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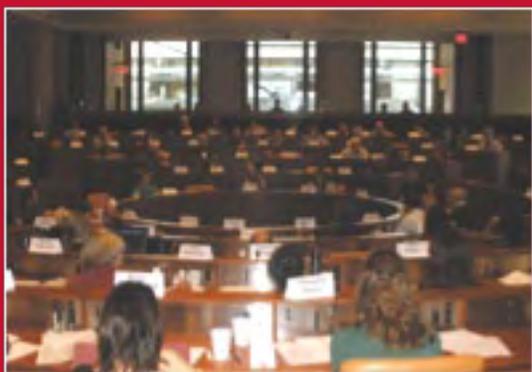
SIMON FRASER UNIVERSITY  
CONTINUING STUDIES



**Proceedings from:  
Building a Vision for Green  
Energy in British Columbia**

November 3-4, 2009

**Edited by Patricia Gallagher and  
Laurie Wood**



## Preface

Continuing Studies in Science and the Centre for Coastal Studies co-hosted this dialogue with the faculties of Environment and Science at Simon Fraser University (SFU) on November 3-4, 2009 at the Morris J. Wosk Centre for Dialogue at SFU Vancouver.

Given the mounting concerns surrounding global climate change impacts, green energy is a topical issue. It has also been a controversial issue in British Columbia, with dialogue around the development of run-of-river hydropower particularly polarized.

The goal of the *Building a Vision for Green Energy in British Columbia* Dialogue was to examine options for renewable energy with a main focus on hydro electric power. To achieve this, presentations, panels and dialogue explored the issues through diverse perspectives including industry, science, institutions, First Nations, and civil society. To help focus the dialogue, presenters addressed overarching questions. They included:

- What are the opportunities for and challenges of developing independent power production in BC (social economic, environmental)?
- Are we on the right path?
- What is needed for better decision-making?
- Would a strategic plan help? If so, what would it look like?

What follows is an edited proceedings of the presentations and dialogue. Selected slides have been included but in some instances the slides are better viewed in their powerpoint format. Complete slide presentations are available on our website (<http://www.sfu.ca/cstudies/science/coastalGreenEnergy.php>)

## Acknowledgments

We wish to gratefully acknowledge the contributions from the presenters and participants who gave freely of their time and expertise. We also wish to thank the dialogue facilitator, Michael Harstone from Compass Resource Management who kept us on track in achieving the program goals. A special thank you to the members of the steering committee for their vision and direction. They include:

Mark Angelo, Rudy North Chair in River Ecology, Rivers Institute, BC Institute of Technology;  
Rupert Gale, Fisheries Project Manager, The Ritchie Foundation;  
Patricia Gallagher, Director, Centre for Coastal Studies and Continuing Studies in Science, SFU; and  
Craig Orr, Executive Director, Watershed Watch Salmon Society.

Last, a special thank you to the dialogue sponsors for making this project possible. They include:

**BC Institute of Technology**

Rivers Institute

**Pacific Institute for Climate Solutions**

**Pristine Power Inc.**

**Simon Fraser University**

Ting Forum for Environmental Education

Faculty of Environment

Faculty of Science

**Watershed Watch Salmon Society**

Gordon and Betty Moore Foundation

Tides Canada

Vancouver Foundation

ISBN 978-0-86491-325-8 Copyright Simon Fraser University

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# WELCOME AND INTRODUCTION

## DAY ONE

### Why are we having this dialogue?

*John Pierce, Dean, Faculty of Environment, Simon Fraser University*

For well over a decade, SFU through Continuing Studies in Science, has actively promoted the understanding of complex environmental issues and the necessity for action through creative policy and institutional arrangements. Added impetus for these mandates now comes from the newly created Faculty of Environment at SFU whose mission is to promote the best teaching and research possible, and also to provide leadership on the resolution of critically important environmental challenges. And improving our carbon productivity through a combination of gains in energy efficiency, demand management and the development of renewable or green sources of energy production is one of those challenges. A recent study from Stanford University published in the November issue of the *Scientific American* makes it clear that we have the potential of shifting the globe to 100 percent renewable energy by 2030. As Jacobson, the lead author notes, "If you make this transition to renewables and electricity, you eliminate the need for 13,000 new or existing coal-fired plants."

