

AECL-7426

ATOMIC ENERGY
OF CANADA LIMITED



L'ÉNERGIE ATOMIQUE
DU CANADA LIMITÉE

**NUCLEAR PROCESS STEAM FOR INDUSTRY
POTENTIAL FOR THE DEVELOPMENT OF AN INDUSTRIAL ENERGY
PARK ADJACENT TO THE BRUCE NUCLEAR POWER DEVELOPMENT**

**Vapeur industrielle d'origine nucléaire pour l'industrie
Potentiel de développement d'un parc industriel contigu au
complexe électronucléaire de Bruce**

W.A. SEDDON

Chalk River Nuclear Laboratories

Laboratoires nucléaires de Chalk River

Chalk River, Ontario

November 1981 novembre

ATOMIC ENERGY OF CANADA LIMITED

NUCLEAR PROCESS STEAM FOR INDUSTRY

Potential for the Development of an Industrial Energy Park
Adjacent to the Bruce Nuclear Power Development

by

W.A. Seddon

EXECUTIVE SUMMARY

Prepared for

THE BRUCE COUNTY ECONOMIC DEVELOPMENT COMMITTEE

and the

ONTARIO ENERGY CORPORATION

Issued previously as CRNL-2141, 1980 December

Advanced Projects and Reactor Physics Division
Chalk River Nuclear Laboratories
Chalk River, Ontario, Canada
1981 November

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L'ENERGIE ATOMIQUE DU CANADA, LIMITEE

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par

W.A. Seddon

Résumé

Le présent rapport récapitule les résultats d'une étude industrielle financée par trois organismes, à savoir le Conseil du Comté de Bruce, *Ontario Energy Corporation* et L'Energie Atomique du Canada, Limitée. Cette étude a été effectuée en collaboration avec *Ontario Hydro* et le ministère ontarien de l'Industrie et du Tourisme.

L'objectif de l'étude était d'identifier et d'évaluer les besoins futurs des industries dévoreuses d'énergie et d'établir dans quelle mesure elles sont intéressées au concept d'un parc industriel contigu au complexe électronucléaire de Bruce. Le parc considéré tirerait parti de l'infrastructure des réacteurs CANDU existants et du fait que la Commission électrique ontarienne (*Ontario Hydro*) est actuellement en mesure de produire dans ses centrales nucléaires de la vapeur et de l'électricité à un coût deux fois moins élevé que celui de l'énergie produite dans les centrales alimentées au charbon ayant une capacité comparable.

Quatre industries dont les besoins totaux en vapeur atteignent environ 1×10^6 lb/h sont prêtes à considérer sérieusement l'emploi de la vapeur d'origine nucléaire. Leurs usines nécessiteraient un investissement en capital de plus de 200 millions de \$ et elles donneraient directement du travail à 350-400 personnes. Ces industries ont demandé à la fin de 1980 une indication ferme du prix de la vapeur afin de pouvoir effectuer leurs évaluations économiques globales. Elles considèrent toutes les quatre que des installations d'amarrage sont essentielles pour leurs opérations et trois d'entre elles requièrent un port à quelques kilomètres du complexe de Bruce.

D'une façon générale, ce sont les coûts élevés de transport et l'absence d'installations d'amarrage qui ont été considérés comme les principaux inconvénients du site de Bruce.

Avec l'aide de l'organisme précité, *Ontario Energy Corporation*, des mesures sont prises actuellement pour coordonner et satisfaire les besoins de l'industrie.

Précédemment publié dans le document CRNL-2141 daté de décembre 1980

Division de physique des réacteurs et des projets avancés
Laboratoires nucléaires de Chalk River
Chalk River, Ontario, Canada

Novembre 1981

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Adjacent to the Bruce Nuclear Power Development

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W.A. Seddon

ABSTRACT

This report summarizes the results of an industrial survey jointly funded by the Bruce County Council, the Ontario Energy Corporation, Atomic Energy of Canada Limited and conducted with the cooperation of Ontario Hydro and the Ontario Ministry of Industry and Tourism.

The objective of the study was to identify and assess the future needs and interest of energy-intensive industries in the concept of an Industrial Energy Park adjacent to the Bruce Nuclear Power Development. The proposed Energy Park would capitalize on the infrastructure of the existing CANDU reactors and Ontario Hydro's proven and unique capability to produce steam, as well as electricity, at a cost currently about half that from a comparable coal-fired station.

Four industries with an integrated steam demand of some 1×10^6 lb/h are prepared to seriously consider the use of nuclear steam. Their combined plants would involve a capital investment in excess of \$200 million and provide direct job opportunities for 350-400 people. They require, by the end of 1980, a firm indication of steam prices on which to base their overall economic assessment. All consider docking facilities essential to their operations with three of the four specifying a port within a few miles of the Bruce site.

In general, the high costs of transportation and the lack of docking facilities were considered to be the major drawbacks of the Bruce location.

With the backing of the Ontario Energy Corporation, efforts are currently underway to satisfy and coordinate the needs of industry.

