

REQUESTOR NAME: Independent Power Producers of B.C.

INFORMATION REQUEST ROUND NO: 1

TO: BRITISH COLUMBIA HYDRO & POWER AUTHORITY

DATE: May 2, 2007

PROJECT NO: 3698461

APPLICATION NAME: Revelstoke Unit 5, Application for Certificate of Public Convenience and Necessity

1.0 Reference: Exhibit B-1, page 2-3, Figure 2-1, key personnel in organization chart

1.1 Please provide resumes for the following key personnel responsible for implementing this project, giving details of previous experience managing and completing similar large construction projects: a) Project Initiator, M. Hemmingsen: and b) Project Manager, K. McKenzie.

2.0 Reference: Exhibit B-1, page 6-12, 6.2.5.1 BC Hydro Energy Gains “Energy gains associated with Revelstoke Unit 5 will result primarily from the preferential operation of the new, more efficient unit, with some small increases from the reduced spill at the generator stations on the Columbia River.” and on page 6-13 “...the new unit is expected to operate at its efficient operating point more than 80% of time when considered across all water conditions.”

2.1 Operating at its ‘efficient operating point’, what % increase in output can the Unit 5 produce compared to the older units?

2.2 Of the 130 GWh/yr of additional energy, how much will be derived from this improved operating efficiency of Unit 5 relative to the older units?

2.3 How many operating hours per year is Unit 5 planned to be running, in order to produce this additional energy?

2.4 How many hours have each of the other units (1 to 4) been operated over each of the past 10 years, and how many hours per year are they expected to operate in the future?

2.5 Please provide the analysis which calculates the remainder of the 130 GWh/yr that is due to the reduced spill at other generating stations.

3.0 Reference: Exhibit B-1, Table 3-1 and Table 3-5, Equipment Expected Life and Sustaining Capital.

3.1 Table 3-5 states that sustaining capital will be provided in years 20, 30, and 40, “based on equipment replacement experience with Units 1-4.” However, in view of the preferential operation of Unit 5, won’t it be expected to have a great many more operating hours than any of the other units at the same number of years? Would this not indicate that its life expectancy might be shorter than the other turbines, or that it might require sustaining capital expenditures at an earlier year, or of a greater amount?

- 4.0 Reference: Exhibit B-1, page 3-9, Construction Costs, “To date, BC Hydro has secured the generator and turbine contract, as discussed above, with a contract value of over 50 percent of the total direct costs for Revelstoke Unit 5 subject to tender volatility.”**
- 4.1 In order to clarify exactly what “tender volatility” risks remain, please provide copies of these secured contracts, redacted if necessary for confidential information
- 5.0 Reference: Exhibit B-1, page 4-12 footnote 13, “The Value of Energy Gain is the levelized price (50 years starting 2011) in \$2006 based on \$88/MWh for the F2006 Reference Price and \$42-\$97/MWh (BC Hydro lowest to highest levelized March 2006 price forecasts) reduced by 8 percent average transmission losses as an estimate of Revelstoke’s at-site value of energy. Water rentals are also subtracted based on the current rate of \$5.147/MWh.”**
- 5.1 The above statement is confusing as to exactly which price was used to value the energy gain, and the spreadsheet included on pages 9 and 10 of Appendix I appears to use a levelized price of \$55/MWh to value this energy. Please clarify which value is actually being used to value this energy, and why that value was chosen.
- 6.0 Reference: Exhibit B-1, page 4-12, 4.2.2 Energy Shaping Benefits “The annualized energy shaping benefits ranged from \$9 million in the 2010/11 study year to \$14 million in the 2015/16 year”.**
- 6.1 In the 2010/11 study year, how much of the \$9 million improvement was due to the reduction in the fuel and operating costs of Burrard?
- 6.2 Please provide the model output from the two studies done for each of the 2010/11 and 2015/16 years, which can substantiate the energy shaping benefits of \$9 million and \$14 million.
- 6.3 The spreadsheets in Appendix I, pages 9 and 10, appear to assume \$11 million for the value of energy shaping in each of the 50 years, which appears to offset over 60% of the cost of the Unit 5 project. Why was \$11 million used for all years?
- 7.0 Reference: Exhibit B-1, Appendix I, Unit 5 Modeling Studies and Economic Analysis.**
- 7.1 Please provide working copies of the Excel models applicable to each of the 4 cases listed in Table 3-4 (2010 and 2011 ISDs for P50 and P90 cost estimates).
- 7.2 Please also include the calculations of the Escalation, Inflation, Capital Overhead and IDC charges for each of those 4 cases (if they are not already included in the models requested in 7.1).
- 8.0 Reference: Exhibit B-1, page 4-12, 4.2.2 Energy Shaping Benefits, “The value of this benefit is a function of the amount of surplus energy available in the system,...” and Appendix I, page 2 states, “The monthly energy generation from F2006 Call projects is based on average generation provided by IPP developers.”**
- 8.1 In view of the fact that Section 4.1.4 states that “Policy Action No. 20 presents additional challenges to these (two coal-fired) projects.” what assumptions were made about attrition from the F2006 Call projects, and how much energy was assumed to come from these projects for the purposes of the Energy Shaping Benefit calculations?
- 8.2 To help illustrate how the value of the shaping benefit depends on the amount of surplus energy

