PROGRAM ON
WATER GOVERNANCE

Site C: Summary of Key Research Results

Richard Hendriks
Philip Raphals
Karen Bakker

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Executive Summary: Key issues with respect to Site C

Jobs: The BCUC alternative portfolio generates significantly more jobs than Site C.

- In the medium and long term, Site C creates far fewer jobs than the alternative portfolios
  - Through 2024, the BCUC alternative portfolio creates 18% to 30% less employment than Site C
    - Site remediation, geothermal construction and DSM will create thousands of jobs each year
  - Through 2030, the BCUC alternative portfolio creates 22% to 50% more employment than Site C
  - By 2054, the BCUC alternative portfolio will have created three times as many jobs as Site C
    - Many of those jobs are in the Peace region, which has the best wind resources in the province

Economics: Site C remains the most expensive option, and further cost over-runs are likely.

- If it weren't for the sunk costs and the termination costs, the BCUC alternative portfolio would be dramatically cheaper than Site C. But even taking these costs into consideration, Site C is not less expensive than the alternatives, because of the high cost of producing Site C electricity.
- Site C is:
  - not less expensive than the BCUC portfolio which includes geothermal and wind resources, as well as additional demand-side management (conservation)
  - more expensive than export market prices, so Site C surplus energy will be sold at a loss
  - much more expensive than the effective cost of the Canadian Entitlement (Columbia River Treaty)

Risks: Site C has significant risks, including geotechnical and First Nations litigation risks.

- The risks of completing Site C are asymmetrical, with more downside than upside:
  - Risk of cost overruns and delays (due in part to geotechnical risks) which could lead to high rate increases
  - Risk of First Nations litigation: Site C was approved without any assessment of treaty rights infringement (Treaty 8), which creates financial risks from a potential future cost award
  - Risk of further deterioration to the long-term plan
    - BC Hydro has consistently and significantly over-forecast future demand for the past 30 years
    - Lower load growth means more years of low-priced exports, and greater rate impacts
    - The costs of the alternative resources are expected to decline considerably

Climate change: Site C generates substantial GHG emissions, which cannot be offset by exports.

- Site C's reservoir will create meaningful GHG emissions, primarily in the 2020s and 2030s. While emissions will decline after that, Site C will make it harder to meet Canada's 2030 GHG reduction commitments
- The BCUC's alternative portfolio (geothermal, wind and conservation), BC Hydro's alternative portfolio and our alternative portfolio all have significantly lower GHG emissions
- The GHG benefit that would result from exporting Site C surplus power to Alberta is not enough to make up for Site C's emissions. Site C's net emissions (after discounting the hypothetical Alberta benefit) would still amount of 0.6 to 2.1 megatonnes, equivalent to running 50,000 cars for 10 years

Site C's negative environmental effects are unprecedented in BC and across Canada

- Site C has more significant negative environmental effects than any other project ever reviewed under the Canadian Environmental Assessment Act (including oil sands projects)
- The scale of impacts results from the rare and ecologically important biodiversity of the Peace Valley

1. Employment

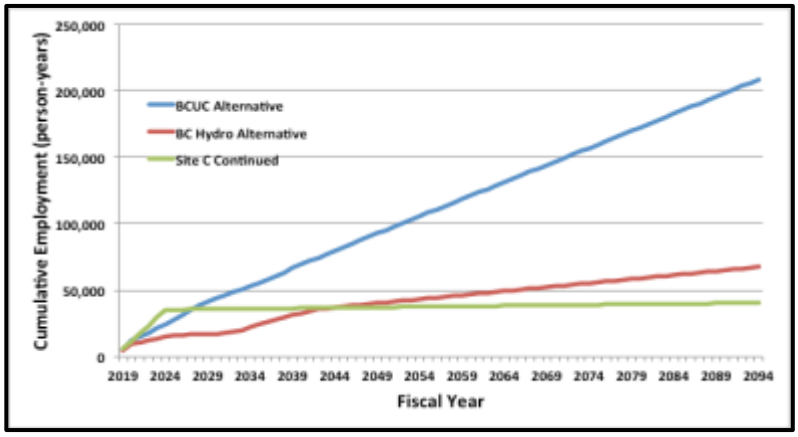
Summary:

- UBC's Program on Water Governance has conducted a detailed comparison of employment generated by Site C versus the alternative portfolios put forward by BC Hydro and the BCUC.
- Our analysis indicates that terminating Site C and pursuing the alternatives results in modest job losses in the short term, and substantial job gains in the medium and long-term.
- These jobs are generated by site remediation, energy conservation, and alternative energy projects.
- Terminating Site C and pursuing any alternative portfolio creates a higher number of sustainable jobs in the province, including in the Peace Region.
- Site C provides the least jobs per dollar spent.