Issued previously as CRNL-2141, 1980 December

Advanced Projects and Reactor Physics Division
Chalk River Nuclear Laboratories
Chalk River, Ontario, Canada
1981 November

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Author's Note

Since this report was originally prepared and issued, considerable progress has been made towards the development of the Bruce Energy Centre. Further enquiries should be directed to

Bruce Energy Centre Development Corporation
101 Bloor Street West
5th Floor
TORONTO, Ontario
M5S 1P8

Non-metric units have been used because these are the most commonly quoted units in industry.

$$1 \times 10^6 \text{ lb/h} = 0.126 \text{ kg.s}^{-1}$$

$$1 \text{ MBtu} = 1.055 \text{ GJ}$$

$$1 \text{ barrel} = 0.159 \text{ m}^3$$

$$10^6 \text{ cu. ft.} = 2.83 \times 10^4 \text{ m}^3$$

$$1 \text{ mile} = 1.6 \text{ km}$$

NUCLEAR PROCESS STEAM FOR INDUSTRY

Potential for the Development of an Industrial Energy Park Adjacent to the Bruce Nuclear Power Development

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NUCLEAR PROCESS STEAM FOR INDUSTRY

Potential for the Development of an Industrial Energy Park
Adjacent to the Bruce Nuclear Power Development

EXECUTIVE SUMMARY

Introduction

This report describes the results of an industrial survey jointly funded by the Bruce County Council, the Ontario Energy Corporation, Atomic Energy of Canada Limited and conducted with the cooperation of Ontario Hydro and the Ontario Ministry of Industry and Tourism.

The objective of the study was to identify and assess the future needs and interest of energy-intensive industries in the concept of an Industrial Energy Park adjacent to the Bruce Nuclear Power Development. The proposed Energy Park would capitalize on the infrastructure of the existing CANDU reactors and Ontario Hydro's proven and unique capability to produce steam, as well as electricity, at a cost currently about half that from a comparable coal-fired station.

At present, the Bruce steam handling and transport system has a capacity of about 16×10^6 lb/h, of which up to 10×10^6 lb/h could be made available for industrial purposes. This latter amount corresponds to approximately one third of Ontario's current industrial steam requirements and, assuming 85% conversion efficiency, the energy equivalent of about 60,000 barrels of oil or 340 million cubic feet of natural gas per day.

Because of assured indigenous uranium resources and the relatively low fuelling costs, nuclear generated steam now offers industry an alternative energy supply with the advantages of long-term security and relatively inflation-proof energy costs.

Industrial Survey

Based on the above potential, an information pamphlet and associated questionnaire (Appendix I) was prepared and mailed to 103 selected industries with operations located in Ontario. Forty-seven replies were subsequently received and followed up by telephone, further correspondence, and personal interviews with senior executives of eight different companies. Twenty-two returns expressed varying degrees of interest ranging from

a wish to be kept informed to specific requests for more detailed information. The remainder showed no interest in pursuing the concept any further. In general, the high costs of transportation and the lack of docking facilities were considered to be the major drawbacks of the Bruce location.

Four industries with an integrated steam demand of some 1×10^6 lb/h are prepared to seriously consider the use of nuclear steam. Their combined plants would involve a capital investment in excess of \$200 million and provide direct job opportunities for 350 - 400 people. They require, by the end of 1980, a firm indication of steam prices on which to base their overall economic assessment. All consider docking facilities essential to their operations with three of the four specifying a port within a few miles of the Bruce site.

Corporate decisions on the new plants are scheduled for early 1981.

Steam Costs*

For the purposes of discussion with potential industrial users, Ontario Hydro provided preliminary cost estimates for the supply of medium pressure steam to the Bruce site boundary, a distance of about 2 miles. These estimates assume that steam supplied to outside customers will result in curtailed electrical production. This curtailing steam is costed on the basis of a system average replacement value of an equivalent amount of steam generated elsewhere by nuclear and coal-fired stations. Because of the higher overall costs associated with coal-fired stations, the system average steam cost is substantially higher than the cost of nuclear steam alone.

The most favourable estimate of \$3.21/MBtu assumed steam demands of 300,000 - 500,000 lb/h at an 80% load factor. It is important to note that about 45% of this cost is associated with replacement steam charges and the costs of transporting the steam to the site boundary.

In the majority of cases, industrial response to the question relating to steam cost indicated that costs varying from \$0.60 to \$2.00 less than the above estimate were necessary to provide a strong incentive for industrial development at Bruce. The large differential between industry's perception and the Ontario Hydro estimate reflects the need to satisfy two basic business concerns:

* See Appendix III for revised costs presented 1980 November 5.

- (a) the need for an energy cost lower than achievable with conventional fuels in order to offset the higher transportation costs envisaged for the supply of raw materials and/or delivery of finished products, and
- (b) the requirement for after tax corporate returns on investment of not less than about 20%.

To put Ontario industrial energy costs into perspective, steam is now most commonly generated using natural gas as the primary fuel. At the time of the survey (1980 May to August) natural gas was available at \$2.30 to \$2.40/MBtu resulting in industrial steam costs ranging from \$3.00 to \$3.50/MBtu*. However, some of the larger industries experience the benefit of co-generation facilities and so produce electricity for their own purposes. Total unit energy costs are therefore less than achievable with conventional steam boilers and purchased electricity.

Nuclear steam must therefore also be able to compete favourably with co-generation cycles.

Industrial projections show total energy costs escalating at not less than 10% per year for the next 5 to 10 years. Bruce nuclear steam is projected to increase at 4.7% per year for the next 20 years and, consequently, its competitive position should be considerably enhanced with time.

