

# Transmission Line Route Planning Process — Ontario Hydro's Experience

By **GEORGE L. WORTMAN**

In this article, I would like to discuss how high voltage transmission line routes are planned in Ontario. I will cover where the planning takes place, our transmission system expansion program, and how we do the planning including the process and organization points of view. Finally, I will discuss a typical route selection project and leave with you some thoughts on the problems and benefits of the current process here in Ontario.

The Province of Ontario lies roughly in the centre of Canada and occupies the northern shores of the Great Lakes system in North America. While many of the rivers flow southward into these Great Lakes and on to the Atlantic Ocean, some in northwestern Ontario flow northward toward the Arctic Ocean. Some of Canada's richest farmland lies in the southwestern part of the province while the northern and central areas are rich in forest and mineral resources. It is highly industrialized and populated in a wide band around the western half of Lake Ontario, the so-called "Golden Horseshoe." The supply of electricity to the people of the province is the responsibility of Ontario Hydro.

## **Ontario Hydro**

Ontario Hydro, originally known as HEPC, was established by law in 1906. The Chairman and the Board of Directors are appointed by the Government of Ontario.

Our corporate goal has been stated recently as follows: "To meet the requirements of the Ontario community for electric service, including the manner of its provision, so as to result in the greatest overall benefit to that community and in the lowest cost to the customer for that service over the long term."

In more tangible terms this means we generate the electricity and transmit it around the province to serve 779,000 customers directly and to supply 334 municipal utilities that in turn service 2,058,000 customers.

To keep up with the demand for electricity, the corporation now operates more than 70 generating stations, 200 transformer stations, and 700 distributing stations. These stations are interconnected by about 40,000 kilometers of transmission lines operating mainly at voltage levels of 115 kilovolt (KV), 230 KV and 500 KV. Total assets are in excess of \$12 billion.

## **Transmission Program**

In the past few years, because of energy conservation, a sluggish economy and large rate increases, the demand for electricity in Ontario has departed sharply from the historical 7 percent growth rate. While current load forecasts point to lower growth rates over the next decade some new transmission facilities will be required.

Figure 1 indicates the 500 KV network which is existing and under construction in southern Ontario. Major regional studies are underway in southwestern and eastern Ontario to determine what new bulk transmission connections are required and where they should be. These lines are needed to meet projected electric demand in these areas in the late 1980s.

In total, we estimate that 1,700 kilometers of 500 KV and 1,730 kilometers of 230 KV lines will be required to be placed in service in the period 1980 to 1990.

## **Traditional Methods**

To consider the planning process through which this transmission program must pass it is useful to look at the life cycle of a

typical transmission line. Figure 2 illustrates the major stages and this article will focus on the ones between "Statement of Need" and "Line Placed In Service."

Before 1970, Ontario Hydro's planning work to locate a transmission line would begin with the study of various available maps and aerial photography. Alternative routes would be spotted to avoid existing and proposed residential and commercial developments, and areas of scenic significance and high construction cost while being as short as possible.

These would be refined by field inspection, compared from an engineering and economic point of view, and the best one identified.

Representatives of several Provincial Government Ministries were consulted as well as other planning and regulatory agencies. Local municipalities were asked if the proposed project would conflict with any planned development.

The public, consisting of either interest groups or affected individuals, was not an integral part of the planning process before 1970.

The public's demand for a say in Hydro's planning activities surfaced in 1971 following rejection of the original site chosen for a transformer station in downtown Toronto. This demand reached a peak in 1972 with the concerns expressed on a proposed 500 KV transmission line in southern Ontario. Public concern resulted in the appointment of Dr. Omond Solandt under the Public Inquiries Act to review Hydro's proposed route; the public had asked for and was given the opportunity to comment on Hydro's project studies. As a result, a new alignment for the proposed line was selected and later approved by Government.