Our "apples to apples" method. Our analysis used the BC Hydro and the BC Utilities Commission alternative portfolios, which provide the same annual energy and meet the same peak demand as the Site C Project. This "apples to apples" approach is also used by BC Hydro in its integrated resource plan. We also used a conservative approach by estimating the employment in the alternative portfolios using BC Hydro's low load forecast of future electricity requirements. Our analysis period includes the 70-year economic life of Site C (2024 to 2094), as used by BC Hydro and the BCUC for their alternative portfolios.

Employment (person-years or "jobs")	BCUC Alternative	BC Hydro Alternative	Site C Continued
Cumulative to 2024	24,612	15,059	35,398
Cumulative to 2030	43,836	17,284	35,842
Cumulative to 2054	105,618	43,421	37,618
Cumulative to 2094	208,498	67,580	40,578

BC Hydro alternative portfolio.[1] In the long-term this portfolio outperforms Site C for job creation. This is because alternative energy generates more jobs per dollar spent. More energy conservation programs in place of wind resources would increase short, medium and long-term employment.



BCUC alternative portfolio.[2] The Commission's alternative portfolio provides somewhat less employment to 2024, but then substantially exceeds Site C, due to site remediation, energy conservation, and alternative energy jobs. Continuing Site C creates more employment during the construction phase. However, Site C operations create very limited employment (74 persons/year), and DSM creates a great deal of employment (30 person-years per $1 million invested, according to BC Hydro).

[1] BC Hydro. August 30, 2017. BC Hydro Submission to the British Columbia Utilities Commission Inquiry into the Site C Clean Energy Project, Appendix Q. (F1-1).

[2] BCUC. November 3, 2017. Illustrative Alternative Portfolio Errata. (A-26-1)

Continuing with Site C creates fewer jobs than the alternative portfolios

- **Total construction jobs**. According to BC Hydro, Site C will create about 44,000 "jobs" or person-years of employment during construction, including direct (on-site), indirect (contractors), and induced (broader economy) jobs.
- **Cost of construction jobs**. Every direct job at Site C costs over $1M. (For total employment, each job costs $225,000.)
- **Operations jobs**. Once construction is complete in 2024, according to BC Hydro the Site C Project would produce 74 jobs/year.

> Approximately 80% of the construction jobs, or 35,000 person-years of total employment, remain on the Site C Project after December 31, 2017. Each job costs about $225,000.

Terminating Site C generates more jobs than the alternative portfolios

- **Site C remediation jobs**. Site C remediation is estimated to cost $1.8 billion, the same spending as the previous two years of construction at Site C. This two-year remediation and 10 years of monitoring is expected to create nearly 10,000 jobs at similar pay and skill levels to current Site C construction jobs. If Site C were terminated, remediation provides a transition period for workers and the local economy.
- **Energy conservation jobs**. According to a study carried out for BC Hydro, spending on energy conservation or demand-side management (DSM) programs creates 30 jobs per $1M spent.[3] Spending on energy conservation programs is the most effective way to create employment.
- **New peak demand project jobs**. If Site C were terminated, BC Hydro requires new resources to meet peak demand requirements as early as 2025, depending on future load. BC Hydro proposed pumped storage hydro, and the BCUC proposed geothermal projects. Planning would begin immediately for these projects, with construction starting in the early 2020s.
- **New wind energy project jobs**. All alternative portfolios involved the development of new wind projects, with construction beginning as early as 2025 depending on future energy requirements. Most wind development would occur in the Peace Region, which has the best wind resources.
- **BC Hydro alternative portfolio**: In the long-term this portfolio outperforms Site C for job creation. This is because alternative energy generates more jobs per dollar spent.