Developments Stemming from the Survey

As a result of the response to the survey, several initiatives have already been taken in an effort to satisfy the needs of industry.

- (a) The Ontario Energy Corporation has been established as the sole agent for the sale of thermal energy from the Bruce Nuclear Power Development. Discussions with Ontario Hydro on steam pricing are in progress.
- (b) The Bruce Thermal Utility, composed of partners in the Bruce AgriPark joint venture, has been incorporated to transport heat energy from the Ontario Hydro site boundary to future industrial users.

*The 1980 September 1 natural gas price increase to \$2.60/MBtu and, stemming from the federal budget on 1980 October 28, a further \$0.30 tax to \$2.90/MBtu will have raised steam costs proportionately.

- (c) The Ontario Energy Corporation is endeavouring to establish an agency to promote and coordinate the entire development.
- (d) The County of Bruce in conjunction with Bruce Township and Ontario Hydro are evaluating the availability of land suitable for industrial development. Two phases are contemplated. Phase one involves approximately 700 acres of land owned by Ontario Hydro and located adjacent to the Bruce Nuclear Power Development site boundary. It has been suggested that Ontario Hydro could lease this land for immediate compatible development.

Phase two involves a long-term, comprehensive plan involving up to 10,000 acres of land located within the five mile controlled development zone.

- (e) In conjunction with the Ontario Energy Corporation, preliminary discussions have been held with Public Works and Transport Canada regarding the feasibility of docking facilities in the vicinity of the Bruce site. A presentation was made to the Great Lakes Seaway Task Force (Appendix II) pointing out the need and importance of a deep water port to industrial development at Bruce.

Major Conclusions

1. Based on the substantial interest shown by four major companies, continuing and immediate efforts to implement the Bruce Industrial Energy Park are justified.
2. The provision of harbour facilities is essential if the above opportunity is to be realized.
3. In general, industries consider that the Bruce location has the disadvantage of high transportation costs associated with the supply of raw materials and delivery of finished products.
4. To offset increased transportation costs and justify capital investment, the overall industrial response indicates that steam prices must be significantly less than achievable using natural gas as the primary fuel. The clear implication is a price below \$3.00/MBtu but with a wide variation depending on the individual respondents.

Principal Recommendations

1. Some incentive steam pricing policy needs to be established to encourage industrial expansion at Bruce.
2. A feasibility study should be initiated with respect to the provision of a deep water harbour within the immediate vicinity of the Bruce Nuclear Power Development.
3. Efforts to establish a coordinating agency, which would assume responsibility for the entire development, should be completed as soon as possible.
4. Further discussions, arranged either through the above agency or the Ontario Energy Corporation, should be continued, when appropriate, with the four industries currently prepared to consider location at Bruce. Their immediate questions concerning steam prices need to be answered without undue delay. Otherwise, Bruce is likely to be eliminated from any further consideration.
5. Based on (a) the 1980 Speech from the Throne in which the Ontario government recognized the strategic importance of nuclear energy and expressed its intent to encourage its future development for industrial purposes; and (b) the significant and immediate opportunity revealed by this survey: it is recommended that the Ontario Ministry of Energy consider the allocation of special funds which can be used to stimulate the entire development. Although cost information is not yet available, it is likely that such funds would be needed to support the provision of docking facilities and assist in the construction of the main steam transport system to the site boundary.

A P P E N D I X I

I N F O R M A T I O N P A M P H L E T A N D

I N T R O D U C T O R Y L E T T E R S

FIRST PRINTING OF PAMPHLET - 1980 MAY

SECOND PRINTING - 1980 AUGUST



NUCLEAR PROCESS STEAM FOR INDUSTRY

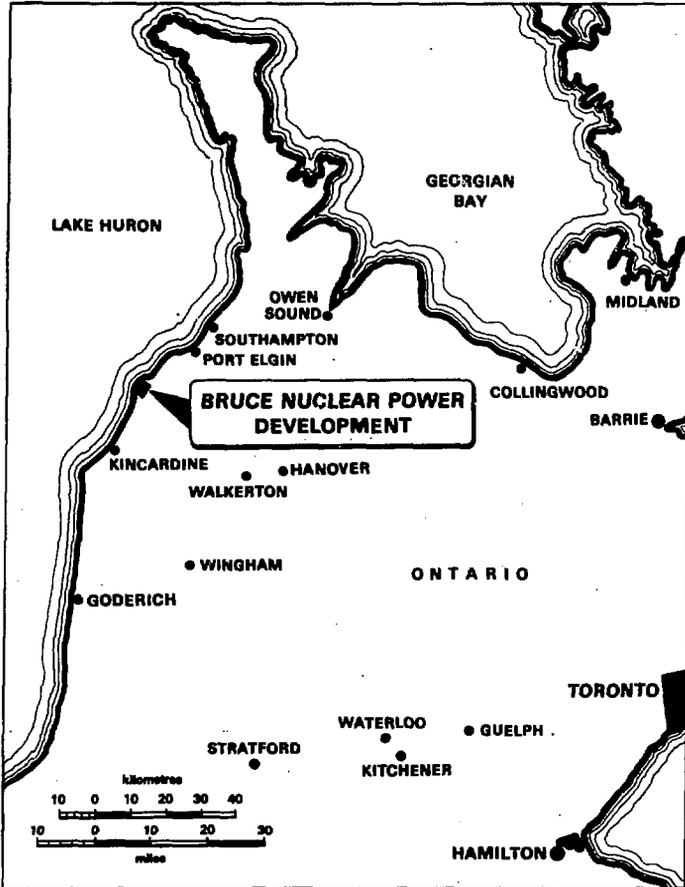
**POTENTIAL FOR DEVELOPMENT OF AN INDUSTRIAL PARK AT THE
BRUCE NUCLEAR POWER DEVELOPMENT, BRUCE COUNTY, ONTARIO**