British Columbia's 2007 energy plan places energy efficiency, demand management through higher prices and the development of clean and renewable sources of energy as central goals to reducing our carbon footprint. At the same time, there is emphasis on energy security, and meeting growing energy demand, particularly from the transportation sector, both public and private. Currently BC generates almost 93 percent of its electrical needs through hydro and to meet these various goals and retain or expand this share, a very ambitious program of renewal power development will have to unfold, and undoubtedly at much higher prices. Already 13 percent of the hydropower within British Columbia comes from run-of-river projects. British Columbia and the rest of Canada have come late to providing incentives for green energy and carbon pricing. Here there is much to be learned from other jurisdictions such as Germany on the efficacy of these approaches, particularly incentives for such

things as feed-in tariffs for solar and wind energy and associated carbon abatement cost. Contrary to popular opinion, the economic and environmental benefits flowing from these subsidies are far from clear.

Within the context of new hydroelectric power generation capacity in British Columbia, a number of issues need to be resolved. (Hopefully this workshop will shed light as opposed to heat on these issues.) Let me give you a couple of examples. George Hoberg, from UBC recently wrote, "At present the province lacks a coordinated integrated process of energy facility decision making." He also argues that in going beyond special interest groups and reaching out to the broader public interest, "We need to define energy policy within the context of three questions." To paraphrase, these are:

1. What are our energy needs after discounting for demand-side management?;
2. What kinds of supplies should we have? and presumably, What are the tradeoffs with respect to these sources? and Where will these be located?;
3. What governance frameworks do we need to effectively site and regulate new facilities?

I think everyone here would agree that British Columbia is in an enviable position to reach its goals of a sustainable energy future. The choices and their associated tradeoffs on both the demand and supply sides, are deserving of a full and open public debate which I am confident that this workshop will play an important part. Through this forum, SFU hopes to

jump start this process and the dialogue associated with it to a new level. British Columbia can provide leadership, just as Canada must do at the UN Conference on Climate Change in Copenhagen in December 2009.



## Introduction

Michael Harstone, Compass Resource Management

Why should we have a dialogue on green energy? In part it is related to the fact that estimates show that over the next 25 to 30 years we will need approximately 50 percent more energy than what we currently use. Set against this backdrop is climate change, which is perhaps the most pressing and urgent environmental issue that we face.

Accordingly, people are passionate about getting informed and having a better understanding of the issues. Green energy projects are considered a possible viable way to mitigate or offset some of these climate change effects. Significant policy plans have been coming down the provincial pipeline over the last eight years related to the energy sector and greenhouse gases, including energy plans in 2002 and 2008. More recently in the August 25th, 2009 throne speech from the Premier, it was stated that green energy will be a cornerstone of British Columbia's climate action plan and that electricity self-sufficiency and clean, renewable power generation will be integral to our efforts to fight global warming. The BC government will capitalize on the world's desire and need for clean energy and for the benefit of all British Columbians.

Concerns, however, have been raised about the fact that there is not a clear overall provincial plan for how these priorities are going to be achieved. Where they typically play themselves out, as you can see in the press, is on site-specific projects or debates on sub-aspects of some of these policies. Figure 1 shows a brief review of some of the articles what have appeared in the newspapers over the past few months on small green energy projects that are being proposed.



Figure 1. Recent newspaper articles on green energy projects.

What is needed here is a broader, deeper discussion about the strategic areas that we should be heading and how they should be implemented. That is what this dialogue will address. The goal, therefore, is to share perspectives and explore a common vision for green energy in the province. Specifically, it is to support a deeper understanding of the issues and to create a safe space to probe and debate the issues and to highlight areas of agreement towards a collective vision. It is hoped that this session will be one in a series on green energy in the province as that vision actually starts to become more concrete.

There is an emphasis in the program on small hydro projects as a case study, basically, to learn from, and to identify what ingredients or success factors could be applied and replicated on a broader scale, towards a vision for green energy. In part, the reason for focusing on small hydro to begin with is recognition that British Columbia is endowed with a vast amount of hydroelectric potential that currently represents around 85 percent of our energy needs. There is another story that could perhaps best be illustrated through a series of maps. Figure 2 is a map of British Columbia – the series of dots and lines represent the transmission routes.

