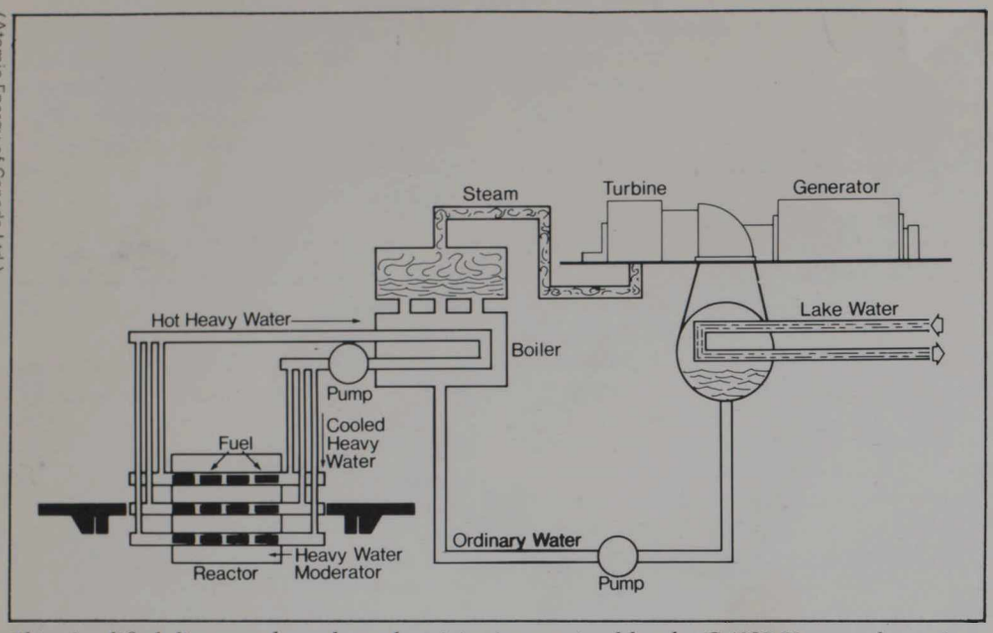
(Atomic Energy of Canada Ltd.)



This simplified diagram shows how electricity is generated by the CANDU natural uranium reactor. The natural uranium fuel in the reactor heats the heavy water, which in turn heats the ordinary water. The steam from the heated ordinary water drives the turbine, which in turn drives the generator producing the electric power.

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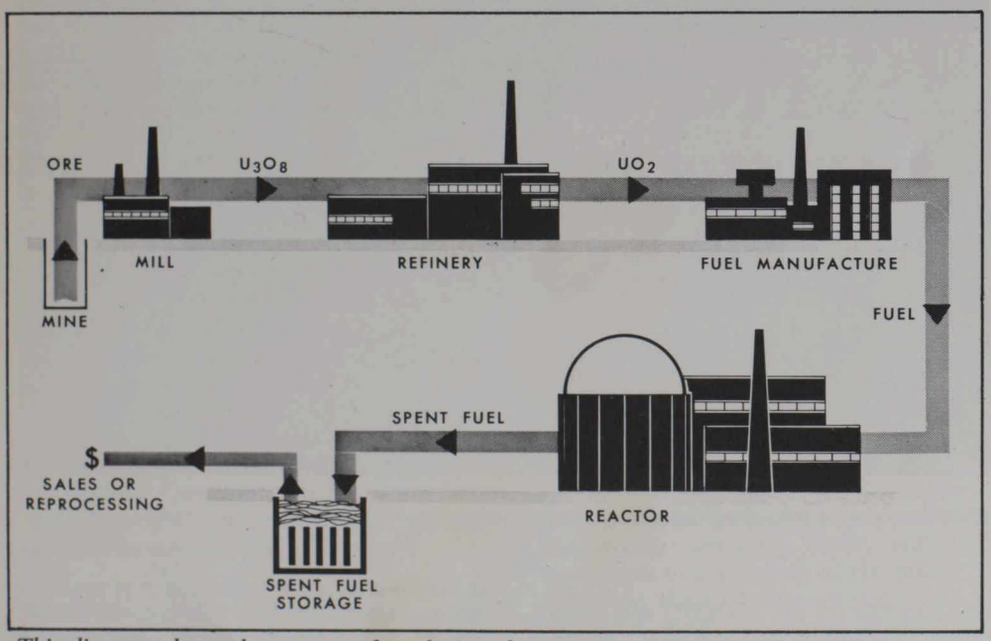

This diagram shows the process of producing electric power from natural uranium through all its stages, from the mine onwards. The plutonium in the spent fuel can be used further for other purposes, including as fuel for breeder nuclear reactors should they become economical in the next few years.

In the meantime, military necessity and the vast resources of the U.S. developed a light-water (that is, ordinary water) enriched-uranium submarine reactor to a high state of technological development at an early stage. A land-based version for electrical generation followed quickly, and today holds a dominant position in terms of generating capacity in operation or under construction around the world.

But Canada remained committed to the natural uranium-heavy water reactor, even though at times it seemed of greater interest to research scientists than to electricity boards.

The Canadian reactor system is called CANDU – which stands for *CA*Nadian-*D*euterium-*U*ranium. As natural uranium offered the lowest fuelling cost and heavy water is the most efficient moderator, these were retained as the basis for power reactor development.

Canada began early to study nuclear energy as a source of electricity. One of the earliest proposals came in August 1951 from Dr. W. B. Lewis of AECL. The Ontario Hydro Electric Power Commission became the major utility participating in the programme, a natural development because Ontario, an energy-rich province, was nearing the end of its economic water-power resources in the 1950s and faced the prospect of importing large supplies of coal from the United States. It leaped at the chance to participate in a programme to develop Canadian uranium resources.

Early in 1954 a nuclear power branch was established in the nuclear laboratories at Chalk River, Ontario, headed by H.A. Smith of Ontario Hydro and composed of engineers drawn not only from AECL, but from five Canadian electric utilities. Construction began of a station called Nuclear Power Demonstration – NPD – on the Ottawa River a few miles away. The original design called for a pressure vessel to contain the high-pressure coolant. Later, to simplify scaling up to larger plants, the design was changed to the novel pressure-tube concept in which each string of fuel bundles is contained in its own slim tube, rather than using a single huge thick-walled vessel to contain the entire reactor core. The pressure tube was to become the unique basis for all future designs of Canadian reactors.

Pickering success story

NPD had the usual teething difficulties of any new design, but they were gradually overcome and it played the role intended, as a test-bed, to demonstrate the feasibility of the Canadian nuclear power system. It continues to be used for valuable training and testing purposes and remains one of the world's major developmental reactors.

Drawing on NPD experience, a full-scale prototype plant was built, starting in 1962, at Douglas Point, Ontario, on the shore of Lake Huron. With a capacity 10 times that of NPD, Douglas Point was built to test the design and components of the Canadian system on a scale in which they would be used commercially. As intended, the experience gained in the design, construction and operation of these two pioneer plants proved to be of great benefit to the Pickering project, and others to follow.

The real Canadian success story surrounds the performance of the Canadian nuclear station at Pickering, on Lake Ontario just east of Toronto. Built at a cost of about $750 million, this is among the most advanced and sophisticated engineering projects ever undertaken in Canada. Since the first of its four reactors went into operation in 1971, the Pickering station has established what is described by Canadian authorities as an almost unbeatable record.

Since December 1972, Pickering has been producing more power than any other nuclear station in the world and doing it with exceptional efficiency. In one month this year the station fed more than 1,000,000,000 kilowatt hours into the Ontario power grid.