



STATEMENTS AND SPEECHES

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No. 58/2 HYDRO-ELECTRIC PROGRESS IN CANADA, 1957

A bulletin released December 31, 1957, by Mr. Alvin Hamilton, Minister of Northern Affairs and National Resources.

Construction of hydro-electric plants in Canada continued to accelerate during 1957 as a result of increasing power demands. The total of 1,501,560 hp. of new capacity added during the year represents the second highest annual increase to date. Other installations currently under construction are expected to add about 2,200,000 hp. of new capacity during 1958 and more than 4,300,000 hp. in the succeeding few years. The greatest increases to individual plant capacities during 1957 occurred at the Bersimis I plant of the Quebec Hydro-Electric Commission and at the Kermano-Kitimat plant of the Aluminum Company of Canada, Limited, each of which brought into operation 300,000 hp. of new capacity. In addition, there are several sites with large potential capacities, which are currently under investigation and on which it is probable that development will be undertaken within a few years time. The total installed capacity of water-power plants in Canada is now listed at 19,871,008 hp. which, however, represents less than 28% of total resources.

In addition to hydro-electric developments, the building of new thermal-electric plants and extensions was increasing in some areas of the country; the construction of main transmission lines, distribution lines and substation capacity also proceeded vigorously during the year. A review of the year's activities in hydro-electric and thermal-electric construction and in distribution facilities, both by utilities and by industrial establishments, is given below by provinces.

Copies of this annual bulletin may be obtained free of charge from the Director, Water Resources Branch, Department of Northern Affairs and National Resources, Ottawa.

British Columbia

Hydro-electric construction was very active in British Columbia where the total of 607,500 hp. of new capacity installed

during the year was the highest among the provinces. An additional 192,000 hp. are under construction for 1958 operation and a considerable amount is in the planning or early development stages for later service.

The British Columbia Power Commission completed the installation, at its Ladore Falls development on the Campbell River, of the second of two units each consisting of a 35,000-hp. turbine coupled to a 30,000-kva. generator. About two miles below the outlet of Upper Campbell Lake, the Commission is proceeding with its Upper Campbell Lake development where the initial installation of a 42,000-hp. turbine and 37,500-kva. generator is expected to be in service by 1 May 1958. Here, a huge earth-fill dam will store water in both the Upper Campbell and Buttle Lakes for use in all three plants in the Campbell River system. Forming a part of the overall development is the diversion of flows into the Campbell River from the Quinsam, the Salmon and the Heber Rivers. The Quinsam diversion has been completed while the other two are under way. Additional construction on Vancouver Island included the commencement of a development on the Ash River, a tributary of the Stamp River, near Port Alberni. Storage and diversion dams are to be constructed at the outlet of Elsie Lake, and, by a tunnel and pipeline conduit, the water will be conducted five miles from Elsie Lake to the powerhouse on the north shore of Great Central Lake. It is planned to install a 35,000-hp. turbine and 28,000-kva. generator for service by 1 March 1959. Development on the mainland included the installation of a third unit at the Whatshan development near Needles, comprising a 16,500-hp. reaction-type turbine and an 11,250-kw. generator, which was completed in January 1957. In addition to the above installations completed or presently under way, three developments are in active prospect: two in the Alberni area of Vancouver Island, located on the Stamp and Sproat Rivers, with potentials of 35,000 hp. and 17,000 hp. respectively, and the third on the Kokish River in the Englewood area in upper Vancouver Island, with a potential of 51,500 hp. Four additional possible developments are under active study and investigation by the Commission: one on Vancouver Island with a potential of 81,500 hp. on the Nimpkish River in the Englewood area; the remaining three on the mainland and consisting of a development of up to 1,900,000 hp. by diverting water from the Chilko to the Homathko Rivers, a second development at Helmcken Falls on the Murtle River, tributary to the Clearwater River, with a potential of 140,000 hp. and the third at Hobson Lake, also in the Clearwater River system, with a potential of 120,000 hp. Dam site foundation drilling has been carried out in connection with the Chilko-Homathko and the Nimpkish developments.

In the thermal-electric field, the Commission completed the installation, at its Georgia gas turbine plant at Chemainus, Vancouver Island, of the first two units each consisting of a simple cycle gas turbine of 26,500 hp. connected

to a 25,600-kva. generator. Currently being added to this plant are two regenerative cycle gas turbine units, each comprising a 24,000-hp. turbine and 25,600-kva. generator, whose installation will be completed by 1 July 1958 to bring the total installed capacity of the plant to 101,000 hp. At Dawson Creek, a tri-fuel internal combustion engine plant was completed with the present total capacity consisting of three 3,000-kw. units and two 1,000-kw. units. The former capacity of the plant was 3,800 kw. A tri-fuel internal combustion engine plant also was completed at Prince George with the present total capacity consisting of four 3,000-kw. units. The former capacity of this plant was 6,475 kw. At Tofino, the capacity of the diesel plant was increased to 1,675 kw. by the addition of a 600-kw. unit. The tri-fuel internal combustion engine plant at Quesnel is scheduled for completion on 15 April 1958 by the addition of a 3,000-kw. unit which will bring total plant capacity to 12,000 kw. At Terrace, a 1,000-kw. diesel unit to be completed by 1 April 1958 will bring the total capacity of the plant to 4,200 kw.; while at Fort St. James, the addition of a 600-kw. diesel unit by 1 March 1958 will increase the installed capacity of that plant to 1,250 kw.