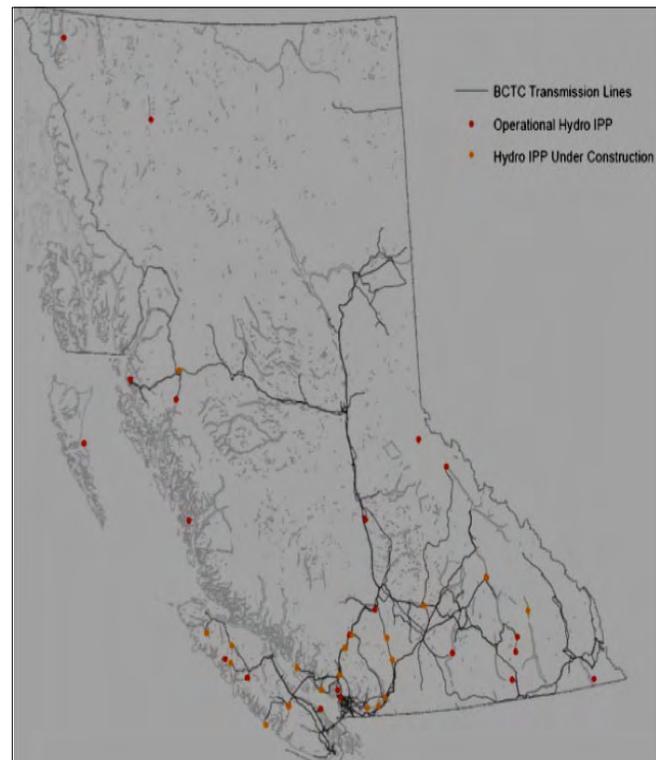


Figure 2. Transmission routes in British Columbia.

Aside from BC Hydro's 25 or more hydroelectric facilities, there are about 40 hydro independent power producers (IPPs) that are currently commercially producing electricity. There are an additional 25 hydro IPPs that are in some state of development and that are expected to be producing electricity by 2012, indicated by yellow dots. In Figure 3, the blue dots represent approximately 700 water license applications that are in varying states of approval or pending approval.

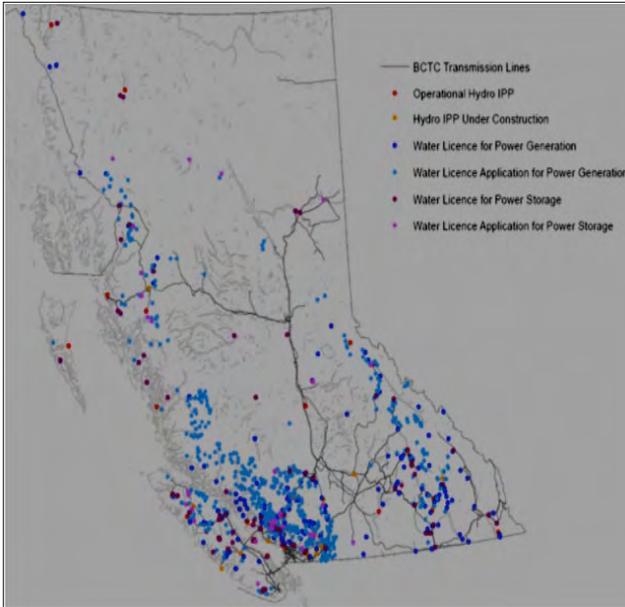


Figure 3. Water License Applications in British Columbia.

The map in Figure 4, produced in a 2007 study by Kerwood Leidel, shows about 8,200 potential hydroelectric sites across the province. This excludes any potential sites within protected areas and also all rivers that have anadromous fish. There are varying degrees of costs associated with these 8,000 sites that offer some potential for hydroelectric potential, so that although there are 8,000 sites identified, only about 120 could actually bring electricity to market for under \$100 per megawatt hour.

In summary, in terms of the hydroelectric potential in the province right now, there are about 90 active plants including BC Hydro and operating IPPs, small hydro IPPs and ones that will be on line by 2012. There are about 700 water license applications for power generation. There are 8,000 potential run-of-river hydro projects that have been identified, not all economically viable. Finally, it has been estimated that there are about 50,000 watersheds in the province and about 300,000 rivers in the province. This

provides an order of scale of how things could be rolled up.

