NPD – the first “CANDU”*

- Following are some notes illustrations associated with the conception and early design of the Nuclear Power Demonstration plant (NPD) that first went critical in April 1962 and delivered the first nuclear-generated electricity in Canada on June 4, 1962

- *The term “CANDU” was not coined until after the demonstration plant, Douglas Point, was in operation in the mid 1950s.
THE CONCEPT (1)

The concept of using nuclear power to produce electricity developed shortly after the Second World War.

In early 1952 Atomic Energy of Canada Limited (AECL) was created as a crown corporation to take over the assets and responsibilities of the Atomic Energy Project. Among AECL's first Board of Directors was Richard Hearn, the Chief Engineer of the Hydro Electric Power Commission of Ontario (HEPC, to later become Ontario Hydro). Hearn was attracted to the concept of nuclear-generated electricity because Ontario was running out of undeveloped hydraulic capacity.

Near the end of 1953, HEPC and AECL agreed to proceed with a jointly-funded feasibility study aimed at defining a possible pilot nuclear power plant. Given the experience with NRX—the heavy water moderated, natural uranium fuelled, reactor concept was considered to be the first choice.
In late 1954 the AECL Board approved, in principle, proceeding with the design and construction of a small demonstration power reactor. Seven private Canadian companies were invited to submit proposals for this work.

Certain key features of the design concept were firmed up by a study team at the Chalk River Laboratories, headed by Harold Smith of HEPC. Basically it involved placing an NRU-type core inside a thick-walled steel pressure vessel.
Project

In 1954, AECL received proposals from the private companies interested in undertaking the design and construction work.

The chosen bidder was Canadian General Electric (CGE), because of its broad-based engineering and manufacturing capability and its offer to contribute significant funding to the program.

HEPC offered to provide the conventional portion of the power plant and undertake to purchase the steam from the nuclear portion to power the conventional generator.

This was accepted by AECL and, subsequently approved by the federal cabinet on March 23, 1955.
CGE Team

An initial design team, numbering less than 30, was assembled in mid-1955 in a relatively new building at CGE’s works in Peterborough. Some were from the joint study team; others were recruited from within AECL and CGE. The initial accommodation was primitive by today’s standards.

Other members of the joint study team stayed at Chalk River to work on the conceptual design of a much larger unit (200 MWe) intended to follow the smaller unit.

A site for NPD was chosen near HEPC’s Des Joachim hydraulic generating station on the Ottawa River which was close to AECL's Chalk River laboratory and had access to power transmission lines.
New design

While work on the detailed design of NPD proceeded, the team at Chalk River reached a conclusion of major importance regarding the larger reactor; that it should be of the pressure tube type rather than of the pressure vessel type.

This major conclusion then posed a vital question. Should NPD continue as a pressure vessel reactor or should it be redesigned as a pressure tube reactor?

While changing the fundamental design would involve a major project delay and additional costs, in March, 1957, the AECL Board made the historic decision to redesign NPD as a pressure tube reactor.
New design (2)

• In six months the CGE design team, which had grown to about 100 produced a comprehensive Design Study.

• The new conceptual design incorporated all of the fundamental aspects of what became to be known as CANDU.

• These included: natural uranium fuel; heavy water moderator; pressure tubes; on-power fuelling; computer control, triplicated safety features.

• The new design was named NPD-2, but after start-up it reverted to just NPD.
Aerial view of NPD on the shore of the Ottawa River, 25 km east of the Chalk River Laboratory, with Training Centre in foreground
Original CGE – NPD staff, summer 1955
AECL president W. J. Bennett (L) and HEPC president Richard Hearn (R) observe as Ontario Premier Leslie Frost and federal Minister C. D. Howe turn the ceremonial sod for NPD in 1958
Sam Horton Plotting criticality, April 4, 1962
View of control room prior to approach to criticality
Observers crowd into control room following first criticality in the early hours of April 4, 1962