



National Energy Board

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## Reasons for Decision

**British Columbia Hydro and  
Power Authority**

**EH-1-89**

**June 1989**

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**Electricity Exports**

# **National Energy Board**

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## **Reasons for Decision**

In the Matter of

## **British Columbia Hydro and Power Authority**

Application Under the *National Energy Board  
Act*

**EH-1-89**

**June 1989**

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# Table of Contents

<b>Abbreviations</b> .....	(iii)
<b>Recital and Appearances</b> .....	(iv)
<b>1. Background</b> .....	1
<b>2. The Applicant</b> .....	2
<b>3. The Application</b> .....	3
<b>4. Intervenor’s Motion</b> .....	4
4.1 Motion to Request Federal Department of the Environment Participation in the Hearing ..	4
4.2 Disposition of Motion .....	4
<b>5. The Evidence</b> .....	5
5.1 Generation Capacity Surplus .....	5
5.2 Energy Capability Surplus .....	5
5.3 Alcan’s Requirements .....	5
5.4 Role of Burrard .....	5
5.4.1 Integrated System .....	5
5.4.2 System Support .....	6
5.4.3 System Loading Order .....	6
5.5 Environmental Issues .....	6
5.5.1 Requisite Provincial Permits .....	6
5.5.2 Ambient Air Quality .....	7
5.5.3 Burrard Emissions Management .....	7
5.5.4 Intervenor’s Concerns/Applicant’s Responses .....	7
5.5.5 Environmental Impacts of Hydraulic Generation .....	8
5.5.6 Federal Standards and Guidelines .....	8
<b>6. Disposition</b> .....	10
6.1 Surplus .....	10
6.1.1 Impact of Burrard’s Availability and Alcan’s Requirements .....	10
6.1.2 Export of Firm Capacity and Energy .....	10
6.2 Environmental Issues .....	11
6.2.1 Provincial Permits .....	11
6.2.2 Air Quality and Burrard .....	11
6.2.3 Hydraulic Operations .....	11
6.2.4 Federal Standards and Guidelines .....	11
<b>7. The Board’s Findings</b> .....	13

## Appendices

I	Map of B.C. Hydro's Main Generation and Transmission Facilities . . . . .	14
II	B.C. Hydro Estimated Dependable Capacity, Peak Demand and Surplus for each month of the Licence Extension . . . . .	15
III	B.C. Hydro Estimated Dependable and Average Streamflow Capability, Demand and Surplus for each month of the Licence Extension . . . . .	18
IV	Amending Order AO-3-EL-162 . . . . .	21

## Abbreviations

### Units of Measurement

km	kilometre (1000 metres)
kV	kilovolt (1000 volts)
kW.h	kilowatt hour (1000 watt hours)
GW.h	gigawatt hour (1 000 000 kW.h)
MW	megawatt (1000 kilowatts)
MW.h	megawatt hour (1000 kW.h)

### Names

Act	<i>National Energy Board Act</i>
Alcan	Alcan Aluminum Limited
AQI	Air Quality Index
Board	National Energy Board
B.C. Hydro or the Applicant	British Columbia Hydro and Power Authority
Bonneville	Bonneville Power Administration
Burrard	Burrard Plant
Cominco	Cominco Limited
ECA	Kootenay Okanagan Electric Consumers Association
GVRD	Greater Vancouver Regional District
NO <sub>x</sub>	nitrogen oxides
Port Moody	City of Port Moody
SCL	Seattle City Light
SPEC	Society Promoting Environmental Conservation
TransAlta	TransAlta Utilities Corporation
WKPL	West Kootenay Power and Light Company, Limited

## Recital and Appearances

IN THE MATTER OF the *National Energy Board Act* and the Regulations made thereunder; and

IN THE MATTER OF an application by the British Columbia Hydro and Power Authority to vary the term of Licence EL-162 pursuant to subsection 21(1) of the *National Energy Board Act*. Filed with the Board under File Number 1923-B7-7.

HEARD at Vancouver, B.C. on 6 and 7 March 1989.

BEFORE:

J.-G. Fredette	Presiding Member
A.B. Gilmour	Member
D.B. Smith	Member

APPEARANCES:

K.C. MacKenzie	British Columbia Hydro and Power Authority
P.D. Feldberg	Alcan Aluminum Limited
E.C. Eddy J.W. Fraser	BC Gas Inc.
A. Hulbert	City of Port Moody
D. Caldwell B. Mueller	ISCA Management Ltd.
K.C. McAllister	Judicial Action
J.E. Miltimore	Kootenay Okanagan Electric Consumers Association
G. Podersky-Cannon G. Wilson	Liberal Party of British Columbia
G.R. Bing	On his own behalf
J.M. Black	On his own behalf
I.G. Waddell, M.P.	Port Moody/Coquitlam
P. Graham	Society Promoting Environmental Conservation
D.G. Bacon	TransAlta Utilities Corporation
A.R. Androsoff	Westcoast Energy Inc.





