

tion on the South River near Nipissing village, sub-stations in Callander, Powassan and North Bay. The transmission system comprises 26.5 miles of 22,000 volt, three-phase, circuit on wooden poles. The generating station contains two 450-kw., three-phase, 2,200-volt, 60-cycle, 450 rev. per min., horizontal generators with 12.5-kw., 125-volt direct-connected exciters, each unit direct coupled to a water wheel of 925 b.h.p. at 86 ft. head. A 27.5-kw., 125-volt, motor-driven exciter is also provided. Three 300-kv-a., 2,200/22,000 volt, single phase, water-cooled transformers connected delta-delta are installed, with one 22,000-volt out-going feeder.

Water for this plant is taken from the South River through an open canal 900 ft. long, then through a wood stave pipe 6 ft. diameter, 2,300 ft. long to a differential surge tank 72.5 feet high, close to the power house, a steel penstock connecting thence to the turbines. The storage pond has an area of about 100 acres and the drainage area of the river is about 350 square miles.

Provision was made for extension, and by additional storage works, it is possible to increase the capacity to 2,500 horse power.

Muskoka System

The power house on the south branch of the Muskoka River at Muskoka Village was formerly owned by the municipality of Gravenhurst and was taken over by the Commission in the latter part of 1915, and has been remodelled and enlarged, and now supplies power over a single circuit 22,000-volt, three phase, 60 cycle line about 26 miles long to Huntsville, and at 6,600 volts, three phase, 60 cycles, to the municipality of Gravenhurst over the municipality's line.

The equipment in this station now comprises one 450-kv-a., three phase, 6,600-volt, 720-rev. per min., 60-cycle generator, direct connected to a 500 b.h.p. turbine; one 750-kv-a. similar 720-rev. per min. generator, direct connected to a 1,000 b.h.p. turbine; one bank of three 400-kv-a., 6,600/22,000-volt transformers connected delta-delta; double low-tension bus, and single high-tension bus. Four outgoing 6,600-volt feeders are provided, two feeding to Gravenhurst and two for future use. One 22,000-volt feeder leaves the station to supply Huntsville. Provision is made in the existing building for a second high-tension feeder.

When this station was taken over by the Commission, only one 450-kv-a. generator was installed. The station was remodelled and enlarged for the larger unit mentioned above, and provision was made for the extension of the building at a future date and for the replacing of existing units so that, when future load conditions require it, there will ultimately be three 1,500-kv-a. generators with a turbine capacity of 6,000 horse power installed.

The present excitation at this plant is provided by a turbine-driven exciter for the 450-kv-a. unit, a motor-driven exciter for the 750-kv-a. unit, which also has a belted exciter for emergency use, which is so arranged that it may excite either generator.

The hydraulic head at this plant is 102 ft. The water is conducted through one steel and one wood stave pipe, each 946 ft. long to the turbines.

Waddell's Falls System

The system comprises a hydraulic generating station on the Severn River at Waddell's Falls near Severn Bridge, and sub-stations at Beaverton and Cannington. Power is transmitted to Beaverton and Cannington over a single-circuit, steel-conductor line at 22,000 volts, three phase, 60 cycles, and over a single circuit aluminum tie line at the same voltage to the Commission's Severn System, connecting at Longford with the town of Orillia

22,000-volt lines from Longford via Orillia to the Big Chute generating station.

The generating station which was constructed by the Commission in 1914 is interesting on account of the low hydraulic head. The normal head is 12 ft., but variations from 9 to 15 ft. occur. The equipment consists of two 400-kv-a., 90-rev. per min., vertical type, 60 cycles, three-phase, 2,300-volt generators connected through flexible couplings to turbines rated at 600 horse power at 100 per cent. gate opening with 12-ft. head. Two exciters, one 20-kw. turbine-driven, and one 30-kw. motor-driven are provided. Two banks of transformers, each consisting of three 2,200/22,000-volt, 150-kv-a. units connected delta-delta are installed. Two outgoing 22,000-volt lines were provided.

There are in this system, 37 miles of 22,000-volt circuit and 23 miles of 4,000-volt circuits from the two sub-stations.

Severn System

This system comprises a hydraulic generating station on Severn River at Big Chute with sub-stations as shown in the diagram.

The generating station as originally built in 1909 by the Simcoe Railway and Power Company contained three 900-kv-a., three-phase, 2,200-volt, 60-cycle, 300-rev. per min., horizontal-shaft generators direct connected to turbines each rated at 1,300 horse power under 56-ft. head; two 100-kw. 580-rev. per min., 125-volt exciters direct connected to 200-h.p. turbines; two transformer banks each consisting of three 600-kv-a., 2,200/25,000-volt water-cooled transformers connected delta-delta, with two outgoing 25,000-volt lines. An extension to the building has been made by the Commission during the past year, and there is now being installed one 1,600-kv-a., three-phase, 60-cycle, 2,200 volt, 300-rev. per min. horizontal generator direct-connected to a 2,300-h.p. turbine. The switching equipment is being rearranged to provide a double high-tension bus for greater flexibility in operation. Space is left for a third bank of transformers, and for two future 22,000-volt line equipments. A double low-tension bus is installed. All power is transmitted at 22,000 volts, three phase, over four lines.

An interesting feature of the transmission lines of this system is the long spans across Matchedash Bay at Wau-
baushene, one being 1,135 ft. long and one 858 ft. long. The west shore tower is 175 ft. high, the middle and east shore towers are 88 ft. high. No. 00 B. & S. 19-strand copper conductors are used on these spans.

The water is taken from the river through a canal 500 ft. long to the head works and then through two steel penstocks 170 ft. long to the turbines.

Eugenia System

This system obtains power from a hydraulic generating station constructed by the Commission at Eugenia on the Beaver River which was placed in service in November, 1915. Extensions are now almost completed to provide double the output. This development is one of the most interesting in Ontario, and has the distinction of having with one exception, the highest hydraulic head of any plant in Canada, being 552 ft. gross. It is also one of the highest heads in the world using reaction wheels.

The first installation consisted of two 2,250-h.p. turbines each direct-connected to 1,410-kv-a., three-phase, 4,000-volt, 60 cycle, 900-rev. per min., horizontal-shaft generators having neutral grounded without resistance; one bank of three 900-kv-a., 4,000/25,000-volt transformers connected delta-delta, single high-tension and low-tension busses, two outgoing 25,000-volt feeders and two 4,000-volt feeders, one each to Markdale and Flesherton.