The construction of major transmission lines by the Commission consisted of 138-kv. lines as follows: 3.8 miles double circuit from the Georgia generating station to the loop tap, 2.8 miles double circuit from the Crofton transformer station to the loop tap and 70.7 miles single circuit from Vernon to Kamloops. In addition, 50 miles of 60-kv. single circuit line were completed between Fort St. John and Dawson Creek and 73.5 miles between Quesnel and Williams Lake. Substations at Prevost, Crofton and Duncan Bay were completed, the Kamloops station was enlarged and the one at Vernon was rebuilt.

The British Columbia Electric Company Limited commenced operation of its Cheakamus development in October when the first of two units, each comprising a 95,000-hp. turbine and 80,000-kva. generator, was brought into service, and the second unit added about a month later. The project consists of a dam on the Cheakamus River near Garibaldi and a tunnel 18 feet in diameter, 6 3/4 miles in length, which diverts water to the powerhouse on the Swamish River. With a maximum height of 91 feet, the dam creates a reservoir having a capacity of 40,000 acre-feet. The development at Clowhom Falls on Sechelt Peninsula, purchased in 1956 from the British Columbia Power Commission, was rebuilt and the 4,000-hp. two-unit installation replaced by a single unit consisting of a 40,000-hp. turbine and 31,500-kva. generator. The concrete gravity dam was raised to a maximum height of 71 feet creating a reservoir with a capacity of 77,000 acre-feet. The plant was to go into operation in December 1957.

At the Company's Bridge River system, the power plant at the La Joie dam commenced operation in November when a 30,000-hp. turbine and 24,500-kva. generator were placed in service. The single unit, located on the downstream end of one of the two existing outlet tunnels, will utilize the water as it is released from the La Joie reservoir for further use at the downstream Bridge River and Seton Creek plants. Work was continued on the final phase of the Bridge River development involving a large storage dam on the Bridge River, a second tunnel through Mission Mountain and a new powerhouse, Bridge River No. 2, on Seton Lake about one-half mile upstream from the present plant. The storage dam, in the vicinity of the existing diversion dam, will provide an additional 750,000 acre-feet of storage bringing the total capacity of the two reservoirs to 1,335,000 acre-feet. The new dam will raise the head on the existing power plant on Seton Lake and is expected to increase the total capacity of the four units in this plant from 248,000 hp. to 276,000 hp. At the Bridge River No. 2 development, four units, each consisting of an 82,000-hp. turbine and 65,500-kva. generator, are expected to be installed during the latter half of 1959, which will provide a total installed plant capacity of 328,000 hp.

In addition to its hydro-electric installations, the British Columbia Electric Company Limited started construction of a gas turbine plant at Port Mann which will consist of four 32,500-hp. turbines, each driving a 30,000-kva. generator. The units will be capable of operating on either oil or natural gas fuel and are scheduled for operation during the summer and autumn of 1958. At Ioco, on Burrard Inlet, land acquisition, engineering and negotiations for government permits were initiated for a large steam plant which will have an ultimate capacity of six units, each rated at 210,000 hp. It is planned to put the first unit into operation in January 1961, the second unit in October 1961, and additional units subsequently as required.

In the construction of major transmission lines, 202 miles of 345-kv. transmission line were brought into service by the Company to provide a second circuit from Bridge River to Vancouver, as well as linking the Wahleach plant, at the higher voltage, to the Ingledow terminal station near Vancouver. An underwater cable was completed from Grief Point to provide energy for homes and industries on Texada Island. The Company continued work on its Ingledow substation which now contains 450 mva., 345/230 kv. transformer capacity and 33 mva., 230/60 kv. transformer capacity. The new major Mainwaring station in the Vancouver area was completed and the reconstructed Newell station in Burnaby was placed in service. Each contains two transformers of 75-mva. capacity, transforming from 230 kv. to 12 kv. for

general distribution. In addition, the Company carried out numerous extensions and alterations to existing substations and distribution services on the rest of the system.

The Aluminum Company of Canada Limited installed the fifth and sixth units, each of 150,000 hp., in its Kemano plant bringing the total capacity to 900,000 hp. The installed generator capacity is 750,000 kva. It is expected that a seventh unit, also of 150,000 hp., will be installed early in 1958.

The Alaska Pine and Cellulose Limited installed a 7,500-kw. double extraction condensing steam turbine, coupled to a 7,500-kva. 0.8 pf. generator, at its mill at Port Alice, British Columbia.

The Consolidated Mining and Smelting Company of Canada Limited commenced field investigation, involving geological mapping and preliminary drilling, at the second power site on the Pend d'Oreille River located about six miles upstream from its Waneta plant.

The West Kootenay Power and Light Company Limited was expected to complete and energize before the end of 1957 a 138-kv. transmission line between its plant at South Slocan and the Whatshan plant of the British Columbia Power Commission. It also has completed a 20-kv. line between the South Slocan plant and Slocan City which will provide power service in the Slocan Valley.

The City of Nelson completed the addition of 2,000 kva. and one feeder position to a 12-4 kv. unit substation, and the complete rebuilding to 4 kv. and addition of 3,000 kva. to a 7 feeder position 12-4 kv. substation. Consideration is being given to the building of a 7,500-kva., 69-12 kv. substation in 1958.