# Chapter 1

## Background

---

In December 1983 the British Columbia Hydro and Power Authority applied to the National Energy Board, in part, for a licence to export firm power and energy to the United States for periods of up to six years. Following a public hearing in March 1984, the Board issued firm export licence EL-162 to B.C. Hydro in July 1984. Licence EL-162 was issued for only a four-year period because of the uncertainties the Board perceived in respect of the firm power requirements of Alcan Aluminum Limited in the years 1988-89 and 1989-90. The Board was not satisfied at the time it issued the licence that there would be firm power and energy surplus to reasonably foreseeable Canadian requirements in the years 1988-89 and 1989-90 if Alcan's planned smelter expansion at Kitimat was to proceed without a corresponding expansion of Alcan's generating facilities.

The Board also found in its July 1984 Decision that there was uncertainty about the availability of energy from the Burrard natural gas-fired thermal plant because B.C. Hydro did not have all the requisite provincial environmental permits to operate the plant. For these reasons, the Board was not prepared at the time to give any credit for supply, reserve, or surplus of capacity or energy that might be generated at Burrard during normal operations.

B.C. Hydro applied on 12 February 1988 for a review of the Board's July 1984 decision which restricted the export of energy generated at the Burrard plant to emergency situations either in Canada or the United States, testing, or for operational reasons. In May 1988 the Board found that, because B.C. Hydro had obtained the requisite provincial environmental approvals to operate Burrard, that is, to generate power for use in Canada or for export, the environmental impact of operation for export would be within the criteria imposed by provincial authorizations. In conducting its review of the July 1984 decision, the Board sought the views of the parties of record to the original proceedings. The operation of Burrard was examined through a comparison of the provincial permits with the applicable federal standards and guidelines. The Board was satisfied that the operation of Burrard was in compliance with the applicable federal and provincial requirements and that the provincial permitting process involved public participation with the right of interested parties to appeal. Consequently, the Board found that no further limitations on the use of Burrard need be imposed by conditions of the export licences and appropriate licence amendments reflecting this finding were issued.

A public hearing, to extend B.C. Hydro's Licence EL-162 to 30 September 1990, was held in Vancouver, British Columbia on 6 and 7 March 1989. The Board issued its decision approving the extension of Licence EL-162, subject to Governor in Council approval, on 28 March 1989. This report sets out the Board's Reasons for Decision on B.C. Hydro's application.

## Chapter 2

# The Applicant

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B.C. Hydro is a crown corporation operating in British Columbia. The company provides electrical service to most of the province, the main exception being the area served by West Kootenay Power and Light Company, Limited. The map included as Appendix 1 shows the main generation and transmission facilities of B.C. Hydro.

B.C. Hydro's system is interconnected in the north with the Alcan system at Kitimat, in the east with the system of TransAlta Utilities Corporation, in the southeast with the systems of Cominco Limited and WKPL, and in the south with the system of the Bonneville Power Administration. Bonneville is an agency of the United States Government, with extensive generation and transmission facilities in the Pacific Northwest area of the United States.

There are four international power lines connecting the B.C. Hydro and Cominco systems to the Bonneville system. Two 500-kV lines cross the international boundary at Douglas, British Columbia, near Vancouver, and two 230-kV lines cross the border at Nelway, British Columbia. In addition, B.C. Hydro owns an international power line that supplies the isolated distribution system of Puget Sound Power and Light Company in the Point Roberts area of the state of Washington.

The export of power over these international power lines is authorized by Licences EL-162, EL-163 and EL-164. The licences were issued to the Applicant by the National Energy Board in July 1984. Licences EL-163 and EL-164 will expire on 30 September 1990, whereas EL-162 was dated to expire on 30 September 1988

# Chapter 3

## The Application

---

By an application dated 10 August 1988, B.C. Hydro applied to the Board for an extension to Licence EL-162. The Board decided on 15 September 1988 that it would treat the application as an application for review pursuant to subsection 21(l) of the *National Energy Board Act* to vary Licence EL-162 and issued AO-2-EL-162 extending the licence for six months to allow time for the review. The Board subsequently decided on 27 October 1988 to hold a public hearing to obtain the evidence and views of all interested parties on the application.

### Board's Explanatory Note

The Board first informed the public of its intention to hold a hearing through the publication, in November 1988, of a notice of an impending hearing. The notice stated that the issues to be addressed at the public hearing would be contained in the Board's hearing order to be issued at a later date. Hearing Order EH-1-89, issued on 16 January 1989, stated that the Board wished to ascertain whether the supply, demand and surplus position of B.C. Hydro could permit the continued export of up to 2000 megawatts of firm power and 6000 gigawatt hours of energy per year until 30 September 1990, including the specific consideration of:

- (i) The extent to which B.C. Hydro intends to depend on the supply of Burrard to export firm power;
- (ii) The effects, if any, of the requirements of Alcan Aluminum Limited on the demand of B.C. Hydro;
- (iii) The environmental impact of generating the power proposed to be exported under this licence; and
- (iv) The status of the requisite provincial permits to operate the Burrard generating station.