> The BCUC Alternative Portfolio envisions investing $80 million/year in energy conservation programs, creating 2,400 jobs per year indefinitely. Each job costs about $35,000.

> The BC Hydro Alternative Portfolio envisions development of more than 1500 MW of wind, creating 17,000 construction jobs, and nearly 600 operations jobs per year indefinitely in the Peace Region.

Conclusion:

Our analysis indicates that terminating Site C and pursuing the alternatives results in modest job losses in the short term, and substantial job gains in the medium and long-term. Site C provides the least jobs per $ spent. **Terminating Site C and pursuing any alternative portfolio creates a higher number of sustainable jobs, including in the Peace Region.**

[3] BC Hydro Power Smart. March 2010. Power Smart Employment Impacts. DSM Programs, Rates and Codes and Standards, F2008 to F2037, p.iv. (Converted to current dollars).

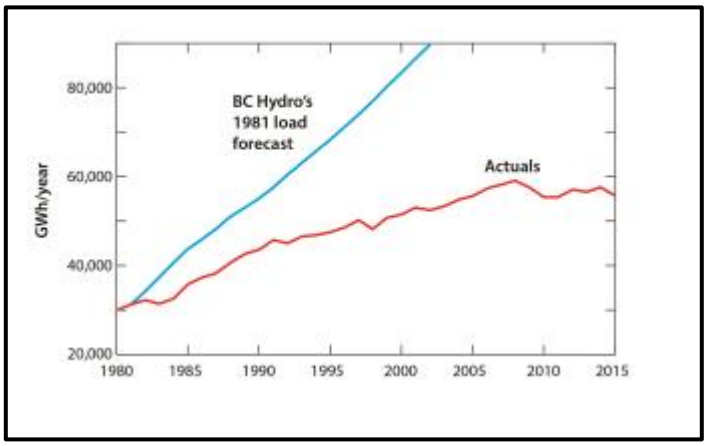
2. Economics

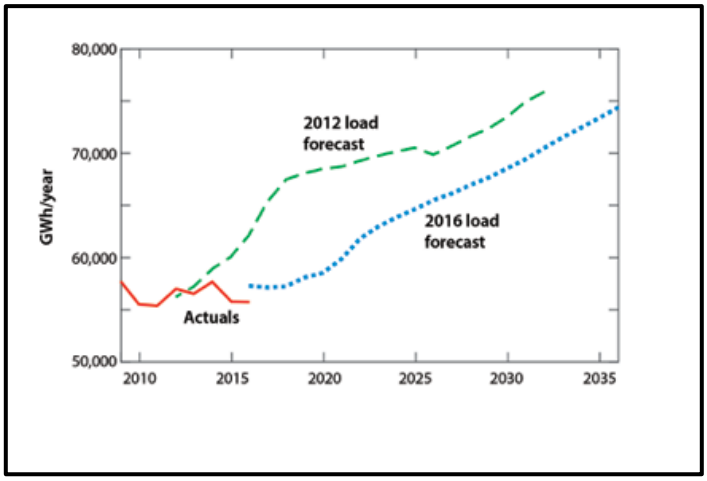
BC Hydro's load forecasts

"The Panel finds BC Hydro's mid load forecast to be excessively optimistic and considers it more appropriate to use the low load forecast in making our applicable findings as required by the OIC. In addition, the Panel is of the view that there are risks that could result in demand being less than the low case."

--BC Utilities Commission, Inquiry Respecting Site C (2017), Final Report, p. 3

Lower load growth means a longer period when Site C power is surplus to BC needs. Our research findings in relation to the load forecasts are as follows:





- **BC Hydro has consistently over-forecast future demand in 85% of cases**. Our review of BC Hydro's load forecasts since 1981, when Site C was first proposed, indicates that 85% of BC Hydro's forecasts of annual future energy requirements are overestimates. Indeed, consumption in British Columbia has still not reached the level that BC Hydro forecast in 1981.
- **Forecast inaccuracy increases over time**. BC Hydro's historic forecasts become more inaccurate over time. The utility's 10-year forecasts overestimate demand by nearly 10%, and its 20-year forecasts by more than 25%.
- **Low-load forecast**. Actual historic loads are more consistent with BC Hydro's low-load forecasts than its mid-load forecasts.
- **Price elasticity**. BC Hydro's estimate of the degree to which electricity consumers reduce consumption in response to price is very low compared to values estimated by researchers and other utilities. Increases in future electricity prices could cause customers to reduce demand much more than forecast by BC Hydro.
- **Electrification**. Deep reductions in British Columbia's GHG emissions would result in more electricity demand. However, the extent of this increase in demand and its timing remain highly uncertain. BC Hydro already includes significant electrification in its load forecasts. Electrification is expected to be modest until at least the 2030s due to very low natural gas prices, even with continuation of $10/year increases in carbon prices. Conservation, efficiency and renewable fuels also play an important role in reducing our greenhouse gas emissions. Furthermore, the rate increases that will result from Site C will only serve to **discourage** further use of electricity.
- **Self-generation**. Residential solar PV costs are projected to decline below Tier 2 residential rates, and commercial solar PV costs below medium general service rates by 2025 in the more cost-effective solar regions (e.g. Cranbrook, Kelowna). This will result in self-generation using solar PV and subsequent reduction in requirements from the BC Hydro grid, similar to what is currently occurring in regions further south.

BCUC alternative portfolio

In developing its alternative portfolio, the Commission found that it required far less new energy and capacity by 2024 than that provided by Site C. A corollary is that much of the energy from Site C will be exported at a loss, since export prices are lower than the cost of production. This is especially in the low load scenario judged most likely by the Commission, since lower load growth results in the surplus lasting into the late 2030s.

- **Low load scenario**. In the low load scenario, which the Commission regards as most likely, the **only** additional generating resources required are 444 MW of wind power, **starting between F2039 and F2041.**
- **Mid load scenario**. In the less likely mid load scenario, the same amount of wind power is required, but starting earlier (between F2029 and F2031). In addition, 81 MW of geothermal power is required, starting in F2025.
- **High load scenario**. In the even less likely high load scenario, in addition to the resources required in the mid-load scenario, 291 MW of wind power is required, starting in F2025 and F2026.

In all cases, the remaining energy and capacity needs can be met by various types of demand-side management (DSM), at far lower cost than generating resources.

If so little new generation is needed to meet needs, even in the medium and high scenarios, why are the BCUC alternate portfolios only marginally superior to completing Site C?

This is because of the sunk cost and the termination costs, which represent a heavy thumb on the scales favouring completing Site C. **Without the sunk costs ($2.1 billion) and the termination and remediation costs ($1.8 billion), the alternative portfolios would be of far lower cost than the "no Site C" option.**

In other words, if this BCUC review had taken place before Site C was approved, rather than three years later, the evidence would have been overwhelmingly in favour of abandoning the Project in favour of the alternatives. **BC Hydro and its shareholder now find themselves in the unenviable situation whereby construction continues on a project that clearly should not have been launched.**

The balance of risks

On its face, the BCUC report appears to reflect uncertainty, with the present value costs of completing the project essentially identical to those of terminating it. However, **the identified risks are not symmetrical**:

- **Site C cost overruns**. There is a substantial risk of further cost overruns and delays, if Site C continues.
- **Lower load growth**. There is a risk that load growth will be lower than forecast, and even lower than the low load forecast, further eroding the Site C Project's financial viability.
- **First Nations litigation**. There is a litigation risk with respect to infringement of Treaty 8 rights, which could include significant damage claims. To date, the courts have addressed only administrative law issues. If Site C is completed, the Crown bears the risk that, if the First Nations sue for infringement of Treaty Rights, the court will find in their favour.
- **Declining costs of alternatives**. The costs of DSM and alternate resources could, in theory, be either lower or higher than the costs used in the BCUC report. In our view, these cost estimates were conservative, and there is greater likelihood that costs of the alternatives will fall further, making Site C more uneconomic.

The Canadian Entitlement

The Commission heard evidence regarding the Downstream Benefits of the Columbia River Treaty. The findings in its Final Report[4] support the easing of the restrictions in the *Clean Energy Act* with respect to the use of this resource in BC Hydro's planning. Though the Commission did not include the Downstream Benefits of the Columbia River Treaty in its alternative portfolios, doing so would further reduce of the costs of those portfolios.