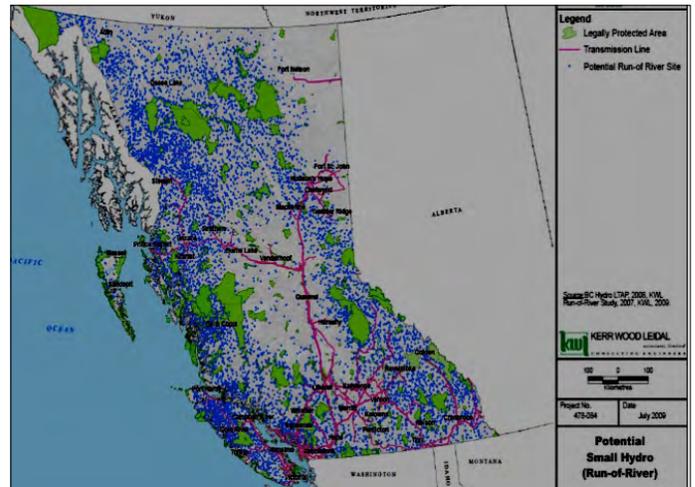


Figure 4. Potential hydro-electric sites in British Columbia.

Figure 5 provides a description of some terminology typically used by the energy sector and others when referring to energy. When we say “energy” what do we actually mean? If we are talking about electrical energy that refers to the average amount of electricity produced over a period of time either of a facility or of a system. It is typically the time period over the course of a year and from a provincial perspective this is expressed as gigawatt hours.

(Electric) Energy:	The average amount of electricity produced over a period of time-e.g. GWH/yr.
(Electric) Capacity:	The maximum electric power that a device or system is capable of producing instantaneously: e.g. MW.
Firm Energy	The energy that is available 100 percent of the time.
Demand Side Management (DMS)	Actions to reduce customer demand for electricity (i.e. conservation focused, e.g. BCH's PowerSmart Program)
IPP	Independent power producers

Figure 5. Some terminology.

Equally important is the concept of electric capacity. This is like the horsepower of the system. It is the instantaneous electric power that a device or a system is capable of producing. Typically that is expressed in terms of megawatts. There is also the concept of firm energy, the average that is available 100 percent of the time. You can see that there are different types of resource options that are more available and have a higher amount of firm energy. Large hydrothermal plants for example can be relied upon 100 percent of the time with more regularity

than small hydro or wind projects that are typically more intermittent. The way that we describe that is by using the terms ‘energy capacity’, or ‘firm energy’. There is also the concept of demand management or demand-side management that represents actions to reduce customer demand for electricity. Usually this is conservation related. In BC most people would be familiar with Power Smart that aims to curb people’s behaviour to use less electricity and shut off the switches. The final term is ‘IPPs’ or Independent Power Producers. These are commercial operations, non-government, that produce electricity for commercial purposes, not for their internal use, as in the case of pulp mills.

Figure 6 provides some quick facts about energy that may be useful in guiding the dialogue.

- BC Hydro produces over 43,000 GWh annually
  - About 85% of this is hydro-electric
  - The remainder is mostly thermal generation (natural gas / biomass)
- BC Hydro currently purchases about 9,000 GWh from close to 50 IPPs
- 70% of these IPPs are run of river hydro-electric
- There are an additional 38 IPPs who have “active” agreements with BC Hydro to produce electricity by 2012
- BC Hydro issued a “Clean Energy Call in 2008 and received 68 bids for new projects from IPPs

Figure 6. Quick facts about energy.

BC Hydro produces around 43,000 gigawatt hours annually - 85 percent of this is from hydroelectric generation and the remainder is mostly thermal generation, natural gas or biomass. BC Hydro currently purchases around 9,000 or 10,000 gigawatt hours from close to 50 IPPs. Seventy percent of those IPPs are run of river hydroelectric projects. ‘Run of river’ projects are typically small hydroelectric facilities that have no storage, so that whatever flows are coming upstream of the dam, after a point of diversion below the powerhouse, are the same river flows that are leaving below the penstocks, where the powerhouse is. There are an additional 38 independent power producers or IPPs who have active agreements with BC Hydro to produce electricity power by 2012. BC Hydro issued a clean energy call in 2008 and they received 68 bids for new projects from IPPs - the status of those is still pending.



# THE DIFFICULT TRADE-OFFS OF GREEN ENERGY

Mark Jaccard, Professor, School of Resource and Environmental Management, Simon Fraser University



Like many of you, I have been frustrated about issues on energy system planning and how to get to a sustainable energy system. I have argued that we need to be discussing these issues more in the political realm. Then in the last election, they were discussed in the political realm and I was dissatisfied because it often resulted in truth being the first casualty of the debates. In fact, as I heard the debates, I noted how the political process, unfortunately, helped to induce some polarized language which often makes dialogue difficult. However, if we are going to move forward, it is important to have effective dialogue.