Included in the list of parties directly served with the hearing order were the parties of record to the original proceedings held under Order EH-1-84.

# Chapter 4

## Intervenor's Motion

---

### 4.1 Motion to Request Federal Department of the Environment Participation in the Hearing

Mr. Ian Waddell, the Member of Parliament for Port Moody/Coquitlam, submitted that the Board did not have the resources to properly consider whether there would be detrimental environmental impacts to Canada resulting from electrical exports that might be made under the extended term of Licence EL-162. Mr. Waddell further submitted that, as intervenors such as volunteer and charitable organizations are limited in resources, the Board should ask the federal Department of the Environment to intervene in the hearing because a fair hearing would not be possible without that department's expertise and resources.

The Society Promoting Environmental Conservation, the Kootenay Okanagan Electric Consumer Association, the City of Port Moody and two intervenors representing themselves supported the motion. The Applicant opposed the motion.

### 4.2 Disposition of Motion

The Board reminded all parties that the hearing would consider evidence on all matters, including the environment. The Board stated that it recognized the government's recent establishment of environmental matters as a priority and that, in its review, the Board would re-examine the facts and determine if current environmental requirements and norms are being met. The Board further stated that it had the expertise to assess and test the validity of evidence presented at the hearing. Consequently, the Board denied the motion.

# Chapter 5

## The Evidence

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### 5.1 Generation Capacity Surplus

The Applicant's estimates of dependable power capacity, peak demand and surplus power are summarized in Appendix 2. B.C. Hydro did not include either the demand of Alcan or any supply it might provide in the calculations of surplus for the reasons detailed in Section 5.3. The supply and demand balances take into account the Applicant's own load, plus its firm commitments to West Kootenay Power and Light, Limited, transfers to Seattle City Light under the Skagit River Treaty as well as a capacity reserve credit reflecting B.C. Hydro's 500kV interconnection with Alberta. Appendix 2 shows that the surplus capacity over the licence extension period ranges from a monthly low of 261 MW to a monthly high of 2000 MW.

### 5.2 Energy Capability Surplus

The Applicant's estimates of monthly energy capability, loads and surplus, under probable load growth assumptions for both dependable and average streamflow conditions, are summarized in Appendix 3. The evidence showed that, under both dependable and average streamflow conditions for any consecutive 12 months of the period April 1989 to September 1990, B.C. Hydro surpluses exceed the 6000 GW.h export quantity permitted under Licence EL-162. The Burrard station is included in the calculation of available energy under both dependable and average streamflows, as are transfers to WKPL and SCL.

The evidence shows hydraulic surpluses under average streamflows, but none, under dependable conditions. Transfers to Alcan are excluded for the reasons detailed in Section 5.3.

### 5.3 Alcan's Requirements

As previously mentioned, the issuance in 1984 of a firm export licence (EL-162), limited to a four-year term, reflected, in part, the Board's concern that Alcan might place additional firm load requirements on the Applicant in the years 1988-89 and 1989-90. Alcan, as an intervenor in the present proceedings, stated that, barring emergencies, it did not anticipate purchasing any power from B.C. Hydro in the period covered by the export application and that, on the contrary, Alcan expected to have power available for sale to the Applicant until at least 30 September 1990. The Applicant stated that it is negotiating with Alcan to purchase part or all of Alcan's firm surplus.

### 5.4 Role of Burrard

#### 5.4.1 Integrated System

The Applicant stated that the source of B.C. Hydro's exports will be from the integrated generating system of which the 912-MW Burrard station is a part. Because Burrard is a high-cost generating station it is used only when required. The annual Burrard capability of 5520 GW.h comprises 3430

GW.h generated from off-peak gas purchases, while the remaining 2090 GW.h comes from gas purchased at regular market prices. Supply can also be supplemented by purchases from Alcan and Alberta.

Currently, 450 MW of the Burrard station's units are operated as synchronous condensers to lend stability to B.C. Hydro's transmission system.

## **5.4.2 System Support**

The Applicant stated that the domestic load had grown to a point where, very shortly, hydraulic capability would not be able to fully supply the firm domestic load. At that point the firm energy capability of Burrard would be required to supplement the hydraulic system.

In addition, the evidence showed that at this time the principal roles for Burrard are as follows:

- emergency back-up during outages;
- emergency supply in poor water years;
- voltage support for the Vancouver area; and
- system back-up should new projects be delayed.

## **5.4.3 System Loading Order**

The Applicant's evidence showed that, in loading its system, resources are allocated on the basis of cost. The Burrard station, because of the relatively high costs associated with its operation, is one of the last stations loaded. However, the witness for B.C. Hydro stated that, because the use of Burrard is dependent upon the cost of energy available from other sources, it is not necessarily the last station loaded onto the system and that the cost of supply from Alcan or Alberta may vary the actual loading order.