available in the system, please model two additional cases for each of the fiscal years modeled in this analysis – one case with 33% more energy from F2006 projects, and one case with 33% less energy from F2006 projects. For purposes of this modeling, simply assume that the energy from all projects is increased or decreased pro-rata, on a monthly basis.

- 8.3 Please summarize the significant results and also provide the model output from these additional cases.

9.0 Reference: Exhibit B-1, page 5-3, “... and may result in formal agreements (IMBAs) between BC Hydro and each of the KNC, ONA and the SNTC...”

- 9.1 What certainty, including without limitation length of term, will any agreements, including IMBAs, with the First Nations referred to above bring to BC Hydro and or the Province with respect to any consultation and accommodation obligations BC Hydro and/or the Province may have with respect to these First Nations? What certainty, including without limitation length of term, will any of these agreements bring to any claims these First Nations may have against BC Hydro and/or the Province with respect to potential or actual infringement of aboriginal rights and title?

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1.0 Reference: Exhibit B-1, page 2-3, Figure 2-1, key personnel in organization chart

- 1.1.1 Please provide resumes for the following key personnel responsible for implementing this project, giving details of previous experience managing and completing similar large construction projects: a) Project Initiator, M. Hemmingsen: and b) Project Manager, K. McKenzie.

RESPONSE:

The following summary provides the relevant experience of the individuals requested:

- a) **M. Hemmingsen - General Manager, Generation Asset Management, Capital Plans, Projects and Procurement**
- **Currently responsible for developing the generation asset management strategy and actions to achieve targeted performance and associated capital plans.**
 - **Manages a portfolio of generation projects with over \$300 million in fiscal 2008 and over \$4 billion dollars in total project costs led by teams of professional project managers.**
 - **Held a series of progressively more responsible positions at BC Hydro from 1994 including Acting Senior Vice President of Distribution, Director of Power Planning & Portfolio Management, and Manager of Corporate Development and Finance.**
 - **While leading Power Planning & Portfolio Management, acquired \$3.8 billion of competitive new long term electricity supply, and completed a Long Term Acquisition Plan to support future investments of over \$10 billion in new electricity infrastructure.**
 - **While leading Corporate Development and Finance, led corporate and finance teams in transaction structuring, negotiations and agreements to separate and establish new operating entities for provision of transmission and back office services. Negotiated associated contracts for service delivery back to BC Hydro in excess of \$1 billion in value from each of BCTC and Accenture Business Services.**

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- **Holds a Bachelor of Business Administration (1986) and is a Chartered Accountant (1989).**
- b) **K. McKenzie, P.Eng., M.B.A. – Project Director**
- **Currently Project Manager of the Revelstoke Unit 5 project.**
 - **Managed numerous projects in the BC Hydro system including hydro-electric facilities, protection and control equipment, generator transformers, gas generation stations and diesel generators.**
 - **This experience has included an assignment as project manager responsible for the design, procurement, installation and testing of four upgraded 130 MW Francis turbine runners at Kootenay Canal GS.**
 - **Holds a Bachelor of Applied Science (1988), a Master of Business Administration (1993) and is a certified Project Management Professional (PMP).**

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2.0 Reference: Exhibit B-1, page 6-12, 6.2.5.1 BC Hydro Energy Gains “Energy gains associated with Revelstoke Unit 5 will result primarily from the preferential operation of the new, more efficient unit, with some small increases from the reduced spill at the generator stations on the Columbia River.” and on page 6-13 “...the new unit is expected to operate at its efficient operating point more than 80% of time when considered across all water conditions.”

1.2.1 Operating at its ‘efficient operating point’, what % increase in output can the Unit 5 produce compared to the older units?