The East Kootenay Power Company Limited constructed two miles of 66-kv. transmission line and 21 miles of rural lines, the latter to serve seven customers in British Columbia and eight in Alberta.

The City of Revelstoke did not carry out any major changes during the year but is contemplating a 600-kw. diesel installation for the near future.

The Northwest Power Industries Limited continued field investigations for the power development on the Nass River.

The Wenner-Gren Foundation commenced preliminary investigations of the water power possibilities in the Rocky Mountain Trench area of the Peace River and will continue this work in 1958.

Alberta

Calgary Power Limited completed and placed in service on 4 October a second unit at its Cascades plant. The new unit, to be used mainly for peak load purposes, consists of a 23,000-hp. Francis-type turbine which operates under a head of 320 feet and is connected to a 20,000-kva. generator. The Company has begun construction of extensions to its Spray and Rundle plants in the Spray Lakes development which will approximately double the capacity of the existing development. A second 62,000-hp. unit is being added to the Spray plant and a 40,000 hp. unit to the Rundle plant, both of which are scheduled for completion in October 1959. Preliminary investigations are being continued by the Company for a possible development at its Big Bend site on the Brazeau River where a gauging station has been established. At the Big Horn site on the North Saskatchewan River below Terkishner Creek and at other nearby sites on that river, investigations for power development were suspended when exploratory drilling revealed disappointing foundation conditions. In thermal power development, the Company is adding to its Wabamun plant a second 66,000-kw. unit which is scheduled for operation in October 1958. Transmission line network was increased by 22.2 circuit miles of 132-kv. line, 90.2 circuit miles of 66-kv. line and 40.3 miles of 22-kv. line. A total of four 5,000-kva. substations were constructed, two at Calgary and one each at Edson and Niton, Alberta.

Northland Utilities Limited installed at its thermal-electric station at Jasper a 1,250-kw. gas engine generating unit which brought the total capacity of the plant to 2,720 kw. At the Fairview thermal plant, which is operated jointly with Canadian Utilities Limited, a new 3,000-kw. gas engine generating unit was brought into operation. A 500-kw. diesel generating unit was removed from the Fairview plant and installed in the Athabasca plant of Northland Utilities Limited. The Company constructed about 40 miles of 69-kv. transmission line between Valleyview and Triangle, Alberta, and will extend this line to Fairview via the Town of Peace River in 1958.

The City of Lethbridge is installing a new 7,500-kw. gas turbine generating unit in its steam plant for operation early in 1958. During the year it completed a 13-kv. line connecting its generating plant with the centre of the city.

The City of Edmonton constructed about four miles of underground transmission cable connecting its thermal-electric station to a bulk substation. The 72-kv. line consists of copper cable conductors insulated by impregnated paper and encased in a 5 9/16-inch diameter steel pipe line carrying oil at 220 psi. pressure. The city also constructed a 40,000-kva. bulk substation and two 10,000-kva. distribution substations.

The Alberta Power Commission reports that 39,812 farms in Alberta were receiving electric service on 30 September 1957, and estimates that a total of about 40,000 farms will have been connected by the end of the year. Of this total, Calgary Power Limited serves about 29,000, Canadian Utilities Limited about 9,340, Northland Utilities Limited about 1,400, the City of Edmonton 142, and the East Kootenay Power Company Limited 117 in the extreme southwestern part of the province. During 1957 about 3,200 of these farms received their initial electric service.

Saskatchewan

The Hudson Bay Mining and Smelting Company has commenced construction of an additional 19,000-hp. stand-by unit for the Churchill River Power Company plant at Island Falls. The cofferdam has been completed and the construction of the unit will be started in 1958 with a view to its operation early in 1959.

The Saskatchewan Power Corporation, whose transmission network covers a large part of the southern portion of the province, at present depends exclusively on thermal units for power production. During the year, capacity was increased by the addition of a 30,000-kw. unit to its Estevan plant, an 8,000-kw. unit to its Kindersley plant and a 3,000-kw. unit to its plant at Swift Current. Main transmission line extensions consisted of the following 72-kv. lines: 61 miles - Glaslyn to Meadow Lake, 30 miles - Kindersley to Eston, 46 miles - Regina to Fort Qu-Appelle, 14 miles - Saskatoon to Floral and 30 miles - Howarden to Davidson. A 30,000-kva. substation was constructed at Estevan, and others totalling 22,500 kva. were completed at Fort Qu-Appelle, Ogema, Eston, Davidson, Prince Albert, North Battleford and Unity. Rural electric service was extended to an additional 6,500 farms during the year, making a total of about 46,500 electrified farms in the province.

Manitoba

The Manitoba Hydro-Electric Board is proceeding with the construction of its development on the Nelson River at Grand Rapid, located about 400 miles north of Winnipeg, to supply power for the International Nickel Company mining development at Moak, Mystery and Thompson Lakes. The power plant, which is to be named the Kelsey Generating Station, will be located upstream from Grand Rapid on a peninsula forming the west shore of the river, and will discharge water into Split Lake. The initial installation is to comprise four 42,000-hp. propeller-type turbines operating under a normal head of 50 feet, each coupled by a vertical shaft to a 37,500-kva. generator operating at 90% power

factor Two of these units are scheduled for operation by 1 July 1960, and the remaining two by 1 January 1961. Additional features of construction include the excavation of a channel on the east side of the river to divert the entire flow of the Nelson River around Grand Rapid, the construction of a 1,400-foot rock-filled cofferdam and of a permanent dam which will provide a mean head of 55 feet. Other work related to the project includes a cantilever bridge, 248 feet long, across the river at Grand Rapid, and 14 miles of railway track between the contractor's site and the Canadian National Railway line at Mile 256.

