mars 1970 d'un montant de \$60 000 000 d'obligations en devises des États-Unis de la série "BN", 9¼%. Les obligations des filiales sont garanties par la Commission et cet engagement est garanti par la province de Québec. Les échéances et exigences des fonds d'amortissement des obligations pour 1970 se chiffrent à environ 112 millions de dollars.

QUEBEC HYDRO-ELECTRIC COMMISSION AND ITS SUBSIDIARY COMPANIES

Notes to Consolidated Financial Statements

December 31, 1969

Note 4

Net Exchange Premium

Consolidated long-term debt includes \$1,318,270,000 payable in U.S. currency which is carried in the accounts at the rate of U.S. \$1 equals Canadian \$1 and 250 million Deutsche Marks carried in the accounts at the Canadian dollar equivalent at the dates of borrowing. The net exchange premium shown on the consolidated balance sheet represents the adjustment arising from the conversion of debt payable in U.S. funds into Canadian funds at the rates of exchange in effect at the time the debt was incurred or included in consolidation, less the premium on debentures purchased for sinking funds.

The exchange premium required to convert into Canadian dollars the net debt payable in foreign currencies at the rates of exchange prevailing at December 31, 1969 would be \$20,835,637 more than the net exchange premium shown on the consolidated balance sheet.

Note 5

Sinking Funds

The Commission invests substantially all of its Sinking Funds in its own debentures and in those of its subsidiary companies. Debentures of an issue purchased for the sinking fund of that issue have been cancelled. The remaining sinking fund investments are carried at par in the case of the Commission's debentures and at cost (\$2,230,000) in the case of other investments.

Note 6

Other Long-Term Debt

	1969 (\$'000')	1968 (\$'000')
Rural Electrification Bureau, 1970-1993	\$10,527	\$11,227
Other long-term debt maturing from 1970 to 1992	2,034	1,277
	<u>\$12,561</u>	<u>\$12,504</u>

The debts to the Rural Electrification Bureau do not bear interest as long as there is no default under the provision of the governing agreements. Maturities for 1970 total approximately \$900,000.

Note 7

Reserves

The Quebec Hydro-Electric Commission Act requires the Commission to create reserves for amortization of the capital invested, for contingencies and for stabilization of rates. In addition to the amounts allocated to the respective reserves at the end of each year, the Commission, as required by the Act, charged to revenue and expenditure and credited to reserves interest on the amounts of the reserves at the average cost of money to the Commission in the year, as follows: 1969 — 5.52%; 1968 — 5.34%.

Note 8

Interest

	1969 (\$'000')	1968 (\$'000')
Interest on long-term debt	\$130,654	\$117,023
Interest on bank loans, overdrafts and short-term notes payable	17,962	12,761
Amortization of debenture discount and expenses	2,899	2,526
	<u>151,515</u>	<u>132,310</u>
Less:		
Interest charged to construction work in progress	43,885	38,559
Profit on disposal of common shares of British Newfoundland Corporation Ltd.	—	1,092
Net interest earned on investments	9,114	3,470
	<u>\$52,999</u>	<u>43,121</u>
	<u>\$98,516</u>	<u>\$89,189</u>

Note 9

Pensions The Hydro-Quebec Employees' Retirement plan is a contributory, benefit-based plan, under which the benefits payable are guaranteed by the Commission, and applies to all Hydro-Quebec employees including those who were employees of the subsidiary companies prior to January 1, 1966, and who are therefore covered by the pension funds of the subsidiaries for service prior to that date. The past service liability not provided for in the consolidated financial statements amounted to approximately \$33 million on the basis of an actuarial survey of the plans at December 31, 1968. The total pension cost of \$10,139,000 for 1969 (\$8,385,000 for 1968) provides fully for contributions to the Plan and to the Quebec Pension Plan in respect of current service, for interest on the above past service liability and for the amortization of the unfunded past service liability over a period ending December 31, 1995.