## 500 KV Bulk Power Facilities Ontario Hydro East System

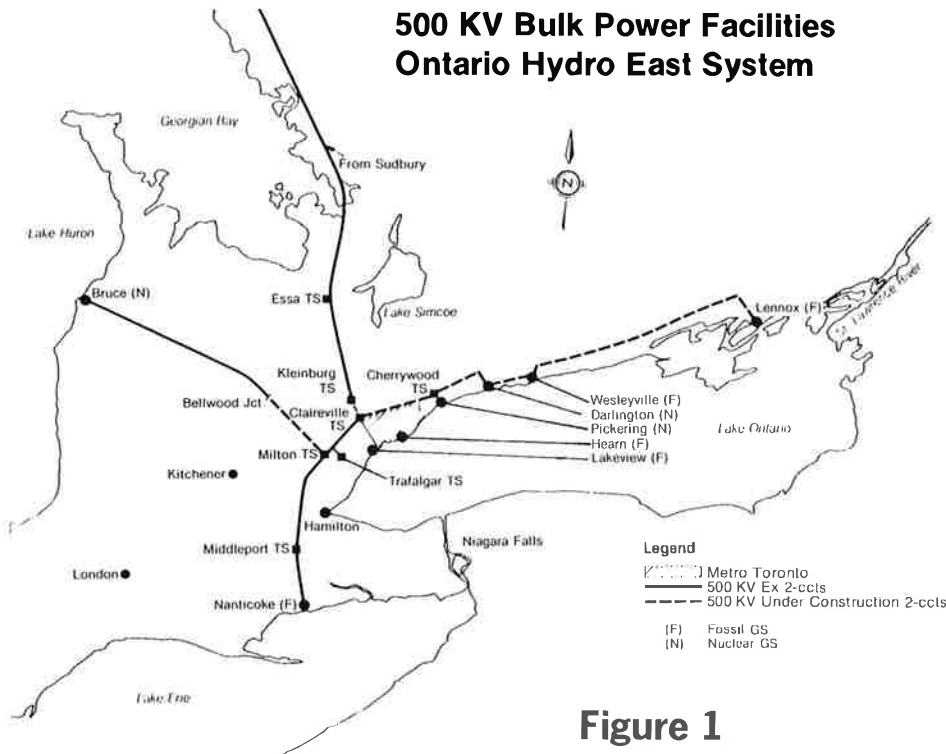


Figure 1

## Project Life Cycle Transmission Lines

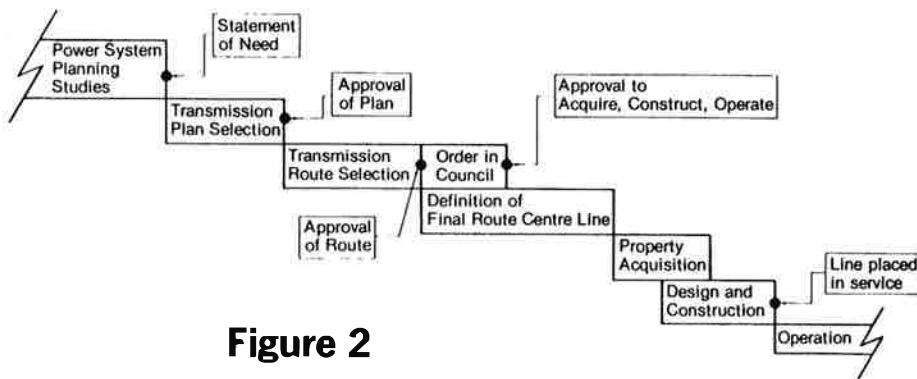


Figure 2

reduced reliability and added costs are substantial. It is estimated that the cost penalty to date for "bottled" nuclear generation at Bruce Generating Station because of the lack of adequate transmission is about \$22 million, most of which is because of the higher cost coal-fired replacement energy.

The events of the early 1970s resulted in two major changes to Ontario Hydro's approach to planning transmission lines: A comprehensive environmental assessment of our proposals and public participation in the planning process.

### Environmental Assessment

The requirement for environmental assessments was made formal in the province by the passage of The Environmental Assessment Act 1975. The initial application of this law was to provincial agencies but in the future this is to be extended to proposals of private corporations. A few major proposed private developments have already been designated for review. A simplified flow diagram of the Act is shown in Figure 3.