RESPONSE:

As identified in Exhibit B-1, Appendix I, Chart I-2, BC Hydro expects Revelstoke Unit 5 to operate at 96 per cent, an efficiency that is slightly over 2 per cent higher than Units 1 – 4.

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1.2.2 Of the 130 GWh/yr of additional energy, how much will be derived from this improved operating efficiency of Unit 5 relative to the older units?

RESPONSE:

Approximately 54 per cent (70 GWh) of the 130 GWh energy gain is due to the operating efficiency of Revelstoke Unit 5.

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1.2.3 How many operating hours per year is Unit 5 planned to be running, in order to produce this additional energy?

RESPONSE:

As identified in Exhibit B-1, Appendix I, Chart I-3, Revelstoke Unit 5 will be operating in all hours except the minimum flow hours. This equates to Revelstoke Unit 5 operating approximately 6800 hours in a year, or about 78 per cent of the time.

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2.0 Reference: Exhibit B-1, page 6-12, 6.2.5.1 BC Hydro Energy Gains “Energy gains associated with Revelstoke Unit 5 will result primarily from the preferential operation of the new, more efficient unit, with some small increases from the reduced spill at the generator stations on the Columbia River.” and on page 6-13 “...the new unit is expected to operate at its efficient operating point more than 80% of time when considered across all water conditions.”

1.2.4 How many hours have each of the other units (1 to 4) been operated over each of the past 10 years, and how many hours per year are they expected to operate in the future?

RESPONSE:

Historic operating record for Units 1-4 in the last 10 years:

*REV Unit	Total Operating Time (Hours)									
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
REV01	8684.4	7725.2	8618.2	8097.7	8602.5	8338.1	7810.7	4488.7	5727.8	4464.4
REV02	7960.9	8626.3	7785.9	8700.2	7865.6	8471.8	7963.8	5024.8	5559.7	5749.9
REV03	5165.8	5934.8	5275.5	5153.8	3485.8	4747.3	5711.5	7823.9	6523.2	7001.0
REV04	5404.4	3984.3	4516.3	4880.6	3391.0	3316.7	4084.9	7208.5	8578.6	6956.0

*Revelstoke

Simulation results project that the total annual operating hours for the existing four units will average around 3,700 hours with Revelstoke Unit 5. Since all four units have the same characteristics, the actual dispatch will be an operation decision based on operating environment, system requirements and unit conditions.

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1.2.5 Please provide the analysis which calculates the remainder of the 130 GWh/yr that is due to the reduced spill at other generating stations.

RESPONSE:

Please refer to the Response to BCUC IR 1.4.5.4.

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3.0 Reference: Exhibit B-1, Table 3-1 and Table 3-5, Equipment Expected Life and Sustaining Capital.

- 1.3.1 Table 3-5 states that sustaining capital will be provided in years 20, 30, and 40, “based on equipment replacement experience with Units 1-4.” However, in view of the preferential operation of Unit 5, won’t it be expected to have a great many more operating hours than any of the other units at the same number of years? Would this not indicate that its life expectancy might be shorter than the other turbines, or that it might require sustaining capital expenditures at an earlier year, or of a greater amount?

RESPONSE:

The expected operation of Revelstoke Unit 5, including operating hours per year, is provided as part of the specifications in the Revelstoke Unit 5 tenders. The supplier then responds with a design for the equipment that meets the expected life of the equipment, factoring in the intended operation of the unit. As a result, the sustaining capital estimates and timeframes described in Exhibit B-1, Table 3-5 are appropriate.

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4.0 Reference: Exhibit B-1, page 3-9, Construction Costs, “To date, BC Hydro has secured the generator and turbine contract, as discussed above, with a contract value of over 50 percent of the total direct costs for Revelstoke Unit 5 subject to tender volatility.”

1.4.1 In order to clarify exactly what “tender volatility” risks remain, please provide copies of these secured contracts, redacted if necessary for confidential information

RESPONSE:

The tender volatility applies to contracts that have not been finalized or secured. Please refer to the response to BCUC IR 1.1.4.

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5.0 Reference: Exhibit B-1, page 4-12 footnote 13, “The Value of Energy Gain is the levelized price (50 years starting 2011) in \$2006 based on \$88/MWh for the F2006 Reference Price and \$42-\$97/MWh (BC Hydro lowest to highest levelized March 2006 price forecasts) reduced by 8 percent average transmission losses as an estimate of Revelstoke’s at-site value of energy. Water rentals are also subtracted based on the current rate of \$5.147/MWh.”