At the Board's steam-electric plant at Brandon, the first two 33,000-kw. generator units were to commence operation in December 1957 and the remaining two in the autumn of 1958. At the Selkirk thermal station, the foundations are being laid for the main building which will house two 66,000-kw. generator units scheduled for initial operation in the latter part of 1959. The Board's program of present and proposed hydro-electric and thermal electric generation and transmission is designed to handle expected power demands up to and including the winter of 1961-62. Proposed extensions to transmission facilities by the Board include 59 miles of 138-kv. double circuit line between the Kelsey Generating Station and the Thompson Lake nickel mine, to be completed by 1 July 1960; 28 miles of 115-kv. double circuit line between the Selkirk Generating Station and the St. Vital Road Terminal Station, scheduled for operation by the autumn of 1959; 9 miles of 115-kv. double circuit line connecting the St. Vital Road and Harrow Street Terminal Stations, of which one circuit is to commence operation in the autumn of 1959; and 12 miles of 115-kv. double circuit line connecting the Parkdale and McPhillips Terminal Stations in Winnipeg, of which one circuit will commence operation in the autumn of 1958.

Sherritt-Gordon Mines Limited will have completed by the end of 1957 its Laurie River No. 2 development comprising one 7,000-hp. Francis turbine operating under a head of 55 feet and connected to a 6,000-kva. generator. This plant is connected to the downstream No. 1 plant by 5 miles of 69-kv. transmission line and is to be automatically controlled from that plant. Concrete sluice-gate sections of the storage dams at the outlets of Eager and Russell Lakes were completed in July.

The City of Winnipeg is continuing with the renovation of its Pointe du Bois hydro-electric station and made repairs to the spillway and sluice gates at the Slave Falls station, both on the Winnipeg River. Two new substations in the Winnipeg area with capacities of 15,000 and 13,334 kva., both reducing from 60kv. to 4.16 kv., are being constructed for operation by 31 January 1958.

The Department of National Defence at Churchill maintains a diesel plant with an installed capacity of 2,100 kw. consisting of four 300-kw. and three 200-kw. units. Construction is presently under way for a 1,136-kw. addition to this plant. Also at Churchill, the National Harbours Board has two 1,500-kw. and one 600-kw. steam turbine generator units, also a 500-kw. diesel-electric stand-by unit.

The Manitoba Power Commission, which distributes electrical power throughout the province except for the City of Winnipeg, completed during the year, or has under construction, about 150 circuit miles of transmission and tie lines with capacity 22 kv. or greater, of which 22 miles were changed over from 33kv. to 66kv. During the year, service was extended to approximately 450 farms and 6,200 residential and commercial customers throughout suburban Winnipeg and rural Manitoba. Substation and terminal station capacities were increased by 47,363 kva. and 33,750 kva. respectively.

Ontario

Demands for power throughout past years have resulted in an intensive construction program by The Hydro-Electric Power Commission of Ontario as a result of which a substantial growth in power requirements has been met successfully. Major construction work during 1957 included developments at the St. Lawrence Power Project, at Sir Adam Beck-Niagara Generating Station No. 2, and at six projects in northwestern Ontario.

Field investigations of new hydraulic sites were carried out in northern areas of the province during the year. The Commission also completed construction of a canal and control works for the diversion of water from Lake St. Joseph in the Albany River drainage to Lac Seul in the English River drainage via the Root River.

The St. Lawrence Power Project, a joint development of the International Rapids Section of the St. Lawrence River, was begun in August 1954 by The Hydro-Electric Power Commission of Ontario on the Canadian side of the river and by the Power Authority of the State of New York on the United States side. The main features of the project include two adjoining powerhouses which form an integral part of a gravity-type dam structure, a dam at Long Sault to control the level of the headpond, a dam at Iroquois Point to regulate flow from Lake Ontario, and some 14 miles of dyke. Other work related to the project included a heavy program of channel improvement and excavation, the relocation of highways, railways, transmission facilities, and the design and construction of new townsites.

Excellent progress was made on all phases of construction throughout 1957. On the Canadian side concrete for the main dam and powerhouse structure was placed, even during the coldest winter months, and at the end of the year more than 86 per cent of all concrete work was completed. Mechanical equipment for the sixteen generating units was partly installed and, by fall, crews had begun the assembly of the generator for the first unit. Five of the sixteen units are scheduled for service in 1958; the rest will be placed in service during the period 1959-1960. Total installed capacity of the turbines will be 1,100,000 hp. A temporary navigation canal by-passing the main construction area on the Canadian side was completed and opened to shipping in April. The canal provides passage for ships through the Cornwall section of the headpond dyke, where a concrete closure structure has been established for the purpose of closing this channel when the headpond is raised. The Cornwall dyke was substantially completed in October when the last of some 5 million cubic yards of earth fill required there was placed and compacted. Only protective riprap remains to be placed. The headpond itself will be established in the summer of 1958 following the closure of the Long Sault Dam. Heavy dredges deepened and enlarged channels in the vicinity of Chimney and Galop Islands and at Iroquois Point. Additional excavation was begun during the year in three other areas, near Point Three Points, Morrisburg, and Cardinal. Those communities or sections of communities in areas to be flooded along the north shore of the river were moved to new locations. Three new town-sites were created to accommodate people from these areas. A section of double-track railway, approximately 40 miles in length, and 35 miles of main highway also affected by flooding were relocated on higher ground.