The affect of this Act on Ontario Hydro is that we, as proponents, must carry out a comprehensive environmental assessment of each proposed addition to our generation and transmission system. This document is submitted to the Minister of the Environment for review and possible hearings, before we proceed with property acquisition or construction.

The transition to full environmental review has been gradual through selected exemption orders to recognize the urgency of some projects which were under construction or well advanced in the planning. These are now all finished. Very small system additions will only require reporting and consultation with the Ministry of the Environment, but not full review.

There are a large number of minor projects; for example, transmission lines less than eight kilometers. To eliminate the unnecessary delay and work of individual review, Ontario Hydro

During the Solandt Commission in 1972-74, Hydro became increasingly aware that Government approval of many miles of line routes obtained in the 1971-72 period was meaningless. This was because of a lack of involvement by the public and fewer environmental parameters

considered than deemed necessary both by environmental and agricultural groups.

Although originally planned for service in 1975-76, major portions of the 500 KV transmission system remain uncompleted today. The effects of these delays in terms of

submitted a Program Environmental Assessment in April 1978 to cover all projects up to a specific size. Although not yet approved, this document outlines the factors that will be considered and the study process to be applied to each individual project in the class.

If the results indicate acceptable impacts and a high level of public acceptance then Hydro would file a report with the Minister and proceed with the project. If the results are otherwise then an individual environmental assessment would be submitted for formal review.

Although not required by the Act, in the view of the Ministry, an important ingredient of any environmental assessment is public involvement.

### Public Participation

The purpose of our public participation programs is for the public and Ontario Hydro to learn about one another's concerns and needs so that Hydro's activities and project proposals will be more acceptable to the public and approving authorities.

Our venture into public participation has been difficult and we have some shining examples of "how not to do it."

Public involvement has evolved through the mid 1970s until it is now an integral part of our planning process and the staff has become quite comfortable with it.

On large projects, citizen committees with their own elected chairmen, work in partnership with Hydro staff providing local information and the value systems to be applied in the analysis of the environmental data.

Some of the lessons we have learned to date are:

- The public must be involved in the very early stages of the study while matters such as the study area, the number of options, the environmental factors and data to be considered are still flexible.
- The level of participation must be matched to the specific project.

