Design and construction work for the nuclear-power program was sustained at a high level during the year. Nearly 6 million kilowatts of electrical generating capacity using CANDU reactors is under construction and close to 1 million kilowatts of this capacity will be in operation early in 1971.

CANDU is named from its use of heavy water (deuterium oxide) as the reactor moderator and natural uranium as the fuel. The principal feature of this system is the economical use of neutrons, the particles which sustain the atomic chain reaction. Neutron economy is achieved by design of the system, choice of structural materials in the reactor and the employment of heavy water. Such a system enables CANDU reactors to operate efficiently using natural uranium fuel, with a consequent low fuel cost.

The economical use of natural uranium makes the CANDU reactor attractive to a number of countries. Power stations employing reactors of this type are being built in India and Pakistan. In Pakistan the 125,000-kilowatt Karachi Nuclear Power Project (KANUPP) will go into operation late in 1970. The first of the CANDU power reactors in India will start operation in 1972. In Canada, 1971 will see the initial operation of the Gentilly nuclear-power station, a 250,000-kilowatt plant, and also the start-up of Units One and Two at Ontario Hydro's 2-million kilowatt Pickering generating station. By the end of 1971, more than 1.5 million kilowatts of CANDU power capacity will be on the line.

DOUGLAS POINT

Operation of the 200-megawatt Douglas Point station continues to provide experience that is being applied in the design and construction of Pickering and Bruce stations. Douglas Point has been in operation since 1967 and has produced more than 1.5 billion kilowatt hours of electricity. Besides serving as a prototype for the larger stations, it provides valuable training for the growing numbers of operating staff needed in the Ontario Hydro program.

One of the major achievements of the year was the successful commissioning of the "on-power" refuelling system. Refuelling of the reactor without shut-down is a basic feature of the CANDU design. The Douglas Point fuelling machines were used to carry out initial loading of the reactor and had also been used to refuel with the reactor shut down. The first on-power refuelling was attempted in December 1969, and the machines were in regular service by the end of March 1970. In the first month of operation, the machines demonstrated a capability in excess of that required for normal equilibrium fuelling.

Improvements in the conservation of heavy water occupied an important place in the program of modifications carried out during the year. More effective equipment for drying the air in the reactor boiler areas was installed and this has increased the efficiency of the heavy-water recovery system.

In the spring of 1969, the station was shut down for turbine inspection and overhaul. A common stage in each of the three low-pressure sections exhibited rotor-blade failure or damage due to vibration. These were removed and will be replaced at the next overhaul. In the meantime the machine is being operated at slightly less than full output.

The shut-down for turbine overhaul coincided with the discovery of some fuel failures in the reactor. Twelve fuel bundles with cracked sheathing were identified. With the fuelling machines operating on-power, failed bundles can be removed from the reactor without interrupting the operation of the station, and so constitute little problem.

The station is being operated on a regular basis at high power. Reduction of radiation fields in the primary coolant system because of cobalt contamination, improvements to certain equipment and modifications to auxiliary circuits are now the main tasks to be done to attain the performance expected at maturity.

GENTILLY

Construction of this 250-megawatt prototype station reached its final stages and completed systems were turned over progressively to the Hydro-Quebec commissioning group. Operation is expected to begin in 1971, thus meeting the tight four-and-a-half-year schedule set when work on the project was started late in 1966.

Gentilly is the first natural-uranium, heavy-water power reactor to use ordinary water as a coolant. The reactor, known as CANDU-BLW (Canada Deuterium Uranium-Boiling Light Water), offers possible construction and operating advantages over power reactors using pressurized heavy water as a coolant. Gentilly is being built by AECL with the co-operation of Hydro-Quebec, which will operate and eventually purchase the station. It is on the south shore of the St. Lawrence river, near Trois-Rivières.

PICKERING

The 2,000-megawatt Pickering station is being built by Ontario Hydro. AECL is designing the nuclear steam supply and control system. The station is on Lake Ontario, some 20 miles east of the centre of Toronto.

All major reactor components of the first two units of this four-unit station have been installed and nearly all major equipment has been delivered. Fuel for the first charge of Unit One had been delivered and heavy-water delivery began early in April.

The present schedule calls for the Unit One reactor to go critical early in 1971 and that of Unit Two later in the year. Unit Three is expected to come into operation in 1972 and Unit Four a year later.

BRUCE NUCLEAR POWER DEVELOPMENT

This project will comprise a 3,000-megawatt nuclear generating station, an 800-ton-a-year heavy-water production plant, an oil-fired auxiliary steam plant to provide a stand-by steam supply for the heavy-water plant and the existing Douglas Point nuclear-power

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