POINT LEPREAU GENERATING STATION

BY

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ABSTRACT

The incorporation of this large unit on N B Power's system has been made possible by innovative power system planning and necessary by the price and supply reliability of oil. Project management and the treatment of environmental impact and public concern may indicate future patterns for nuclear energy in Canada.

1. INTRODUCTION

In July, 1974 it was announced that a CANDU-600 MWe nuclear generating station would be built by N B Power at Point Lepreau on the Bay of Fundy about 24 miles south-west of Saint John. The station is scheduled to be in service in October 1979 and in commercial operation in 1980 to supply future needs for electrical energy in New Brunswick and to provide a measure of relief from dependency upon foreign oil.

The introduction of a single 600 MWe unit on the New Brunswick grid offers the economy of size but during the first few years of operation it will present problems with reserve back-up due to its large size relative to other units on the N B system. In an effort to alleviate this problem, a proposal was made in 1973 to supply steam to an AECL owned heavy water plant which would be located on a site adjacent to the nuclear plant. An 800 ton/yr D_2O plant would have reduced the turbine-generator size by 168 MWe. This proposal was rejected by AECL in favour of a site at Gentilly, Quebec.

The problems of reserve back-up may also be overcome through interconnection agreements with neighbouring utilities similar to the arrangement made for the 900 MWe Coleson Cove Thermal

Station (3 x 300 MWe) where 400 MWe was sold to New England utilities for a 10 year period. Another solution is simply to install additional reserve capacity. Both of these methods are being utilized to back-up the 600 MWe Point Lepreau Unit.

2. LOAD GROWTH

From the beginning of the electric utility business in the 1880's when electricity was first made available to the public, the fraction of total energy consumed in this form has steadily increased. Most planners today believe that the future use of electricity will represent an even larger share of total energy than it currently represents because of its versatility and because it can be generated from a wide range of sources. Per capita usage of electric energy in New Brunswick has always been below the Canadian average and presently is about 75% of the national level. The demand for electric energy in N B has increased during the past ten years at a rate of 13% compounded annually. This rate has produced a three hundred percent increase during the period.

It is reasonable to assume that this element of "catch up" in the annual increase of electricity use by the people of this Province will continue. Accordingly, N B Power planners and their consultants are currently projecting an 8.5% growth rate over the next ten years. While this is a much lower growth rate than that realized in the recent past (13.6% in 1974) it will nevertheless put a heavy demand on existing and planned facilities.

The Federal Department of Energy, Mines and Resources have estimated (4) an electrical energy growth rate of 7.1% for Canada over the next 30 years. Over the 5 to 6 year period of construction for a nuclear plant the load growth must surely lie somewhere between the presently experienced 13.6% and the national expectation of 7.1%.

3. SITING

Of great importance was the location of the plant and a series of very comprehensive studies covering economic, environmental, and social considerations was undertaken.

Fresh water locations were considered, however, the attendant environmental problems related to the required condenser cooling system together with the availability of a number of coastal sites appearing to offer much better waste heat dissipation resulted in the conclusion that a coastal site would provide the best opportunity for plant construction with minimal environmental effects. A total of 21 sites were investigated between Dalhousie in the North and Point Lepreau in the South. Investigations included not only the physical features, geology, seismic history, access, intake and discharge facilities, population, fresh water supply, etc. but also a complete range of environmental and socio-economic considerations.

The 21 possible sites were thus reduced to the three shown on Figure 1. They are Point Lepreau 24 miles south-west of Saint John; Point Caplin, 30 miles east of Bathurst; and Quinn Point, 25 miles west of Bathurst.