At the Sir Adam Beck-Niagara Generating Station No. 2 on the Niagara River, the Commission amended its program in 1953 to provide for an associated pumping-generating station and four additional units at the main station. Construction for the pumping-generating station was begun the following year, and the installation of the four main generating units was begun in 1955. By the end of 1957 work on both these projects was well advanced. At the main generating station two of the additional units were placed in service in December. Work on the final two will be largely completed in the spring and the units will be placed in service in May and July of 1958 respectively. Each of the four units, like the twelve already in operation, has a rated capacity of 105,000 hp. At the pumping-generating station three units of the six units planned were placed in service in the latter part of 1957. During periods of low demand the units will pump water diverted from the main power canal into a reservoir having a capacity of some 16,000 acre-feet. In periods of high demand they will operate in reverse as turbines, each unit having a capacity of 47,000 hp. at maximum discharge of 5,600 cubic feet per second. Flow from the reservoir in turn will augment the flow in the

power canal and thus increase the output of the units in the main generating station. Work on the installation and assembly of the generators for the three remaining units progressed favourably. They are expected to be in service in the spring of 1958.

Marking the fulfillment of the Niagara River remedial works program, the construction of a control dam in the Niagara River about a mile upstream from the falls was completed in the early part of the year and the last four gates were placed in operation. The completed dam with its 14 concrete piers incorporates 13 sluiceways, each 100 feet in width and equipped with bascule-type submersible gates. A service deck 1,500 feet in length spans the structure. Other portions of the remedial works program involved the excavation of certain areas of the river-bed and the placing of fill on the United States side of the river, which was carried out by the United States Army Corps of Engineers in 1954, and similar work on the Canadian side, which was carried out by the Commission in 1955.

The development of Whitedog Falls on the Winnipeg River was undertaken by the Commission in 1955 and considerable preparatory work was carried out at the time and during the following year. The total turbine capacity will be 81,000 hp. and initial service is scheduled for February 1958. At the end of 1957, construction of the main dam for the three-unit generating station was substantially completed. The dam incorporates a powerhouse, adjoining headworks, and a sluiceway structure with nine sluice-gates, two of them motor-operated. It extends some 1,150 feet across the south channel of the river at Whitedog Island. By the end of the year the dam, including the south bulkhead, gate sluices, log-chute head-block, and a compacted earth-fill wing dam on the north shore, had been completed. Mechanical equipment for the two motor-operated sluice-gates was installed also. Concrete placing in the powerhouse structure was completed and work crews began the assembly and erection of turbines and generators.

The construction of the Caribou Falls Generating Station was commenced by the Commission in 1956. It is located in the northwestern section of province, on the English River about 17 miles northwest from Whitedog Falls, and its three units which will total 102,000 hp. are scheduled for service by October 1958. Early in 1957 the powerhouse site was dewatered and excavation was begun for a main dam structure which will extend 1,260 feet across the river. By the end of the year much of the new station had taken shape. East and west bulkheads and the erection bay were built and concrete was placed for piers and sluices in the headworks area. In the powerhouse area the structural work for the first unit was almost complete and the installation of the turbine and generator was

started. Structural work for the second and third units was also well advanced and at the second unit the installation of embedded parts for the turbine was partially complete. In addition to this work, four auxiliary block dams were built which will assist in containing the headpond where contours are below the desired maximum water-level. Clearing of trees and brush from the headpond was finished early in the fall. Only salvaged pulpwood remains in the area, cut and piled ready for moving. At the Manitou Falls Generating Station, provision for the installation of a fifth unit was made in the headworks in the event of increases in loads in the northwestern section of the province. By late spring in 1956 it was apparent that the output of an additional 18,500-hp. unit would be required. Therefore in the spring of 1957 the Commission began work on this installation and such excellent progress was made during the year that the expected in-service date was advanced to March 1958.

In its Cameron Falls and Alexander Generating Stations on the Nipigon River the Commission began work on the installation of two additional units in 1956. At the Cameron Falls station a 25,00-hp. unit will be housed in a separate structure east of the present six-unit powerhouse. During 1957 the site was dewatered and work on the structure was carried out. By the end of the year this work was near completion and the turbine for the unit was partially assembled. At the Alexander Falls station a 19,000-hp. unit will be housed in an extension to the present main structure. Although construction was hampered by deep water as well as by cold weather, the turbine was installed and the generator was partially assembled by the end of the year. Both additional units are expected to be in service by mid-1958.

In its Cameron Falls and Alexander Generating Stations on the Nipigon River the Commission began work on the installation of two additional units in 1956. At the Cameron Falls station a 25,000-hp. unit will be housed in a separate structure east of the present six-unit powerhouse. During 1957 the site was dewatered and work on the structure was carried out. By the end of the year this work was near completion and the turbine for the unit was partially assembled. At the Alexander Falls station a 19,000-hp. unit will be housed in an extension to the present main structure. Although construction was hampered by deep water as well as by cold weather, the turbine was installed and the generator was partially assembled by the end of the year. Both additional units are expected to be in service by mid-1958.