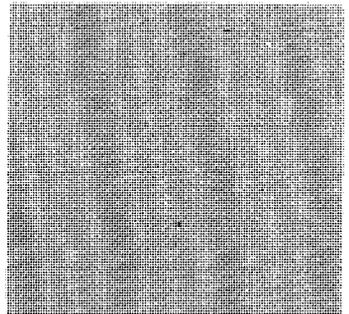
BRUCE NUCLEAR POWER DEVELOPMENT
BRUCE ENERGY PARK
STEAM SUPPLY
STEAM COSTS
ELECTRICITY COSTS

LAND AVAILABILITY AND TRANSPORTATION
LABOUR FORCE AND HOUSING
COMMUNITY RESOURCES AND ATTITUDES
ENERGY SELF-SUFFICIENCY

August 1980



Town	Population (1979)
Owen Sound	19,732
Southampton	2,733
Port Elgin	5,949
Kincardine	5,481
Walkerton	4,591
Hanover	5,907
Wingham	2,859
Goderich	7,408

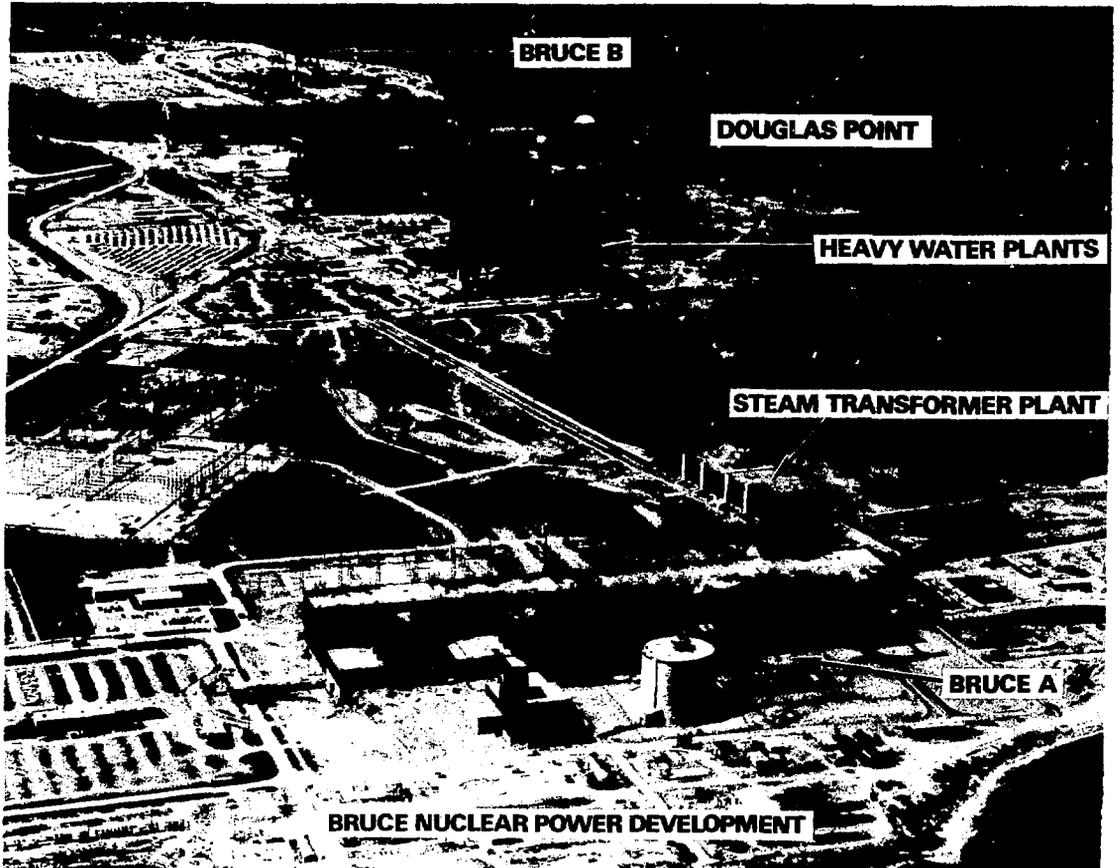


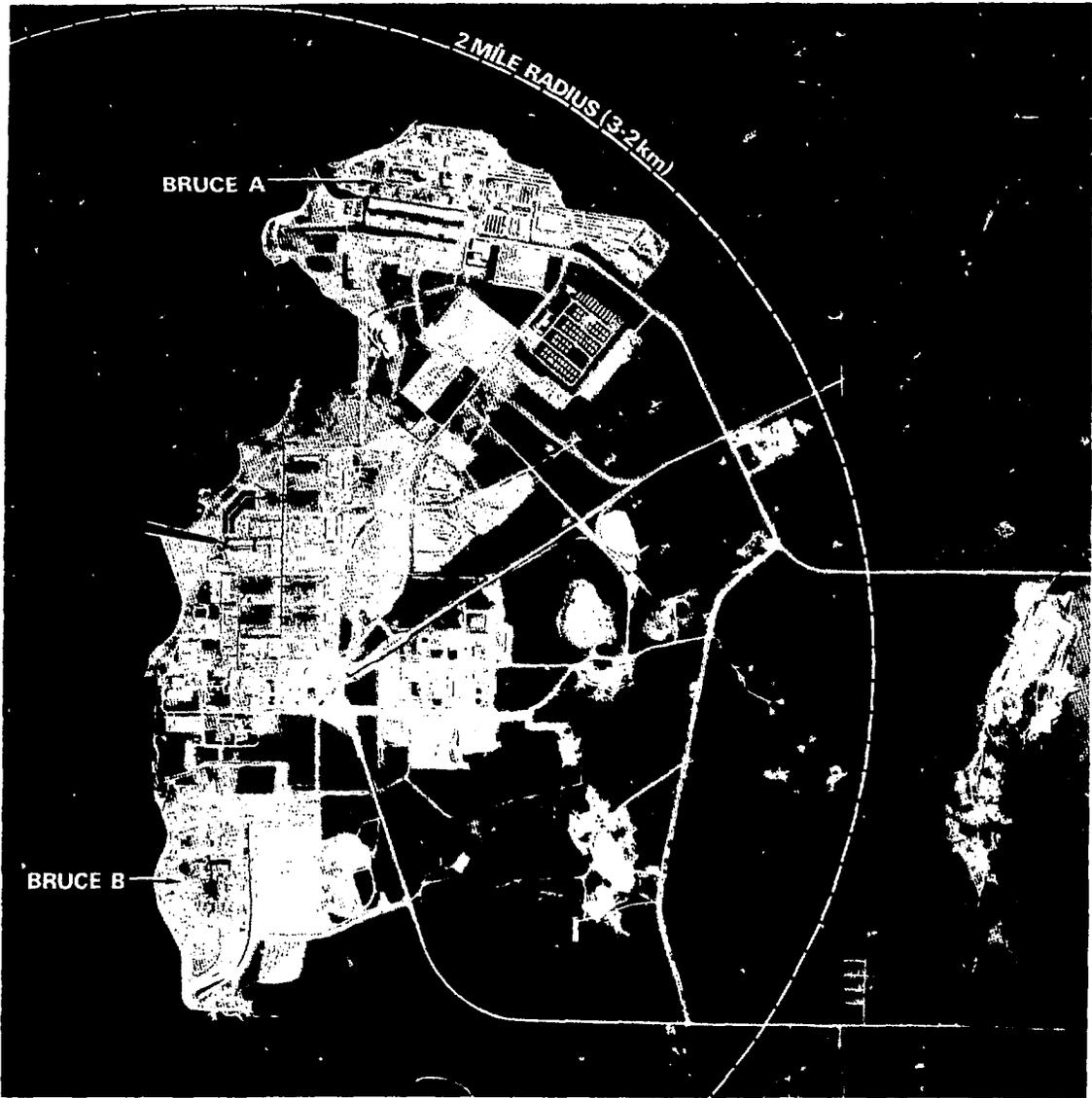
BRUCE NUCLEAR POWER DEVELOPMENT

Owned and operated by Ontario Hydro, the Bruce Nuclear Power Development will, on completion in 1987, be one of the world's largest nuclear energy centres. It will contain three nuclear generating stations, two heavy water production plants, a steam supply system and associated support facilities. At the present time five nuclear reactors, consisting of Douglas Point and the four-unit Bruce A Nuclear Generating Station, have a combined electrical capacity of 3200 megawatts (MWe). Expansion to 6200 MWe is on schedule with the construction of the four-unit Bruce B Nuclear Generating Station - essentially a duplicate of Bruce A. With all nine reactors in operation, the output will be sufficient to meet the peak electrical demands of a city more than twice the size of Metropolitan Toronto.

BRUCE ENERGY PARK