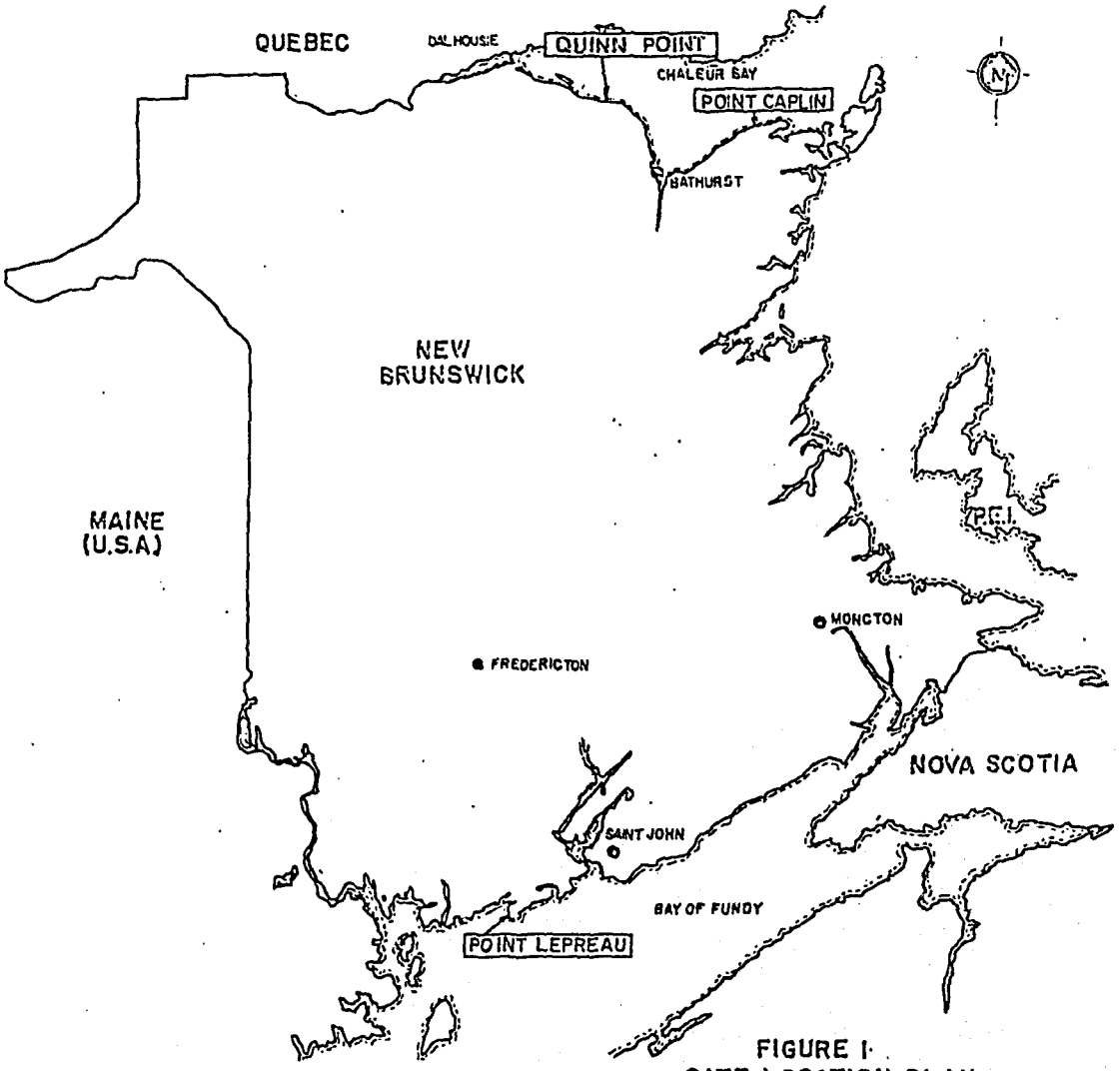


FIGURE I
SITE LOCATION PLAN

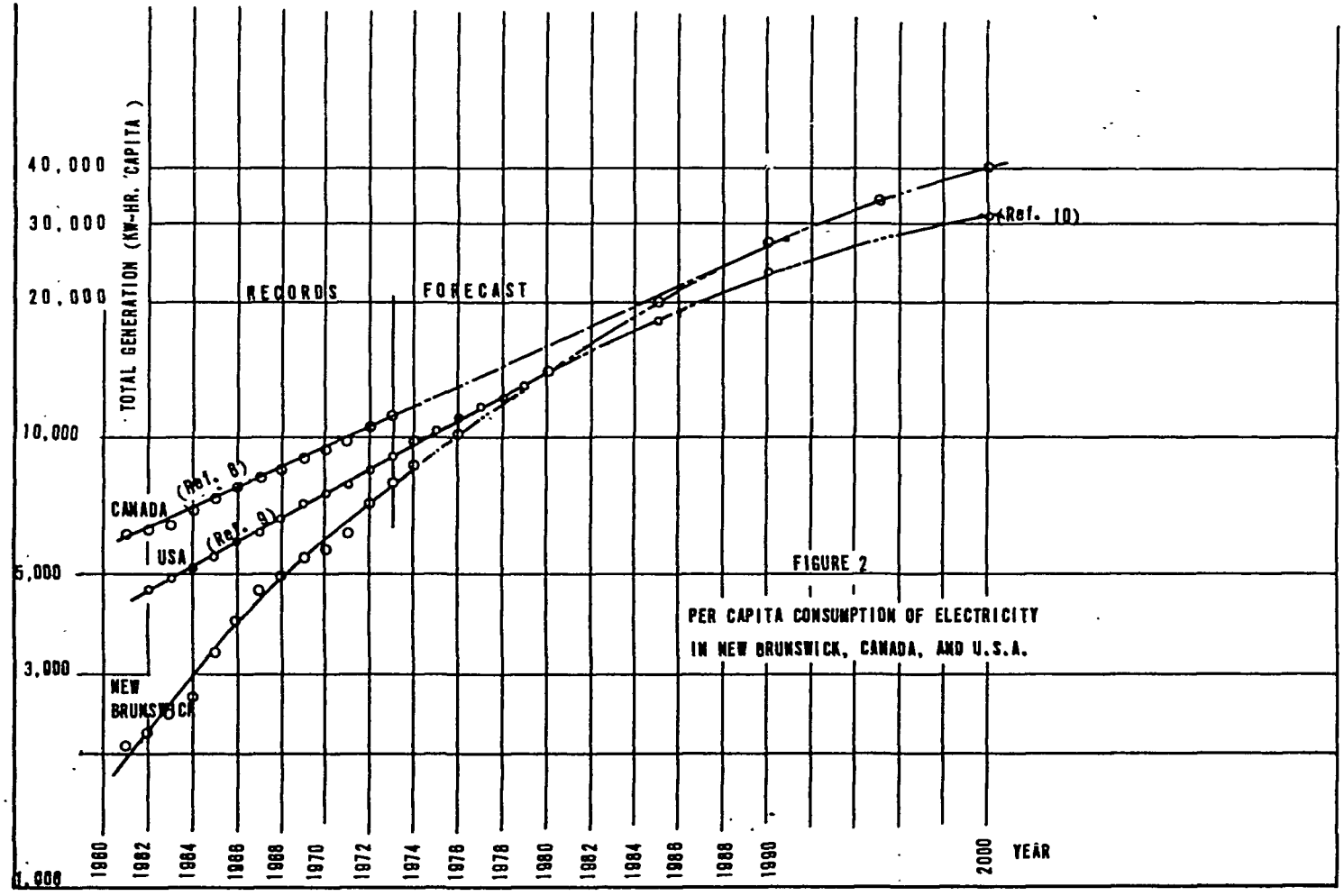


FIGURE 2

PER CAPITA CONSUMPTION OF ELECTRICITY IN NEW BRUNSWICK, CANADA, AND U.S.A.

Point Lepreau was finally chosen as the preferred site because of lower cost (about $30 million), minimum family relocation, more reliable cooling water structures because of the absence of ice in the Bay of Fundy, and better environmental conditions.

Communication with the public was recognized as an important aspect of the introduction of nuclear power and during the conceptual stage of the project at least 50 separate meetings were held with N B Community organizations, institutions, and schools. Over 32,000 people were contacted by this program.

Following the announcement of the Point Lepreau site, further public meetings were held in nearby communities. A summary of the environmental report was made available to the public by the N B Dept. of Environmentand coverage was given in the major provincial daily newspaper which also ran a series of articles covering all aspects of nuclear power. Radio and TV coverage was also extensive.

Site Approval was given by the Atomic Energy Control Board in October, 1974.