In February 1957 the Commission undertook the development of a single-unit station at Silver Falls on the Kaministikwia River in northwestern Ontario. The new station is scheduled for service in September 1959. It will consist of an intake structure and tunnel which will convey water some 9,000 feet to a powerhouse housing a 60,000-hp. unit. The tunnel, about 14 feet in diameter and lined with concrete, will be provided with a surge tank. Preparatory work at the site began early in the year. By December an access road had been built and about 1,500 feet of tunnel had been driven.

The Commission, although actively engaged at this time on the development of eight widely separated hydro-electric projects, is nevertheless aware of the pressing need for alternative sources of power. The St. Lawrence Power Project is the last major hydro-electric development within economic transmission distance of large load centres in the southern Ontario system. Even in northwestern Ontario there are now distinct advantages to be derived from the development of thermal-electric resources. In the fall of 1957 the Commission undertook to build three new thermal-electric generating stations, one at Fort William and two in the Toronto-Hamilton area. Meanwhile work was well under way for the enlargement of the present Richard L. Hearn Generating Station in Toronto to 1,200,000 kw., or three times its present size. Studies are being continued in conjunction with Atomic Energy of Canada Limited and other interested agencies with regard to the development of a large-scale reactor for the production of energy for nuclear resources.

During 1957, the Commission increased its mileage of in-service transmission and rural distribution lines as follows: 47 circuit miles of 230-kv. line, 259 circuit miles of 115-kv. line, 166 circuit miles of 13- to 14-Kv. line and 861 circuit miles of rural distribution line. It is estimated that at the end of 1957 the total number of rural customers served by the Commission was 454,000, including about 140,900 farm customers.

Apart from the activities of the Commission, the Great Lakes Power Company, Limited, placed in operation on 8 April at its Upper Falls plant on the Montreal River a new unit comprising a 30,000-hp. turbine driving a 25,000-kva. generator. Total plant capacity is now 55,300 hp. The dam at this site had been raised previously by 33 feet to a height of 86 feet above the river bed, providing an average operating head of 232 feet. The Company also is proceeding with two other hydro-electric developments; one on the Montreal River at Centre Falls where one unit of 30,300 hp. under a head of 115 feet, driving a 22,222-kva. generator, will come into operation about 1 April 1958, and the other on the Michipicoten River at Cat Falls having similar turbine

and generator ratings, but with an average operating head of 100 feet, and scheduled for operation in May 1959.

Quebec

The Province of Quebec continued its extensive hydro-electric power activities with a net capacity increase during 1957 of 473,900 hp. after allowing for the dismantling of 10,100 hp. of capacity. In addition, new capacity currently under construction will add about 900,000 hp. during 1958 and more than 2,700,000 hp. in later years.

The Quebec Hydro-Electric Commission completed the installation of the fourth and fifth units in its Bersimis I development some 300 miles northeast of Montreal, raising the installed capacity of the plant to 750,000 hp. Each unit is rated at 150,000 hp. and operates under a head of 875 feet; power is delivered to the new Bout-de-l'Île substation on the Island of Montreal. The ultimate capacity of the underground powerhouse will be 1,200,000 hp. in eight units. At Bersimis II, about 23 miles downstream, good progress was achieved in the preliminary stages of construction. The project involves the excavation of an intake tunnel 4,000 feet long and a diversion tunnel about 1,100 feet in length, the erection of two dams--one of concrete and the other of rock fill--and the construction of 60 miles of road. The powerhouse will have a total installation of 855,000 hp. in five units, each turbine being rated at 171,000 hp. under a head of 375 feet.

At the Beauharnois development on the St. Lawrence River, some 30 miles from Montreal, the Commission proceeded with the construction of the third and final section of the powerhouse which will contain 11 units each of 73,700 hp. under a head of 80 feet. Dredging operations were continued towards the enlargement of the intake canal. Initial operation of this section is expected late in 1958 and the completion of the entire plant, with a total installed capacity of 2,235,000 hp., in 1960.

Among other activities of the Commission, the construction of a storage dam at the outlet of Lake Ste. Anne on the Toulouste River, a tributary of the Manicouagan River, is nearing completion. This dam will allow a higher firm output from the plant of the Manicouagan Power Company which is installing additional capacity to meet the initial power requirements of the Canadian British Aluminum Company plant near Baie Comeau. Studies and surveys are being carried out for developments in the Lachine Rapids section of the St. Lawrence River and in the Manicouagan region on the north shore of the St. Lawrence River. In the field of transmission, progress was made on the construction of three additional 300-Kv. lines--Labrieville to Quebec City, Labrieville to Hauterive (near Baie Comeau) and a tie line between the plants Bersimis I and Bersimis II.

Price Brothers Company Limited placed in service on 21 September its new Murdock-Willson power development located at the mouth of the Shipshaw River just below Willson Falls. The plant contains one 82,000-hp. turbine under a head of 265 feet, connected to a 70,000-kva. generator, and is remotely controlled from the Company substation in the Kenogami Paper Mill three miles away. The Company's existing 10,100-hp. Murdock plant, which was taken out of service on 20 October, will be abandoned. A new 3-mile 69-kv. transmission line has been constructed between the Murdock-Willson powerhouse and the Kenogami Paper Mill.

