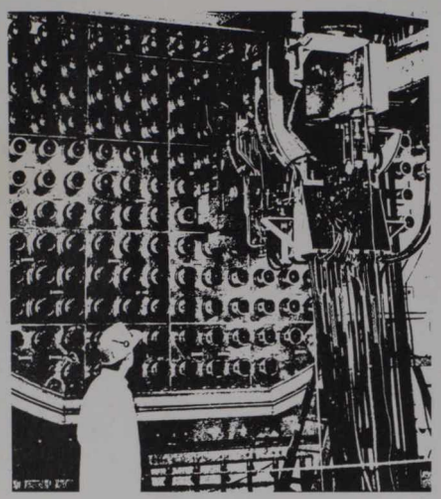
Cover picture shows
The Pickering nuclear generating station fuelling machine and reactor force.

Canada Today



CONTENTS

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Energy

Canada achieves nuclear power success

During the last year or so, Canada has achieved a unique place among world leaders in the commercial generation of electricity from nuclear energy.

The Canadian Government agency responsible for nuclear research and development and the marketing of the programme's products, Atomic Energy of Canada Limited (AECL), says in a recent assessment of the Canadian nuclear power system:

"Canada has pioneered and brought to the stage of large-scale commercial application a nuclear power system that is without equal among proven, present-day types in making efficient and economical use of uranium fuel."

There is considerable evidence to substantiate this claim. Not the least of this evidence was the commercial sale last spring to Argentina of a Canadian-designed reactor against competing offers by two United States companies and one in West Germany. Canada is also hoping to win its second commercial export sale to Italy against tough international competition by the end of this year. It would also like to make a deal with Britain for joint exploitation of a co-operative nuclear reactor programme in future, but this proposal remains under consideration.

Perhaps the most convincing evidence is the Pickering nuclear power station in Ontario, now the largest in the world. Its four units have an installed capacity of 2,160,000 kilowatts. The second largest is the Dresden plant in the United States with an installed capacity of 1,910,000 kilowatts. The largest nuclear power plant currently operating in Britain is at Wylfa, on the Isle of Angelsey, with installed capacity of 1,001,000 kilowatts; four new ones under construction will have installed capacity of 1,320,000 kilowatts each.

Since entering full production, the Pickering station has operated for long periods at 95 to 99 per cent of installed capacity. The average for U.S. nuclear stations in recent years has been between 50 and 70 per cent.

Canada's connection with the atomic age may be dated from May 1930 when a rich deposit of uranium-bearing pitchblende was discovered on the isolated shores of Great Bear Lake, in the Northwest Territories. When the atomic age dawned a dozen years later this find gave Canada nearly all of the free world's then known resources of uranium ore – and ensured that Canada had a degree of access to the early decisions about nuclear policy by Britain and the United States enjoyed by no other countries.

The true birthday of the atomic age was 2 December, 1942, the day the Italian refugee Enrico Fermi achieved the first chain reaction in his crude reactor in a converted squash court in Chicago. By coincidence on that same day, a joint British-Canadian research team moved into quarters in a run-down mansion in Montreal to pursue a similar nuclear goal.

British team in Canada

Britain had decided to move its whole nuclear team to Canada, to be out of the way of the blitz and nearer the American team of scientists in Chicago and New York. In 1943 a three-nation committee was established to co-ordinate the deadly race to produce an atomic bomb. There were two known methods of designing a reactor to make plutonium, the artificial radioactive element which was the stuff of one of the first atomic bombs. The one that looked quicker and easier was undertaken by the United States, using graphite as the moderator. Canada was assigned the task of studying reactors using deuterium oxide – 'heavy water' – as the moderator.

The other element that could be used to make an atomic bomb was highly enriched uranium. This led the United States to develop a gaseous diffusion process for uranium enrichment. Canada went ahead with development of a reactor using natural uranium as fuel and heavy water as moderator and coolant. In 1953 Britain, feeling the need for new sources of electricity, started the Calder Hall design and in 1966 brought into operation the world's first full-scale nuclear power plant, based on the well-proven design using natural uranium fuel with graphite as moderator and gas as coolant.

A main factor in Canada's decision in the early 1950s to proceed with a natural uranium-heavy water system was its economic potential as an electricity generator compared with estimates by the U.S. Atomic Energy Commission of costs for enriched-uranium reactors. This indicated that the enriched-uranium systems could be built for less than the natural-uranium systems, but that the fuelling cost would be two or three times as much. The heavy-water system also avoided the huge cost of building a uranium enrichment plant. Canada thus decided to set out virtually alone among advanced industrialized nations to develop the natural-uranium heavy-water nuclear power reactor.