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## ATOMIC RESEARCH IN CANADA

(Prepared by Dr. W.B. Lewis, Senior Vice-President,  
Atomic Energy of Canada Limited, Chalk River, Ont.)

A number of large nuclear electricity-generating stations are being brought into operation in Canada, Pakistan, and India, all stemming from the "heavy-water-moderated" type of nuclear reactor introduced and developed by Atomic Energy of Canada Limited (AECL). A brief review of them and other large-scale engineering activities will serve to show how closely the research and development work of AECL is linked to activities that form an important part of the national economy.

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Heavy water (deuterium oxide) had been chosen for slowing or "moderating" the neutrons from nuclear fission to maintain the fission chain reaction in the experimental NRX reactor at Chalk River. The virtue of heavy water in permitting high-power density had been demonstrated in the operation of NRX from 1947 to 1952, when a thermal power of 30,000 kilowatts was attained using less than ten tons of natural uranium fuel. The power was raised to 40,000 kilowatts in 1954. The 200,000-kilowatt experimental NRU reactor designed and constructed from 1950 to 1957 uses heavy water for both coolant and moderator and its fuel is changed with the reactor at power without shutting down. In the NRX and NRU reactors, the temperature of the coolant was too low to generate steam for power, but in 1951 it became clear that a heavy-water power reactor could be designed that would have a very low fuelling cost compared to coal. The first design employed a pressure vessel to contain the hot coolant, but in 1956 the promising performance of zirconium alloys allowed the preliminary design of the power reactors now coming into large-scale use. This design, given the name CANDU (CANada-Deuterium-Uranium), retains the desired fuelling economy and makes it the only type yet in operation anywhere in the world that can claim the designation of "near-breeder" and "advanced converter" with an expectation that the type will remain economically competitive for the foreseeable future. Moreover, it could meet the power needs of the whole world for many hundreds, and possibly thousands, of years if operated with fuel recycling on enriched uranium and thorium as fuel. All the reactors so far built have been designed to operate on natural uranium fuel, but fuel recycling is possible.

By virtue of its success with nuclear generating stations, Canada was able to make a strong presentation at the fourth United Nations International Conference on the Peaceful Uses of Atomic Energy in September 1971. During the month of July, 8 per cent of the electricity supplied by the