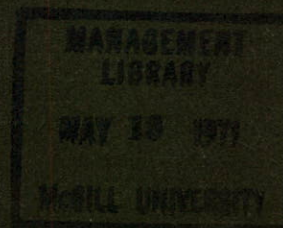


*Cover photos:*

- 1—Preliminary drilling at Manic 3
- 2—General Laboratories, Institute of Research
- 3—Parabolic reflectors of microwave link with Churchill Falls
- 4—Slogan for 1970-71 advertising campaign





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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, 1970

Respectfully submitted,

Minister of Natural Resources,

Quebec, March 8, 1971

# Quebec Hydro-Electric Commission

## *Head office :*

75 Dorchester Boulevard West,  
Montreal 128

### **The Commission**

#### *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.

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#### *Construction*

General Manager :  
Guy Monty, Eng.

#### *Distribution and Sales*

General Manager :  
Maurice St-Jacques, Eng.

#### *Finance and Accounting*

General Manager :  
Edmond A. Lemieux, C.A.

#### *Engineering*

General Manager :  
Lionel Cahill, Eng.

#### *Personnel*

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Alexandre Beauvais, Eng.

#### *Production and Transmission*

General Manager :  
J. J. Villeneuve, Eng.

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#### *D.P. and Management Information Systems*

Director :  
André Duval

#### *Institute of Research*

Director :  
Lionel Boulet, Eng.

#### *Organization and Methods*

Director :  
Jean Lespérance

#### *Economic Research*

Director :  
Jean-Charles de Groote

#### *Public Relations*

Director :  
Marcel Couture

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#### *Manicouagan Region*

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#### *Mauricie Region*

Director :  
Robert Brunette, Eng.

#### *Richelieu Region*

Director :  
Gaston Galibois, Eng.

#### *Saint-Laurent Region*

Director :  
Louis G. Boivin, Eng.

#### *Laurentides Region*

Director :  
Marcel Lapierre, Eng.

#### *Matapedia Region*

Director :  
Gabriel Gagnon, Eng.

#### *Montmorency Region*

Director :  
Pierre Godin, Eng.

#### *Saguenay Region*

Director :  
Jules Harvey, Eng.

#### *West Zone*

Director :  
Edward E. Copping, Eng.

#### *South Zone*

Director :  
Georges A. Lauzon, Eng.





*Roland Giroux, President*



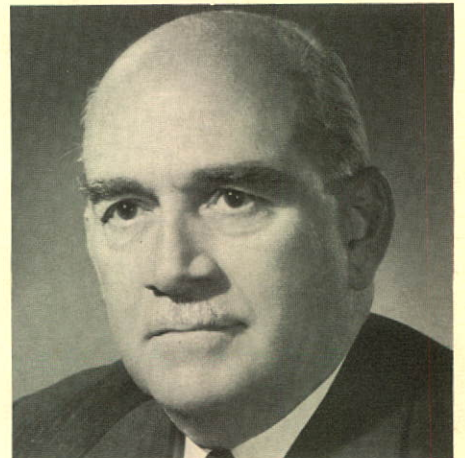
*Georges Gauvreau, Commissioner*



*Yvon DeGuise, Commissioner*



*Robert A. Boyd, Commissioner*



*Paul Dozois, Commissioner*



## President's Report

cost of borrowing and the commissioning of new installations caused a steep rise in interest chargeable to operations, which increased by \$24,645,000 or 22.9% more than in 1969.

Of vital concern is the task of making a careful choice between the various options available for meeting the continuous increase in system load. Extensive preliminary studies are necessary, owing to the considerable amount of construction work that must be undertaken and the large sums that will have to be invested to create the new generating capacity we will need after 1976.

While closely watching the evolution in the cost of electrical energy produced by conventional and nuclear-powered thermal stations, we have intensified the studies begun several years ago on the Quebec rivers flowing into James Bay. These studies dealt particularly with five rivers that have a potential of more than 10 million kilowatts in generating capacity and about 70 billion kilowatthours of annual production.

Without anticipating either the conclusions of present studies or the ensuing decisions, and without prejudging the difficulties of all kinds that may arise, it can be said in general that the present cost of electrical energy produced by other means favors an examination of the undeveloped hydraulic resources of the Laurentian plateau.


In order to increase the productivity of staff and invested capital, a number of steps were taken during the year to improve management and operating methods. As a result of the experience gained since 1963, administrative structures throughout the province were modified so as to cut operating costs, eliminate duplication and improve customer service. A new directorate—Data Processing and Management Information Systems—has been created to rationalize and extend the use of computers throughout the enterprise. And Hydro-Quebec has joined in the struggle being waged in nearly all industrialized countries against the many forms of pollution that threaten the natural environment.

Early in the fall, the Institute of

Research inaugurated its General Laboratories building and Hydro-Quebec began direct collaboration, in the field of research, with electrical equipment manufacturers and both foreign and Canadian electrical utilities. In the field of teaching, close collaboration with local universities was instituted.

Efforts to have electricity chosen as the sole source of energy in new buildings, and to bring the benefits of electricity to as many homes as possible met with encouraging results.

As in the past, all members of the staff have cooperated actively in the Commission's endeavors, and I take this opportunity to express our gratitude to them.



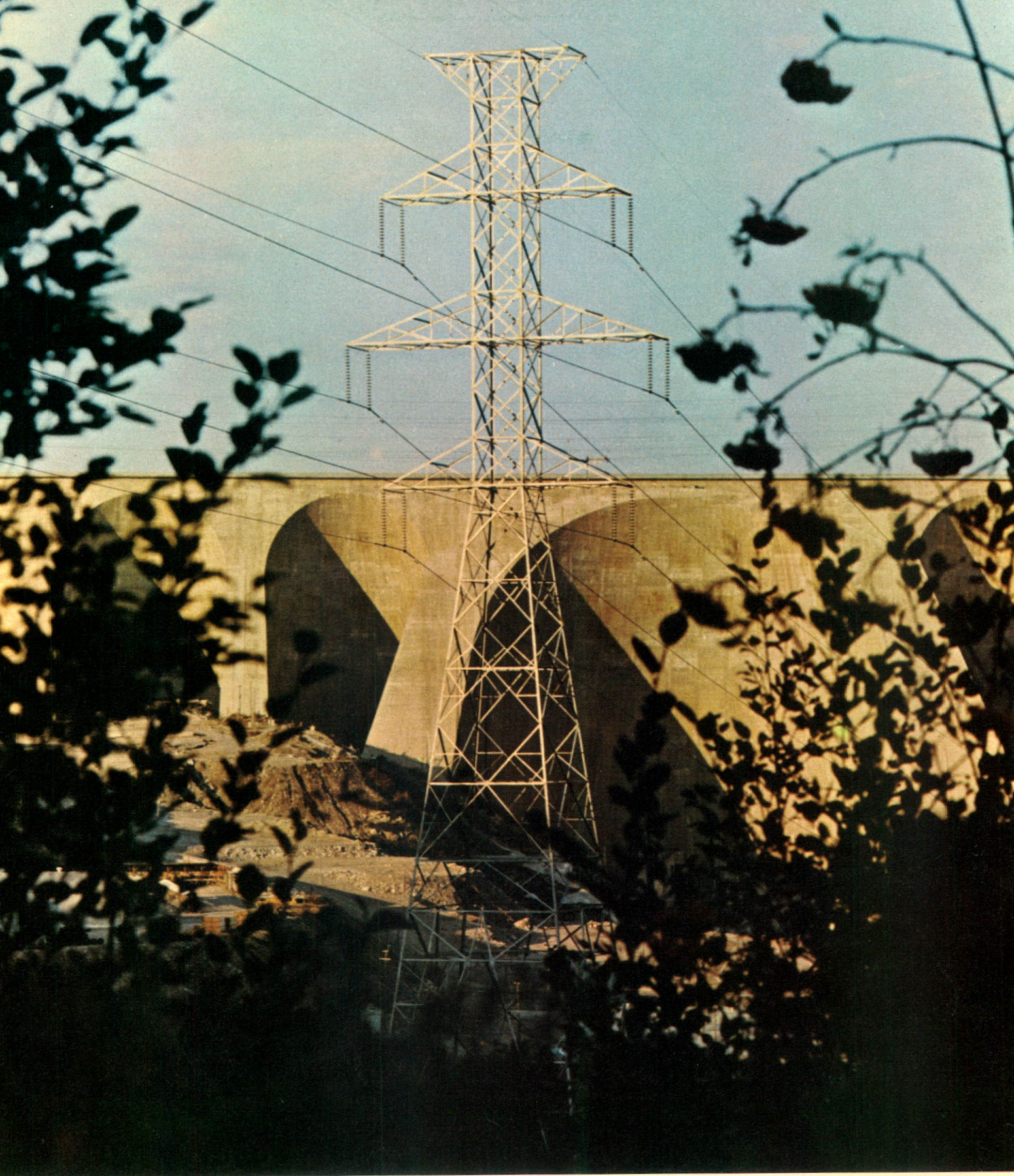
President  
Montreal, March 5, 1971

The vast Manic 5 reservoir, which has been filling since the spring of 1964, came into full operation for the first time during 1970 and contributed greatly to the year's excellent results.

This new reservoir has more than doubled Hydro-Quebec's water storage capacity. Because of it, during 1970 we were able to withdraw sufficient water from other reservoirs to meet increased demand in the province, supply additional back-up power to neighboring systems, and at the same time reduce both thermal production and energy purchases. Thus, the new reservoir has had a double impact on financial results, since it produced not only an increase in revenue but also a reduction in expenditures.

During the year, there was some slowing down in the rate of inflation. Leaving aside the costs of fuel and power purchased, expenditures increased by 9.3%, compared with 9.7% in 1969. Although the cost of borrowing dropped slightly as the year progressed, interest rates on long-term loans were nevertheless extremely high. The average effective interest rate on long-term borrowings contracted in 1970 rose to 9.68%, compared with 8.63% in 1969. This high





*Daniel Johnson Dam*

Photo : Jacques Lambert





*Construction begins at Manic 3*

Photo: Jacques Lambert



Highlights	1970	1969
Installed capacity (kilowatts) at December 31	10,617,253	9,808,921
Maximum firm demand in service area (kilowatts)	8,873,000	8,100,000
Total electricity sales (millions of kilowatthours)	50,612	46,313
Total revenue from electricity sales	\$ 478,246,000	\$ 416,012,000
Total number of customers at December 31	1,821,488	1,761,052
Average consumption per residential customer (kilowatthours)	7,064	6,831
Number of permanent employees at December 31	12,012	11,934
Net long-term debt at December 31	\$ 2,675,814,000	\$ 2,553,867,000
Reserves (net worth) at December 31	\$ 913,081,000	\$ 796,439,000



## Financial Results\*

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

Gross revenue for the year was \$494,319,000, an increase of \$63,211,000 or 14.7% over 1969. Increased *sales of electricity*, accounting for \$62,234,000 of this gain, reflect (a) the new rates that became effective March 15, resulting in about \$26,000,000 of additional revenue, (b) the normal growth of consumption in Quebec, and (c) an increase in deliveries outside the province.

### Expenditure

Expenditures for the year totaled \$264,762,000, an increase of only \$10,199,000 or 4%, as compared with increases of 8.5% and 11.5% recorded in 1969 and 1968 respectively. This small increase for 1970 was due to the large amount of off-peak hydraulic production which, besides permitting an increase in export sales, resulted in a saving of \$10,703,000 in *fuel costs* (Tracy) and *power purchased*.

Excluding these two items, however, expenditures amounted to \$245,288,000 and show an increase of \$20,902,000 or 9.3%, a more accurate reflection of the increase in operating expenses. *Provision for renewals (depreciation)* rose by \$7,317,000 or 14.2% because of major installations placed in service during the year.

### Other income and interest charges

A change has been made this year in the presentation of the *consolidated statement of revenue and expenditure*, which now shows, under the heading of *other income*, the net *investment income* and the *net profit on repurchase of debentures*. Also changed is the presentation of interest costs, which were previously shown in a note to the financial statements.

This new presentation shows that *interest on long-term debt* increased by \$17,789,000 or 13.6%, that *interest on bank indebtedness and notes payable* decreased by \$5,241,000 or 29.2%, and that *interest charged to construction work in progress* decreased by \$11,806,000 or 26.9% (which, again, is due to major installations placed in service during the year). As a result, total interest chargeable to operations increased to \$132,275,000 in 1970, which is \$24,645,000 or 22.9%

more than in the year 1969.

### Net income

The new format of the *consolidated statement of revenue and expenditure* shows a new item called *net income before interest on reserves* amounting to \$116,642,000 in 1970 compared with \$84,765,000 in 1969, an increase of \$31,877,000 or 37.6%.

This item represents the net income for the year before deducting *interest for reserves* and *reserve provisions* as required by the Act governing Hydro-Quebec. When *interest on reserves* of \$46,910,000 and *reserve provisions* of \$69,732,000 are added to the *reserves*, these are brought to a total amount of \$913,081,000 constituting in effect the Commission's net worth. It represents 24.6% of the Commission's invested capital as measured by total *assets* less *current liabilities* and *other liabilities*. The net worth at December 31, 1969 was 22.5% of invested capital.