1.5.1 The above statement is confusing as to exactly which price was used to value the energy gain, and the spreadsheet included on pages 9 and 10 of Appendix I appears to use a levelized price of \$55/MWh to value this energy. Please clarify which value is actually being used to value this energy, and why that value was chosen.

RESPONSE:

Please refer to the response to BCUC IR 1.54.1.

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6.0 Reference: Exhibit B-1, page 4-12, 4.2.2 Energy Shaping Benefits “The annualized energy shaping benefits ranged from \$9 million in the 2010/11 study year to \$14 million in the 2015/16 year”.

1.6.1 In the 2010/11 study year, how much of the \$9 million improvement was due to the reduction in the fuel and operating costs of Burrard?

RESPONSE:

This benefit of \$3 million/year is in addition to the \$9 million energy shaping benefits. The dispatch cost of Burrard is above the cost of imports in the GOM analysis therefore imports displace the use of Burrard in economic dispatch. The cost savings attributed to the reduced reliance on Burrard for dependable capacities are discussed in Exhibit B-1, Section 4.2.3.

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6.0 Reference: Exhibit B-1, page 4-12, 4.2.2 Energy Shaping Benefits “The annualized energy shaping benefits ranged from \$9 million in the 2010/11 study year to \$14 million in the 2015/16 year”.

1.6.2 Please provide the model output from the two studies done for each of the 2010/11 and 2015/16 years, which can substantiate the energy shaping benefits of \$9 million and \$14 million.

RESPONSE:

Please refer to the responses to BCUC IR 1.52.1, BCUC IR 1.53.5 and BCOAPO IR 1.10.1.

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6.0 Reference: Exhibit B-1, page 4-12, 4.2.2 Energy Shaping Benefits “The annualized energy shaping benefits ranged from \$9 million in the 2010/11 study year to \$14 million in the 2015/16 year”.

1.6.3 The spreadsheets in Appendix I, pages 9 and 10, appear to assume \$11 million for the value of energy shaping in each of the 50 years, which appears to offset over 60% of the cost of the Unit 5 project. Why was \$11 million used for all years?

RESPONSE:

Please refer to the response to BCOAPO IR 1.9.1.

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7.0 Reference: Exhibit B-1, Appendix I, Unit 5 Modeling Studies and Economic Analysis.

- 1.7.1 Please provide working copies of the Excel models applicable to each of the 4 cases listed in Table 3-4 (2010 and 2011 ISDs for P50 and P90 cost estimates).

RESPONSE:

Please refer to the model provided in the response to BCUC IR 1.53.1.

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7.0 Reference: Exhibit B-1, Appendix I, Unit 5 Modeling Studies and Economic Analysis.

- 1.7.2 Please also include the calculations of the Escalation, Inflation, Capital Overhead and IDC charges for each of those 4 cases (if they are not already included in the models requested in 7.1).

RESPONSE:

Capital overhead is calculated at 13 per cent on the inflated dollars. Interest During Construction (IDC) is compounded monthly at the following rates (6.59 per cent for 2007/2008, 6.85 per cent for 2008/2009, 6.45 per cent for 2009/2010 and 6.01 per cent for 2010/2011) on the spent capital. The “loadings”, Escalation, Inflation, Capital Overhead and IDC, total charges for each of the four cases are shown in Exhibit B-1, Table 3-4. The total inflation factors (escalation + CPI inflation) used by BC Hydro are shown in Exhibit B-1, Table 3-6.

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8.0 Reference: Exhibit B-1, page 4-12, 4.2.2 Energy Shaping Benefits, “The value of this benefit is a function of the amount of surplus energy available in the system,...” and Appendix I, page 2 states, “The monthly energy generation from F2006 Call projects is based on average generation provided by IPP developers.”

1.8.1 In view of the fact that Section 4.1.4 states that “Policy Action No. 20 presents additional challenges to these (two coal-fired) projects.” what assumptions were made about attrition from the F2006 Call projects, and how much energy was assumed to come from these projects for the purposes of the Energy Shaping Benefit calculations?

RESPONSE:

Consistent with the F2006 Call Report submitted as Exhibit B-22 in the 2006 IEP/LTAP proceeding, the combined attrition and outage rate is assumed to be 30 per cent. The F2006 Call was assumed to contribute 4233 GWh/year, of which 1128 GWh/year is from coal-fired projects.

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1.8.2 To help illustrate how the value of the shaping benefit depends on the amount of surplus energy available in the system, please model two additional cases for each of the fiscal years modeled in this analysis – one case with 33% more energy from F2006 projects, and one case with 33% less energy from F2006 projects. For purposes of this modeling, simply assume that the energy from all projects is increased or decreased pro-rata, on a monthly basis.