Thus, exports, if any, would first be made from hydraulic surpluses on the B.C. Hydro system before other sources of supply such as Alcan, Alberta coal or gas-fired generation, or additional energy available from the Burrard station at applicable peak gas prices would be utilized. The witness for B.C. Hydro stated that exports from any particular source would be dependent upon market conditions.

## **5.5 Environmental Issues**

### **5.5.1 Requisite Provincial Permits**

The evidence showed that, under the *British Columbia Waste Management Act*, B.C. Hydro requires two environmental permits for the use of the Burrard plant. The first is an effluent permit (PE-7178) which was issued in 1985 and does not require renewal. That permit sets limits for cooling water discharge temperatures, discharge volumes and miscellaneous wastes from the Burrard plant as well as the monitoring of Burrard Inlet in the vicinity of the plant.

The second permit required is an air emission permit (VA-330) issued by the Director of the Greater Vancouver Regional District specifying air emission limits. This permit provides for the curtailment of the operation of Burrard in the event of poor ambient air quality. All permits issued by the GVRD

require periodic renewal. B.C. Hydro had applied to the GVRD for an extension of the air emission permit beyond its expiry date of 30 April 1989. The GVRD permitting process is a public procedure.

There is also a Provincial Energy Removal Certificate in effect which allows energy to be exported until 30 September 1990.

### **5.5.2 Ambient Air Quality**

B.C. Hydro's evidence showed that the GVRD operates an air quality monitoring network to provide continuous measurement of air pollution levels in the Greater Vancouver area. The GVRD evaluates the regional air quality using provincial criteria which are consistent with air quality objectives established by the federal Department of the Environment. The federal objectives define the levels of contaminant concentration as Maximum Desirable, Maximum Acceptable and Maximum Tolerable.

The index pollutants measured are sulphur dioxide, carbon monoxide, nitrogen oxides, ozone and suspended particulates. There is also a short-term daily air quality index (AQI) calculated from current hourly air quality measurements of the gaseous index pollutants.

The Applicant's evidence indicates that, for the most part, air quality in the Greater Vancouver Region meets the federal air quality objectives. Measurements exceeding objectives occur infrequently and are associated with poor atmospheric dispersion during the fall and winter and with the occurrence of photochemical episodes in the summer.

B.C. Hydro's evidence showed that the GVRD and the provincial government have entered into a two-stage air management planning project. Stage one, scheduled for completion in mid-1989, will identify air quality problems and general air management needs while stage two will assess future emission control strategies and procedures to achieve goals.

### **5.5.3 Burrard Emissions Management**

The Applicant's evidence showed that the operation of Burrard is currently regulated by an ambient control regime based on nitrogen dioxide measured in the vicinity of the plant. Through the ambient air control program, the operation of Burrard is curtailed when the GVRD AQI index reaches 50, a limit equal to the federal Maximum Acceptable guideline. Combustion modification techniques have resulted in a 40 percent reduction in the of emission of nitrogen oxides and studies are continuing to investigate additional emission reduction with the objective of making Burrard the cleanest plant of its type in North America.

### **5.5.4 Intervenors' Concerns/Applicant's Responses**

The Board heard interventions at the hearing from SPEC, the ECA, the Liberal Party of British Columbia, Judicial Action, Mr. I.G. Waddell, M.P., and Messrs. Bing and Black who represented themselves. Others who had stated their intention to intervene did not participate at the hearing or were satisfied that their concerns were addressed through the GVRD air quality permit system.

SPEC, ECA, Mr. Waddell, M.P., and Mr. Bing raised concerns about air quality, visual pollution and the emissions of nitrogen oxides, ozone, carbon monoxide and other trace emissions. The Liberal Party of British Columbia supported the application provided that the price of exports results in the

people of British Columbia receiving the fullest value possible, due them by their ownership, while maintaining the long-term environmental integrity of the province. The party also believed the use of existing generating facilities in British Columbia should be maximized, prior to the construction of additional generation in the province. Mr. Black expressed his concerns about B.C. Hydro's pre-building generation and exporting power from these facilities at prices below cost with the subsequent transfer of the pre-building costs to domestic residential customers. Judicial Action stated that the energy exported could be better used for alternative purposes to serve the people of British Columbia at affordable prices.

SPEC stated the Burrard plant should be shut down sooner than required under the AQI because pollution readings generally keep rising even after a plant is shutdown during periods of atmospheric stagnation. Mr. Waddell, M.P., Mr. Bing and SPEC felt that Canadians pay a price in air quality degradation and suffer from visual pollution each time Burrard is used for export purposes and that export commitments should be met without the use of Burrard. B.C. Hydro argued that the operation of Burrard is regulated under its air emission permit which requires the curtailment of the operation of Burrard whenever the GVRD Air Quality Index exceeds the federal Maximum Acceptable guideline.

SPEC, ECA and Mr. Waddell, M.P., and Mr. Bing also expressed concerns over the contribution of Burrard to NO<sub>x</sub> emissions in the Vancouver Region and stated that NO<sub>x</sub> emissions lead to health, environmental and economic problems. However, B.C. Hydro's environmental evidence showed that the operation of Burrard meets all current applicable federal and provincial standards.