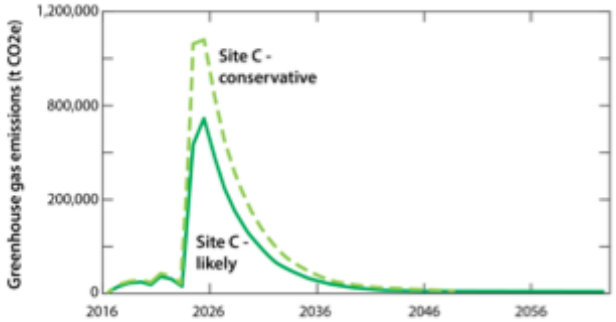
[4] BCUC. November 1, 2017. British Columbia Utilities Commission Inquiry Respecting Site C. Final Report to the Government of British Columbia, Appendix B.

3. Greenhouse gas emissions

Summary

There has been considerable commentary regarding the potential for energy from Site C to offset greenhouse gas emissions in BC and elsewhere. The available evidence supports a different conclusion. Including emissions reductions due to exports, Site C would have net GHG emissions of 0.6 Mt to 2.1 Mt over its 100-year lifetime. This is equivalent to 50,000 personal automobiles operating for 10 years. The alternative portfolios produce no GHG emissions from operations, and the alternative portfolios produce lower construction-related emissions than Site C.

- **Site C emissions**. Site C's reservoir creates greenhouse gas emissions from decomposition of biomass (i.e. trees and soil). According to BC Hydro, these emissions total 4.3 million tonnes (Mt) to 5.8 Mt over the 100-year operating life of Site C, with most emissions occurring within 10 years after flooding.
- **Alternative portfolio emissions**. The alternative portfolios consist entirely of "clean" resources such as demand-side management, upgrades at existing hydroelectric facilities, wind, and geothermal. Therefore, the alternative portfolios do not produce GHG emissions.



Source: Comparative Analysis of Greenhouse Gas Emissions of Site C versus Alternatives Report, UBC Program on Water Governance

- **Comparison of emissions**. Under BC Hydro's mid-load forecast, the energy surplus from Site C is 20,400 GWh in total. Electricity planners properly evaluate GHG emission reductions based on a comparison with the alternative new (lower carbon) resources **not** with the existing (higher carbon) resources. BC Hydro also does its analysis this way, which is correct. However, BC Hydro failed to provide updated data in its submission to the BCUC, so we provided the updated analysis to the Commission.

Site C emissions including exports

- **Domestic emissions**. Site C has 4.3 Mt to 5.8 Mt of emissions (depending on reservoir emissions); the alternative portfolio has 0 Mt of emissions
- **Export emissions**. If the Site C energy surplus were exported into Alberta, the benefit is 3.7 Mt (in total), which results from an offset of 180 t/GWh under the current Alberta policy regime for replacing coal with 1/3 natural gas and 2/3 renewables, identical to what Ontario used to replace coal. Exporting to other jurisdictions in the United States is very unlikely to improve upon exporting to Alberta due to much greater commitments to carbon reduction in Washington, Oregon and California than in Alberta.
- **Site C increases GHG emissions even after export.** Subtracting emissions reductions due to exports, Site C would have net GHG emissions of 0.6 Mt to 2.1 Mt over its 100-year lifetime. This is equivalent to 50,000 personal automobiles for 10 years. The alternative portfolio produces significantly lower GHG emissions.

BCUC conclusion

On the basis of this and other evidence, the Commission reached the only reasonable conclusion – **building Site C will not reduce greenhouse gas emissions, and will in fact increase emissions above 2016-2017 levels**.

4. Other significant environmental effects

Site C environmental effects

As determined by the Joint Review Panel, the Site C Project will have more significant adverse environmental effects than any other project ever assessed during the 25-year history of the *Canadian Environmental Assessment Act*. This unprecedented level of effects results from the Peace River Valley's biodiversity and importance to First Nations' land use and culture.