## Simplified Flow Diagram of the Environmental Assessment Act, 1975

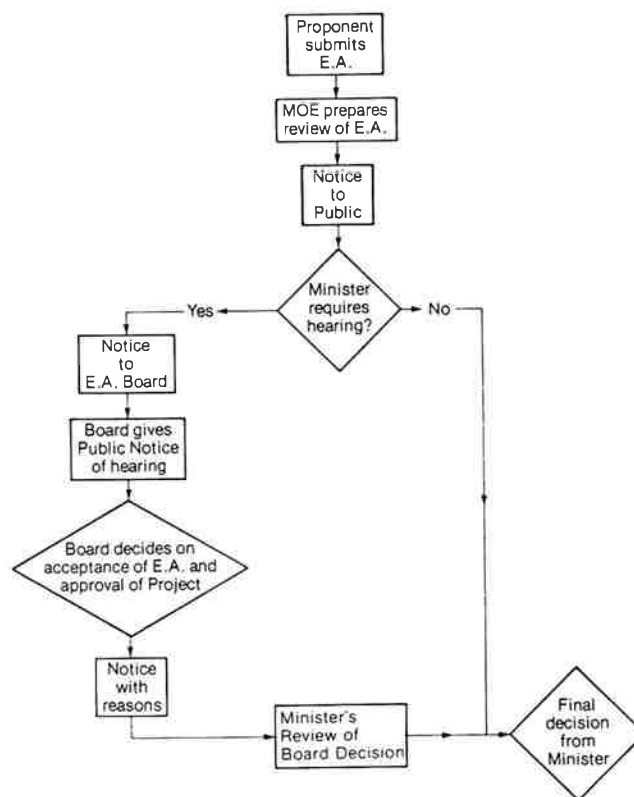


Figure 3

## Transmission Route Planning & Approval Process Ontario Hydro

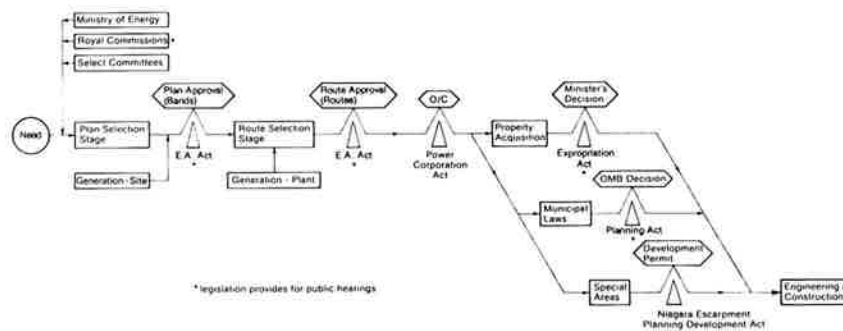


Figure 4

- The study process and analysis techniques must be simple so that the public can see how their values have been input and how they have contributed to the conclusions.
- The corporation must support public involvement by committing the resources, budget and schedule allowances before the project is started.
- The roles of both Hydro and the public individuals/committees must be thoroughly discussed and agreed at the outset of the study.

### Current Process

These new developments have added to the front end of other pieces of legislation, enacted in past years which have an affect on our planning and under which Government approvals must be obtained. Some of the more significant ones are indicated in Figure 4, which may be considered as a simplified version of the current planning and approval process. At the moment, we expect that only a few major transmission projects would be expected to go through two approval stages under the Environmental Assessment Act (E.A. Act).

On the diagram are six locations during the course of the project where the applicable legislation provides opportunities for formal public hearings. In smaller projects only one or two hearings would be triggered; however, on major projects at least three and possibly four hearings before completely separate and independent hearing bodies are expected. These reviews occur at different stages of the project and decisions reached in earlier stage hearings are often called in question at subsequent hearings. At present, the terms of reference for each body are not specific enough to prevent this. Herein lies the major problem for Ontario Hydro with the current approval process."

The Royal Commission on Electric Power Planning (R.C.E.P.P.)

was appointed in 1974 to study long range electric power planning in Ontario. The Commission has identified the duplication for hearings in the existing legislation and we expect that their final report, due this fall, will contain recommendations to resolve it.

### Organizational Response

Now I would like to briefly discuss the impact that this process has had on our organization and the way in which we now conduct our route selection studies.

In 1975, in response to the increasing delays and difficulties in obtaining new generation sites and transmission routes, four departments were pulled together from various parts of the organization to form the Route and Site Selection Division. The mission of this division is to provide generating station facility sites and transmission system routes and sites which meet the requirements of corporate plans and are acceptable to approving authorities. Our operating budget for 1979 is six million dollars. This does not include the cost of acquiring the transmission rights-of-way.

The current transmission work program has 30 active projects which have durations ranging from one to four years. The in-service dates for the lines under study range between 1980 and 1990. A multi-disciplinary team is assigned to each project under the direction of a project engineer. The disciplines on any given team may include biologists, landscape architects, social scientists, foresters, agrologists, urban planners, etc. Each project is separately authorized, designed and funded and conventional project management techniques are used to control the work.

Once the final route is established and all approvals obtained, the project is transferred to another division for property acquisition, final design and construction.

### Route Selection Studies

The major steps of a typical transmission line route selection study are shown in Figure 5. While a continuous dialogue is maintained with the public throughout the study, we have indicated the positions where major reviews usually take place. In addition to engineering and economic