### Financing

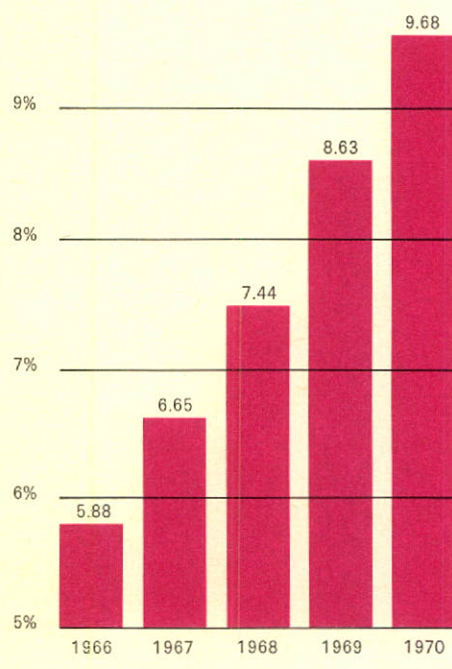
Funds generated internally by the year's operations totaled \$173,775,000, compared with \$135,734,000 in 1969. This figure comprises *net income*, plus *provision for renewals* and other charges not requiring cash outlays. The *net profit on repurchase of debentures* does not represent a cash inflow and so has been excluded from the calculation of funds generated by the year's operations.

These funds permitted Hydro-Quebec to repay maturing debentures of \$77,252,000, to meet sinking fund requirements of \$31,365,000 and to provide \$65,158,000 for the financing of fixed assets additions totaling \$291,107,000, as against \$242,646,000 in 1969.

The Commission's operations on the long-term capital market provided an amount equivalent to \$231,899,000 in Canadian funds. The average effective interest rate on long-term borrowings contracted for in 1970 was 9.68%, compared with 8.63% in 1969 and 7.44% in 1968. Long-term interest rates remained extremely high throughout the year, although they did not reach the peak of 9.99% paid for an issue in December 1969. The

### Growth in interest rates

Growth of average effective cost of yearly borrowings since 1966.



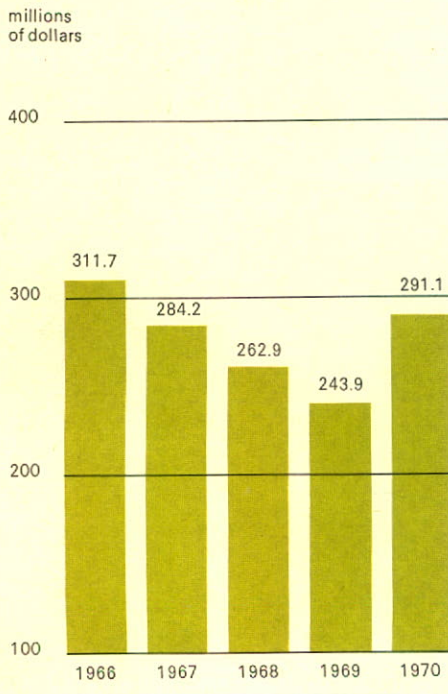


effective cost on the year's first long-term issue in February was 9.75%, and on the last issue, in October, 9.63%.

The Commission borrowed \$15 million (Eurodollars) on the European markets and \$135 million U.S. on the American market (\$3 million of the latter was received in January 1971). Once again, the Quebec Deposit and Investment Fund purchased a significant amount of Hydro-Quebec debentures — \$22,500,000 of a \$50,000,000 issue in February, and the full amount of a \$30,000,000 issue in June. At the beginning of 1970, \$8,300,000 U.S. was received on a loan that had been negotiated in the U.S.A. in 1969.

At December 31, 1970 the net amount of *long-term debt* was \$2,675,814,000 or \$121,947,000 more than a year before. *Notes payable* of \$128,858,000 were down \$55,034,000 from 1969 but this reduction was partly offset by an increase of \$35,112,000 in *bank indebtedness*. During the same period, working capital, that is the difference between *current assets* and *current liabilities*, decreased by \$47,734,000.

#### Capital Expenditures 1966-1970



#### Sales revenue

A sharp increase in sales of surplus energy to neighboring systems and a normal growth in the electricity needs in the province combined to produce total energy sales of 50.6 billion kWh in 1970, an increase of 4.3 billion kWh or 9.3% over 1969. Total revenue from these sales amounted to \$478,246,000, compared with \$416,012,000 in 1969.

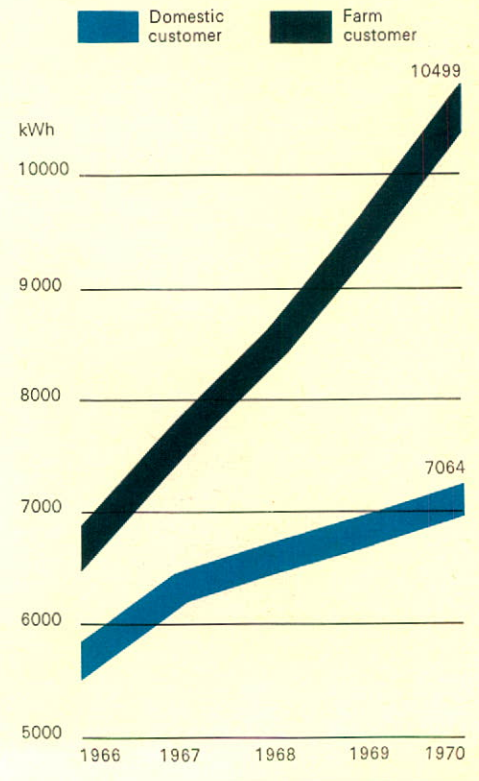
Exports of surplus or interruptible energy more than tripled, increasing from 826 million to 2.6 billion kWh, with corresponding revenue of \$9,588,000 as against \$1,844,000 the preceding year. However, sales of surplus energy within the province decreased from 819 million kWh to 574 million kWh in volume and from \$2,957,000 to \$2,115,000 in revenue.

#### Provincial sales

Sales of firm power in the service area amounted to \$459,752,000 for 44.9 billion kWh, an increase of 13.8% in revenue and 7.1% in energy. The rate of increase in energy is close to

#### Average annual consumption

Growth of average annual consumption per domestic customer and per farm since 1966.





the average annual rate of 7.2% recorded since 1965, but lower than the 7.7% increase recorded in 1969.

In 1970, the 207,000 commercial, industrial and other customers who make up the general and industrial categories (still undergoing reclassification) consumed a total of 30.9 billion kWh worth \$263,730,000. This compares with 29 billion kWh and \$235,833,000 in 1969, an increase of 6.5% in energy and 11.8% in revenue.

#### Residential customers

Sales to residential customers reached \$162,203,000 for 10.8 billion kWh, an increase of 740 million kWh or 7.3% in energy and \$24,113,000 or 17.5% in revenue. At the year-end, the number of residential customers was 1,533,418, or 56,023 more than the preceding year. Average annual consumption per residential customer was 7,064 kWh, compared with 6,831 kWh in 1969 and 6,562 kWh in 1968.

#### Farm customers

Consumption by farm customers was 865 million kWh, 9.4% more than in 1969, and revenue from this sector was \$12,028,000, an increase of \$1,457,000 or 13.8%. The number of farm customers continued to decrease and was 82,339 at December 31, or 1,387 less than the year before. However, the annual consumption per farm passed the 10,000-kWh mark in 1970, rising from 9,439 to 10,499 kWh.

### Marketing

The Marketing Directorate's unremitting efforts to have electricity chosen as the sole source of energy in new residential, commercial and industrial buildings produced excellent results in 1970.

In the residential sector alone, 6,260 of the new housing units completed during the year were built in accordance with NOVELEC standards. Of this total, 1,793 were single-family dwellings and 4,467 were housing units in buildings ranging from duplexes to small apartment houses. In the commercial and institutional sector, the "all-electric" concept was adopted in 54 new institutions, most of them

homes for the aged; the connected loads amount to 35,000 kW.

The NOVELEC certificate, launched early in the year, attests that the contractor has met the Quebec Electrical League's "all-electric" standards for power supply, thermal insulation, mechanical ventilation, doors and windows, capacity of the heating systems and control devices, electrical outlets, the water heater and the cable feeding the electric range.

During 1970, considerable success was achieved with new methods of direct participation by Hydro-Quebec representatives from the very beginning of the design and financing of new construction. As the result of incentives offered to builders, agreements were reached covering a total of 12,409 "all-electric" dwellings, almost 4,000 of which were completed during the year.

A total of 153 studies involving a potential load of 114,000 kW were carried out by Hydro-Quebec's CAL-MEC computer service to evaluate the cost of installing and using electric heating in new buildings.

#### Industrial development

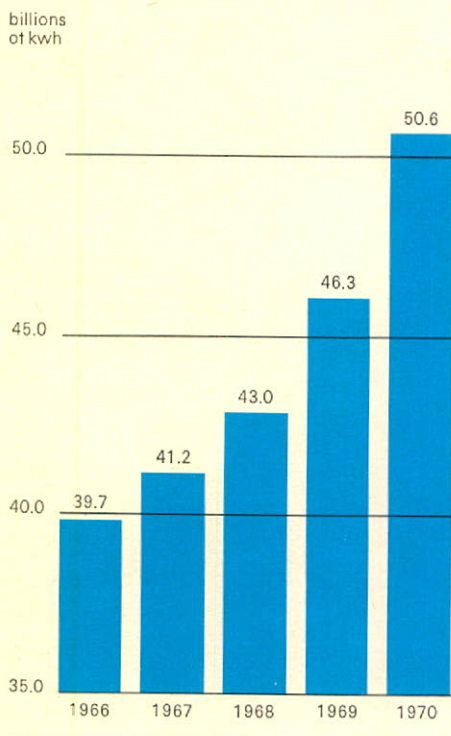
At the year-end, the newly created Industrial Development service was continuing or completing negotiations for the establishment of 25 new plants that would result in additional load of about 800,000 kW.

During the year, the Industrial Development service broadened its contacts in industrial and financial circles. The publication and distribution of a booklet entitled "Financial Assistance to Industrial Development of Quebec" aroused favorable comment both at home and abroad. The booklet summarizes forms of financial assistance by governments as well as sources of financing available to Quebec industrialists.

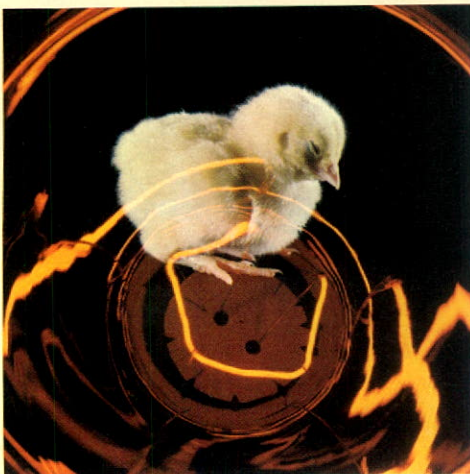
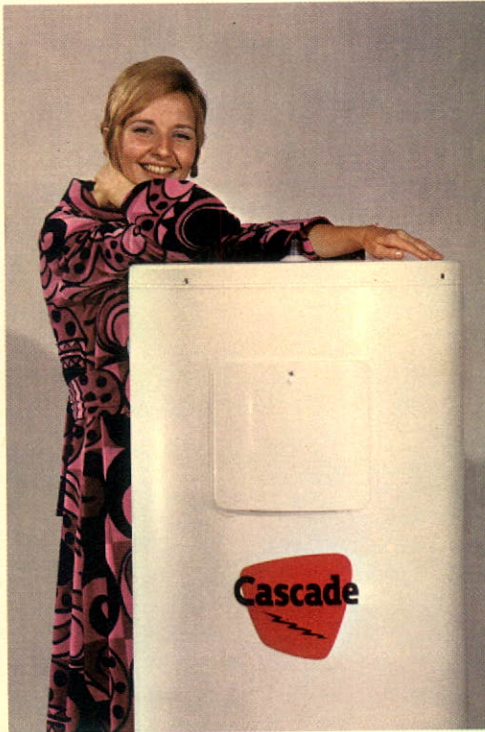
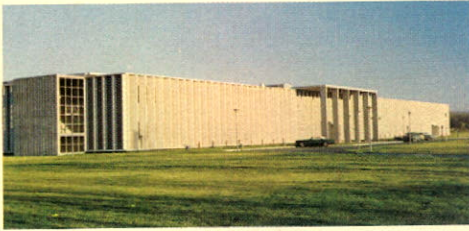
A total of 54 contracts for the supply of electricity were renewed with industrial customers whose firm demand is 3,000 kW or more. These renewed contracts totaled 828,300 kW, of which 207,150 kW represented new firm power. One new contract for 10,000 kW was signed.

During the year, 12,155 electric water heaters were installed on a rent-

Total sales of electrical energy







*Marketing activity—extending the uses of electricity*





*The year 1970 was marked by a large increase in hydraulic generation.*

Photo : Félicien Gagnon



al basis in customers' premises (compared with 13,473 in 1969), bringing the total number of rented water heaters at December 31 to 127,314. The number of loans granted by Hydro-Quebec for the purchase of Cascade water heaters was down to 1,302, compared with 1,455 in 1969.

The number of loans for renovation of electrical wiring systems in dwellings was 4,021 for a total of \$1,274,000, as against 4,550 loans totaling \$1,441,000 in 1969.

In the agricultural sector, the "Well-Electrified Farm" emblem was awarded to 148 farms, bringing the number of such farms in the province to 906. Average annual consumption by a "well-electrified" farm is about 30,000 kWh, while the average consumption by all Quebec farms in 1970 was 10,499 kWh.