In response to some of the intervenors' concerns about ground level ozone impacts on health and agriculture, B.C. Hydro stated that the Burrard station was not a major contributor to ozone production and testified that it is developing control strategies to further minimize the impact of Burrard on ozone production.

ECA and Mr. Waddell, M.P. voiced concerns about other emissions from Burrard such as carbon monoxide and hydrogen sulphide. B.C. Hydro's witness testified that fuel combustion controls reduce the production of carbon monoxide and that carbon monoxide monitors are being installed at the plant to assist in the combustion control program. B.C. Hydro stated the contribution of Burrard emissions to sulphur compounds is very low because the gas supply for the plant is essentially sulphur-free.

### **5.5.5 Environmental Impacts of Hydraulic Generation**

B.C. Hydro was questioned about any environmental impacts due to exports resulting from hydraulic generation. The Applicant testified there had been no significant changes in its hydraulic generating system since the 1984 hearing and that environmental impacts of hydraulic generation will not change under the proposed extension of Licence EL-162.

### **5.5.6 Federal Standards and Guidelines**

Evidence was presented by B.C. Hydro which compared the operation of Burrard with the relevant federal environmental standards and guidelines.

Federal standards establish limits on concentrations of pollutants in the ambient air. The evidence showed that B.C. Hydro's requirement to curtail operations under the GVRD air emissions permit during the proposed licence extension period is a standard exceeding that of similar fossil fuel-burning



plants in the region. B.C. Hydro's evidence comparing Burrard with guidelines for new stationary sources of fossil-fuel electricity generating plants showed that Burrard meets applicable federal requirements.

The operation of Burrard was also compared with the applicable provisions of the federal design phase code for new plants. The evidence showed that B.C. Hydro's discharges under the provincial effluent permit conform to the relevant recommendations of the federal design phase code. As well, the provincial monitoring program under the effluent permit conforms with the applicable provisions in the federal design phase code.

# Chapter 6

## Disposition

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The Board has given consideration to all the evidence and submissions presented and has reached the following conclusions.

### 6.1 Surplus

To ascertain whether B.C. Hydro could export up to 2000 MW of firm power and up to 6000 GW.h energy per year during the proposed licence extension period, the Board examined B.C. Hydro's estimated supply, demand and surplus position to 30 September 1990.

#### 6.1.1 Impact of Burrard's Availability and Alcan's Requirements

The Board is satisfied that its earlier concerns over the availability of energy from Burrard, which led the Board to not giving credit for supply, reserve or surplus for capacity or energy that might be generated at Burrard, no longer exist. The Board notes the Applicant's requirement for the Burrard plant for system support and to supplement its hydraulic generation system. Accordingly, the Board recognizes the possibility that any surplus available for export may include electricity generated at the Burrard plant.

In addition the Board notes that Alcan's requirements up to 30 September 1990 can be met from Alcan's own generation. Accordingly, the Board is satisfied that those requirements no longer need to be considered in the Board's examination of surplus.

#### 6.1.2 Export of Firm Capacity and Energy

The Board finds that the Applicant's estimates of capacity under dependable streamflows, and of energy capabilities under both dependable and average streamflows along with its estimates of firm commitments and probable load growth assumptions are reasonable.

With respect to the export of firm capacity, the Board notes that, in most months during the proposed export period, B.C. Hydro's estimates of surplus capacity under dependable streamflows are less than 2000 MW. However, the Board is satisfied that, in some months B.C. Hydro could export up to the requested 2000 MW and that, in other months, some surplus capacity is available for export. With respect to the export of firm energy, the Board is satisfied that B.C. Hydro could export up to 6000 GW.h in any consecutive 12-month period to 30 September 1990.

The Board has taken into consideration intervenors' concerns about exports from Burrard and notes that the plant's use for export purposes will largely be determined by the marketplace for electricity and that its use for export will likely be minimal due to the high cost of Burrard generation. The Board notes that firm export Licence EL-162 is conditioned to ensure there is a premium charged for incremental production from Burrard and such a condition would continue to apply to any licence extension issued hereunder.

## **6.2 Environmental Issues**

### **6.2.1 Provincial Permits**

The evidence submitted with the application shows that B.C. Hydro has all the necessary permits to operate Burrard to generate power for use in Canada or for export. These include an effluent permit, an amended air emission permit and an energy removal certificate. The Board is aware that the air emission permit is being reviewed by the GVRD and notes that B.C. Hydro will have to secure the appropriate renewal of the air emission permit before exports from Burrard generation can be made. The Board is satisfied that the GVRD permitting process addresses the appropriate technical aspects of the air quality issue and involves public participation.

### **6.2.2 Air Quality and Burrard**

The Board notes that the GVRD measures air pollution and controls the operation of Burrard based on a daily air quality index which is equivalent to the federal Maximum Acceptance Level and that the GVRD along with the provincial government are conducting a long-term air management study to assess future air control strategies. The Board accepts the Applicant's undertaking to ensure that Burrard will conform to the air control strategies that will evolve.