Significant adverse environmental effects under the *CEAA*

Projects assessed under the Canadian Environmental Assessment Act	Number of Significant Environmental Effects
Site C Project	20
Lower Churchill Hydroelectric Generation Project	5
New Prosperity Gold and Copper Mine Project	5
Jackpine [Oilsands] Mine Expansion Project	5
Pacific Northwest LNG	3
Cheviot Coal Project	2
Encana Shallow Gas Infill Development Project	2
Kemess North	2
Labrador-Island Transmission Link	1
LNG Canada	1
Northern Gateway Project	1
White Pines Quarry	1

Alternative portfolio environmental effects

The alternative portfolios are very unlikely to have significant adverse environmental effects. The spatial flexibility of the alternative wind and geothermal resources allows them to be designed and located so as to avoid significant adverse environmental effects. Cost-effective, technically feasible and proven mitigation measures are available to further minimize any environmental effects.

5. List of UBC reports

Employment

UBC Briefing Note: Comparative Employment Assessment of Site C versus Alternatives (17 November 2017)

UBC Spreadsheet Analysis: Comparative Employment Assessment of Site C versus Alternatives (17 November 2017)

UBC Analysis of Allied Hydro Council Report (19 November 2017)

First Nations*

First Nations and Site C (May 2016)

Environmental Issues**

Site C – Environmental Effects (May 2016)

Site C – Comparative GHG analysis (July 2016)

Economics***

Site C – Economics Report (April 2017)

Site C – Economics Report - Errata (April 2017)

***Additional co-author**

This report was co-authored with Dr. Gordon Christie, Professor, Faculty of Law, University of British Columbia.

****Reviewers:**

The GHG analysis report indicated above were independently reviewed by:

- Dr. Arthur Fredeen (Professor, Natural Resources and Environmental Studies, University of Northern British Columbia)
- Dr. Normand Mousseau (Professor, Université de Montréal and Director, Trottier Energy Institute)

*****Reviewers:**

- Ian Goodman (President, The Goodman Group)
- Dr. Norman Mousseau (Professor, Université de Montréal and Director, Trottier Energy Institute)
- Dr. Mark Winfield (Professor and Co-Chair, Sustainable Energy Institute, York University)

6. List of submissions made by the UBC Program on Water Governance to the BC Utilities Commission Inquiry on Site C

Our team's technical submissions made to the British Columbia Utilities Commission can been viewed on their website or accessed via the links below.

F106-1 Program on Water Governance, UBC, Reassessing the Need for Site C & Comparative Analysis of Greenhouse Gas Emissions of the Site C versus Alternatives (2 reports in here) (August 27 2017)

F106-2 Program on Water Governance, UBC, Submission to the BC Utilities Commission (August 30 2017)

F106-5 Program on Water Governance, UBC, An Updated Portfolio Present Value Cost Analysis (October 11 2017)

F106-6 Program on Water Governance, UBC, Policy issues of relevance to the BCUC Inquiry Respecting Site C (October 16 2017)

F106-7 Program on Water Governance, UBC, Comments on BC Hydro's Appendix M (October 16 2017)

F106-10 Program on Water Governance, UBC, Submission #6 — Comments on the Commission's Draft Alternative Portfolio (October 19 2017)

F106-10-1 Spreadsheet

F106-11 Program on Water Governance, UBC, Submission #6 — Alternative Portfolios with regard to the Site C Project (October 19 2017)

F106-11-1 Spreadsheet

7. About the Authors

Dr. Karen Bakker is Professor and Canada Research Chair at the University of British Columbia, where she is the Director of the Program on Water Governance (http://www.watergovernance.ca). A Rhodes Scholar with a PhD from Oxford University, she was named one of Canada's Top 40 under 40 in 2011, and named a Fellow of the Royal Society of Canada's New College of Scholars, Artists and Scientists in 2014.

The mandate of the Program on Water Governance is to conduct interdisciplinary research on water sustainability issues, and disseminate research to the academic community, policy-makers and decision-makers. In her role as Director, Dr. Bakker leads large interdisciplinary teams of natural and social scientists, engineers, and health specialists to conduct analyses of pressing water issues. Over the past two decades, she has conducted research in Europe, Latin America, and Southeast Asia as well as North America. The Program on Water Governance has conducted research on a broad range of topics, including water privatization, Indigenous water governance, the impacts of hydroelectric development, water security, and transboundary water governance.