The Bruce A and Douglas Point reactors are unique in that they are producing large quantities of process steam for the production of heavy water, as well as electricity for the Ontario grid. This large-scale and efficient use of nuclear steam is the basis of an imaginative new concept - an industrial Energy Park adjacent to the Bruce Nuclear Power Development. Already a group of private investors and the Ontario Energy Corporation have initiated an Agripark to use low temperature (40 - 60°C) heat from the Bruce reactors for greenhouses and a fish farm. A one-acre experimental greenhouse is now in production, and eventual plans call for 150 acres of greenhouse sustained year-round by low grade heat.





Aerial view of the Bruce Nuclear Power Development. The dotted line indicates the approximate location of the site boundary.

STEAM SUPPLY SYSTEM

For heavy water production, high pressure steam, at 600 psig, 490°F, is diverted from the turbine inlet and converted by steam transformers into medium pressure steam at 180 psig, 380°F. Augmented by an oil-fired back-up steam plant, the existing medium pressure steam handling system has a total capacity of some 16 million pounds per hour. This is more than sufficient to serve the steam requirements of four heavy water plants. Although originally designed for this purpose, recent cancellations and postponements in the construction of two heavy water plants has left approximately 10 million pounds per hour of steam handling capacity in excess of Ontario Hydro's foreseeable requirements. This excess handling capacity offers a unique opportunity to serve large industrial steam demands. Up to several million pounds per hour of medium pressure steam can be provided with a reliability of greater than 99%.