## Good guys and bad guys

I would like people to see the world in a more nuanced way; that is, it is not a simple world. In fact, my first message is that we easily slip into the idea that there are good guys and bad guys, and we love terminology that helps us to work within that concept. We talk about green consumerism or green cities and green corporations and we probably ask, “What are we striving for?” But also, quite often those terms are left vague and there can be some notion nestled in behind that about what is good and what is bad.

Soon I will be going to Beijing where I have been co-chairing a taskforce on sustainable use of coal for the Chinese government. My co-chair is the head of the Chinese Coal Association. It is exciting because it

seems that our recommendation will include something like a carbon tax that China would implement. I have been involved with the China Council for about 20 years now, which has implemented many things as a result of the different processes used. Part of this group was a taskforce that addressed coal, all the way from mining through to its use and its combustion. These people are also coalminers and at some point in the recommendations that they submitted to the Chinese government there was ‘green’ coalmining. Green coalmining? What is that? I couldn’t get my head around this. However, I bought into it because I wanted the carbon tax. At the end of the day we have a recommendation that will do green coalmining although I have no idea what that is. But people on the taskforce were very excited to have the word ‘green’ in front of coalmining. In reality, what I have learned from working in this area, is that all of our energy options involve impacts and risks, and therefore tradeoffs, when making energy supply decisions. There are no good guys and bad guys.

## Weighing the options

If someone says to you, “Option ‘A’ has impacts so I oppose it,” that is when you have to ask, “What was your option ‘B’ and how does it compare to option ‘A’? By what criteria and with what weighting do they compare option A with option B?” For example, in the lead up to the last election I would hear someone who I admire on CBC Radio every Monday morning talk about opposition to any small hydro. But I never heard him talk about what we should be doing instead of that and I found that very frustrating.

### Criteria

Possible criteria could include the following:

- greenhouse gas emissions,
- local environmental impacts,
- local social impacts and benefits,
- financial costs and benefits, and,
- the robustness, or performance under a range of uncertain futures.

In academia we refer to this as ‘multi-attribute tradeoff analysis’. Unfortunately, the real world is complicated. There aren’t good guys and bad guys. Very rarely does an option outperform all other options with all of those criteria. That would be a wonderful kind of win-win situation but it is very rare. Consequently, we have to be mature and realize that we are going to have to make difficult decisions about trade-offs in which we have different values and we will put different weights on these criteria. It is not going to be easy but if we are going to have this kind of dialogue, I would argue that we have got to start there.

I wrote a book about trade-offs and choices in energy options - *Sustainable Fossil Fuels* - which was not as much focused on fossil fuels as it was on energy options and trade-offs. There have been two types of reactions to the book - some people think of it as a book about fossil fuels but others are picking up the challenge that the book puts out: What do we mean by the word ‘sustainable’? What do we mean by the word ‘green’? Can there even be a world in multi-attribute trade-off analysis where you might say, “Fossil fuels, in this country, at this time, is the option that we would call the greenest given the trade-offs that we are looking at.” ?

With reference to options, for example, someone might give you the simple world in which this one is bad and we shouldn’t do it but someone else will say, “Well, we just need to use less energy. This problem can go away. We are using too much electricity and other forms of energy, so that’s going to be the solution.” If someone suggests this latter option, then there are some questions that you have to ask, such as: What are the drivers of electricity use? How do we accelerate the rate of energy efficiency? How do our efficiency efforts in BC compare to elsewhere? and, What happens to electricity use when we are also trying hard to reduce greenhouse gas emissions?

When we say that we’re going to improve electricity efficiency, it is important to study the data presented in Figure 1 describing energy consumption per household from 1978 to 2006 for a number of different drivers of electricity use. These data are from the USA but almost identical data are available for Canada.

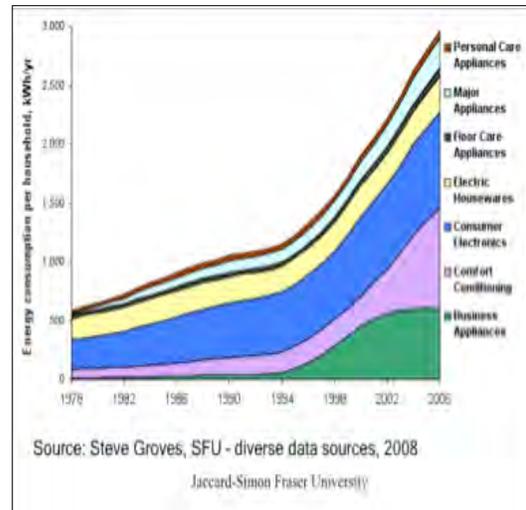


Figure 1. Drivers of electricity use: US household data.