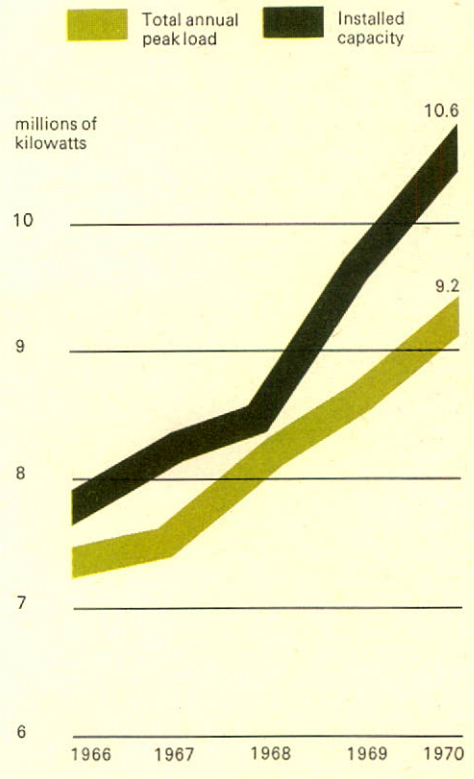
## Production

Installed capacity of the system passed the 10 million kilowatt mark during 1970, reaching 10,617,253 kW by the year-end. The increase over the previous year was 808,332 kW or 8.2%, consisting principally of the 807,500 kW furnished by five generating units commissioned at Manic 5. The remainder of the increase is the net result of minor changes carried out at various locations, such as the retirement of four small hydroelectric stations and one diesel station at Chaudière, Parent, Saint-Elzéar and Val-Barrette, and establishment of a new diesel station at Fort-George on James Bay.

### Maximum demand

The maximum demand in the service area, or peak system demand, increased sharply from 1969 to 1970. The peak system demand in 1970 was 8,881,000 kW and occurred at 5 p.m. on December 22 when the temperature was  $-2^{\circ}\text{F}$ . The previous year's peak system demand had been 8,100,000 kW on December 23, 1969, at 5.30 p.m. when the temperature was  $-3^{\circ}\text{F}$ . Excluding 8,000 kW of secondary power supplied, the peak firm-power system demand was 773,000 kW (or 9.5%) higher in 1970 than in the pre-

**Installed capacity and annual peak demand**





vious year, compared with the average increase of 7.8% recorded since 1966.

This exceptional increase in demand coincided with a heavy reduction in generating capacity caused by ice on the Beauharnois canal and the absence of a unit at Outardes 4 powerhouse. Consequently, when the peak occurred, even by using Tracy thermal station to the full, our powerhouses could supply no more than 8,393,000 kW, which was only 269,000 kW more than the energy supplied during the 1969 peak when a net balance of 24,000 kW was "exported." To meet this situation, Hydro-Quebec limited energy "exports" to 335,000 kW required by contracts, and obtained reserve power available from neighboring systems. The system demand was satisfied through a net "importation" of 488,000 kW, and no load-shedding was necessary.

At the time of maximum system demand, the total demand, which includes energy delivered outside the system and secondary energy, was 9,216,000 kW—an increase of 7.3% over the previous year. Since 1966, the average annual increase in total demand has been 5.7%.

## Hydraulic conditions

Even though run-off was about average in 1970, gross hydraulic generation (including losses) increased 18% from 43.5 to 51.3 billion kWh as a result of production for the first time from the usable reserve of the Manic 5 reservoir, one of the largest in the world, and due to net withdrawals from other reservoirs. This large increase in hydraulic generation permitted a reduction in thermal production and enabled additional back-up power to be supplied to neighboring systems while still meeting the increased demand in the province.

### Manic 5 reservoir

Although the impounding of Manic 5 reservoir began in 1964, water has been regularly tapped from it since then in order to increase production at the downstream powerhouses (Manic 2, Manic 1 and McCormick). On April 13, the tapping outlet was

closed for the last time and by May 10 the reservoir had reached 1,115 feet above sea level, which is the minimum level for operation of the Manic 5 powerhouse. The first generating unit at this station began operating on July 31.

The usable reserve, which began to accumulate on May 10, had reached a value of 8.3 billion kWh by the year-end. When the reservoir is full, the usable reserve will have a value of 21.1 billion kWh and will reach 28.9 billion kWh after Manic 3 powerhouse is commissioned in 1975-76.

Between January 1 and December 31, Hydro-Quebec's total hydraulic reserves increased from 14.1 to 23.1 billion kWh, due mainly to the advent of a usable reserve at the Manic 5 reservoir.

As a direct consequence of the use of reserves and the advent of a usable reserve at Manic 5, production at the Tracy thermal power station, which had been kept at a high level until April, was drastically reduced for the remainder of the year and in fact was called upon only at peak periods and during other brief intervals. Production at Tracy during the year totaled 1.04 billion kWh (most of it occurring between January and April), compared with 3.6 billion kWh in 1969, resulting in a saving in fuel. Hydraulic reserves were sufficient to enable 1.5 billion kWh of back-up power to be supplied to neighboring systems over and above contract power.

## Purchase and sales contracts

At the year-end, installation of the first two generating units was under way in the 5,225,000-kW underground powerhouse being built by Churchill Falls (Labrador) Corporation Limited at Churchill Falls, Labrador, 700 miles northeast of Montreal. According to the terms of a contract signed on May 12, 1969, virtually all the production from this powerhouse will be delivered to Hydro-Quebec.

The contract stipulates that power deliveries are to start on May 1, 1972. Deliveries should reach their full annual rate of 31.5 billion kWh when

### Water reserves in 1970

Accumulation of usable reserves, expressed in billions of kWh, in all reservoirs during the year. The commissioning of Manic 5 reservoir has increased total energy capacity of all reservoirs from 20.2 to 41.3 billion kWh.

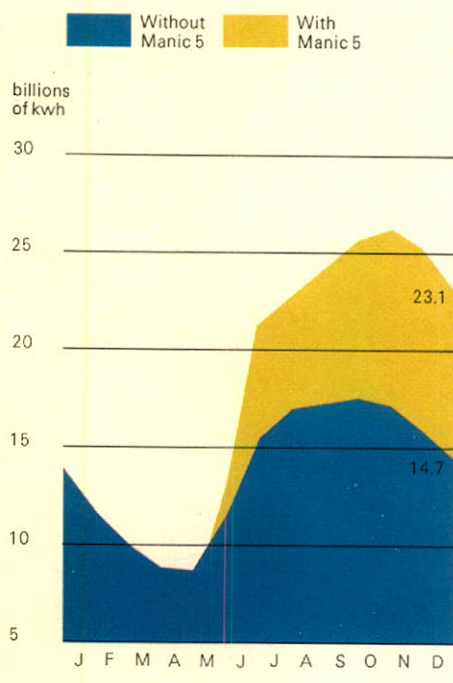
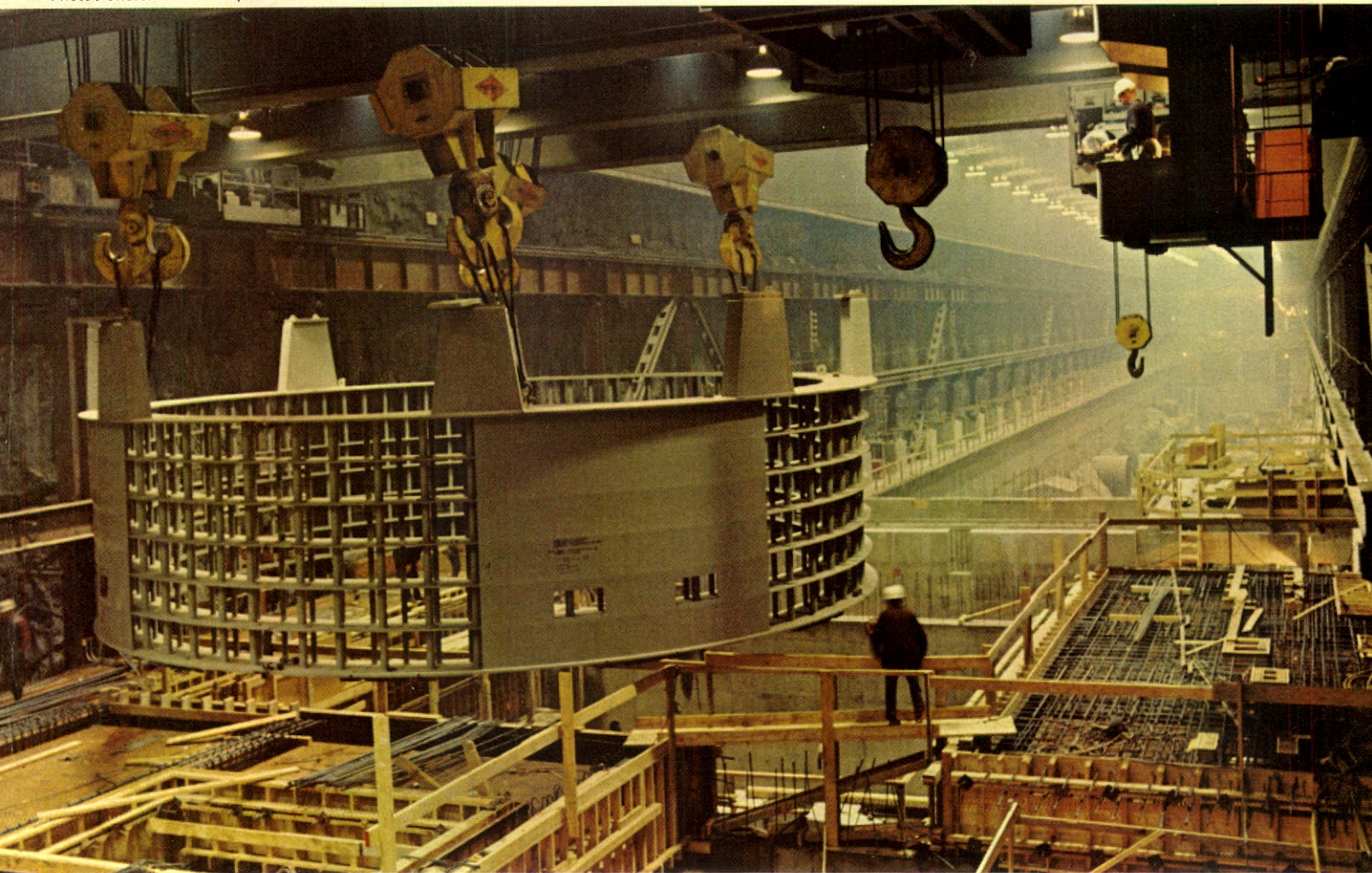




Photo : Churchill Falls Corporation



*Installation of first generators at Churchill Falls underground powerhouse*





*Excavation starts at Manic 3*

Photo : Jacques Lambert



the 11th and last generating unit is put in service 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. Taking into account the transmission costs and line losses, as well as the various financial conditions, the 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. Moreover, Hydro-Quebec holds 34.2% of CFLCo. shares.

### Ontario and New Brunswick

The agreements in principle that had been reached early in 1969 with the two neighboring networks were confirmed during the year by the signing of definite contracts for delivery of large quantities of power from 1971 to 1977, using reserves that our system will have available during that period. These two contracts and related agreements represent a total revenue of about \$145,000,000 for Hydro-Quebec and will provide the two neighboring provinces with about 40 billion kWh.

The contract with the Hydro-Electric Power Commission of Ontario was signed on October 2 and provides for delivery, between June 1, 1971 and May 31, 1977, of a total of 28 billion kWh during the six years of the agreement, as well as any surplus energy that may be agreed upon by the two parties. (Under the terms of a separate agreement signed on September 28, Hydro-Quebec agrees to deliver to Ontario Hydro a total of 2.6 billion kWh of interruptible power between June 22, 1970 and May 31, 1971).

The new agreement replaces various smaller contracts that have already expired or are due to expire shortly, and required the negotiation of special agreements with other parties concerned: the MacLaren-Quebec Power Company and the Ottawa Valley Power Company.

The contract signed on June 18 with The New Brunswick Electric Power Commission covers the period November 1, 1971 to October 31, 1976. Basic power to be delivered is 65,000 kW until October 31, 1973,

215,000 kW until October 31, 1974, 250,000 kW until October 31, 1975 and 320,000 kW until October 31, 1976. The load factor will be 90%. (Since this contract was signed, it has been agreed that Hydro-Quebec would deliver up to 55,000 kW of additional energy from November 1, 1971 to March 31, 1972. This power will be interruptible four hours a day from Monday to Friday in case of a deficiency in production on the Quebec side.)

### Power to the United States

Under an agreement signed on June 4 with the Cedars Rapids Transmission Company Limited of Ontario (whose lines have been connected to the Les Cèdres powerhouse since 1912), Hydro-Quebec supplied 94,000 kW of back-up energy to the City of New York from June 9 to September 15. Hydro-Quebec reserved the right to interrupt the supply on 24 hours' notice.

The energy was transmitted to the Consolidated Edison Company of New York, which experienced a shortage of generating capacity, through the systems of Long Sault Inc. and the Niagara Mohawk Power Corporation.

A small network serving 539 customers in three communities in northern Vermont (Derbyline, North Derby and Beebe) and operated by Hydro-Quebec since 1963, was sold on June 10 to the Vermont Electric Cooperative Inc. Originally owned by International Electric Company, this network belonged to Southern Canada Power when the latter became a subsidiary of Hydro-Quebec in 1963. Hydro-Quebec has agreed to continue supplying energy until the end of 1972.

### Major power projects

Although the construction program for Manic 5 powerhouse called for commissioning of the first three of the powerhouse's eight 161,500-kW units during the latter part of 1970, it was possible to commission five units between July 31 and December 9. The other three will be put into service early in 1971, giving the powerhouse a total installed capacity of 1,292,000 kW.

Manic 5 will be the largest of



the seven Hydro-Quebec powerhouses on the Manicouagan and Outardes Rivers. The stations already in service are Manic 2 (1,015,200 kW), Manic 1 (184,410 kW), Outardes 4 (632,000 kW) and Outardes 3 (756,200 kW). The sixth powerhouse, Manic 3 (1,176,000 kW), will be put in service in 1975 and 1976. No date has yet been fixed for the restart of work at the site of the seventh station, Outardes 2 (454,000 kW).

Manic 5 powerhouse is fed directly from the reservoir created by the Daniel Johnson Dam. This reservoir has a capacity of 4,900 billion cubic feet of water, 1,250 billion of which constitute the usable reserve. Now that this reservoir is in use, water leaving the Manic 5 turbines flows downstream to other powerhouses, increasing their production considerably. For example, the load factor at Manic 2 powerhouse will increase from 27% to 63.5%.