4. STATION DESIGN

The reactor is a so-called "Standardized" (5) natural uranium fueled pressurized heavy water moderated and cooled reactor similar to Hydro Quebec's Gentilly-2, Cordoba in Argentina, and the proposed unit for South Korea. However, it is intended that Point Lepreau will eventually be a two-unit station and this consideration affects site layout and building design, in particular the design of the control room and other parts of the Service

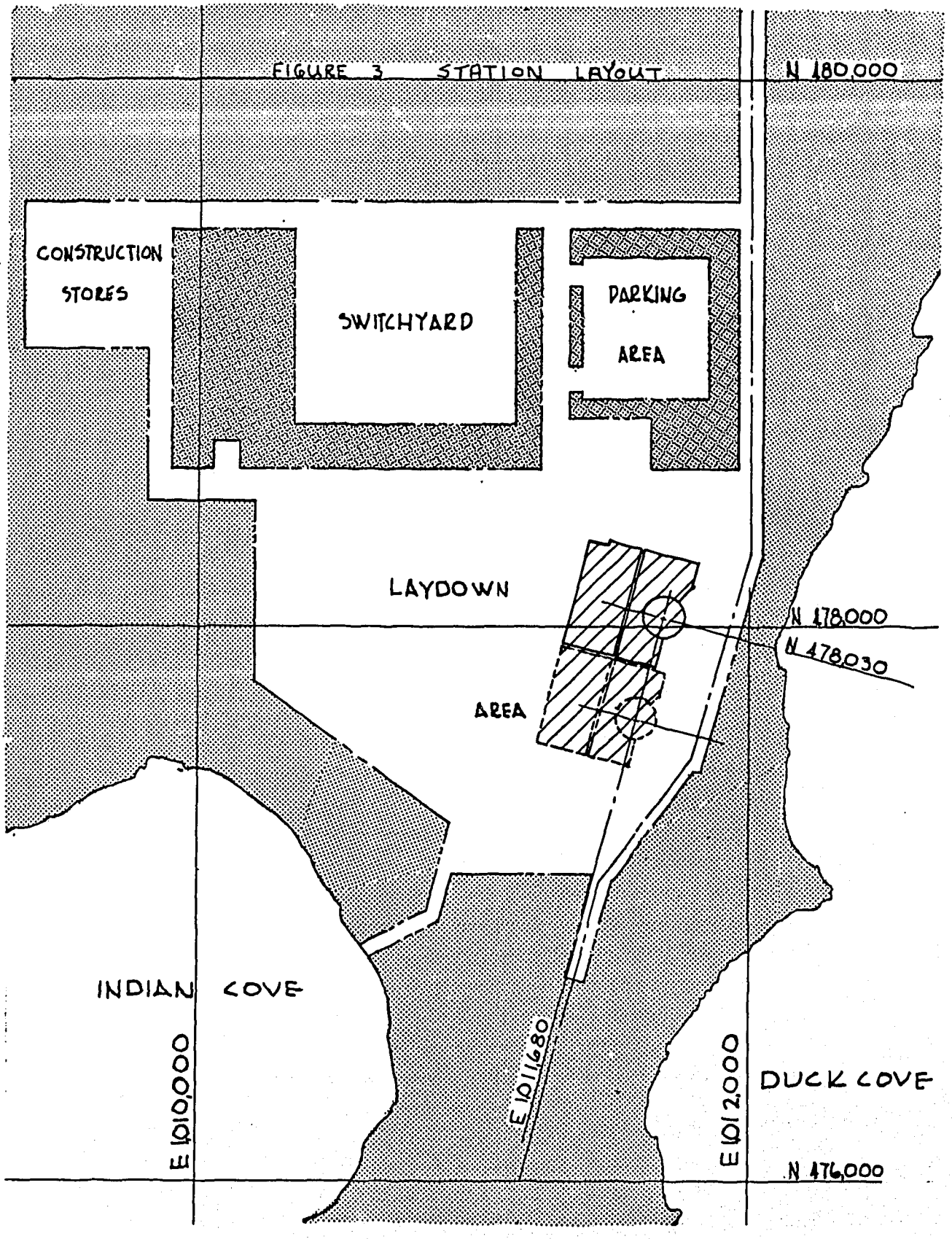


FIGURE 3 STATION LAYOUT
N 180,000
CONSTRUCTION STORES
SWITCHYARD
PARKING AREA
LAYDOWN
AREA
N 178,000
N 178,030
INDIAN COVE
E 1010,000
E 1011680
E 1012,000
DUCK COVE
N 176,000

Building, and the cooling water system. The site layout is shown in Fig. 3.

The Point Lepreau Generating Station is the first coastal Candu 600 MWe plant. This prompted an extensive study of condenser tube materials for salt water application, and careful consideration of secondary side feedtrain material selection and feedwater chemistry.