If you think about efficiency gains for major appliances - fridges, stoves, dishwashers, clothes washers, clothes dryers – energy efficiency has been improving quite significantly. However, when we look at the data over the last 20 years there is a category referred to as ‘other’, that we might also call miscellaneous electricity use. This category has been steadily growing and it is now growing at an accelerating rate.

A typical household in British Columbia uses about 13,000 - 14,000 kilowatt hours per year for a 1,600 square foot house that is not using electricity for space heating or water heating. Other consumption is primarily ‘gadgets’. The data for sales and consumption show that these have increased from about 500 kilowatt hours per year in 1980 to an average of about 2,000 kilowatt hours per year for the average household in the United States. When you say “We’ve got to make efficiency happen,” I agree but you have to get into my world and say “How do we make that happen? What are the things that are involved in that?”

### Energy efficiencies

What if we ran programs to try to make efficiency happen? Figure 2 presents some data that we have on fridge efficiencies over the last five decades in kilowatt hours per cubic metre.

Actual fridge use over that time would have gone up per fridge because these appliances got larger with more gadgets on them. But the efficiency per

cubic metre improved because of better compressors in the heat-pump system and better insulation. Therefore, if you now say we want to improve energy efficiency, what you are really saying is, "I want to accelerate the rate at which efficiency is already happening." And that leads to the question: How am I going to do that? I would argue strongly that you have got to use regulations. But what if I tried to do it with subsidies? The dots represent pretend consumers - you can see that there are always people buying more or less efficient fridges. On average, however, the more efficient fridges were bought and that is what drags the efficiency line down.

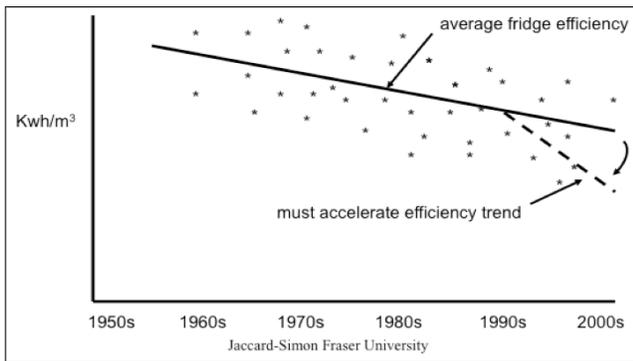


Figure 2. Efforts to accelerate efficiencies with subsidies.

What I would have to do is actually find people who were going to buy less efficient fridges and make sure I gave the subsidy to them, because we can't subsidize all the consumer products people are buying. It ends up that you can't identify the people who would have bought the efficient fridges and so the money, half of it at least, goes to the people who would have been below the line anyway. And that means that you don't lower to that dotted line. I have often heard this argument in the British Columbia debate: Well, we just won't build anything because we're going to do it all with energy efficiency. I would be happy to have further discussions about that and what issues are related to that because this is a big challenge.

Figure 3 shows the results of a study of electricity sales in Canada from 1990 to 2005. 96 percent of domestic electricity sales in Canada during this period were analyzed including data from 26 utilities. We tried to find out the real impact of demand-side management programs, which for the most part refers to electricity efficiency subsidies. Note that the red line and the black line are almost identical. The best estimate we have from our analysis of these

data is that the programs had very little effect on lowering the efficiency line.

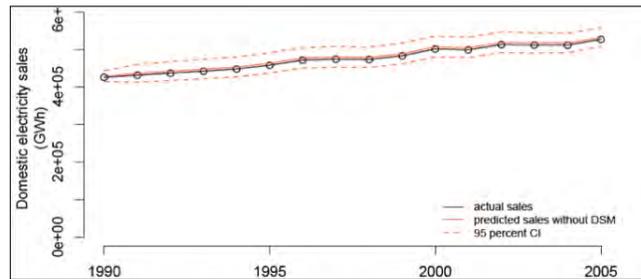


Figure 3. Estimated effectiveness of efficiency subsidies in Canada.