At the base of the central arch of the dam, two outlets, each measuring 17 feet by 11 feet, were permanently closed on April 13 and will be filled with concrete in 1971. While the reservoir was filling during construction of the dam, water was discharged through these outlets to protect the crest of the dam against flooding and to enable downstream power stations to generate more power.

The eight generating units at the Manic 5 powerhouse will operate under a head of 491 feet of water and a total average flow of 22,345 cubic feet per second to produce an average of 7.4 billion kWh annually. Power will be sent to the Micoua substation via four 315-kV transmission circuits, two of which are already in service.

### **Manic 3**

Operations at the Manic 3 construction site began in the spring, and the workforce will reach 2,500 by 1973. The site is located 77 miles downstream from Manic 5, 41 miles upstream from Manic 2, and 2½ miles east of the road to Manic 5 that runs between the Manicouagan and Outardes Rivers.

Manic 3 underground powerhouse will contain six generating units with a total installed capacity of

1,176,000 kW operating under a head of 312 feet of water to produce 5.4 billion kWh annually. The load factor will be 55% and total average flow, 26,300 cubic feet per second. Commissioning of the units will be carried out from December 1975 to October 1976.

At the site of the Manic 3 dam, the river has cut a deep valley between steeply sloping banks which would make excellent abutments for an arch dam. However, an earth and rockfill dam must be built, owing to the presence of an alluvium-filled gorge extending about 400 feet beneath the riverbed at this location. To seal off the gorge and thus prevent seepage under the dam, a concrete cut-off wall will be poured in place; it will consist of a double row of interlocked concrete piles and panels extending down through the alluvium and two feet into the bedrock. The central part of this wall will be poured in 1971 and 1972.

The main dam will contain 11 million cubic yards of earth and rockfill and will impound a reservoir with a capacity of 388 billion cubic feet of water, 25 billion of which will constitute the usable reserve. A side valley to the east of the main dam will be closed off by a concrete auxiliary dam containing the intake, spillway and log-chute.

Preliminary work in 1970 consisted of preparing the site for the construction camp, erecting temporary buildings, constructing a permanent bridge to be put in service early in 1971, and excavating to uncover the sites of the diversion tunnel's upstream and downstream headings. This tunnel, 55 feet in diameter and 2,340 feet long, will be driven through the east bank of the river between January and October 1971.

### **Other projects**

During the year, further steps were taken to improve the environment altered by excavation of the Beauharnois canal between 1929 and 1932. The Saint-Timothée remedial dam, under construction for the past few years, was put into service early in the fall, and in 1971 its gates will be brought under remote control from



the nearby Les Cèdres powerhouse. This dam, together with those at Pointe-du-Buisson, Pointe-des-Cascades and Ile Juillet, is used to partly restore water levels which existed along a section of the St. Lawrence River before this section was diverted into the Beauharnois canal.

In 1967, dredging operations began in the Saint-Louis River, a small stream running parallel to the Beauharnois canal and passing through the parishes of Saint-Clément, Saint-Louis-de-Gonzague and Saint-Etienne. Dredging of this stream has now been completed over a length of 16 miles.

During the year, the Powerhouse Construction Directorate carried out specialized maintenance, construction and repair work at the following power stations : Paugan, Beauharnois, Farmers Rapids, Rapide-des-Iles, La Gabelle, Chute-Garneau, Saint-Alban and Bryson.

## Gentilly nuclear station

This first nuclear power station in the province has been under construction since the fall of 1966 at Gentilly on the south shore of the St. Lawrence River, nine miles east of Trois-Rivières. Commissioning of the station, scheduled for the spring of 1971, will add 250,000 kW of installed capacity to the system.

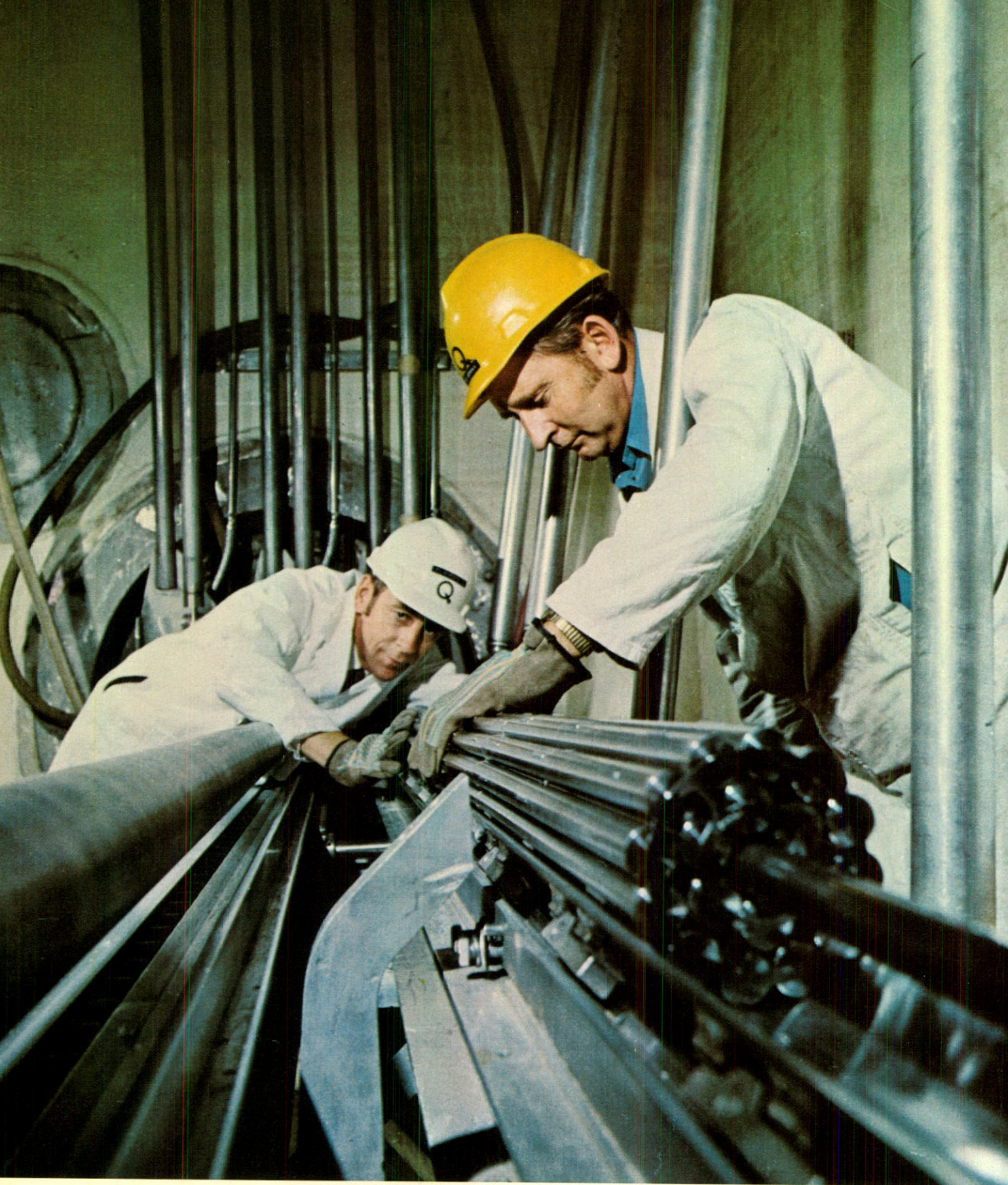
The reactor was handed over to the commissioning staff on October 27 and went critical for the first time at 10.50 p.m. on November 12. The multiple tests that followed until the end of December proved satisfactory. The next phase of the commissioning procedure consists in gradually increasing the power while observing the behavior of the reactor and related components, and then driving the turbo-generator with the steam produced.

The Gentilly nuclear power station is a prototype using natural uranium as fuel, heavy water as the moderator and ordinary water as the coolant and the heat transport medium that provides steam to drive the turbine. It differs from other CANDU-type nuclear stations previously built by Atomic Energy of Canada Limited, which use heavy water as both



*Control room, Gentilly nuclear power station*





*Specialists insert fuel rods into reactor at  
Gentilly nuclear power station*

Photo : Alain Rinfret



moderator and coolant.

The savings expected from this new prototype will result from lower construction costs and a reduction in heavy-water losses (heavy water costs about \$30 a pound). Construction was carried out by Hydro-Quebec for Atomic Energy of Canada. Hydro-Quebec will operate the station long enough to evaluate its characteristics and determine its operating costs, and can acquire the station when it achieves continuous, dependable operation.

The commissioning staff, which numbered 280 at the year-end, consists mainly of Hydro-Quebec engineers, technicians, operators and maintenance personnel but includes engineers from Atomic Energy of Canada and the consulting engineers, as well as Ontario Hydro and Electricité de France.

Besides being an important stage in the development of the Canadian system of nuclear generation, Gentilly is providing Hydro-Quebec with the nucleus of the specialized staff it will require to operate the nuclear plants that will be built in the years to come.

## Projects under study

During 1970, studies of Quebec's principal undeveloped hydraulic resources were accelerated and before the end of 1971 certain decisions will be made regarding the various possibilities for meeting increases in demand after 1976.

The major study involved five Quebec rivers flowing into James Bay which have a total hydroelectric potential of more than 10,000,000 kW and could supply about 70 billion kWh a year. Other studies dealt with a proposed pumped-storage plant, changes in the cost of energy produced by nuclear and conventional thermal plants, and an inventory of the province's undeveloped rivers.

In the spring of 1971, hundreds of men will move into the Quebec side of the James Bay watershed to collect hydraulic, topographical, geological and other data on the river basins of the Nottaway, Broadback, Rupert,

Eastmain and Grande Rivière.

The most southerly of these rivers are the Nottaway, Broadback and Rupert. It is planned to connect them in such a way that they form a single hydrographic unit with a potential of more than 5,600,000 kW at 80% load factor and an estimated production capability of 39.3 billion kWh a year.

At the year-end, engineers were still working on the computer studies to determine how much of this potential would be economic to develop. Their report is expected to be presented on September 1, 1971.

The overall project comprises a 22-mile canal to divert the flow of the Nottaway into the Broadback, which in turn would be diverted into the Rupert through three underground tunnels side by side and each about 4,000 feet long. Nine or ten powerhouses could be built along the Rupert River. The capacities of individual powerhouses would range from 282,000 kW to 1,272,000 kW, and their operating heads from 40 feet to 180 feet.

The mouth of the Rupert River is 475 miles northwest of Montreal. The entire Nottaway-Broadback-Rupert complex, draining an area of 50,000 square miles, would be regulated by a system of 11 reservoirs created by the construction of about 120 dikes varying in height from 4 feet to 100 feet.

Studies of the Eastmain River and the Grande Rivière are less advanced than those of the Nottaway-Broadback-Rupert complex. These two rivers have a potential of 4,800,000 kW at 75% load factor.

Preliminary studies are being carried out on the Chamouchouane River, which flows into Lac Saint-Jean at Saint-Félicien. This river has a drainage area of 6,090 square miles and its hydroelectric potential is estimated at 620,000 kW.

Preliminary studies have been completed on the Moisie River, which flows into the lower north shore of the St. Lawrence River, near Sept-Îles. With its flow augmented by diversion of a small part of the Caniapiscau River, the Moisie would have a hydroelectric potential of 1,800,000 kW at 80% load factor and an annual production of 11 billion kWh.



It is proposed to build a large pumped-storage plant at Lac Saint-Joachim on the north shore of the St. Lawrence River, about 35 miles downstream from Quebec City. As the salinity of the river-water at this location could cause serious corrosion of equipment, particularly the pump-turbines, long and costly tests will be necessary to avoid this problem.

The path of the access route to the proposed underground powerhouse and the location of its switching station were determined during 1970. The powerhouse would operate under a head of 1,160 feet and would eventually have an installed capacity of 3,600,000 kW, to be built in three stages.

Lac Saint-Joachim would be transformed into a large storage reservoir by constructing four dikes. The river would serve as the lower basin to supply water to the pump-turbines or receive water from them. Energy received from Churchill Falls powerhouse and other base-load stations during the night and on weekends would be used to pump water into the reservoir for subsequent use in generating power during peak hours.

## Transmission

On November 19, the third 735-kV line between the Manic-Outardes complex and the load centres was put in service between Micoua substation and Laurentides substation (near Quebec City). The remaining section between Laurentides substation and Duvernay substation (near Montreal) was half completed by the year-end. The 255-mile Micoua-Laurentides line was damaged in November 1969 by a severe ice-storm which caused 28 towers to collapse. Despite the additional work required, the new line was completed in time to transmit energy produced by the first five units of the new Manic 5 powerhouse during the annual peak-load period in December.

The 158-mile Laurentides-Duvernay section of the line should be put in service on October 1, 1971, together with a 21-mile 735-kV tie line now under construction between

the Boucherville and Duvernay substations in the Montreal area. This date will then mark the completion of the 735-kV system designed to transmit energy from the Manic-Outardes complex to the load centres. This system comprises three long lines and three short tie lines. Two of the long lines run from Manicouagan substation to Boucherville substation, a distance of 366 miles, while the third runs from Micoua substation to Duvernay substation. The three tie lines connect the two collector substations (Micoua and Manicouagan), the two intermediate substations (Laurentides and Lévis), and the two terminal substations (Boucherville and Duvernay). This initial 735-kV system contains 1,228 miles of lines, 1,050 of which are in service.