From its examination of the evidence, the Board concludes that the air quality in the Greater Vancouver Region complies with federal air quality objectives at most times and that measurements exceeding the objectives occur infrequently under adverse weather conditions. Because of the emission controls imposed on the operation of Burrard by the GVRD, the Board is satisfied with the use of the Burrard plant to satisfy domestic or export requirements. The Board recognizes that to satisfy B.C. Hydro system requirements the Burrard plant may be operating while exports are taking place.

The Board also notes the Applicant's undertakings to minimize the impact of Burrard as a contributor to the production of ozone. The Board believes that intervenors' concerns about the impact of Burrard air emissions on health and agriculture are being addressed by B.C. Hydro's air emission reduction program, by its studies, to the extent that these may lead to further reduction of these emissions and by the GVRD's air quality monitoring program under the air emission permit. The Board further notes the Applicant's installation of monitoring devices to assist it in the control of gaseous emissions from the plant.

### **6.2.3 Hydraulic Operations**

The Board is satisfied that the incremental environmental effects resulting from hydraulic exports under the proposed licence extension will be negligible since B.C. Hydro's facilities and operations have not changed in any significant respect since the Board's July 1984 decision.

### **6.2.4 Federal Standards and Guidelines**

Although federal standards and guidelines relate to new plants, the Board examined the federal standards and guidelines and recognized them as a benchmark against which to evaluate the performance of Burrard. Based on its examination, the Board is satisfied that Burrard meets the applicable guidelines for ambient air pollution for new stationary generating sources. The Board also

compared the operation of Burrard with federal design codes for new plants and is satisfied that provincial monitoring conforms with the applicable design codes.

# Chapter 7

## The Board's Findings

---

The Board has satisfied itself that the power and energy that may be exported are surplus to reasonably foreseeable Canadian requirements and that the operation of Burrard will meet applicable federal environmental standards and guidelines, and has considered all other matters that appear to be relevant. Accordingly, on 28 March 1989, the Board issued to B.C. Hydro, subject to Governor in Council approval, an extension to 30 September 1990 of the continuing export of up to 2000 MW of power and up to 6000 GW.h of energy in any consecutive 12 month period allowed under Licence EL-162. Amending Order AO-3-EL-162 is attached as Appendix 4.

The foregoing constitutes our Reasons for Decision and decision in the matter of the present application of the British Columbia Hydro and Power Authority pursuant to Section 21 of the *National Energy Board Act*.

J.-G. Fredette  
Presiding Member

A.B. Gilmour  
Member

D.B. Smith  
Member

# **Appendix I**

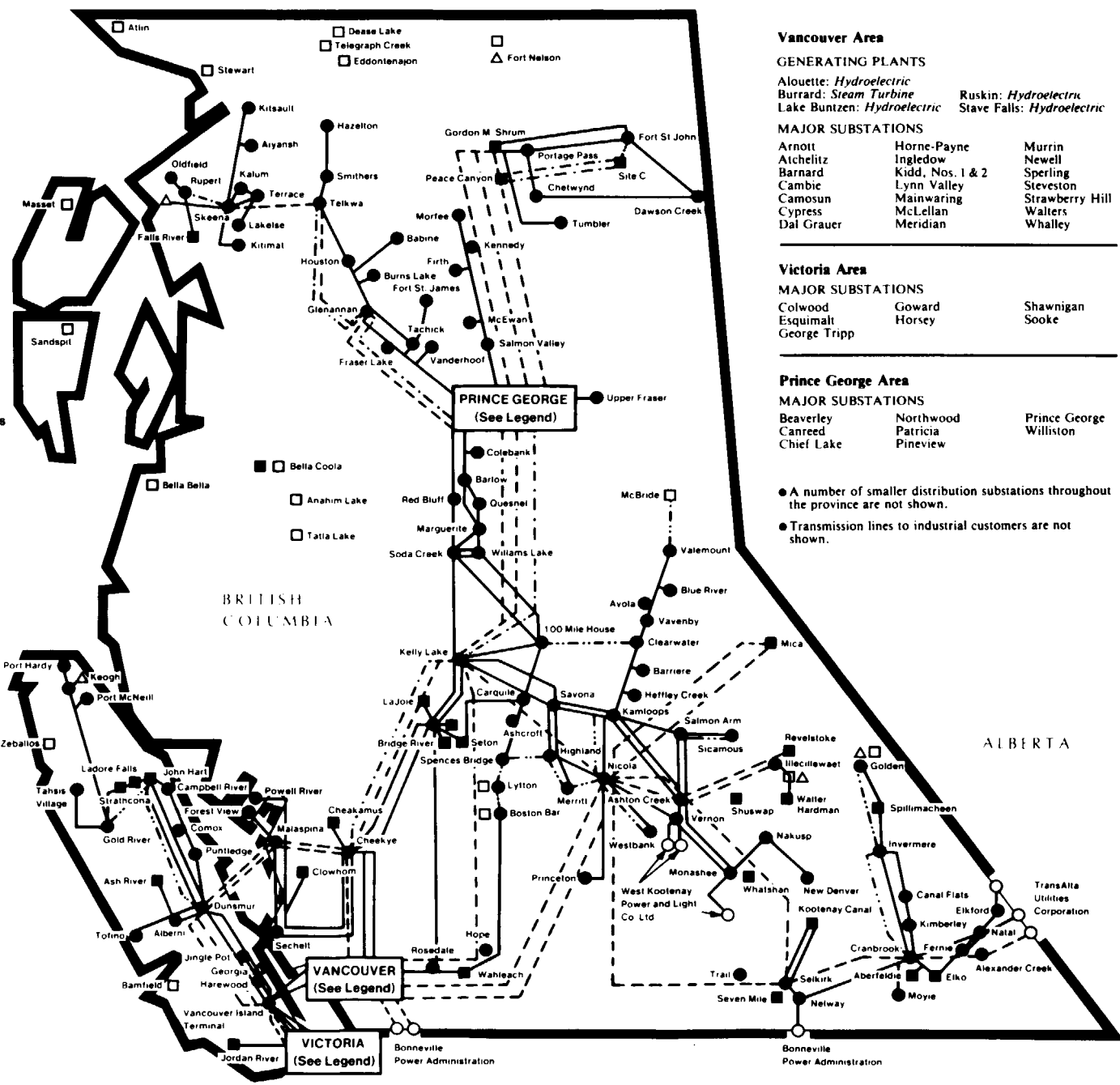
## **Map of B.C. Hydro's Main Generation and Transmission Facilities**