AECL commissioned Canatom Ltd. to review operating experience with salt water cooled condensers. A very thorough study was carried out and a recent report (6) summarizes the findings. The recommendation for salt water cooled sites is that titanium tubes with aluminum bronze tube sheets be used for the main condensers. The combination seems to offer the best long term prospects of minimum tube failure rates.

In addition to reducing condenser tube leakage, a titanium tubed condenser along with steel feedwater heater tubes would eliminate copper from the secondary side and the possibility of copper desposits in the boilers. Incoloy-800 boiler tubes used in Candu 600 MWe reactors are, like other materials, susceptible to copper deposits and a system without copper alloys will not only eliminate copper deposition but permit operation at pH 9.5-10 which will considerably reduce carbon steel corrosion and ferrous deposition (7).

The unacceptable high failure rate of some foreign nuclear steam generators in recent years has necessitated increased Canadian effort in secondary side chemistry and system materials, and a continuing evaluation of current practice. The material selection for Point Lepreau and the chemical control

program represent the latest thinking on the subject.

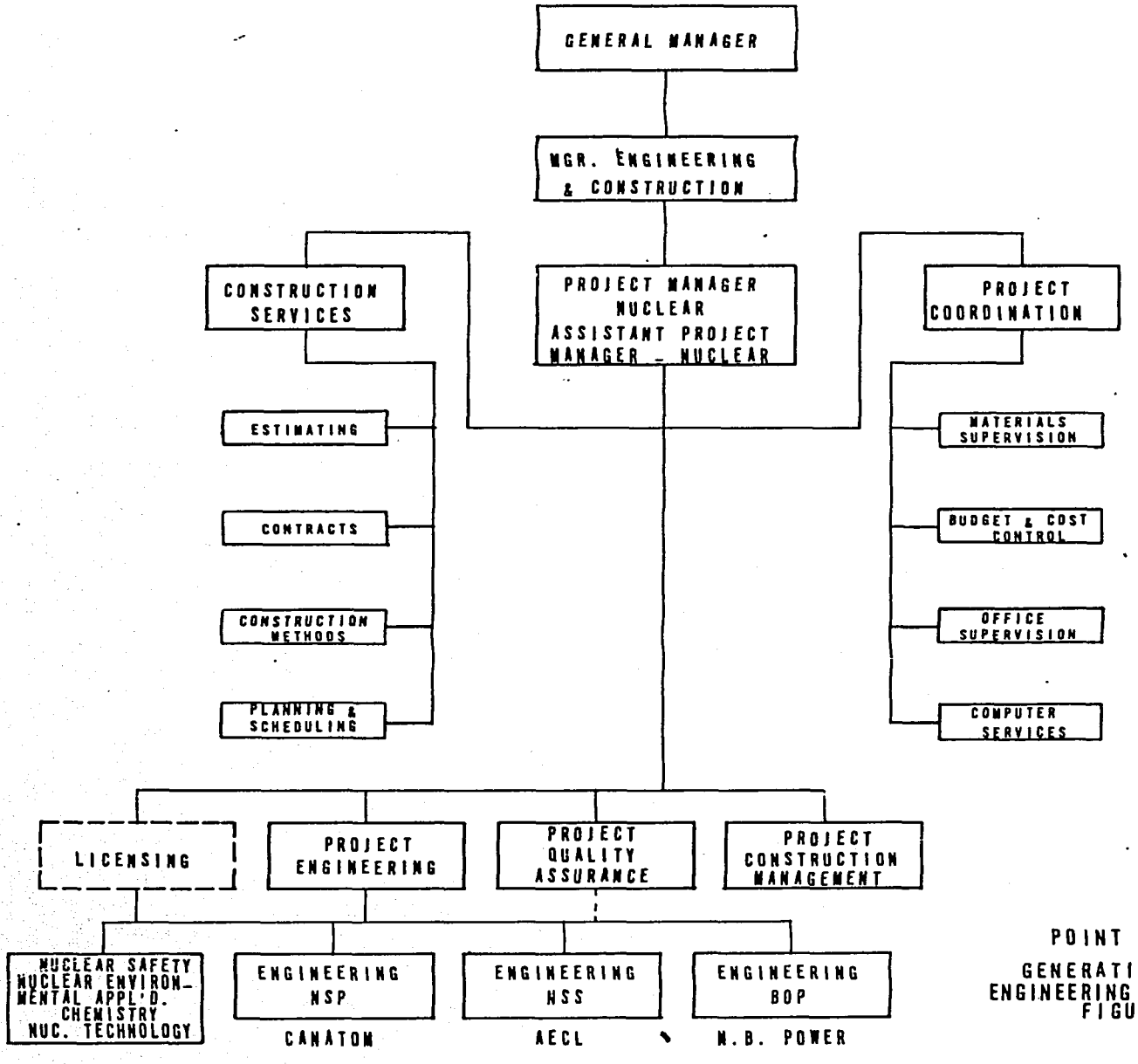
Although the use of titanium tubes is expected to provide high reliability for the main condenser, even a remote possibility of sea water leakage into the various heavy water and other reactor based systems requiring cooling cannot be tolerated. Accordingly, a recirculated fresh water loop, cooled, in turn by sea water will be used. The Raw Service Sea Water System supplies sea water to the turbine hall auxiliaries that are designed for cooling with sea water, and to the recirculated water system heat exchangers.