### Churchill Falls lines

Other 735-kV lines, which will be integrated into the initial system, are being built to transmit energy from the powerhouse presently under construction at Churchill Falls, Labrador. Hydro-Quebec will take delivery of this energy at a point 152 miles north of Sept-Îles, where it will be received via three 735-kV transmission lines. Two of these lines will continue from the delivery point to Manicouagan substation, a distance of 256 miles, while the third will run 266 miles from the delivery point to Micoua substation.

Construction of this latter line and one of the two others was so well advanced by the year-end that they may both be ready for service in August 1971, five or six months ahead of schedule. For its part, Churchill Falls (Labrador) Corporation Limited is proceeding with construction of the three 735-kV lines, each 125 miles long, from the powerhouse to the delivery point.

The additional energy from Churchill Falls also necessitates construction of other 735-kV lines to augment the initial system between the Manic-Outardes complex and the load centres. By the year-end, tree-felling was almost completed on the right-of-way for the fourth 735-kV line between the complex and the Quebec City area, and line construction should





Photo : Jacques Lambert

*Suspension tower of a 735-kV transmission  
line to Churchill Falls*



begin in February 1971. This 269-mile line will start at Micoua substation, run inland through the Arvida region and terminate at the new Jacques-Cartier substation near Quebec City. Commissioning of the line is scheduled for the fall of 1972.

### **315-kV lines**

The first of two 315-kV double-circuit lines between Manic 5 power station and Micoua substation, a distance of 67 miles, was put in service on July 15, and the second will follow in May, 1971.

In order to deliver 5 billion kilowatt-hours to New Brunswick between 1971 and 1976, Hydro-Quebec is building a 263-mile, 315-kV line between Lévis and Matapédia. The line will be strung with two conductors per phase. Construction of the sections between Lévis and Rivière-du-Loup (114 miles) and Rimouski and Matapédia (83 miles) will begin in January 1971. The latter section should be commissioned in August 1971, but will operate at only 230-kV until the section between Rivière-du-Loup and Rimouski (66 miles) is completed in 1972.

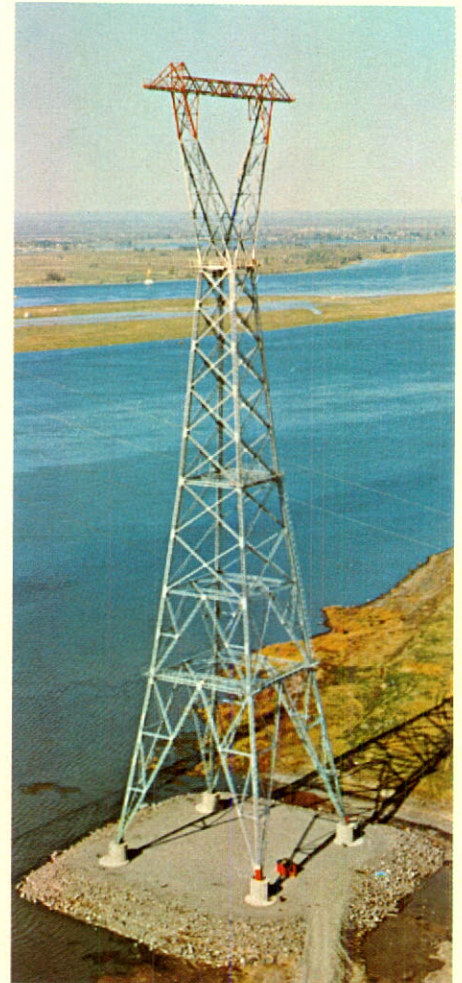
The site of the future Sainte-Scholastique airport is traversed from one side to the other by a 315-kV line linking Chomedey and Lafontaine substations. In 1971, ten miles of this 16-mile line will be relocated so that it skirts the airport site.

### **230, 120 and 69 kV**

To meet increased electricity needs in the Eastern Townships, a new 26-mile 230-kV double-circuit line was put in service at the end of the year between Boucherville and Saint-Césaire substations, supplementing the 230-kV line that has been in service between these two substations since 1963.

During the year, five line sections totaling 12 miles in length were added to the 120-kV system in various locations. In addition, 64 miles of 69-kV and 44-kV circuits were put in service.

In Montreal, a total of about five miles of new 120-kV underground circuits were installed between the following substations: Guy and Maisonneuve, Atwater and Maisonneuve,



*Tower for 735-kV crossing of St. Lawrence River (part of Boucherville-Duvernay line)*

Photo: Marcel Bourassa



and Laurent and Mont-Royal. A 300-foot 66-kV underground line to supply Dosco substation was completed.

## New transformer capacity

A transformer bank rated 1,000,000 kVA—the largest ever used in Quebec—was put in service at the year-end at Boucherville substation, near Montreal. Boucherville is an important substation on the 735-kV system. The new transformer bank, which supplies power to the 315-kV system in the metropolitan area, is made up of three single-phase transformers, each rated 333,333 kVA and weighing 265 tons when filled with oil. This is the first of a series of similar transformer banks that will be installed at several 735-kV substations to reduce distribution costs and save space in the substations. The new transformer bank installed at Boucherville replaced a 600,000-kVA bank; the three remaining 600,000-kVA banks in service there will eventually be replaced by 1,000,000 kVA banks, freeing the smaller units for use elsewhere on the system.

In 1970, a total of approximately 3,300,000 kVA in new transformer capacity was added to the system in the form of additions to existing substations and new substations put in service.

Capacity of the Micoua substation was increased to 1,530,000 kVA by the addition of a 510,000-kVA transformer bank. This substation receives energy from the Manic 5 powerhouse and increases its voltage for transmission to the load centres. At Chaudière substation near Quebec City, two 125,000-kVA transformers that lower voltage from 230kV to 69kV have replaced two 60,000-kVA units. The capacity of the Saint-Césaire substation, which supplies the Eastern Townships, has been increased by 200,000kVA, and the capacity of Sorel Terminal Station by 125,000 kVA.

The largest substation commissioned during the year is La Suète in Quebec City. It is equipped with three 60,000-kVA transformers which step down the voltage from 230kV to 25 kV. The 120-kV substations commis-

sioned during the year are Berri (Montreal), Gamelin (Hull), Landry and Renaud (Laval), Grand-Pré (Louiseville), Maniwaki, and Terrebonne. Construction of two other substations, Rimouski and Delson, was completed by the year-end.

## Substations under construction

During the year, work began on the construction of three new 735-kV substations which, when completed, will bring to eight the number of 735-kV substations on the system. Two of these new substations, Montagnais and Arnaud, will serve as switching stations for the three 735-kV transmission lines that will link Churchill Falls powerhouse to the Hydro-Quebec system. The first stages of these two switching stations will be completed in time for the commissioning of the first two lines in the fall of 1971 and the spring of 1972.

Arnaud substation is located at Pointe-Noire near Sept-Iles, some 100 miles northeast of Baie-Comeau. It will be equipped with two 735/315-kV step-down transformers brought from Boucherville, each rated 600,000 kVA, and with two other transformers to reduce 315-kV power to 161-kV for local distribution. Montagnais substation, located 137 miles north of Sept-Iles, will also be equipped to supply local loads.

Other substations under construction during the year include Matapédia and Montmagny (230kV), and Maisonneuve (120kV) in Montreal.

The largest of the new substations under construction is Duvernay, situated near Saint-François de Sales, 25 miles from downtown Montreal. Its first stage will be put in service in October 1971. The substation's initial equipment will include two 250,000-kVAR synchronous condensers, which will assure voltage regulation under full-load conditions—the first such machines to be connected to the 735-kV system.

Eventually, Duvernay substation will have four incoming 735-kV lines, twelve outgoing 315-kV lines and nine outgoing 120-kV lines. Its total transformer capacity will be 11,000,000



kVA, making it one of the largest electrical substations on the continent. For this reason, it will be provided with facilities for the reception of visitors.

### **Substations planned**

Two more 735-kV substations are planned. One of them, the Jacques-Cartier switching station, will be located near Pont-Rouge, about 20 miles west of Quebec City, and will in a way be an extension of the Laurentides substation, which has no more space available for expansion. Jacques-Cartier will be put in service in 1972 after it has been connected to the new 735-kV transmission lines under construction on the North Shore. Eventually, transformer capacity will be added to supply local demand.

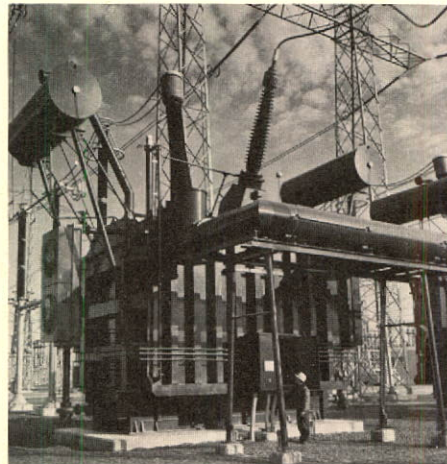
The second 735-kV substation in the planning stage is an intermediate station at Nicolet. One of the 735-kV lines connecting the Lévis and Boucherville substations will be looped into the new substation, which will be equipped with two 1,000,000-kVA transformer banks feeding six 230-kV lines.

### **Distribution system**

Another 750 miles of new circuits ranging from 4 to 25 kV were added to the distribution system in 1970, bringing the total length of distribution lines in the territory to 45,465 miles.

These new lines include 30 miles of underground circuits laid principally in new housing developments where customers are called on to pay, directly or indirectly, the difference between the cost of underground and overhead distribution. New housing units connected to the system during the year totaled about 1,890, most of them in the Montreal area.

Underground distribution work carried out in 1970 cost about \$4,450,000 and includes the initial installation of a distribution system for the future complex of government buildings in Quebec City, the continuation of urban renewal work in Longueuil, several conduits under the Trans-Canada highway in the Matapédia region and the burying of circuits



*One phase of a 1,000,000-kVA transformer bank at Boucherville substation*



under two miles of streets in the City of Montreal. In addition, the underground circuits on St. Lawrence Boulevard in Montreal were renovated over a three-mile stretch between Craig and Jean-Talon streets.

Capital expenditures for the whole of the distribution system amounted to \$54,000,000 as against \$52,300,000 in 1969. The cost of extensions and additions to supply new customers was \$22,700,000 as against \$21,274,000 in 1969. Small transformers installed during the year, either to serve new customers or to meet increased load, totaled 400,000 kVA in capacity and cost \$3,260,000.

In December, a complete distribution network was put in service at Fort-George on the eastern shore of James Bay at the mouth of the Grande Rivière. This network, which now serves 270 customers, is supplied by two generating units with a combined capacity of 1100 kW. The population of Fort-George comprises about 1,000 Cree Indians, 50 Eskimos and 100 whites. An additional generating unit is to be installed in 1971 and other families will be connected to the local network.

On the lower North Shore, two other communities have been electrified: Middle Bay (25 families) and Rivière-Saint-Paul (75 families). These two villages were connected to the Blanc-Sablon network by 23 miles of lines. Blanc-Sablon is located 900 miles northeast of Montreal.

## Telecommunications

Commissioning of the microwave link between the Hydro-Quebec system and Churchill Falls powerhouse is scheduled for August 1971, in time for the tests that will precede commissioning of the first generators at Churchill Falls.

This link will be used for transmission-line protection and all other operating needs. It will cover a total distance of 374 miles between Haute-rive substation near Baie-Comeau and Churchill Falls powerhouse, where Churchill Falls (Labrador) Corporation Limited will have its own transmitter-receiver station.

Between Haute-rive and the Sainte-Marguerite microwave station near Sept-Îles, the link will operate via six ordinary relay stations using line-of-sight transmission. But, because of the absence of access roads and local electricity supplies, the remaining distance will be covered by two transhorizon hops using transmission by tropospheric scatter.

In the St. Maurice River valley, microwave links are being set up between Mont-Carmel station near Shawinigan and the Rapide-Blanc and La Trenché powerhouses, which will be remotely controlled from La Tuque powerhouse starting in 1971. Similar links will later be set up between Mont-Carmel and the Beaumont and La Tuque powerhouses, so that eventually all four powerhouses in the upper St. Maurice valley can be remotely controlled from Shawinigan.

## Remote control

New remote-control equipment installed in Outardes 4, Outardes 3 and Manic 5 powerhouses, as well as in Manicouagan substation, will be put in service early in 1971 to bring these stations under remote control from the Manicouagan dispatching centre; Manic 1 powerhouse is already controlled from this centre.

The 12 new or re-equipped substations put in service on the system during the year are all remotely controlled. In addition, five existing substations—Longue-Pointe, Montréal-Est, Jeanne-d'Arc, Saint-Jérôme and Pandora—were brought under remote control, raising to 134 the number of remotely controlled substations of all types.

On the Island of Montreal, three existing substations and the new Berri substation were brought under remote control; thus 22 of the island's 28 major substations are now remotely controlled.

## Institute of Research

The year 1970 witnessed the start of research work in the Institute's General Laboratories building and the signing





*Construction of the High Voltage Laboratory,  
Hydro-Quebec Institute of Research*

Photo : Alain Rinfret



of two important agreements that assure financial aid from the federal government and increased cooperation between the universities and the Institute.

Officially inaugurated in September, the General Laboratories building has a floor area of 216,000 square feet and houses 80 researchers' offices, 60 laboratories, a machine shop, a cafeteria, an auditorium and a library. More than 50 researchers were already at work by the year-end.

Construction of the High Voltage laboratory is well advanced and it is expected that various tests requested by Hydro-Quebec and the electrical industry can be carried out in the summer of 1971.

The High Power laboratory will be completed in 1972, but the Medium Voltage section is expected to be in service by the end of 1971. There will be six short-circuit transformers rated 1,200,000 kVA each and a  $\pm$  750-kV synthetic test bank.