### Generalized Flow Diagram Route Selection Studies

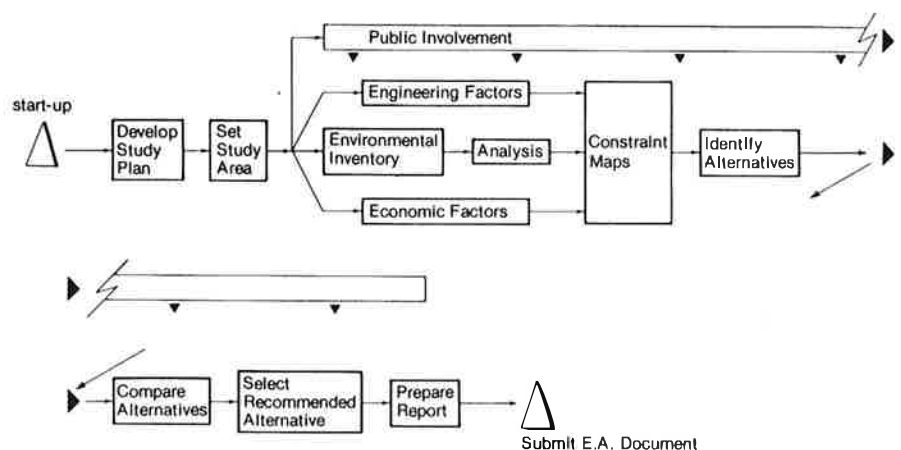


Figure 5

factors, a number of environmental factors are studied. These include: Human settlement, timber production, mineral resources, wildlife, recreation, aquatic communities, terrestrial communities, appearance of the landscape, and agriculture. Following an initial period of study design, a study area is chosen. One of our study areas covered about 20,000,000 ha (75,000 square miles) and was used for studies of a high capacity tie line in northern Ontario between our east and west operating systems.

The information is gathered within this area and a value system applied to it. This analysis results in a map of the area depicting the various levels of constraint to the construction and operation of a transmission line. In this instance, the analysis and mapping was done by computer and automatic plotters. Alternative routes were then identified through the areas of least constraint and following engineering, economic and environmental comparison a preferred route is selected. An Environmental Assessment Report is then prepared and submitted for approval to the Government. This launches us into the approval process which we discussed earlier.

Finally I would like to leave you with some personal thoughts about the problems and benefits of the Ontario process based on our experience to date. The problems lie in three main areas - extended lead times, higher costs and increased uncertainty, and although they are interwoven, I will deal with them separately.

For our purpose, the words "lead time" mean the estimated period of time from initiation of project planning until the completed facilities are placed in-service. Environmental assessment review and public involvement have added to the traditional lead times for transmission lines. For major projects lead time up to eight years must be planned. For small lines and stations this may be reduced to five years. Such long lead times reduce the accuracy of scheduling and estimating and the sense of urgency about making

important early planning decisions is eroded. They also make it difficult for Hydro to respond to the needs of private industry that are not under the same constraints with respect to lead times and approvals.

Information normally reviewed annually by the corporation such as load forecasts, financial position and system planning criteria must be plugged in each year, sometimes requiring deferments or cancellations or review of previous work. The number of assumptions is increased particularly with respect to which elements of the system, now in the latter planning stages, will actually be placed in service as planned.

Higher planning costs, of course, have resulted because much more planning work and documentation is required. Higher capital costs have also resulted because the newer routes tend to have more angles and design problems and because of increased environmental constraints on construction activity.

Putting aside, for a moment, the questions of fairness and justice, in the past the issues of location and compensation were largely between the landowners and Hydro. Now with the introduction of other parties and public involvement, potentially affected people who try to make their own personal planning decisions are left in a state of uncertainty for several years.

Turning now to the benefits of the process, I think they also fall in three main areas: The non-judicial nature of the process, public understanding, and broadened considerations in reaching planning decisions.

The legislation which controls the planning process for transmission lines in Ontario has been framed so that Government appointed Boards and Commissions, and not the Court system, conduct the public hearings and make the final decisions. In some cases this may be appealed to the Government of Ontario. Subsequent recourse to the Courts of the land, with

the serious delays which result, has been confined to only a few projects.

The formal public hearings and our policy of public participation is resulting in increasing understanding of the concerns and needs of the public and serves the corporation well as a "listening post" to assess the effectiveness of its policies and activities. Hydro reports to the Provincial Government and the final approvals for our major works are of a political nature. We therefore put forward not only the engineering, economic and environmental considerations but also the views of the public involved in the planning studies.

The introduction of the public and additional reviewing agencies has resulted in a broadening of the factors which are studied and documented before recommendations are made. This is improving the quality of the final planning decision and ensures that it is in tune with the needs of today's society.

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