Steam at pressures approaching 600 psig could also be made available, but would entail the construction of an additional steam transformer and distribution system.

STEAM COSTS

Ontario Hydro is prepared to supply steam to the Bruce site boundary, a distance of about two miles. Estimated total energy costs are very dependent on overall demand, load factor, and the possibility of condensate return. Escalation in steam costs over the next 20 years, however, is projected to be 4.7% per annum, which is about half the current rate of inflation.

Based on Ontario Hydro's own experience, the costs of nuclear generated steam are significantly less than those obtainable with fossil fuels. Even with the cheapest alternative (coal) the overall cost of nuclear generated steam (or electricity) is now about one-half that from a comparable coal-fired station.

ELECTRICITY COSTS

Effective January 1, 1980, the energy cost for a large industrial user is 1.20 cents per kWh. Additional peak power charges depend on the supply voltage and class of service. For example, with a 115 kV supply, rates range from \$0.76 to \$5.14 per kW per month for standby service or firm power, respectively.

LAND AVAILABILITY AND TRANSPORTATION

About 10,000 acres of unserved land suitable for industrial development lie within a five mile radius of the Bruce Nuclear Power Development. Prices range from \$1,200 to \$2,000 per acre. Water and sewer services could be provided independently or in conjunction with Ontario Hydro's existing facilities.

Bruce County and Bruce Township are currently proceeding with official plan amendments to permit the establishment of an industrial park. Convenient access is available via road and rail transport. Long term potential exists for harbour development and access to the Great Lakes. Small grass strip airports exist in neighbouring communities. A larger federal airport also serves Warton about 40 miles to the north.

LABOUR FORCE AND HOUSING

Because of a decline in the construction work force at the Bruce complex, the local labour market is expected to be a continuing source of both skilled and unskilled male and female workers. The total labour force is currently about 5540 of which some 2500 are engaged in construction.

A large variety and substantial supply of affordable housing is to be found in neighbouring communities. The 1979 residential property taxes in Kincardine and Port Elgin averaged about \$600 per household.

COMMUNITY RESOURCES AND ATTITUDES

Bruce County and the individual townships have a strong commitment to nuclear power and industrial development. Nearby towns are well equipped and able to accommodate significant growth within the short term future. The communities provide all the basic municipal services and utilities along with schools, hospitals, accommodation, commercial facilities, and a significant fraction of the existing and potential labour force. Recreational opportunities are wide in scope and comparable to those found in larger urban centres.

Overall, a very supportive, capable and positive attitude is taken towards industrial diversification and expansion.

ENERGY SELF-SUFFICIENCY

Reducing imports of oil and coal is more than good business — it is a national priority. The Province of Ontario has already taken a significant step towards energy self-reliance by using Canadian uranium to replace expensive fossil fuels for the generation of electricity.

With a total installed capacity of 5064 MWe, CANDU nuclear power stations built by Ontario Hydro have already saved more than \$1.5 billion dollars in foreign exchange on the purchase of imported coal. By 1990, it

is projected that this figure will have grown to \$16 billion and total nuclear capacity to almost 13,000 MWe.

Daily production at the Bruce complex, alone, corresponds to the energy equivalent of 115,000 barrels of oil, or 23,000 tons of coal.

The next bold initiative is to use part of the nuclear energy directly in the form of steam for industrial processes. Using CANDU reactors, Ontario's indigenous uranium offers both long term security of supply and relatively inflation-proof energy costs. Industry is now invited to share in this challenge and opportunity.



Cultivation of the first winter crop of tomatoes and cucumbers at the Bruce AgriPark.

BRUCE NUCLEAR POWER DEVELOPMENT
PROCESS STEAM FOR INDUSTRY

DATE _____

Please enter data or check as appropriate -

1. If you were considering further expansion and were prepared to locate elsewhere, in what order, rated from 1 to 9, would you consider the importance of the following ?

Energy costs - Steam _____

Electricity _____

Transportation costs - (which is preferred, Road Rail Water All three) _____

Proximity to raw materials _____

Proximity to markets _____

Land - Serviced, or Unserviced, (≤ 100 acres 200 acres >400 acres) _____

Labour - (Skilled Unskilled) _____

General community services - (Housing, Schools, Hospitals, Recreation, Shopping, etc.) _____

Other - (Specify) _____

2. Would you be interested in - a) A visit to the Bruce site ? Yes No

b) Discussing in more detail the potential use of steam from the Bruce Nuclear Power Development ? Yes No

c) A general seminar to discuss the overall concept ? Yes No

3. What, in your opinion, would be the approximate total unit energy cost, in 1980 dollars / million Btu, needed for nuclear steam to provide a strong incentive for future industrial development at Bruce ?

\$ _____ to \$ _____ / MBtu.

Please detach and return to -

Business Card or Address -

Dr. W.A. Seddon,
Advanced Projects and Reactor Physics Division,
Atomic Energy of Canada Limited Research Company,
Chalk River Nuclear Laboratories,
Chalk River,
Ontario. KOJ 1J0



Office of the
Deputy Minister

**Ministry of
Energy**

Queen's Park
Toronto, Ontario

May 16, 1980

One of the measures announced by the Government of Ontario in the recent Speech from the Throne is to encourage the full development of our nuclear energy potential for industrial purposes.