An agreement between the federal government, the provincial government and Hydro-Quebec provides for a loan of \$17,500,000 from the federal government to help finance construction of the Institute. This loan, which is guaranteed by the Province of Quebec, will be paid back over a period of 25 years starting in 1975. The federal government will also make cash grants of \$325,000 a year for at least 10 years to help cover operating costs. To ensure that the Institute effectively meets the requirements of the entire Canadian electrical industry, the agreement provides for the creation of a federal-provincial review board as well as an advisory committee composed of representatives from the federal government, provincial government, Canadian electrical utilities and Canadian manufacturers of electrical equipment.

Under the terms of the second agreement, the Institute will contribute to higher education by making its scientific staff and laboratories available to university graduates. As part of this agreement, Hydro-Quebec and the Institut National de la Recherche Scientifique (National Institute of Scientific Research) of the University of Quebec have created an Energy

Research Centre which is housed in eight offices and two laboratories of the General Laboratories building.

Since September, the Energy Research Centre has been offering a program of advanced interdisciplinary studies leading to master or doctor of science degrees from the University of Quebec. The Centre's board of management includes representatives from both industry and the university community. Several prominent guest professors from outside the province have joined the Centre.

## Oil exploration

As the result of an agreement with Hydro-Quebec, the Société acadienne de Recherches pétrolières, Limitée (SAREP), a subsidiary of Texaco Exploration Canada, Ltd., carried out initial exploratory drilling in and around the Magdalen Islands last fall. Resumption of work will depend on the outcome of a complete analysis of the results obtained as well as data gathered in previous studies.

The agreement concluded in 1967 between SAREP and Hydro-Quebec, which was granted the oil-exploration permits by the Quebec Minister of Natural Resources, covers an area of 3,300,000 acres comprising the Magdalen Islands and the surrounding sea-bed in the Gulf of St. Lawrence.

Before undertaking drilling operations, SAREP signed another agreement with Amoco Canada Petroleum Company Limited, which holds federal permits in the same area. This agreement, which makes the federal permits available to SAREP, is restricted to an area of 171,438 acres comprising Ile Brion (one of the Magdalen Islands) and the surrounding sea-bed. SAREP then contracted to transfer to Hydro-Quebec the latter's share of all rights, titles, interests and obligations stemming from the SAREP-Amoco agreement.

Drilling of the first well started on Ile Brion on September 18 and had reached a depth of 10,519 feet by the end of the first stage. Seismic soundings were also carried out during the year on Ile Brion, Grosse-Ile, Havre-



aux-Maisons, Cap-aux-Meules and Havre-Aubert. Total cost of all this work amounted to \$2,000,000, half of which was paid by Hydro-Quebec.

## Supplies

The value of material, equipment and services ordered during the year was 13% greater than in 1969, due mainly to the new 735-kV lines being built to transmit power from Churchill Falls. In 1970, the Supply Department issued 69,415 orders worth \$272,493,000, as against 70,734 orders worth \$241,136,000 in 1969. Once again, the policy of bulk purchasing resulted in large savings.

Revenue from the sale of real estate totaled \$1,713,000, up \$324,000 over the preceding year. The acquisition of real rights and properties needed for projects throughout the province involved negotiation of a greater number of purchases, servitudes and agreements than in 1969 (6,482 compared with 4,351). However, their total value was slightly less (\$1,754,000 compared with \$1,755,000). During the year, a total of \$783,559 was paid to landowners for clearing the rights-of-way of transmission lines crossing their land.

During 1970, considerable progress was made in mechanizing the accounting for material held in stock in Hydro-Quebec's stores throughout the province. By December 31, machine accounting had been installed in 106 stores, or 11 more than one year previously, and covered 96% of the items held in stock.

In November, the Commission authorized the formation of a committee whose function is to reduce both the investment in stocks and the operating costs of stores. The committee has already implemented a rationalization program for the entire system of stores management. This program will be carried out over a period of two years and will bring about a reduction in the number of different items carried in stock. Usable, non-standard items remaining in some stores will be disposed of throughout the territory.

Committees have been author-



*Drilling for oil on Ile Brion*



ized to continue, extend and accelerate the work of standardizing the stocks of material and equipment held in stores. This work has been in progress for several years.

At Baie-Comeau, construction started on a new administrative centre for the Manicouagan region. It will be finished in 1971. A new service and administrative centre under construction at Drummondville will also be completed in 1971.

During the year, the planning and coordination committee for administrative buildings prepared two standard designs for administrative and service buildings—one for the districts and another for sub-districts.

## New administrative structures

In order to cut operating costs, eliminate duplication and improve customer service, the Commission proceeded during the year to modify the administrative structures established following nationalization of the last of the private power companies in 1963. The service area was divided into eight distribution regions and four production zones after nationalization.

Distribution and sales, production and transmission now come under a single administrative unit in the Abitibi, Matapedia, Saguenay, Mauricie, Manicouagan and Montmorency regions, while the Saint-Laurent region (Island of Montreal) remains a distribution unit only.

Until results of the studies in progress become available, the Laurentides region (which now includes the Joliette district) and the Richelieu region (from which the Victoriaville district has been removed) remain distribution units, while the South and West zones remain production units.

The Manicouagan region is a new administrative unit resulting from the union of the East zone with the distribution districts of Sept-Iles and Hauterive, but its territorial limits are those of the former East zone. The limits of the Mauricie region remain the same except that the Joliette district has been taken away and the

Victoriaville district added. The Montmorency region, which includes networks not connected to the system, now takes in the Thetford district but the districts of Sept-Iles and Hauterive have been taken away.

## Engineering and Construction

Reorganization of the Construction Department, whose functions were separated from the Engineering Department in 1969, was almost entirely completed during the year. This involved the division of responsibilities between Engineering and Construction and the establishment of new structures. Splitting of the former Engineering Department into two distinct administrative units was made necessary by the growth of the enterprise and by the resultant multiplicity, complexity and extent of responsibilities in the two fields of engineering and construction.

## Data processing

As a result of studies undertaken in 1968 to determine Hydro-Quebec's needs in the field of data processing, the Commission created in December a new directorate—Data Processing and Management Information Systems—to work in close collaboration with the standing committee appointed two years ago. In consultation with users, the new Directorate will design information systems incorporating the latest techniques and will rationalize the use of computers within the enterprise. Its immediate task is to establish an overall plan to meet the administrative-information needs of the various departments and regions, in accordance with a list of priorities established by the standing committee.

Hydro-Quebec already uses third-generation computers for management information and scientific calculations and intends to make this powerful tool available to its entire management team both at head office and in the regions.

## General Planning

The long-term programs of Hydro-Quebec's various administrative units will henceforth be studied and coor-



minated by a new, permanent General Planning committee. Members of the committee are specialists in the enterprise's main areas of activity but the president, commissioners and general managers are also *ex officio* members. The committee's mandate is to determine the general objectives of Hydro-Quebec, recommend the best means of attaining these goals and ascertain whether the results obtained meet the proposed objectives.

During the year, Hydro-Quebec joined the struggle being waged in nearly all industrialized countries against the many forms of pollution that threaten the natural environment. Since May, a permanent environment-protection committee has been charged with the task of ensuring that Hydro-Quebec continues to produce and distribute electricity without threat to the environment. Up to now, the committee has studied problems requiring immediate action, supervised the proper execution of recommended measures, and undertaken a campaign among supervisory personnel to ensure that protection of the natural environment is of constant concern at all levels of the enterprise.

## Personnel

During the year, negotiations with various unions resulted in the signing of two new labor agreements affecting more than 1,100 employees. Only one work stoppage occurred during the year when 145 employees went on strike for 10 days. At the year-end, negotiations were continuing with a view to the signing of five other collective agreements affecting more than 800 employees.

An agreement for the period June 4, 1970 to May 30, 1973 was signed on November 2 with the Syndicat national de la Construction (Hauterive) which comprises 1,070 tradesmen. Another agreement for the period from July 2, 1970 to June 27, 1973 was signed on November 27 with Local 546 of the International Association of Machinists and Aerospace Workers, which groups 37 constables and sergeants at the Manicouagan-Outardes complex.

The 145 members of Hydro-Quebec's Interprofessional Syndicate (Manicouagan-Outardes) rejected the agreement that had been accepted by their negotiating committee and went on strike from October 8 to 19. However, negotiations continued and resulted in the signing of a contract on January 28, 1971.

## Salaries and staff

Permanent employees numbered 12,012 at the year-end, 78 more than a year earlier, while construction workers totaled 2,070 in October, as against 2,211 a year earlier. Without counting employee benefits, the salaries and wages paid to permanent staff totaled \$118,278,000 compared with \$109,166,600 in 1969, while the amount paid to construction workers was \$18,326,000 compared with \$21,499,000 the preceding year.

During the year, 685 persons were hired and assigned permanent positions. This total was 15 less than last year. A total of 28 active employees and 46 pensioners died and 131 members of the permanent staff retired.

## Scholarships

Fifteen scholarships with a total value of about \$72,000 were awarded to promising employees to enable them to pursue full-time studies. In addition, 900 employees took evening courses in a variety of subjects at institutes for adult education. Hydro-Quebec also awarded 27 scholarships (including 18 renewals) worth a total of \$144,000 to Quebec university students, other than employees, for studies leading to doctoral degrees. However, after present commitments for the 1971-72 academic year have been discharged, Hydro-Quebec will cease to award these outside scholarships, and instead of direct aid to students will increase its collaboration with Quebec universities, especially in the field of research.

## Accident prevention

Among operating personnel, the accident frequency rate, which measures the number of lost-time accidents per million manhours of work, rose from 8.3 to 8.9 in 1970. There were 203 accidents, four of them fatal, com-



pared with 192, three of which were fatal, in 1969.

Among construction personnel, the accident frequency rate was 31.3 in 1970, compared with 17.8 in 1969. There were 148 lost-time accidents, two of them fatal, compared with 103, five of which were fatal, in 1969.

Among Engineering Department personnel, the frequency rate was 10.3 in 1970, as against 25.6 in 1969. There were 19 accidents in 1970, none of them fatal, compared with 71 in 1969, one of which was fatal.

### **Health Directorate**

At the year-end, the Health Directorate was completing a series of radioprotective measures and installations at the Gentilly nuclear station, which is scheduled to be put in service in 1971. The power station's Radioprotection Service was setting up laboratories for radiological measurement inside and outside the station, training station personnel in radioprotection, formulating a plan of action in case of emergency, and studying the environs of the station.

The Health Directorate staff includes 6 permanent doctors, 8 auxiliary doctors and close to 50 male and female nurses. Staff in the 18 clinics for operating and construction personnel throughout the territory intensified their activity in the detection and prevention of illness among employees, especially cardiovascular diseases. The clinics received close to 35,000 visits from employees, 19,000 of them first-aid cases, and carried out more than 20,000 medical examinations.





Photo : Paul Garceau



**Financial and Statistical Statements**

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## Auditors' Report

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We have examined the consolidated balance sheet of the Quebec Hydro-Electric Commission and its subsidiary companies as at December 31, 1970, 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 these consolidated financial statements forming the report of the Commission, present fairly the financial position of the Commission and its subsidiary companies as at December 31, 1970, 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,  
March 3, 1971.

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

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



**Consolidated Statement of Revenue and Expenditure**

(in thousands of dollars)

for the year ended December 31, 1970

		1970	1969
Revenue	Sales of electricity . . . . .	\$478,246	\$416,012
	Increase in unbilled revenue . . . . .	4,820	4,315
		<b>483,066</b>	<b>420,327</b>
	Other operating income (net) . . . . .	11,253	10,781
		<b>494,319</b>	<b>431,108</b>
Expenditure	Operating, maintenance, administration and other expenses (including fuel \$3,827 and \$12,641) . . . . .	144,344	143,704
	Provision for renewals (depreciation) . . . . .	58,805	51,488
	Provincial levy on energy generated . . . . .	27,784	23,744
	School and municipal taxes . . . . .	18,182	18,091
	Power purchased . . . . .	15,647	17,536
		<b>264,762</b>	<b>254,563</b>
Net operating income		<b>229,557</b>	<b>176,545</b>
Other income	Investment income (net) . . . . .	10,564	9,114
	Net profit on repurchase of debentures (note 4) . . . . .	8,796	6,736
Income before interest charges		<b>248,917</b>	<b>192,395</b>
Interest charges	Interest on long-term debt . . . . .	148,443	130,654
	Interest on bank indebtedness and notes payable . . . . .	12,721	17,962
	Amortization of debenture discount and expenses . . . . .	3,190	2,899
	Interest charged to construction work in progress . . . . .	(32,079)	(43,885)
		<b>132,275</b>	<b>107,630</b>
Net income	before interest on reserves . . . . .	<b>116,642</b>	<b>84,765</b>
	Interest on reserves (note 7) . . . . .	46,910	39,284
Available for reserves		<b>\$ 69,732</b>	<b>\$ 45,481</b>
Reserve provisions (note 7)	Contingencies . . . . .	\$ 38,227	\$ 18,002
	Stabilization of rates . . . . .	9,661	8,407
	Amortization . . . . .	21,844	19,072
		<b>\$ 69,732</b>	<b>\$ 45,481</b>

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



**Consolidated Balance Sheet**

(in thousands of dollars)

as at December 31, 1970

<b>Assets</b>		1970	1969
<b>Fixed assets</b>	Property and plant, at cost:		
	In service . . . . .	\$3,899,146	\$3,404,418
	Less reserve for renewals (accumulated depreciation) . . . . .	756,845	705,882
		<b>3,142,301</b>	2,698,536
	Construction work in progress . . . . .	388,530	608,383
		<b>3,530,831</b>	3,306,919
	Construction, operating and sundry equipment, at cost less amount amortized . . . . .	27,338	25,486
		<b>3,558,169</b>	3,332,405
<b>Current assets</b>			
	Cash and short-term investments, at cost . . . . .	4,868	15,917
	Accounts receivable . . . . .	57,895	51,135
	Unbilled revenue . . . . .	36,464	31,644
	Materials and supplies, at cost . . . . .	27,201	29,594
	Expenses applicable to future operations . . . . .	6,031	3,415
		<b>132,459</b>	131,705
<b>Other assets</b>			
	Investments, at cost (note 1) . . . . .	132,219	132,219
	Unamortized debenture discount and expenses . . . . .	47,053	44,924
	Accounts receivable . . . . .	12,546	14,527
	Deferred cost on purchase of energy (note 2) . . . . .	7,368	1,920
		<b>199,186</b>	193,590
		<b>\$3,889,814</b>	\$3,657,700