Note 10

Commitments

a. Churchill Falls —

In May 1969, the Commission executed a contract for the purchase, starting in 1972, of a very large amount of energy from a generating station at Churchill Falls in Labrador with a rated capacity of 5,225,000 kilowatts, construction of which has been commenced by Churchill Falls (Labrador) Corporation Limited ("CFLCo.").

CFLCo. has entered into long-term and interim financing contracts which, with internally generated funds, will, in its opinion, permit it to cover the cost of the project estimated at \$950 million. The Commission holds 34.2% of the Common Stock of CFLCo. and \$100 million of its General Mortgage Bonds at a total cost of approximately \$124.8 million. If CFLCo. is not able to obtain otherwise any further funds which may be necessary to complete the project it can call upon the Commission to purchase units of Subordinated Debentures and shares of Common Stock.

The power contract provides for the purchase by the Commission for a period of 40 years from the completion of the project, scheduled for 1976, of all of the power generated at Churchill Falls in excess of the requirements (not exceeding 12% of the energy generated) of Newfoundland. This contract will be automatically renewed for a further period of 25 years, upon already agreed terms. The price to be paid by the Commission for the energy will vary until the year 2016 and will depend upon the final cost of construction of the plant. It is estimated that the maximum total annual payments by the Commission for energy will range from \$93 million to \$80 million until the year 2016 and will be approximately \$63 million during the remaining 25 years. In addition, the Commission is obligated to pay to CFLCo. an amount equal to a part of the interest charges on the First Mortgage Bonds, General Mortgage Bonds and other indebtedness of CFLCo.

The Commission estimates that these payments will not exceed \$15 million per annum, declining as the Bonds and other indebtedness are retired. Subject to certain limitations and compensations, the contract requires the Commission to make payments for energy whether or not taken; the Commission can also be required to make additional advances, against the issue of units of Subordinated Debentures and shares of Common Stock, to service the debt of CFLCo. and to cover its expenses if funds are not otherwise available.

The Commission has arranged with The Hydro-Electric Power Commission of Ontario and The New Brunswick Electric Power Commission for the sale to them in the years 1972 to 1978 of substantial amounts of power in excess of its own requirements.

b. Other commitments —

Commitments in respect of construction contracts and for the purchase of materials and equipment amounted to approximately \$164 million at December 31, 1969.

Summary of Consolidated Revenue and Expenditure

(in thousands of dollars)

		1969	1968	1967	1966	1965
Revenue	Sales of electricity	\$416,012	\$386,942	\$353,508	\$313,530	\$288,156
	Increase in unbilled revenue	4,315	3,049	5,054	1,942	878
	Other operating income (net)	10,781	7,837	7,141	6,024	7,527
		431,108	397,828	365,703	321,496	296,561
Expenditure	Operating, maintenance, administration and other expenses	143,704	130,050	112,947	95,216	82,586
	Provision for renewals (depreciation) .	51,488	45,751	42,622	54,191	49,502
	Provincial levy on energy generated . .	23,744	22,088	22,179	21,679	19,524
	School and municipal taxes	18,091	17,999	14,476	11,237	9,776
	Power purchased	17,536	18,750	18,230	18,203	19,022
		254,563	234,638	210,454	200,526	180,410
Net Operating Income		176,545	163,190	155,249	120,970	116,151
Other Expenses	Interest: on long-term debt	130,654	117,023	105,095	93,117	83,672
	on bank loans, overdrafts and short-term notes payable . .	17,962	12,761	13,069	9,444	4,676
	Amortization of debenture discount and expenses	2,899	2,526	2,375	2,460	2,474
	Interest charged to construction work in progress	(43,885)	(38,559)	(33,763)	(31,169)	(29,744)
	Profit on disposal of common shares of British Newfoundland Corporation Ltd.	—	(1,092)	—	—	—
	Net interest earned on investments	(9,114)	(3,470)	(4,156)	(2,446)	(1,539)
		98,516	89,189	82,620	71,406	59,539
	Profit on purchase for sinking funds .	(6,736)	(3,738)	(2,922)	(1,490)	(400)
	Interest on reserves	39,284	33,852	28,589	25,315	22,291
		131,064	119,303	108,287	95,231	81,430
Available for Reserves		\$ 45,481	\$ 43,887	\$ 46,962	\$ 25,739	\$ 34,721
Reserve Provisions	Contingencies	\$ 18,002	\$ 19,328	\$ 23,872	\$ 4,740	\$ 15,338
	Stabilization of rates	8,407	7,800	7,171	6,309	5,781
	Amortization	19,072	16,759	15,919	14,690	13,602
		\$ 45,481	\$ 43,887	\$ 46,962	\$ 25,739	\$ 34,721