Recent reactor safety thinking has postulated accidents which result, for various reasons, in the total loss of the station cooling system. As a result, Point Lepreau will have an Emergency Water Supply System, completely separate from the main cooling system. Fresh water will be used along with diesel engine driven pumps.

The feasibility of using heated water discharge from the station for an aquaculture operation is being studied by the University of New Brunswick and various Federal and Provincial Government agencies. This and other environmental factors such as the tidal and wave action of the Bay of Fundy are having a profound effect on the cooling water system design.

5. PROJECT MANAGEMENT

Atomic Energy of Canada Ltd. are designers of the nuclear steam supply system. The balance of plant design is being carried out by N B Power and Canatom Ltd.



POINT LEPREAU
GENERATING STATION
ENGINEERING ORGANIZATION
FIGURE 4

N B Power is performing the overall management of project functions including design engineering, construction, and commissioning. The Engineering Organization is shown in Fig. 4. Centralized management is exercised by a Project Manager leading a team which consists of engineering, construction, quality assurance, and support service groups.

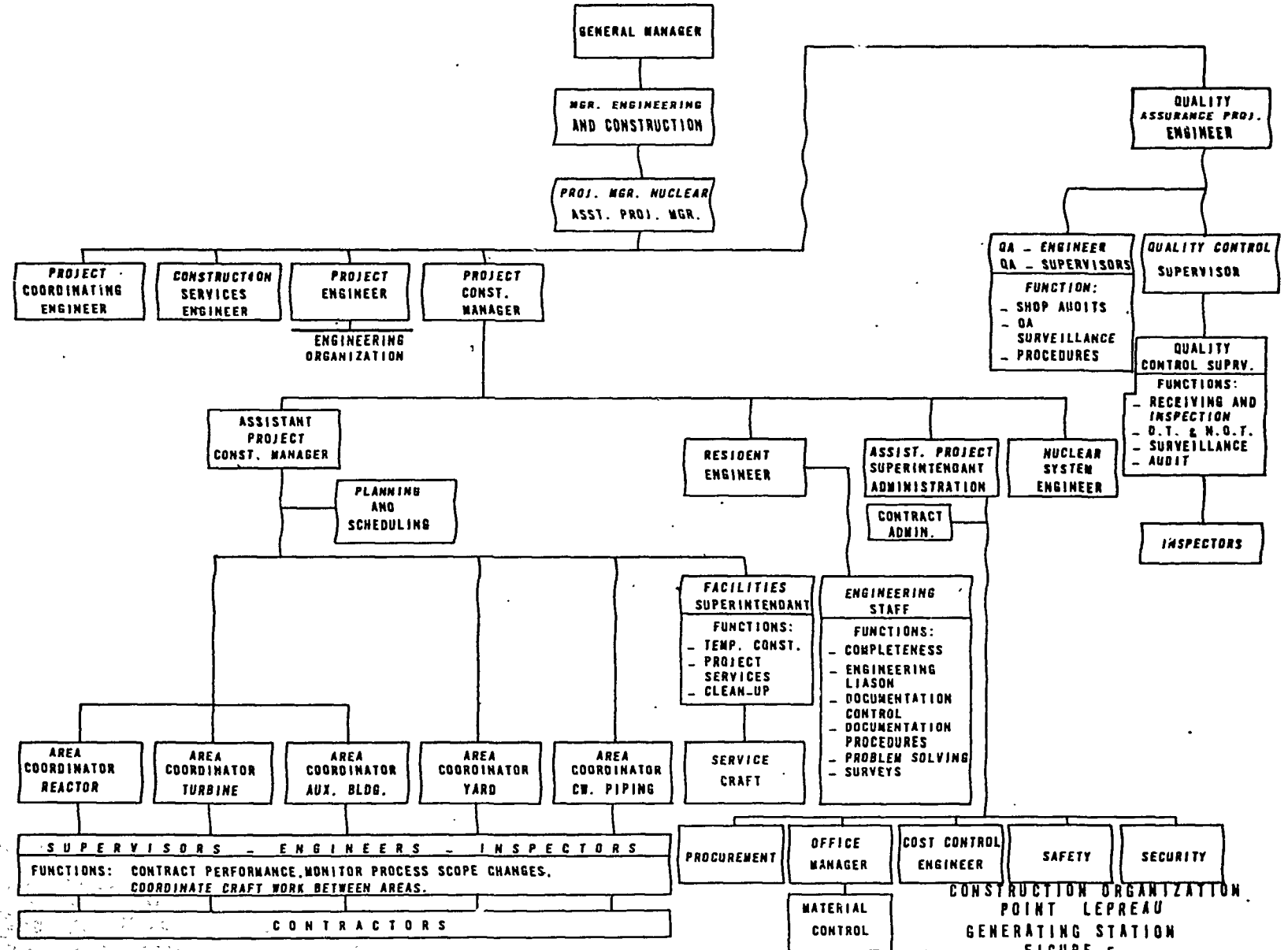
Co-ordination of station design is carried out by the Project Engineering group.