The author of more than 100 academic publications, Dr. Bakker's work has been published in leading scientific journals (*Science, Global Environmental Change)*, and she has published books with Oxford, Cornell, UBC, and University of Toronto Presses. Her work has been translated into Spanish and French, and she has been an invited speaker at Oxford, Berkeley, Harvard, and also at Stanford--where she spent the 2015/2016 academic year as a sabbatical fellow jointly hosted by the School of Earth, Energy and Environmental Sciences and the Centre for the Advanced Study of the Behavioural Sciences.

Fluent in French and Spanish, Dr. Bakker regularly acts as an advisor to governments and non-governmental and international organizations, including the Conference Board of Canada, the OECD, and the United Nations. Dr. Bakker also actively engages in public policy debates and has published widely for the popular press, including op-eds and articles in the *New York Times*, *Globe and Mail*, *Huffington Post*, *Guardian*, *Wall Street Journal*, *Sunday Times*, *Independent*, and *Dissent*. In 2017, Dr. Bakker was awarded a Social Sciences and Humanities Research Council of Canada Impact Award and a Pierre Elliott Trudeau Foundation Fellowship.

More information and publications at: www.karenbakker.org.

Philip Raphals is cofounder and executive director of the Helios Centre, a non-profit energy research and consulting group based in Montreal. Over the last 25 years, he has written extensively on issues related to hydropower and competitive energy markets, and has appeared many times as an expert witness before energy and environmental regulators in several provinces.

Mr. Raphals has been formally recognized as an expert witness by energy regulators in the provinces of Quebec, Nova Scotia and Newfoundland and Labrador:

- In Quebec, he has provided expert testimony in 14 proceedings before the Régie de l'énergie du Québec. The Régie has recognized his expertise in fields including transmission ratemaking, security of supply, energy efficiency and avoided costs;

- The Nova Scotia Utilities and Review Board has qualified Mr. Raphals as expert in sustainable energy policy, least-cost energy planning and utility regulation (including transmission ratemaking). He provided expert testimony in two proceedings there concerning the Maritime Link, including critical

analysis of long-term demand forecasts, resource options and financial analyses submitted by NSP Maritime Link Inc., a subsidiary of Emera, in support of its proposal to build an undersea transmission link between Newfoundland and Nova Scotia, and the accompanying long-term electricity supply contracts. In its decision, the Board quoted Mr. Raphals' report and relied in part on his analyses;

- The Newfoundland and Labrador Public Utilities Board has qualified Mr. Raphals as an expert in electric utility rate making and regulatory policy. He has provided expert testimony in in 2011 Muskrat Falls Review and in its hearings on the 2013 General Rate Application of Newfoundland and Labrador Hydro.

Mr. Raphals is currently acting as an expert witness in rate proceedings before the Manitoba and Newfoundland and Labrador Public Utilities Boards.

Mr. Raphals appeared as an expert witness on behalf of Grand Riverkeeper Labrador Inc. in the hearings of the Joint Review Panel (JRP) on the Lower Churchill Generation Project, which relied on his analysis of project justification. The Panel cited him in its report and relied on his analyses for several of its findings.
In British Columbia, Mr. Raphals appeared as an expert witness on behalf of the Treaty 8 Tribal Association in the hearings of the Joint Review Panel on the Site C Hydroelectric Project. The Panel cited him in its report and relied on his analyses for several of its findings. He also presented expert affidavits in two related proceedings before the B.C. Supreme Court.[5]

Mr. Raphals chairs the Renewable Markets Advisory Panel for the Low Impact Hydropower Institute (LIHI) in the United States. He has been an invited speaker before the Senate Standing Committee on Energy, the Environment and Natural Resources and at numerous energy industry conferences, including the Canadian Association of Members of Public Utility Tribunals (CAMPUT). He has also been an invited speaker at Yale University, Concordia University and McGill University.