Five-Year Consolidated Sales and Revenue

		1969	1968	1967	1966	1965
Electric Energy Generated & Purchased (in millions kWh)	Generated (net)	46,760	43,068	41,201	39,461	34,844
	Purchased	4,298	4,660	4,576	4,551	4,939
		51,058	47,728	45,777	44,012	39,783
	Losses and internal use	4,287	4,076	4,134	3,929	3,673
	Delivered as per agreement (net) . . .	458	582	411	353	5
	Total Electric Energy Sold	46,313	43,070	41,232	39,730	36,105
Electric Sales (in millions kWh)	Domestic	10,883	10,125	9,432	8,345	7,607
	Commercial (including Municipal) . .	5,505	4,367	3,609	2,985	2,945
	Industrial: Primary	23,334	22,174	21,342	20,514	18,775
	Secondary	819	640	687	1,074	664
	Street Lighting and Luminaires	413	402	336	283	249
	Transportation	164	176	218	43	50
	Wholesale: Primary	3,710	3,802	3,674	4,132	4,093
	Secondary	826	642	951	1,543	357
	Interdepartmental	659	742	983	811	1,365
	Total Electric Sales	46,313	43,070	41,232	39,730	36,105
Sales Revenue (in thousands of dollars)	Domestic	\$148,661	\$139,670	\$124,090	\$101,618	\$ 93,656
	Commercial (including Municipal) . .	83,912	70,816	60,806	51,122	49,891
	Industrial: Primary	150,602	144,999	138,090	130,090	116,974
	Secondary	2,957	2,228	2,137	2,625	2,003
	Street Lighting and Luminaires	10,346	9,629	7,593	6,799	5,646
	Transportation	1,318	1,363	1,684	382	430
	Wholesale: Primary	14,383	14,714	14,340	15,130	14,790
	Secondary	1,844	1,285	1,804	3,352	875
	Interdepartmental	1,989	2,238	2,964	2,412	3,891
	Total Sales Revenue	\$416,012	\$386,942	\$353,508	\$313,530	\$288,156
Total Customers Domestic and Farm Customers	(year-end)	1,761,052	1,707,773	1,646,302	1,581,241	1,539,073
	(year-end)	1,561,121	1,518,118	1,465,676	1,406,047	1,365,059

**Statistics of Electricity Generated and Purchased
and its Disposal in 1969**

Gross Generation		The consolidated system (in millions kWh)	
Hydro-Electric Stations			
Upper Ottawa	(6 plants)		2,402
Gatineau	Paugan	955	
	Others (4 plants)	1,239	2,194
Lower Ottawa	Carillon	2,592	
	Others (9 plants)	944	3,536
Upper Saint Lawrence	Beauharnois	11,653	
	Other (1 plant)	755	12,408
Saint Maurice	Trenche	1,575	
	Beaumont	1,372	
	La Tuque	1,247	
	Shawinigan 2	1,124	
	Others (4 plants)	3,569	8,887
Bersimis	Bersimis 1	5,328	
	Bersimis 2	2,790	8,118
Outardes	Outardes 3	760	
	Outardes 4	564	1,324
Manicouagan	Manicouagan 2	3,239	
	Others (A) (2 plants)	729	3,968
Other rivers	(16 plants)		663
Total	(54 hydro-electric stations)		43,500
Thermal-Electric Stations			
	Tracy	3,566	
	Others (15 plants)	34	3,600
Total generation	(B)	(70 plants)	47,100
Less: station use			340
Total generation (Net)			46,760
Purchased from	Alcan		3,842
	MacLaren Power Co.		244
	Sundry Purchases		212
Total			4,298
Less: delivered as per agreement (net)			458
Energy supplied			3,840
Net system total output			50,600
Total Sales			46,313
Losses			4,287
System Peaks (MW)	Primary		8,499
	Secondary		95
	Foreign network support		175