CPM schedules are being developed for engineering, procurement, construction, and commissioning. These CPM schedules will form the basis for the "working" schedules used by various levels of management for control and reporting. A computerized material control system monitors every item of equipment purchased for the plant.

The Construction Organization is shown in Fig. 5. The Project is unique in Canada in that all construction work will be done by contractors.

N B Power is implementing a quality assurance program applicable to all suppliers of equipment and construction work. Procedures are being established to attain shop and construction performance in accordance with specification requirements. Contractors procedures are being reviewed for compl'ance with requirements. Inspections are being conducted during manufacture and installation as necessary to check performance, and a sampling and testing program is being organized. Records of all inspections and tests are being maintained.

Cost reporting systems are operated to provide both an



CONSTRUCTION ORGANIZATION
POINT LEPREAU
GENERATING STATION
FIGURE 5

accurate forecast of final project cost and accurate cash flow estimates. The final cost forecast is periodically adjusted as actual costs are committed to reflect the trend of the job as closely as possible. THE CPM system provides a cost forecasting feature which allows accurate project cash flow estimates on a month to month basis in advance, based on scheduled work and money committed.

6. FINANCING AND SCHEDULE

New Brunswick is the first province to have 100% equity in its first nuclear project and to arrange for all of the financing. A portion of the debt financing will be obtained through N B Power's normal commercial sources and 50% of the total cost will be borrowed from the Federal government. N B Power will bear full financial risk of the project including the cost of the physical assets and interest and escalation during construction and commissioning.