From 1992 to 1994, Mr. Raphals was Assistant Scientific Coordinator for the Support Office of the Environmental Assessment of the Great Whale Hydroelectric Project, where he coauthored with James Litchfield and Roy Hemmingway a study on the role of integrated resource planning in assessing the project's justification.

In 1995, Mr. Raphals was commissioned by the Quebec Department of Natural Resources to prepare a report on electricity regulation in British Columbia, focussing on the structure and practices of the British Columbia Utilities Commission. The report formed part of the documentation supporting Quebec's Public Debate on Energy, which eventually led to the creation of the Régie de l'énergie.

In 1997, Mr. Raphals advised the Standing Committee on the Economy and Labour of the Quebec National Assembly in its oversight hearings concerning Hydro-Quebec. In 2001, he authored a major study on the implications of electricity market restructuring for hydropower developments, entitled *Restructured Rivers: Hydropower in the Era of Competitive Energy Markets*. In 2005, he advised the Federal Review Commission studying the Eastmain 1A/Rupert Diversion hydro project with respect to project justification. Later, he drafted a submission to this same panel on behalf of the affected Cree communities of Nemaska, Waskaganish and Chisasibi.

[5] In one of the two cases, the expert affidavit was not received by the Court.

In 2013, Mr. Raphals was an invited participant in an expert roundtable on electricity surpluses and economic development, convoked by the Quebec Commission on Energy Issues. The Commission's report relied on several of his analyses.

In 2015, he was a finalist for the R.J. Tremplin Prize, awarded by the Canadian Wind Energy Association for "*scientific, technical, engineering or policy research and development work that has produced results that have served to significantly advance the wind energy industry in Canada.*"

Richard Hendriks is the director of Camerado Energy Consulting, an Ontario-based firm providing environmental assessment, energy planning, policy analysis, and research services to clients across Canada. For the past two decades, he has been engaged in the planning and assessment of several proposed large-scale hydroelectric developments, and provided testimony before regulatory bodies concerning their environmental effects, economic viability, socio-economic impacts and implications for Indigenous rights. Mr. Hendriks has played a key role in environmental assessment and negotiation processes regarding large hydroelectric and mining projects for several First Nations across Canada, including for the Innu Nation in Labrador with respect to the Lower Churchill Project, and for the Treaty 8 Tribal Association, with respect to the Site C Hydroelectric Project.

From 1999 to 2002, Mr. Hendriks was the environmental and engineering analyst for Innu Nation in relation to hydroelectric development proposals in Labrador. There, he participated in environmental assessment, negotiation of an environmental protection chapter of an impacts and benefits agreement in relation to the proposed Lower Churchill Project, and technical and research support for negotiation of a compensation agreement for the existing Churchill Falls Project.

In 2003, Mr. Hendriks joined Chignecto Consulting Group as an Associate where he provided resource negotiation and environmental assessment support services to Indigenous groups across Canada. His work included negotiation of impacts and benefits agreements, regulatory interventions, and assessment of environmental, economic and social impacts and benefits related to hydroelectric, transmission and mining developments.

Since 2009, as director of Camerado Energy Consulting, Mr. Hendriks has conducted and managed environmental, technical and economic review of several large-scale proposed resource projects, including the Lower Churchill Hydroelectric Generation Project, the Labrador-Island Transmission Link, the Site C Clean Energy Project, the Côte Gold Project, and the Slave River Hydro Project. He has also assessed the potential for compensation to Indigenous communities for historic and ongoing effects of hydroelectric and transmission development in Ontario, Labrador, Manitoba and the Northwest Territories.

In 2010, Mr. Hendriks testified before the Alberta Utilities Commission during its Inquiry on Hydroelectric Power Generation that was reviewing the policy, planning and regulatory context for additional hydroelectric development in that Province. The following year, Mr. Hendriks presented testimony on several economic and environmental matters before the Joint Review Panel for the Lower Churchill Project, who accepted many of his recommendations. More recently, Mr. Hendriks testified on several occasions before the Joint Review Panel for the Site C Project, who adopted several of his recommendations. In May 2014, the Manitoba Public Utilities Board qualified Mr. Hendriks as an expert in the policy and planning aspects of large-scale hydroelectric developments, including the socioeconomic implications and environmental consequences for Indigenous communities of these developments.