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**Figure A1-1**  
**British Columbia Hydro and Power Authority - Electric Transmission System**

**BRITISH COLUMBIA HYDRO AND POWER AUTHORITY**  
**ELECTRIC TRANSMISSION SYSTEM**  
**AT 31 MARCH 1983**  
**WITH PLANNED ADDITIONS**

- Hydroelectric Generating Stations
  - Diesel-Electric Generating Stations
  - △ Gas Turbine Electric Generating Stations
  - Substations
  - Interconnections
- Transmission Lines 60 kV - 360 kV (existing and under construction)
  - - - Transmission Lines 500 kV (existing and under construction)
  - · - · Transmission Lines 60 kV - 360 kV (planned)
  - · - - Transmission Lines 500 kV (planned)



**Vancouver Area**

**GENERATING PLANTS**

- Alouette: *Hydroelectric*
- Burrard: *Steam Turbine*
- Lake Buntzen: *Hydroelectric*
- Ruskin: *Hydroelectric*
- Stave Falls: *Hydroelectric*

**MAJOR SUBSTATIONS**

Arnot	Horne-Payne	Murrin
Atcheltz	Ingledow	Newell
Barnard	Kidd, Nos. 1 & 2	Sperling
Cambie	Lynn Valley	Steveston
Comosun	Mainwaring	Strawberry Hill
Cypress	McLellan	Walters
Dal Grauer	Meridian	Whalley

**Victoria Area**

**MAJOR SUBSTATIONS**

Colwood	Goward	Shawnigan
Esquimalt	Horsey	Sooke
George Tripp		

**Prince George Area**

**MAJOR SUBSTATIONS**

Beaverley	Northwood	Prince George
Canreed	Patricia	Williston
Chief Lake	Pineview	

- A number of smaller distribution substations throughout the province are not shown.
- Transmission lines to industrial customers are not shown.

**Appendix II**  
**B.C. Hydro Estimated Dependable Capacity, Peak Demand and Surplus for each month of the Licence Extension**

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**Table a2-1**

**British Columbia Hydro and Power Authority  
Estimated Dependable Capacity, Peak Demand and Surplus  
For each month of the Licence Extension**

(MW)

	1989									1990									
	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
Capacity:																			
Hydro	9480	9480	9480	9480	9480	9480	9480	9480	9480	9480	9480	9480	9480	9480	9480	9480	9480	9480	9480
Thermal	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
Purchases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	9640	9640	9640	9640	9640	9640	9640	9640	9640	9640	9640	9640	9640	9640	9640	9640	9640	9640	9640
Maintenance	2450	2255	2025	1075	965	1775	1475	700	300	540	1125	1875	2450	2255	2025	1075	965	1775	
Net Supply	7190	7385	7615	8565	8675	7865	8165	8940	9340	9100	8515	7765	7190	7385	7615	8565	8675	7865	
Forecast Peak Demand	6038	5759	5639	5479	5578	5841	6495	7419	7644	7496	7425	6751	6204	5924	5784	5629	5734	5984	
Required Reserve	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	
Reserve Credit	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	
Export Limit	-	-	-	2000	2000	-	-	-	-	-	-	-	-	-	-	-	2000	2000	-
Voltage Stability Limit	-	-	-	-	-	-	-	-	700	-	-	-	-	-	-	-	-	-	
Dependable Surplus	427	901	1251	2000	2000	1229	945	796	700	879	365	289	261	736	1106	2000	2000	1156	