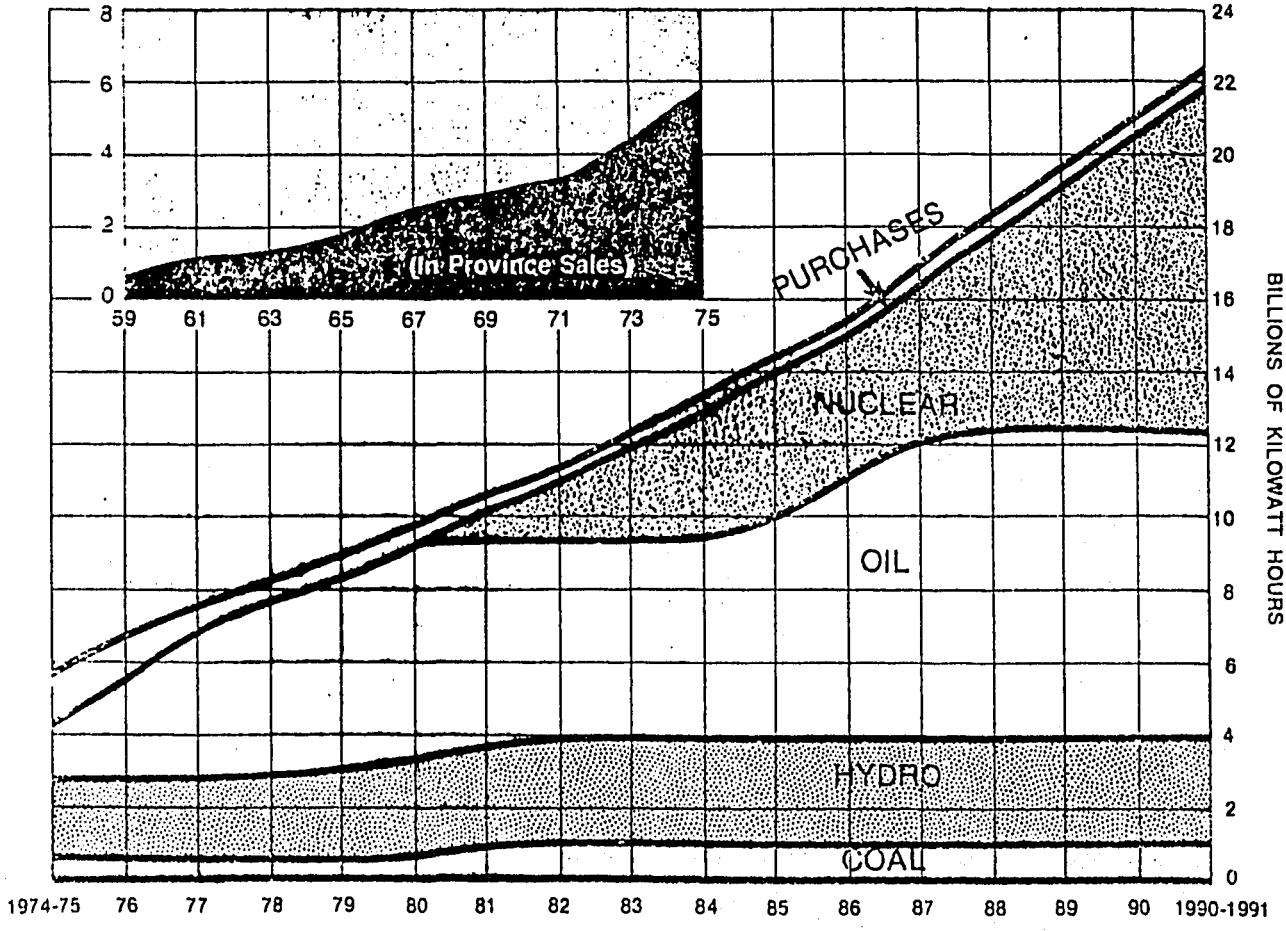
The schedule calls for an "in service" date of 67 months from date of first announcement of the nuclear program in March 1974. This is a very tight schedule. Labour disputes and manufacturers working at or over capacity can easily lead to delays. The high cost of delay demands close control over all aspects of the work.

7. FUTURE NUCLEAR PLANS

A comprehensive public information program is on-going to improve public understanding of the need, safety, security, competitive costs of nuclear power, and the role it must play in

FIGURE 6

New Brunswick (in Province) Estimated Annual Generation (by source)



N. B.'s expanding economy.

In addition to the design and construction activities, both in and out-of-Province operation and maintenance training programs will begin this year. Key personnel for station operations have been taken on staff. The number of personnel attached to various nuclear organizations will be increased and it is expected that by 1978, 70% of the operations staff will have been hired and licensed.

The uncertainty in supply and instability in price of fossil fuels will make nuclear generation the preferred base load source for future expansion in N. B. (Fig. 6). Plans call for a second unit at Point Lepreau and the development of a northern site.

We are but a few months along on our first nuclear plant and little time exists at this stage for retrospection. Nevertheless the feeling exists that perhaps we assessed quite accurately the magnitude and scope of the engineering problems associated with such a project, but we did not appreciate the extent of the environmental considerations. We have spent and are spending considerable time and money on aspects such as siting, environmental assessment, cooling water system design, and anti-nuclear propaganda; most of which we felt would have been resolved at this stage of the Canadian nuclear program. It seems the same anti-nuclear arguments are presented with each new station, and environmental and siting criteria are no where near standardized. Hopefully, for future nuclear stations these considerations will represent a more reasonable proportion of total project effort.

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