(A) Units 6 and 7 of McCormick under rental are considered as one plant.

(B) Hydro-Quebec owns 69.

**Hydro-Quebec Employees' Retirement Fund
Auditors' Report**

We have examined the statement of assets and reserve of the Hydro-Quebec Employees' Retirement Fund as at December 31, 1969 and the statement of revenue and expenditure for the year ended on that date. Our examination included a general review of the accounting procedures and such tests of accounting records and other supporting evidence as we considered necessary in the circumstances.

In our opinion, the accompanying statements of assets and reserve and of revenue and expenditure present fairly the assets of the Fund as at December 31, 1969 and its revenue and expenditure for the year ended on that date, in accordance with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Montreal, Canada,
April 6, 1970.

Léo Davignon, C.A.
of Davignon, L'Abbé, Verner & Associés
Raymond, Chabot, Martin, Paré & Associés
Chartered Accountants

H. Marcel Caron, C.A.
of Clarkson, Gordon & Co.
Chartered Accountants

Hydro-Quebec Employees' Retirement Fund
Statement of Revenue and Expenditure
for the year ended December 31, 1969

		1969	1968
Revenue	Contributions: Employees	\$ 3,738,421	\$ 3,677,750
	Hydro-Quebec	7,449,455	7,329,783
		<u>11,187,876</u>	<u>11,007,533</u>
	Additional past service contributions less cancellations	11,597	207,928
		<u>11,199,473</u>	<u>11,215,461</u>
	Less: Refunded to employees leaving service	267,516	295,225
		<u>10,931,957</u>	<u>10,920,236</u>
	Revenue from investments	3,648,557	2,835,038
		<u>14,580,514</u>	<u>13,755,274</u>
Expenditure	Pensions paid	2,315,934	1,925,011
Net Revenue	transferred to reserve	<u>\$12,264,580</u>	<u>\$11,830,263</u>

The accompanying note is an integral part of the financial statements.

Hydro-Quebec Employees' Retirement Fund

Statement of Assets and Reserve

as at December 31, 1969

Assets (note)	1969	1968
Investments, at cost:		
Bonds of, or guaranteed by the Province of Quebec	\$43,883,718	\$38,252,352
Municipal and School Commission bonds	13,826,647	13,226,275
Other bonds.	166,161	—
	<u>57,876,526</u>	<u>51,478,627</u>
(Par value \$62,450,900, approximate market value \$46,082,000)		
Common stocks (market value \$447,000)	350,000	—
Short term investment	5,500,000	—
	<u>63,726,526</u>	<u>51,478,627</u>
Accrued interest on investments.	1,024,750	874,151
Past service contributions receivable from employees.	37,127	61,027
Amount receivable from Hydro-Quebec.	424,283	534,301
	<u>\$65,212,686</u>	<u>\$52,948,106</u>
Reserve		
Balance as at January 1	\$52,948,106	\$41,117,843
Net revenue for the year.	12,264,580	11,830,263
Balance as at December 31	<u>\$65,212,686</u>	<u>\$52,948,106</u>

The accompanying note is an integral part of the financial statements.