The Bruce Nuclear Power Development will shortly be the largest concentration of nuclear power generation in Canada and possibly in the world, and the Ministry of Energy is pleased to support an initiative which is now being taken to share the abundant thermal energy available at Bruce with industries which use substantial quantities of heat in their processes.

Sponsored by the Bruce County Council, the Ontario Energy Corporation, the Ministry of Industry and Tourism and Atomic Energy of Canada Ltd., and with the full cooperation and support of Ontario Hydro, the survey described in the attached document will help us plan Canada's first Energy Centre; a synthesis of energy production and industrial development which may prove to be a pattern for growth in the future.

Your participation in the survey will be greatly appreciated.

Yours sincerely,

Robert Welch
Minister of Energy

RW:sm
Encl.



**Atomic Energy
of Canada Limited**
Research Company
Chalk River
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du Canada, Limitée**
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E. Critoph
Vice-President & General Manager

1980 May 16

Atomic Energy of Canada Limited has been asked by the Bruce County Economic Development Committee and the Ontario Energy Corporation to evaluate the prospects for creating an industrial *Energy Park* adjacent to Ontario Hydro's Bruce Nuclear Power Development. The Ontario Government has strongly endorsed this concept which would capitalize on the proven reliability and economy of an existing steam supply system, together with the well established role of CANDU reactors as major producers of low cost electricity.

To encourage such a development, Ontario Hydro is prepared to supply steam to the Bruce site boundary. Based on their experience, nuclear steam costs are significantly lower than those obtainable with fossil fuels. This competitive advantage is expected to increase substantially as fossil fuels escalate in price.

As a first step towards the implementation of an *Energy Park*, we have been requested to survey the future needs and interests of major industrial steam users. I have asked Dr. W.A. (Bill) Seddon to act on our behalf and would be grateful if, as an initial response, you would complete and return to him the question page from one of the enclosed pamphlets. The second copy is for your records.

Bill will be contacting your company in the near future and, together with Ontario Hydro representatives, would welcome the opportunity to discuss the concept and projected energy costs in more detail.

We look forward to hearing your views on the feasibility of an industrial *Energy Park* adjacent to the Bruce Nuclear Power Development.

Yours sincerely,

Encl: Info. Pamphlet (2)

APPENDIX II

PRESENTATION TO GREAT LAKES/SEAWAY
TASK FORCE. WINDSOR, 1980 SEPTEMBER 16

**Docking Facilities in the Vicinity of the
Bruce Nuclear Power Development**

**Presentation to
the Great Lakes Seaway Task force**

by

R.H.C. Axell, Ontario Energy Corporation

and

**W.A. Seddon
on behalf of the
Bruce County Economic Development Committee,
the Ontario Energy Corporation and
Atomic Energy of Canada Limited**

Windsor, 1980 September 16

Summary

This presentation stems from the results of a recent study jointly funded by the Bruce County Council, the Ontario Energy Corporation, Atomic Energy of Canada Limited and conducted with the full cooperation of Ontario Hydro and the Ontario Ministry of Industry and Tourism.

The background and history to the development of the potential use of thermal energy that can be made available from the Bruce Nuclear Power Development(1-4) is presented in detail in the accompanying appendices.

This survey of over 100 energy intensive industries was undertaken to ascertain their future needs and interests in the concept of an Industrial Energy Park adjacent to the Bruce Nuclear Power Development. The proposed Energy Park would capitalize on the infra-structure of the existing CANDU reactor system and Ontario Hydro's proven and unique capability to supply steam, as well electricity, reliably and more economically than from fossil fuel fired stations. The use of nuclear energy in the form of steam for industrial process heat offers both long-term security of supply and relatively inflation-proof energy costs.

The Ontario Energy Corporation is the agent for the promotion, distribution and sale of thermal energy from both the Bruce and Pickering Nuclear Generating Stations.

A utility organization, Bruce Thermal Utility (BTU), has been incorporated. This utility will transport the thermal energy to the agricultural and industrial users that will locate adjacent to the Bruce Nuclear Power Development.

An organization is being established to undertake the necessary development activities and to promote and market the thermal energy for industrial and other uses.

Sufficient interest has been expressed by industry that these and other immediate efforts to implement the concept are justified. However, replies clearly indicate that a major disadvantage of the Bruce site is the lack of docking facilities. Access to the Great Lakes is essential to a number of industries which have expressed a real desire to participate.

If Ontario is to reap maximum benefit from this indigenous and proven resource by the development of an

industrial capability at the Bruce, then a deep water port to be located within several miles of the site must be seriously considered. We request that the Great Lakes Task Force consider and recommend ways in which water transportation, including a deep water harbour, could be provided to facilitate industrial development associated with the Bruce Nuclear Power Development.

Bruce Nuclear Power Development

Owned and operated by Ontario Hydro, the Bruce Nuclear Power Development will, on completion in 1987, be one of the largest nuclear energy centres in the world. It is, however, unique in that the existing CANDU reactors provide vast quantities of steam for the production of heavy water in addition to supplying electricity for the Ontario grid. This dual role not only improves the station's overall operating efficiency but also takes advantage of the significantly lower costs of nuclear generated steam, currently less than half that from fossil fuel fired stations.