The Manicouagan Power Company is meeting its construction schedule on its McCormick Dam Project No. 2, which is an extension of the Company's Manicouagan River plant at First Falls near Baie Comeau. The first of three additional units (Nos. 3, 4 and 5), each comprising a 60,000-hp. turbine under a head of 124 feet and driving a 40,000-kva. generator, was placed in operation on 6 December. Units Nos. 4 and 5 are expected to be installed early in 1958. The Company's 161-kv. transmission line from the McCormick Dam substation to the Canadian British Aluminum Company smelter plant at Baie Comeau was placed in service on 5 November. To provide additional power for the smelter plant, the Company is arranging to build another 161-kv. line, $3\frac{1}{4}$ miles long, from its 161-kv. substation at Manicouagan to the Quebec Hydro-Electric Commission's substation at Hauterive.

The Eastern Smelting and Refining Company Limited completed construction and placed in operation on 17 May its hydro-electric plant on the Chicoutimi River at Chicoutimi. The plant contains a 42,000-hp. turbine under a head of 273 feet with a 40,000-kva. generator, and power is supplied to the Company's nearby smelter by a one-mile 161-kv. line.

The Aluminum Company of Canada Limited proceeded with construction of its development on the Peribonka River at Chutes des Passes which will contain five units at 200,000 hp. each, to be operated under a head of 625 feet. The first unit is expected to commence service in the autumn of 1959. Two transmission line circuits eventually will tie the Chutes des Passes station with the Company's present network at Isle Maligne. Work is progressing, and is expected to be essentially completed in 1958, on a project to divert water from Manouan Lake into the Bonard River which empties into the Peribonka River above Passe Dangereuse.

The Shawinigan Water and Power Company made good progress on the construction of its 330,000-hp. development on the St. Maurice River at Rapide Beaumont, 10 miles upstream from La Tuque. The plant will comprise six 55,000-hp. turbines operating under a head of 125 feet

and driving 45,000-kva. generators, initial operation being scheduled for November 1958, and completion of the six units in the summer of 1959. Extension to the Company's transmission system consisted of 16 miles of 66-kv. line between St. Adrien and Weedon. At present, a total of 42,325 farms receive electrical power from the Company.

The James Maclaren Company Limited, which is affiliated with the Maclaren-Quebec Power Company, is building for completion in 1959, a hydro-electric station of 50,000 hp. on the Lievre River at Dufferin Falls in Buckingham.

The Gatineau Power Company presently is converting all of its 25-cycle equipment to 60 cycles. Construction was started on a new 240-kv. line from Lachute to St. Jerome to be operated initially at 115 kv. A new 69-kv. line, to be operated initially at 26.4 kv., was completed from St. Jovite to Arundel. Rural distribution circuits were extended for 91.3 miles and 8,802 farms now receive electrical power from the Company.

The lower St. Lawrence Power Company completed three 5,000-kva. distribution substations at Mont Joli, Rimouski and Matane. Twelve miles of distribution line were added during the year and a 45-mile 161-kv. transmission line between Les Boules and Causapsca will be placed in service by the end of December 1957 to be operated initially at 69 kv. A total of 8,476 farms are now served by the Company.

The Southern Canada Power Company placed in service 17.8 miles of 110-kv. transmission line between Magog and Bromptonville to tie in with the Shawinigan system together with another 16 miles of 48-kv. line. Rural and distribution mileage has increased by 17.0 and 20.0 miles respectively. The total number of customers has increased to 83,051, of which 12,693 are farms. The Company has discontinued the use of its 800-hp. hydro-electric plant on the Yamaska River at Farnham.

Other power-producing agencies carried out extensions to their transmission and distribution systems. The Quebec Power Company completed a 24-mile single-circuit 66-kv. transmission line between Quebec City and Beaupré. About 9,340 farms were receiving electrical service from the Company at the end of the year. The Shawinigan Engineering Company is preparing plans and specifications for the City of Sherbrooke for constructing a 100-kv. substation to consist of two regulation transformers, 30,000 and 40,000 kva. respectively, 110/48 kv., to receive power from the Shawinigan Water and Power Company transmission system. The Northern Quebec Power Company Limited was serving 237 farms at the end of the year.

The Quebec Department of Hydraulic Resources, through its extensive system of storage reservoirs, successfully maintained regulation of flow for power production and flood control on a number of important rivers. Surveys were continued to determine the storage possibilities in the watershed of the Bell-Nottaway River, tributary to James Bay, and in the watershed of Payne River, a tributary of the Ungava Bay. Extensive repairs to the Gouin Dam on the upper St. Maurice River, to Mercier Dam on the Catineau River and to the Allard Dam on the St. Francois River at the outlet of Lake St. Francois, will be completed in the near future.

New Brunswick

The New Brunswick Electric Power Commission placed on test, on 4 November, the first unit of its Beechwood development on the Saint John River, with the second unit scheduled for completion by 31 January 1958. Provision has been made for the installation of a third similar unit. Each unit consists of a 45,000-hp. turbine under a head of 60 feet, driving a 40,000-kva. generator. Currently under construction at Saint John is a new 50,000-kw. steam plant which is expected to be completed in July 1959. During the year, the Commission extended its transmission facilities by 68.4 miles of 138-kv. line from the Beechwood plant to Fredericton and 30.4 miles of similar line from Fredericton to Grand Lake, Queen's County, in addition to which, 59 miles of 69-kv. transmission line and 121.1 miles of rural distribution line were completed. About 190 miles of additional 138-kv. transmission line are presently under construction. The Moncton Terminal and Grand Lake Terminal substations, each rated at 50,000 kva., were completed on 31 October while another substation of 10,000-kva. capacity is currently under construction at Moncton. Electrical service was extended to 1,000 farms, making a total of about 26,000 farms presently supplied by the commission.