RESPONSE:

As identified in the response to BCUC IR 1.13.2.4, the ranges for the 2010-2011 study and the 2015-2016 study were -6,000 GWh to +5,600 GWh and 300 GWh to 11,800 GWh respectively. For the two years that were modeled (F2011 and F2016) 33 per cent of the F2006 Call energy would be 991 GWh and 1,411 GWh, respectively, well within the range of conditions analyzed.

If it is assumed that the \$5 million difference in shaping benefits between the two studies is attributed to the difference in the energy balance then by way of linear interpolation, 991 GWh and 1411 GWh would correspond to a reduction of \$0.7 million/year and an increase of \$1 million/year respectively from the base case assumption regarding the F2006 Call. With reference to the UCC calculation in Exhibit B-1, Appendix I, a range of +/- \$1 million/year around the \$11 million/year of shaping benefits results in a +/- \$2/kW-yr difference in the UCC.

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8.0 Reference: Exhibit B-1, page 4-12, 4.2.2 Energy Shaping Benefits, “The value of this benefit is a function of the amount of surplus energy available in the system,...” and Appendix I, page 2 states, “The monthly energy generation from F2006 Call projects is based on average generation provided by IPP developers.”

1.8.3 Please summarize the significant results and also provide the model output from these additional cases.

RESPONSE:

Please refer to the response to IPPBC IR 1.8.2.

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- 1.9.1 What certainty, including without limitation length of term, will any agreements, including IMBAs, with the First Nations referred to above bring to BC Hydro and or the Province with respect to any consultation and accommodation obligations BC Hydro and/or the Province may have with respect to these First Nations? What certainty, including without limitation length of term, will any of these agreements bring to any claims these First Nations may have against BC Hydro and/or the Province with respect to potential or actual infringement of aboriginal rights and title?

RESPONSE:

BC Hydro notes that the correct reference for this IR is Exhibit B-1, page 5-13, lines 19-20.

With respect to First Nations, BC Hydro's primary objective was to ensure that adequate consultation occurred with the three First Nations identified as interested in Revelstoke Unit 5 - the Ktunaxa Nation Council (KNC), the Okanagan Nation Council (ONC) and the Shuswap Nation Tribal Council (SNTC) – so that BC Hydro would have certainty around all aspects of the project, including ongoing certainty until decommissioning. In this respect, risks over the project will be minimized, not just those at the project's outset.

As set out at Exhibit B-1, Pages 5-8 and 5-13, there are two types of First Nation agreements relating to Revelstoke Unit 5:

- (1) Capacity Funding Agreements – These agreements provided funding to each of the KNC, ONC and SNTC to enable these First Nations to participate in the Environmental Assessment Office (EAO)-led harmonized environmental assessment of Revelstoke Unit 5. The Capacity Funding Agreements are an input into the consultation required of BC Hydro pursuant to the BC *Environmental Assessment Act* (see Section 5.3 of the EAO's Section 11 Order, attached in Exhibit B-1, Appendix K) and the *Canadian Environmental Assessment Act (CEAA)*. Copies of the Capacity Funding Agreements have been filed with the BCUC on a confidential basis pursuant to BC Hydro's response to BCUC IR 1.21.1.**
- (2) Impact Management Benefit Agreements (IMBAs) – As stated in Exhibit B-1, Page 5-13, IMBAs have not yet been concluded with the three First Nations.**

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Concluding IMBAs with each of the KNC, ONC and SNTC is not a pre-requisite to obtaining an Environmental Assessment Certificate or a favourable CEAA determination under the harmonized environmental assessment process for Revelstoke Unit 5. However, BC Hydro is of the view that continuing negotiations towards reaching this form of agreement will be of benefit to providing greater certainty to BC Hydro's operations and will reduce or eliminate risks to BC Hydro and the Province. associated with potential post-construction judicial reviews or court challenges. As stated in Exhibit B-1, Pages 5-18, Line 14-16, IMBAs are designed to address the future operation of the Revelstoke GS as it relates to First Nation interests and impacts, and to set the foundation for the subsequent additions at Revelstoke Unit 6, Mica Unit 5 and Mica Unit 6. IMBAs are common agreements used by parties, including those in the private sector, to formalize how First Nations interests will be addressed and/or accommodated. BC Hydro has entered into a number of these agreements in the past to address various First Nation interests and project-specific impacts. Clearly defining the expectations and obligations of the parties over the life of the Revelstoke GS will ensure First Nations interests are met and enable BC Hydro to operate with greater certainty.