Approved on behalf of the Commission:
(signed) Roland Giroux, President
(signed) Georges Gauvreau, Commissioner

(signed) E.-A. Lemieux
General Manager
Finance and Accounting

Montreal, Canada, April 6, 1970

Hydro-Quebec Employees' Retirement Fund

Note to Financial Statements

December 31, 1969

These statements show only the position of the assets of the Hydro-Quebec Employees' Retirement Fund, but do not purport to show the adequacy of the Fund to meet the obligations of the Hydro-Quebec Retirement Plan, which are guaranteed by the Commission. An actuarial survey of the obligations of the Plan as of December 31, 1968 show an unfunded past service liability of approximately \$33 million. It is calculated that current contributions are sufficient to cover obligations in respect of current service, interest on the above unfunded past service liability, and the amortization of this unfunded past service liability over the period until December 31, 1995.

Hydro-Quebec Generating Stations in Operation or under Construction

December 31, 1969

STATIONS IN OPERATION		Capacity	
Hydro-Electric		(kilowatts)	
1 — Beauharnois	1,574,260	52 — Thurso	275
2 — Manic 2	1,015,200	53 — Val-Barrette	130
3 — Bersimis 1	912,000		
4 — Outardes 3	756,200	Thermal Electric	
5 — Bersimis 2	655,000	54 — Tracy	600,000
6 — Carillon	654,500	55 — Les Boules	36,000
7 — Outardes 4	632,000	56 — Cap-aux-Meules	8,665
8 — La Trenché	286,200	57 — Havre-Saint-Pierre	4,000
9 — Beaumont	243,000	58 — Blanc-Sablon	1,550
10 — La Tuque	216,000	59 — Natashquan	1,350
11 — Paugan	201,975	60 — La Baleine	1,000
12 — Manic 1	184,410	61 — Parent	700
13 — Rapide-Blanc	183,600	62 — La Tabatière	550
14 — Shawinigan 2	163,000	63 — Saint-Augustin	475
15 — Les Cèdres	162,000	64 — Île-aux-Grues	400
16 — Shawinigan 3	150,000	65 — Johan-Beetz	355
17 — Grand'Mère	148,075	66 — La Romaine	320
18 — Chelsea	144,000	67 — Harrington Harbour	273
19 — La Gabelle	123,750	68 — Île-d'Entrée	222
20 — Rapide-des-Îles	109,890	69 — Tête-à-la-Baleine	170
21 — Farmers Rapids	98,250		
22 — Première-Chute	93,150		
23 — Rapides-des-Quinze	89,600		
24 — Rapide 7	57,000		
25 — Bryson	56,000		
26 — Rapide 2	48,000		
27 — Rivière-des-Prairies	45,000		
28 — Hemmings Falls	28,800		
29 — Hull 2	27,280		
30 — Sept-Chutes	18,720		
31 — Saint-Narcisse	15,000		
32 — Drummondville	14,600		
33 — Métis 1	6,400		
34 — Pont-Arnault	5,450		
35 — Bell Falls	4,800		
36 — Métis 2	4,250		
37 — Chaudière	3,500		
38 — Saint-Alban	3,000		
39 — Saint-Raphaël	2,550		
40 — Sherbrooke	2,256		
41 — Chute-Garneau	2,240		
42 — Corbeau	2,000		
43 — Magpie	1,800		
44 — Rawdon	1,720		
45 — Burroughs Falls	1,600		
46 — Sainte-Adèle	1,280		
47 — Chute-Wilson	840		
48 — Parent	800		
49 — Saint-Elzéar	700		
50 — Anse-Saint-Jean	500		
51 — High Falls	340		

STATIONS UNDER CONSTRUCTION			
Hydro-Electric			
		in	capacity
		service	kW
70 — Manic 5	1970-71	1,296,000	
71 — Manic 3*	1975-76	1,176,000	
72 — Outardes 2**	—	454,000	
Nuclear Electric			
73 — Gentilly	1971	250,000	

* Construction is to start in the spring of 1970.

** Construction has been suspended since 1968.

Installed Capacity of the 53 Hydro-Electric Stations in Operation	9,152,891
Installed Capacity of the 16 Thermal Stations in Operation	656,030
Total capacity in operation, December 31, 1969	9,808,921