Nova Scotia

The Nova Scotia Power Commission completed in August its Bear River plant at Bear River, Annapolis County, with one 5,300-hp. turbine under a net head of 142 feet, operating a 4,000-kw. generator. A 25,000-hp. development on the Sissiboo River near Weymouth, Digby County, is in active prospect and investigations are proceeding with respect to the Commission's proposed Wreck Cove development on Cape Breton Island. Under construction for completion in July 1959 is a 20,000-kw. addition to the Trenton steam plant. During the year, extensions to the transmission system included 61.0 miles of 69-kv. line and 17.0 miles of 23-kv. line; 18.0 miles each of 69-kv. and 23-kv. line are under construction. There were 30.6 miles of rural

distribution lines completed and electric service was extended to 448 farms raising the total of farms connected to about 18,840. The Commission completed substations at Trenton, Onslow in Colchester County and Whycomagh, Inverness County, the capacities being 15,000, 3,750 and 3,000 kva. respectively. Two additional substations, each of 5,000-kva. capacity, are under construction at Blockhouse and Bridgewater in Lunenburg County.

The Nova Scotia Light and Power Company Limited has under construction at its Hemlock Falls plant on the Avon River at Windsor Forks a 5,000-hp. unit which, late in 1958, will replace the existing two units of 1,150 hp. each. On 7 February the Company dismantled its 360-hp. plant on the East River at Chester. In active prospect is a 6,500-hp. development on the Mictaux River at Alpena although no construction dates have been set for the project. In the thermal-electric field, the Company completed on 4 October the addition of a 45,000-kw. unit to its Water Street plant in Halifax, and is currently constructing another similar unit for operation in August 1959. Nineteen miles of 23-kv. transmission line were completed during the year while 23 miles of 69-kv. line and 5 miles of 23-kv. line are under construction for operation early in 1958.

The Seaboard Power Corporation Limited is currently constructing, for operation in September 1959, an additional 16,000-kw. unit to its steam plant in Sydney.

Newfoundland

The Maritime Mining Corporation Limited completed in February on Venams Brook at Green Bay, Newfoundland, a 460-hp. unit operating under a head of 229 feet. In August a 760-hp. unit, under a head of 241 feet, was installed on Snooks Arm at Green Bay, Newfoundland.

The Bowater Power Company Limited is continuing the construction of its hydro-electric development on the Corner Brook River at Corner Brook where two 6,000-hp. turbines, under a head of 526 feet and connected to two 5,100-kva. generators, are expected to commence operation early in 1958. In the Grand Lake Watershed, Newfoundland, two developments are in active prospect; one on Hinds Brook to comprise 50,000 hp. in two units under a head of 679 feet, and the other on Little Grand Lake to consist of one 14,000-hp. unit under a head of 205 feet.

The Newfoundland Light and Power Company Limited is constructing, for operation late in 1958, a new-hydro-electric plant on Rattling Brook near Noris Arm to comprise 17,000 hp. in two units operating under a head of 307 feet. Also under construction, for later 1958 operation, is an additional 20,000-kw. unit at the Company's St. John's steam plant.

The Union Electric Light and Power Company Limited is expanding its Trinity River hydro-electric plant near Trinity by the addition of one unit, under a head of 260 feet, to consist of a 2,000-hp. turbine connected to a 1,875-kva. generator. Completion is expected in 1958. The Company is currently constructing 33 miles of 48-kv. transmission line between Lockston and Clarenville, Trinity Bay.

The United Towns Electric Company Limited is adding a third unit of 3,600-hp. capacity to its hydro-electric plant at Lookout Brook. The unit will operate at a head of 550 feet and, when completed in 1958, will increase total installed capacity of the plant to 7,300 hp.

The British Newfoundland Corporation Limited is actively considering a hydro-electric development at Bay d'Espoir in the central part of Newfoundland where 350,000 hp. may be developed under a head of about 530 feet. In connection with its proposed Hamilton River power site in Labrador, the Corporation completed the all-weather access road from Mile 286 of the Quebec-North Shore and Labrador Railway to the Hamilton River and surveyed the small remaining section leading to the selected powerhouse site.

Yukon and Northwest Territories

To encourage the development of the resources of Northern Canada, the Federal Government established in 1948 the Northern Canada Power Commission, an agency for the construction and management of electric power utilities. The Deputy Minister of Northern Affairs and National Resources is Chairman of this Commission and the Director of the Water Resources Branch is a member.

Hydro-electric construction activities of the Commission during 1957 were confined to the Yukon Territory. These included the installation of a second 3,000-hp. unit at its Mayo River hydro-electric plant, which was put into operation in December; also steady progress on development of the Whitehorse Rapids project on the Yukon River about $1\frac{1}{2}$ miles upstream from Whitehorse, where the initial installation is scheduled for completion in the autumn of 1958 and will consist of two 7,500-hp. Kaplan units under a head of 63 feet. Provision is being made for the installation of a third unit.