How do we compare to other jurisdictions in terms of electricity usage? Based on my studies of other jurisdictions around the world I would say that BC Hydro is probably one of the top five utilities in the world in terms of how it does electricity efficiency. Although there is still a lot to criticize in terms of BC Hydro's programs and the effectiveness of subsidies overall they are doing well in terms of energy efficiency; for example, they have introduced a new pricing strategy so that consumers see the highest price for electricity in the last units they consume. As well, BC is pursuing new regulations to guide energy efficiency in terms of buildings and equipment.

### Effect of greenhouse gas emissions cap and pricing policies

What happens when we pursue greenhouse gas emission reductions by putting on caps and introducing pricing policies? Our research group has done an analysis of this. We have shown that there will be a rapid increase in renewables (solar, wind, hydropower, geothermal) but only with supporting policies and a mature understanding by interest groups of difficult trade-offs. There will also be a dramatic increase in energy conservation and efficiency (technological and behavioural), but only with compulsory regulations, pricing and growing public awareness and even some kinds of subsidy and information programs properly designed to be effective. Finally, there will be a rapid shift toward electricity use for transportation, through plug-in hybrid and battery electric vehicles, for example, as well as for heating buildings and water and for specific thermal applications in industry.

Figure 4 describes the results of a study using simulations showing what would happen in terms of

electricity consumption at different GHG price levels, with the BC British Columbia results isolated. The reference case represented by the blue line shows electricity consumption in penta joules in British Columbia that would be forecast if we did nothing about greenhouse gas emissions. If there was a cap and trade system or a carbon tax then that would ramp up and drive the technical changes in transportation and buildings; the electricity demand is described for \$50, \$100 and \$200 per ton. These are only forecasts and there is a great deal of uncertainty around them. But this is a credible model, which is used by the US government and others. It simply shows you that when you act on greenhouse gas emissions the electricity use is going to go up. A recent study shows that the \$200 per ton level is the price to reach the goals that scientists say we must meet – that is, for Canada, an 80 percent reduction of emissions by 2050.

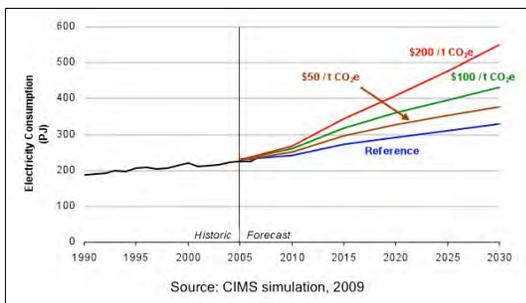


Figure 4. BC electricity consumption at different GHG price levels.

What does that mean in terms of where that electricity is going to be used? You can see in Figure 5 that more and more of the electricity would be used in buildings and transportation and especially in industry as we try to produce less fossil fuels.

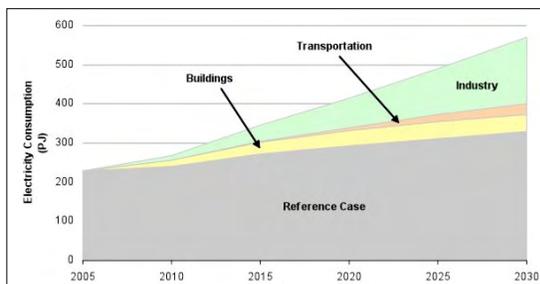


Figure 5. Sources of increased BC electricity demand - \$200 /tCO<sub>2</sub>.

### Ownership issues: public versus private

Another relevant issue is the debate about public versus private ownership. I don't have a strong opinion on this either way. To help the dialogue, however, I would like to describe what I think some of the evidence is telling us. The evidence appears to be going in different directions and again there does not seem to be a simple solution. The electricity policy for BC, under the NDP in the 1990s and the Liberals in the 2000s, has been to encourage independent power producers. I chaired the BC Utilities Commission for five years under the NDP government. During this time, the government, BC Hydro, and the commission were primarily pushing independent power producers. That changed a bit at the end of the NDP era.

### Financial risk management for ratepayers and taxpayers

The question is: Is what the NDP pursued and what the Liberals have pursued in the years since then a good idea? What about financial risk management for ratepayers and taxpayers? One of the things to remember is that future investments in electricity generation are going to stay very risky. For example, we really don't know what technological changes will come along or what kind of reactions there will be. We don't know if we should stay with fossil fuels longer because we can actually store carbon and that might be cheaper. We don't know what all of the impacts might be to systems from large hydropower development. We don't know about using biomass because we also need biomass - we need the land for protecting biodiversity and other values and we need that land for fibre and for food.