Liabilities		1970	1969
Long-term debt	Bonds and debentures — guaranteed by the Province of Quebec (notes 3 and 5) . . . . .	\$2,637,766	\$2,515,523
	Less sinking funds (notes 3 and 4) . . . . .	55,680	53,943
		<b>2,582,086</b>	2,461,580
	Net exchange premium (note 5) . . . . .	82,133	79,726
		<b>2,664,219</b>	2,541,306
	Other long-term debt (note 6) . . . . .	11,595	12,561
		<b>2,675,814</b>	2,553,867
<hr/>			
Notes payable	Notes payable maturing within three years of which \$123,700 and \$154,574 are due within one year . . . . .	<b>128,858</b>	183,892
<hr/>			
Current liabilities	Bank indebtedness . . . . .	40,408	5,296
	Accounts payable and accrued liabilities . . . . .	73,594	63,944
	Accrued interest . . . . .	46,820	43,094
		<b>160,822</b>	112,334
<hr/>			
Other liabilities	Workmen's compensation awards . . . . .	2,471	2,546
	Customers' deposits and advances . . . . .	8,768	8,622
		<b>11,239</b>	11,168
<hr/>			
Reserves (note 7)	Contingencies . . . . .	367,036	310,519
	Stabilization of rates . . . . .	165,625	147,289
	Amortization . . . . .	380,420	338,631
		<b>913,081</b>	796,439
<hr/>			
		<b>\$3,889,814</b>	\$3,657,700
<hr/>			

On behalf of the Commission:  
(signed) Roland Giroux, President  
(signed) Yvon DeGuise, Commissioner  
Montreal, March 3, 1971.

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

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



**Consolidated Statement of Reserves**

(in thousands of dollars)

for the year ended December 31, 1970

	Total	Contingencies	Stabilization of rates	Amortization
Balance, December 31, 1969 . . . . .	\$796,439	\$310,519	\$147,289	\$338,631
Add:				
Interest on reserves . . . . .	46,910	18,290	8,675	19,945
Provision from consolidated revenue . . . . .	69,732	38,227	9,661	21,844
Balance, December 31, 1970 . . . . .	<b>\$913,081</b>	<b>\$367,036</b>	<b>\$165,625</b>	<b>\$380,420</b>

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



**Consolidated Statement of Source and Application of Funds**

(in thousands of dollars)

for the year ended December 31, 1970

	1970	1969
<b>Source of funds</b>		
Operations of the year		
Net income before interest on reserves . . . . .	\$116,642	\$ 84,765
Less net profit on repurchase of debentures . . . . .	8,796	6,736
	<u>107,846</u>	<u>78,029</u>
Plus:		
Provision for renewals (depreciation) . . . . .	58,805	51,488
Amortization of operating equipment . . . . .	3,934	3,318
Amortization of debenture discount and expenses . . . . .	3,190	2,899
	<u>173,775</u>	<u>135,734</u>
Issue of debentures (less discount and expenses) . . . . .	229,492	265,789
Net exchange premium . . . . .	2,407	8,059
Sundry items (net) . . . . .	1,350	4,385
	<u>\$407,024</u>	<u>\$413,967</u>

<b>Application of funds</b>		
Additions to fixed assets (cost) . . . . .	\$292,905	\$244,846
Less amortization of construction equipment . . . . .	1,798	2,200
	<u>291,107</u>	<u>242,646</u>
Maturities of long-term debt . . . . .	77,252	39,549
Purchase of sinking fund investments (cost) . . . . .	31,365	29,001
Purchase of shares and bonds from Churchill Falls (Labrador) Corporation Limited . . . . .	—	75,000
Decrease in notes payable . . . . .	55,034	14,676
(Decrease) increase in working capital . . . . .	(47,734)	13,095
	<u>\$407,024</u>	<u>\$413,967</u>

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



Notes to Consolidated Financial Statements

December 31, 1970

		1970 (\$'000')	1969 (\$'000')
	Note 1		
Investments, at cost	Churchill Falls (Labrador) Corporation Limited (see note 9)		
	Debentures, General Mortgage, 7½%, due 2010 (par value \$100 million) . . . . .	\$ 90,500	\$ 90,500
	Common shares:		
	Fully paid . . . . .	34,333	34,333
		<u>124,833</u>	<u>124,833</u>
	Gelco Enterprises Ltd., 4% unsecured note, due 1991 . . . . .	7,250	7,250
	Sundry investments . . . . .	136	136
		<u>\$132,219</u>	<u>\$132,219</u>
	Note 2		
Deferred cost on purchase of energy	In accordance with the terms of a contract with Churchill Falls (Labrador) Corporation Limited (see note 9), 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		Year of Issue	Year of Maturity	Bonds and Debentures (\$'000')	Sinking Fund Investments (\$'000')
Series	Interest Rate				
(Note 4)					
Bonds and Debentures	Quebec Hydro-Electric Commission				
"D"	3%	1947	1971-1973 . . . . .	\$ 20,300	
"K"	3½%	1953	1978 . . . . .	40,547 U.S.	\$13,212
"L"	3¼%	1954	1974 . . . . .	20,843	468
"M"	3½%	1955	1975 . . . . .	28,162	
"N"	3½%	1956	1981 . . . . .	43,416 U.S.	14,171
"O"	4¼%	1956	1976 . . . . .	18,741	
"P"	4¼%	1956	1981 . . . . .	29,404 U.S.	7,416
"Q"	4¾%	1957	1977 . . . . .	40,412 U.S.	5,696
"S"	5%	1957	1975, 1982 . . . . .	22,247	
"T"	3¾%	1958	1983 . . . . .	43,542 U.S.	8,802
"V"	5%	1958	1979 . . . . .	16,359	
"W"	5%	1959	1980 . . . . .	24,252	150
"X"	5%	1959	1984 . . . . .	39,001 U.S.	656
"Y"	6%	1959	1979 . . . . .	20,712	
"Z"	5½%	1960	1982 . . . . .	28,680	
"AA"	5½%	1960	1983 . . . . .	21,481	
"AB"	5½%	1961	1985 . . . . .	34,672	
"AC"	5½%	1961	1985 . . . . .	32,102	
"AD"	5½%	1962	1982 . . . . .	36,182	
"AF"	5¾%	1962	1984 . . . . .	46,212	
"AG"	5%	1963	1988 . . . . .	272,371 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"	5¼%	1963	1986 . . . . .	44,822	
"AN"	5%, 5½%, 5½%	1964	1971, 1984, 1994 . . . . .	46,926	
"AO"	4½%	1964	1994 . . . . .	50,000 U.S.	4,239
"AP"	4¾%	1964	1989 . . . . .	45,980 U.S.	870
"AQ"	5½%	1964	1988 . . . . .	55,547	
"AR"	5½%, 5%	1965	1987, 1995 . . . . .	69,976	
"AS"	4¾%	1965	1985 . . . . .	50,000 U.S.	
"AT"	5¼%	1966	1987 . . . . .	50,000 U.S.	
"AU"	6%	1966	1991 . . . . .	47,939	
"AV"	5¾%	1966	1992 . . . . .	60,000 U.S.	
"AW"	6%	1966	1980, 1990 . . . . .	47,493	
"AX"	6¼%	1966	1991 . . . . .	40,000 U.S.	
"AY"	6¼%	1967	1993 . . . . .	60,000 U.S.	
"AZ"	6½%	1967	1978, 1990 . . . . .	48,321	
"BA"	6¼%	1967	1993 . . . . .	50,000 U.S.	
"BB"	6½%	1967	1992 . . . . .	50,000 U.S.	
"BC"	6¾%, 7%, 6% and 7%	1967	1971-1977, 1980, 1994 . . . . .	55,500	
"BD"	6½%	1968	1989 . . . . .	60,000 U.S.	
"BE"	7½%, 7½%, 7%	1968	1971-1978, 1980, 1994 . . . . .	47,600	
"BF"	7¼%	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"	7¼%	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 . . . . .	50,000 U.S.	
"BM"	9½%	1970	1975 (1990 at the option of the holders) . . . . .	50,000	
"BN"	9¼%	1970	1995 . . . . .	60,000 U.S.	
"BO"	9½%	1970	1990 . . . . .	30,000	
"BP"	9½%	1970	1997 . . . . .	72,000 U.S.	
"BQ"	9¼%	1970	1985 . . . . .	15,000 U.S.	
				\$2,487,181	\$55,680

\*Sinking fund debentures



Notes to Consolidated Financial Statements

December 31, 1970

Note 3 — Bonds and Debentures (Continued)

Series	Interest Rate	Year of Issue	Year of Maturity	Bonds and Debentures (\$'000')	Sinking Fund Investments (\$'000')
(Note 4)					

**The Shawinigan Water and Power Company**  
First Mortgage Sinking Fund Bonds

"M"	3%	1946	1971 . . . . .	\$ 25,000 U.S.	
"N"	3%	1946	1971 . . . . .	5,849	
"O"	3¼%	1947	1972 . . . . .	11,833	
"P"	3½%	1948	1973 . . . . .	19,834	
"Q"	3%	1950	1975 . . . . .	14,650 U.S.	
"R"	4¼%	1956	1976 . . . . .	10,632	
"S"	5¼%	1961	1981 . . . . .	14,784	
				<b>102,582</b>	
Sinking Fund Debentures					
—	5½%	1957	1972 . . . . .	13,347	
				<b>\$ 115,929</b>	

**Southern Canada Power Company, Limited**  
First Mortgage Bonds

"B"	3½%	1946	1976 . . . . .	\$ 5,450	
"C"	3½%	1948	1976 . . . . .	2,500	
"D"	3¾%	1951	1981 . . . . .	2,500	
				<b>\$ 10,450</b>	

**Quebec Power Company**  
First Mortgage Sinking Fund Bonds

"F"	3%	1947	1972 . . . . .	\$ 2,623	
"G"	6¼%	1962	1982 . . . . .	12,522	
				<b>\$ 15,145</b>	

**Gatineau Power Company**  
First Mortgage Bonds

"E"	3¼%	1948	1973 . . . . .	\$ 2,198	
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Note 3 — Bonds and Debentures (Continued)

Series	Interest Rate	Year of Issue	Year of Maturity	Bonds and Debentures (\$'000')	Sinking Fund Investments (\$'000')
(Note 4)					
<b>Lower St. Lawrence Power Company</b>					
First Mortgage Sinking Fund Bonds					
"E"	4½%	1953	1973 . . . . .	\$ 755 U.S.	
"F"	5½%	1959	1984 . . . . .	910 U.S.	
				<u>\$ 1,665</u>	
<b>Northern Quebec Power Company, Limited</b>					
First Mortgage Sinking Fund Bonds					
"B"	5½%	1954	1974 . . . . .	\$ 388	
<b>Saguenay Electric Company</b>					
First Mortgage Sinking Fund Bonds					
"C"	4½%	1953	1973 . . . . .	\$ 990	
General Mortgage Sinking Fund Bonds					
"A"	5½%	1962	1982 . . . . .	3,820	
				<u>\$ 4,810</u>	
Total Bonds and Debentures . . . . .				<u>\$2,637,766</u>	<u>\$55,680</u>

Contracts were signed by the Commission before December 31, 1970 for the issue on January 5, 1971, of \$3,000,000 (U.S.) Series "BP", 9½% debentures and of \$71,500,000 (U.S.) Series "BR", 8¼% debentures and on April 15, 1971 of \$3,500,000 (U.S.) Series "BR", 8¼% debentures.

Bonds and debentures of subsidiary companies are guaranteed by the Commission, guarantee which is in turn guaranteed by the Province of Quebec.

Long-term debt maturities and sinking fund requirements in each of the next five years are approximately as follows:

	Maximum maturities and requirements (\$'000')	Maturities at the option of the holders (\$'000')	Minimum maturities and requirements (\$'000')
1971 . . . . .	\$ 81,214		\$ 81,214
1972 . . . . .	97,419	\$25,000	72,419
1973 . . . . .	140,506		140,506
1974 . . . . .	147,687	70,000	77,687
1975 . . . . .	149,915	50,000	99,915
	<u>\$616,741</u>	<u>\$145,000</u>	<u>\$471,741</u>



Notes to Consolidated Financial Statements

December 31, 1970

Note 4

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 5

Net Exchange Premium

Consolidated long-term debt includes \$1,417,988,000 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, 1970 would be \$63,988,000 less than the net exchange premium shown on the consolidated balance sheet.

Note 6

Other  
Long-Term Debt

	1970 (\$'000')	1969 (\$'000')
Rural Electrification Bureau, 1971-1993 . . . . .	\$ 9,827	\$10,527
Other long-term debt maturing from 1971 to 1992 . . . . .	1,768	2,034
	<u>\$11,595</u>	<u>\$12,561</u>

The debts to the Rural Electrification Bureau do not bear interest as long as there is no default under the provisions of the governing agreements.

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: 1970 — 5.89%; 1969 — 5.52%.

Note 8

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 \$10,997,000 for 1970 (\$10,139,000 for 1969) provided 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.



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Note 9

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, in process of construction 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.

In 1970, the Commission has signed contracts with The Hydro-Electric Power Commission of Ontario and The New Brunswick Electric Power Commission for the sale to them in the years 1971 to 1977 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 \$227 million at December 31, 1970.