- thermal capacity includes two gas turbine generators but excludes Burrard
- requirements include peak of WKP&L and transfers to SCL under Skagit Treaty
- reserve credit reflects capacity reserve reduction due to 500 kv interconnection with Alberta
- Alcan demand is excluded because Alcan has no requirements from B.C. Hydro

**Appendix III**  
**B.C. Hydro Estimated Dependable and Average**  
**Streamflow Capability, Demand and Surplus for each**  
**month of the Licence Extension**

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**Table a3-1**

**British Columbia Hydro and Power Authority  
Estimated Dependable and Average Streamflow Capability, Demand and Surplus  
For each month of the Licence Extension**

**(GW.h)**

DEPENDABLE FLOW	1989										1990								
	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
Dependable Energy Capability:																			
Hydro	3141	3256	3174	3184	3244	3246	3571	3752	3963	4241	3454	3323	3094	3100	3188	3198	3216	3072	
Thermal	290	510	495	510	510	495	370	100	0	0	0	150	290	510	495	510	510	495	
Other Resources	395	395	395	395	355	355	395	815	815	815	815	805	395	395	395	395	355	355	
Total	3826	4161	4064	4089	4109	4096	4336	4667	4778	5056	4269	4278	3779	4005	4078	4103	4081	3922	
Forecast Energy Load	3406	3356	3204	3229	3299	3246	3656	3927	4218	4306	3879	3998	3489	3435	3278	3303	3376	3322	
Dependable Energy Surplus	420	805	860	860	810	850	680	740	560	750	390	280	290	570	800	800	705	600	
AVERAGE FLOW	1989										1990								
	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
Average Energy Capability:																			
Hydro	3711	3441	3304	3354	3424	3346	3881	4002	4393	4481	4054	4033	3794	3520	3378	3428	3501	3422	
Thermal	290	510	495	510	510	495	370	100	0	0	0	150	290	510	495	510	510	495	
Other Resources	395	395	395	355	355	395	395	815	815	815	815	805	395	395	395	355	355	395	
Total	4396	4346	4194	4219	4289	4236	4646	4917	5208	5296	4869	4988	4479	4425	4268	4293	4366	4312	

Forecast Energy Load	3406	3356	3204	3229	3299	3246	3656	3927	4218		4306	3879	3998	3489	3435	3278	3303	3376	3322
Average Energy Surplus	990	990	990	990	990	990	990	990	990		990	990	990	990	990	990	990	990	990

For BOTH Dependable and Average Flow Conditions:

- Burrard and other resources are included in energy capability calculations
- requirements include WKP&L and transfers to SCL under Skagit Treaty
- Alcan requirements excluded because Alcan has no requirements from B.C. Hydro

## Appendix IV

# Amending Order No. AO-3-EL-162

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IN THE MATTER OF the *National Energy Board Act* and the Regulations thereunder; and

IN THE MATTER OF an application by the British Columbia Hydro and Power Authority (B.C. Hydro) pursuant to subsection 21(1) of the *National Energy Board Act*, to vary Licence EL-162; filed with the Board under File No. 1923-B7-7.

WHEREAS the National Energy Board has issued to B.C. Hydro Licence EL-162, as amended, for the exportation of firm power and energy at points on the international boundary between Canada and the United States of America;

AND WHEREAS B.C. Hydro by an application dated 10 August 1988 has applied for an extension of Licence EL-162;

AND WHEREAS the Board has issued an extension to 30 March 1989 of Licence EL-162 to allow time for a review, pursuant to subsection 21(1) of the *National Energy Board Act*, for a further extension of Licence EL-162 to 30 September 1990;

AND WHEREAS a public hearing for a review, has been held commencing on the 6th day of March, 1989, in the City of Vancouver, in the Province of British Columbia, at which B.C. Hydro and all interested parties were heard;

AND WHEREAS the requested amendment would not increase the total annual quantity of energy authorized for export under Licence EL-162.

AND WHEREAS B.C. Hydro currently has possession of the required environmental operating permits under the provincial *Waste Management Act*;

AND WHEREAS B.C. Hydro has requested renewal of the Air Emission Permit expiring 30 April 1989 from the provincial authorities;

AND WHEREAS the Burrard Generating Station may not be operated without B.C. Hydro possessing all the required environmental operating permits;

IT IS ORDERED THAT Licence EL-162 be amended by revoking Condition 1 therefrom and substituting therefor the following:

"1.The term of this licence shall commence on the date of revocation of Licence EL-128, and shall end on 30 September 1990."

Issued under subsection 21(2) of the *National Energy Board Act*, in the City of Ottawa, in the Province of Ontario, on 28 March 1989.

NATIONAL ENERGY BOARD

Louise Meagher  
Secretary