The Bruce Nuclear Power Development has the capacity to supply about 10 million pounds of steam per hour to industry. Put into perspective, this corresponds to about one-third of Ontario's daily industrial steam requirements and the energy content of 50,000 barrels of oil per day. The latter figure does in fact correspond to the quantity of fuel oil consumed by Ontario manufacturing industries in 1977 (5).

In today's climate of rapidly escalating fossil fuel prices and the need to conserve oil for transportation, the Bruce Nuclear Power Development offers considerable potential to Canadian industry and Ontario in particular. Specific advantages are:

- (a) A secure energy supply. The uranium fuel is mined and processed domestically with large reserves indigenous to Ontario and Western Canada.
- (b) The technology is proven, reliable and predominantly Canadian in content.
- (c) Nuclear power costs are relatively inflation-proof and already significantly cheaper than achievable with fossil fuels. As the latter increase in price it is projected that the competitive position of the nuclear option will be further enhanced because uranium fuelling costs represent only a small fraction of the overall unit energy costs.

Industrial Survey

It was against the above general background that Atomic Energy of Canada Limited was asked by the Bruce County Economic Development Committee and the Ontario Energy Corporation, to undertake a survey of major industries to ascertain their real needs and interest in the creation of an Energy Park adjacent to the Bruce Nuclear Power Development. As part of this study we prepared an information pamphlet (Appendix A) which contained a simple questionnaire seeking information on their basic needs and priorities.

In total we contacted just over 100 energy-intensive industries with establishments located in Ontario. The concept generated a very favourable response with 47 replies received to date. In fact, sufficient interest has been expressed that immediate efforts to implement the Energy Park are justified.

Access to the Great Lakes is considered essential for the economic delivery of raw materials and/or finished products. Replies indicate that a port would need to be located within a few miles of the site and be capable of servicing Seaway Vessels with a draught of 27 feet.

Local communities are well equipped and able to accommodate significant growth in the near future. Overall, a very supportive, capable and positive approach is being taken towards industrial diversification and expansion.

General Conclusions

Conservation and the effective use of our fossil fuel resources are now dominant factors in meeting Canada's overall energy needs. Reducing imports is a national priority and of special significance to Ontario which is responsible for about 36% of Canada's energy demand.

Substitution, utilizing a nuclear energy resource such as the Bruce Nuclear Power Development, offers an immediate cost effective and demonstrated alternative, for example, the supply of steam to the Bruce Heavy Water Plant. In fact, the existing and potential steam handling supply system could easily supply a large fraction of the conceivable needs of Ontario's industry for decades.

Recommendation

We would ask that the Great Lakes Seaway Task Force consider and recommend ways in which water transportation, including a deep water harbour, could be provided to facilitate industrial development associated with the Bruce Nuclear Power Development.

References

1. A.C. Madge, Chairman; Bruce County Task Force Report 1979. Feasibility of an Industrial Energy Park in the BNPD area.
2. Speech from the Throne, Fourth Session of the Thirty-First Parliament of the Province of Ontario, 1980, March 11.
3. A. Porter, Chairman; The Report of the Royal Commission on Electric Power Planning, Vol. 1 p. 112-113, Vol. 7 p. 39. (1980).
4. N.J. MacGregor, B.W. Schmidt, D.H. Haycock and I. MacNaughton, An Ontario Opportunity - Energy Self Sufficiency, 1979 November.
5. Consumption of Fuel and Electricity by Ontario Manufacturing Industries; report for 1977, Ministry of Treasury and Economics, Central Statistical Services, 1979 November.

Appendices Containing Back-Up Material

- A Nuclear Process Steam for Industry, Potential for Development of an Industrial Park at the Bruce Nuclear Power Development, Bruce County, Ontario; 1980 May. Second printing 1980 August.
- B Introductory Letters to Appendix A.
- C Reference 3; Extracts from the Report of the Royal Commission on Electric Power Planning Vol. 1 and 7 (1980).
- D Bruce Nuclear Power Development, Ontario Hydro pamphlet, 1980 April.
- E May 2 - The First Ontario Energy Centre - Conceptual Development, taken from reference 4.

A P P E N D I X I I I

REVISED STEAM COSTS AND PROVISION OF OTHER SERVICES
BY ONTARIO HYDRO

Revised Steam Costs and Provision of Other Services
by Ontario Hydro

Ontario Hydro, in a letter dated 1980 November 5, advised the Ontario Energy Corporation that it is prepared to supply up to 250,000 lb/h or medium pressure steam to the site boundary by 1982 October. Subject to a section of the steam pipeline capital costs being absorbed by other parties, prices would be in the range of \$1.50 to \$1.90 MBtu (1982 dollars), based on an interruptible rate independent of demand and load factor.

Stemming from the federal budget 1980 October 28, natural gas will, for comparison, be priced at \$3.50/MBtu in 1982 August. Steam generated from this source would then be at least \$4.20 to \$4.70/MBtu.

Ontario Hydro is also prepared to cooperate in any way possible including the provision of other needed services such as water, sewer, roads, etc., at market value prices. Subject to the approval of the Atomic Energy Control Board they will also allow, on a temporary basis, the use of the outfall channel from the Bruce B Nuclear Generating Station as a docking facility. The depth of the channel (13' to 15') is inadequate for lake freighters but is suitable for barges.

Ontario Hydro also notes that the bay at Inverhuron would make an excellent harbour and estimates costs of about \$22 million for a facility capable of serving two full size vessels simultaneously.

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