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**Summary of Consolidated Revenue and Expenditure**  
(in thousands of dollars)

		1970	1969	1968	1967	1966
<b>Revenue</b>	Sales of electricity . . . . .	\$478,246	\$416,012	\$386,942	\$353,508	\$313,530
	Increase in unbilled revenue . . . . .	4,820	4,315	3,049	5,054	1,942
		<b>483,066</b>	<b>420,327</b>	<b>389,991</b>	<b>358,562</b>	<b>315,472</b>
	Other operating income (net) . . . . .	11,253	10,781	7,837	7,141	6,024
		<b>494,319</b>	<b>431,108</b>	<b>397,828</b>	<b>365,703</b>	<b>321,496</b>
<b>Expenditure</b>	Operating, maintenance, administration and other expenses (1) . . . . .	144,344	143,704	130,050	112,947	95,216
	Provision for renewals (depreciation) . . . . .	58,805	51,488	45,751	42,622	54,191
	Provincial levy on energy generated . . . . .	27,784	23,744	22,088	22,179	21,679
	School and municipal taxes . . . . .	18,182	18,091	17,999	14,476	11,237
	Power purchased . . . . .	15,647	17,536	18,750	18,230	18,203
		<b>264,762</b>	<b>254,563</b>	<b>234,638</b>	<b>210,454</b>	<b>200,526</b>
<b>Net operating income</b>		<b>229,557</b>	<b>176,545</b>	<b>163,190</b>	<b>155,249</b>	<b>120,970</b>
<b>Other income</b>	Investment income (net) . . . . .	10,564	9,114	3,470	4,156	2,446
	Net profit on repurchase of debentures . . . . .	8,796	6,736	3,738	2,922	1,490
	Profit on disposal of common shares of British Newfoundland Corporation Ltd. . . . .			1,092		
<b>Income before interest charges</b>		<b>248,917</b>	<b>192,395</b>	<b>171,490</b>	<b>162,327</b>	<b>124,906</b>
<b>Interest charges</b>	Interest on long-term debt . . . . .	148,443	130,654	117,023	105,095	93,117
	Interest on bank indebtedness and notes payable . . . . .	12,721	17,962	12,761	13,069	9,444
	Amortization of debenture discount and expenses . . . . .	3,190	2,899	2,526	2,375	2,460
	Interest charged to construction work in progress . . . . .	(32,079)	(43,885)	(38,559)	(33,763)	(31,169)
		<b>132,275</b>	<b>107,630</b>	<b>93,751</b>	<b>86,776</b>	<b>73,852</b>
<b>Net income</b>	before interest on reserves . . . . .	<b>116,642</b>	<b>84,765</b>	<b>77,739</b>	<b>75,551</b>	<b>51,054</b>
	Interest on reserves . . . . .	46,910	39,284	33,852	28,589	25,315
<b>Available for reserves</b>		<b>\$ 69,732</b>	<b>\$ 45,481</b>	<b>\$ 43,887</b>	<b>\$ 46,962</b>	<b>\$ 25,739</b>
<b>Reserve provisions</b>	Contingencies . . . . .	\$ 38,227	\$ 18,002	\$ 19,328	\$ 23,872	\$ 4,740
	Stabilization of rates . . . . .	9,661	8,407	7,800	7,171	6,309
	Amortization . . . . .	21,844	19,072	16,759	15,919	14,690
		<b>\$ 69,732</b>	<b>\$ 45,481</b>	<b>\$ 43,887</b>	<b>\$ 46,962</b>	<b>\$ 25,739</b>

(1) Including fuel \$3,827—1970; \$12,641—1969; \$11,399—1968; \$5,132—1967; \$767—1966.



## Five-Year Consolidated Sales and Revenue

		1970	1969	1968	1967	1966
Electric Energy Generated & Purchased (in millions kWh)	Generated (net) . . . . .	52,165	46,760	43,068	41,201	39,461
	Purchased . . . . .	4,001	4,298	4,660	4,576	4,551
		<b>56,166</b>	<b>51,058</b>	<b>47,728</b>	<b>45,777</b>	<b>44,012</b>
	Losses and internal use . . . . .	4,422	3,829	3,830	3,723	3,714
	Delivered as per agreement (net) . . .	858	458	582	411	353
	Increase in unbilled sales . . . . .	274	458	246	411	215
Total Electric Energy Sold . . . . .		<b>50,612</b>	<b>46,313</b>	<b>43,070</b>	<b>41,232</b>	<b>39,730</b>
Electric Sales (in millions kWh)	Domestic and farm . . . . .	11,696	10,883	10,125	9,432	8,345
	Commercial (including Municipal) . .	6,684	5,505	4,367	3,609	2,985
	Industrial: Primary . . . . .	24,032	23,334	22,174	21,342	20,514
	Secondary . . . . .	574	819	640	687	1,074
	Street Lighting and Luminaires . . . .	429	413	402	336	283
	Transportation . . . . .	161	164	176	218	43
	Wholesale: Primary . . . . .	3,784	3,710	3,802	3,674	4,132
	Secondary . . . . .	2,569	826	642	951	1,543
	Interdepartmental . . . . .	683	659	742	983	811
	Total Electric Sales . . . . .	<b>50,612</b>	<b>46,313</b>	<b>43,070</b>	<b>41,232</b>	<b>39,730</b>
Sales Revenue (in thousands of dollars)	Domestic and farm . . . . .	\$174,231	\$148,661	\$139,670	\$124,090	\$101,618
	Commercial (including Municipal) . .	103,303	83,912	70,816	60,806	51,122
	Industrial: Primary . . . . .	159,122	150,602	144,999	138,090	130,090
	Secondary . . . . .	2,115	2,957	2,228	2,137	2,625
	Street Lighting and Luminaires . . . .	11,586	10,346	9,629	7,593	6,799
	Transportation . . . . .	1,306	1,318	1,363	1,684	382
	Wholesale: Primary . . . . .	14,921	14,383	14,714	14,340	15,130
	Secondary . . . . .	9,588	1,844	1,285	1,804	3,352
	Interdepartmental . . . . .	2,074	1,989	2,238	2,964	2,412
	Total Sales Revenue . . . . .	<b>\$478,246</b>	<b>\$416,012</b>	<b>\$386,942</b>	<b>\$353,508</b>	<b>\$313,530</b>
Total Customers (year-end) . . . . .		<b>1,821,488</b>	<b>1,761,052</b>	<b>1,707,773</b>	<b>1,646,302</b>	<b>1,581,241</b>
Domestic and Farm Customers (year-end) . . . . .		<b>1,615,757</b>	<b>1,561,121</b>	<b>1,518,118</b>	<b>1,465,676</b>	<b>1,406,047</b>



# Statistics of Electricity Generated and Purchased and its Disposal in 1970

Gross Generation		The consolidated system (in millions kWh)	
Hydro-Electric Stations			
Upper Ottawa	(5 plants)		2,559
Gatineau	Paugan	957	
	Others (3 plants)	1,207	2,164
Lower Ottawa	Carillon	2,640	
	Others (9 plants)	984	3,624
Upper Saint Lawrence	Beauharnois	11,815	
	Other (1 plant)	345	12,160
Saint Maurice	Trenche	1,769	
	Beaumont	1,553	
	La Tuque	1,344	
	Shawinigan 3	1,119	
	Others (4 plants)	3,905	9,690
Bersimis	Bersimis 1	5,690	
	Bersimis 2	3,077	8,767
Outardes	Outardes 3	3,756	
	Outardes 4	2,861	6,617
Manicouagan	Manic 5	1,281	
	Manic 2	3,249	
	Others (A) (2 plants)	587	5,117
Other rivers	(14 plants)		624
Total	(51 hydro-electric stations)		51,322
Thermal-Electric Stations			
	Tracy	1,041	
	Others (16 plants)	39	1,080
Total generation	(B)	(68 plants)	52,402
Less: station use			237
Total generation (Net)			52,165
Purchased from	Alcan		3,505
	Maclaren-Quebec Power Co.		337
	Sundry Purchases		159
Total			4,001
Less: delivered as per agreement (net)			858
Energy supplied			3,143
Net system total output			55,308
Total Sales			50,612
Increase in unbilled sales			274
Losses			4,422
System Peaks (MW)	Primary		9,186
	Secondary		30
	Foreign network support		0

(A) Units 6 and 7 of McCormick under rental are considered as one plant.  
(B) Hydro-Quebec owns 67.



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

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We have examined the statement of assets and reserve of the Hydro-Quebec Employees' Retirement Fund as at December 31, 1970 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, these financial statements present fairly the assets of the Fund as at December 31, 1970 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  
March 3, 1971.

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

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



# Hydro-Quebec Employees' Retirement Fund

## Statement of Revenue and Expenditure

(in thousands of dollars)

for the year ended December 31, 1970

		1970	1969
Revenue	Contributions: Employees . . . . .	\$ 4,163	\$ 3,738
	Hydro-Quebec . . . . .	8,249	7,449
		<u>12,412</u>	<u>11,187</u>
	Additional past service contributions less cancellations . . . . .	131	12
		<u>12,543</u>	<u>11,199</u>
	Less refunded to employees leaving service . . . . .	442	267
		<u>12,101</u>	<u>10,932</u>
	Revenue from investments . . . . .	4,782	3,649
		<u>16,883</u>	<u>14,581</u>
Expenditure	Pensions paid . . . . .	2,705	2,316
Net Revenue	transferred to reserve . . . . .	<u>\$14,178</u>	<u>\$12,265</u>

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



# Hydro-Quebec Employees' Retirement Fund

## Statement of Assets and Reserve

(in thousands of dollars)

as at December 31, 1970

Assets (note)	1970	1969
Investments, at cost:		
Bonds of, or guaranteed by the Province of Quebec . . . . .	\$50,891	\$43,884
Municipal and School Commission bonds . . . . .	14,995	13,827
Other bonds . . . . .	150	166
(Par value \$71,972; market value \$57,350)	<u>66,036</u>	<u>57,877</u>
Common stocks (market value \$1,150) . . . . .	1,479	350
Short-term investment . . . . .	10,000	5,500
	<u>77,515</u>	<u>63,727</u>
Accrued interest on investments . . . . .	1,335	1,025
Past service contributions receivable from employees . . . . .	68	37
Amount receivable from Hydro-Quebec . . . . .	473	424
	<u>\$79,391</u>	<u>\$65,213</u>
Reserve		
Balance as at January 1 . . . . .	\$65,213	\$52,948
Net revenue for the year . . . . .	14,178	12,265
Balance as at December 31 . . . . .	<u>\$79,391</u>	<u>\$65,213</u>

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

On behalf of the Commission:  
 (signed) Roland Giroux, President  
 (signed) Yvon DeGuise, Commissioner  
 Montreal, Canada, March 3, 1971.

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



## **Hydro-Quebec Employees' Retirement Fund**

### **Note to Financial Statements**

December 31, 1970

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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 shows 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.

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Hydro-Quebec Generating stations in operation or under construction  
December 31, 1970

STATIONS IN OPERATION			
Hydro-Electric		Capacity (kilowatts)	
1 — Beauharnois	1,574,260	Thermal Electric	
2 — Manic 2	1,015,200	51 — Tracy	600,000
3 — Bersimis 1	912,000	52 — Les Boules	36,000
4 — Manic 5	807,500	53 — Cap-aux-Meules	11,737
5 — Outardes 3	756,200	54 — Havre-Saint-Pierre	6,000
6 — Bersimis 2	655,000	55 — Blanc-Sablon	1,550
7 — Carillon	654,500	56 — Natashquan	1,350
8 — Outardes 4	632,000	57 — Fort-George	1,100
9 — La Trenche	286,200	58 — La Baleine	1,000
10 — Beaumont	243,000	59 — Saint-Augustin	725
11 — La Tuque	216,000	60 — La Tabatière	500
12 — Paugan	201,975	61 — Île-aux-Grues	425
13 — Manic 1	184,410	62 — Johan Beetz	355
14 — Rapide-Blanc	183,600	63 — La Romaine	350
15 — Shawinigan 2	163,000	64 — Parent	350
16 — Les Cèdres	162,000	65 — Harrington Harbour	260
17 — Shawinigan 3	150,000	66 — Tête-à-la-Baleine	230
18 — Grand' Mère	148,075	67 — Île-d'Entrée	60
19 — Chelsea	144,000		
20 — La Gabelle	123,750		
21 — Rapide-des-Îles	109,890		
22 — Rapides-Farmers	98,250		
23 — Première-Chute	93,150		
24 — Rapides-des-Quinze	89,600		
25 — Rapide 7	57,000		
26 — Bryson	56,000		
27 — Rapide 2	48,000		
28 — Rivière-des-Prairies	45,000		
29 — Chute-Hemmings	28,800		
30 — Hull 2	27,280		
31 — Sept-Chutes	18,720		
32 — Saint-Narcisse	15,000		
33 — Drummondville	14,600		
34 — Métis 1	6,400		
35 — Pont-Arnault	5,450		
36 — Chute-Bell	4,800		
37 — Métis 2	4,250		
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 — Chute-Burroughs	1,600		
46 — Sainte-Adèle	1,280		
47 — Chute-Wilson	840		
48 — Anse-Saint-Jean	500		
49 — High-Falls	340		
50 — Thurso	275		

STATIONS UNDER CONSTRUCTION  
Hydro-Electric

	In service	Capacity kW
4 — Manic 5	1970-71	1,292,000
68 — Manic 3	1975-76	1,176,000
69 — Outardes 2 *		454,000

Nuclear Electric

70 — Gentilly	1971	250,000
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\* Construction has been suspended since 1968.

Installed Capacity of the 50 Hydro-Electric Stations in Operation	9,955,261
Installed Capacity of the 17 Thermal Stations in Operation	661,992
Total capacity in operation, December 31, 1970	10,617,253