In a world of uncertainty, you have to decide how much of that is best to share between private investors who want to take risks and public investors, either through a publicly owned utility or as taxpayers. There is no simple answer. However, when people pretend that there is no risk on the public side, that concerns me; for example, we put a lot of money into the Site C dam study (over \$100 million). Another example was a study by BC Hydro in 1999 to evaluate the idea of a natural gas pipeline to Vancouver Island and building a number of natural gas generating plants, again a very risky strategy paid for by more than \$100 million of taxpayers' money. On the other hand, IPPs have been trying to find

opportunities in British Columbia and I know they have invested a lot of money, but this did not cost us as taxpayers. These are the kinds of financial risk questions that we need to address.

### **Environmental protection and risk management**

What about questions related to environmental protection and risk management? For example, would public or private be better? Again, I am pointing out the other side of the argument because what I often heard in the debate during the election was that we have to have public ownership. When I was chairing the Utilities Commission, we required BC Hydro to do integrated resource planning, which included looking at energy efficiency, alternative, green options for supply, and involvement of the public and community in the process. At the end of the process BC Hydro came out and said, “We’re not going to burn fossil fuels. We’re going to do coal generation at pulp mills which may involve a little bit of natural gas but otherwise, we’re mostly going to do renewables.” That was their plan. Some time after when I was no longer associated with the Commission, I heard that BC Hydro had not followed the plan: they didn’t do any public consultations and they were considering building a natural gas pipeline to Vancouver Island which would result in a significant increase in the greenhouse gas emissions from the electricity sector. I couldn’t believe this because there had been a large public involvement process and I didn’t understand how a public corporation could do that.

I contacted some people proposing that we do an independent analysis of this plan. However, this became a problem because many of my contacts were reticent to get involved in this type of proposal because of their connections with BC Hydro and dependence on the organization for other types of contracts. This was an interesting issue for me. I learned about what happens when there is a monopoly entity in society and yet you are trying to have a balanced debate and dialogue. It was a very trying time because I wanted to inform people about why we should not go ahead with a project that would dramatically increase our greenhouse gas emissions. And it made me think a bit more about the challenges of public compared with private ownership. It also made me realize why my colleagues in Scandinavia keep a lot of things in public ownership including

the major generating facilities but when it comes to small-scale projects they do it all with independent power producers. And, in fact, that is basically the norm throughout the world. Also, with respect to this proposal how would the government (Ministry of Environment) override BC Hydro to address the issues related to greenhouse gas emissions by doing an environmental assessment for building a natural gas pipeline to Vancouver Island? That was a very extremely difficult thing to do as well.

### **Long-term benefits from favourable hydropower sites**

Finally, there are the issues associated with long-term benefits from favourable hydropower sites. In 1997 and 1998, I was directed by the NDP government to put together a taskforce on reforming the electricity sector. Our recommendation was that all the hydro facilities should stay in public ownership. We did not see any evidence in the world of energy economists that transmission systems are better run by private entities compared with public if there are the right incentives for public corporations. We made a strong argument for keeping the transmission system publicly owned and likewise the distribution system. The NDP did not implement these recommendations. In 2002 and 2003, the Liberal government, did put in a system that is very similar to the ones that I have recommended for BC and also for Quebec.

I am also interested in the question about the long-term legacy of these hydropower sites in British Columbia. I know that water licenses have a limited term, maybe 40 years, and then they revert to the Crown. But I wonder about the facilities themselves. I am more interested in where, in year 40 or 50, those facilities actually do revert to the Crown. These are interesting ideas that we should be talking about and exploring.

### **Suggestions for green energy trade-off analysis**

How do we do this kind of green energy tradeoff analysis? Table 1 describes some key suggestions. First, we should avoid a priori conclusions – for example, decentralized is better or large hydro is better than small or vice versa. The world is not that simple. Also, we need to establish clear objectives, economic, environmental, social, and those kind of evaluative criteria described above. It is very difficult to address the question about how we

trade off between local environmental impacts and global environmental impacts. One of the things I think about is if we don't succeed as humanity in getting our greenhouse gas emissions down, then the impacts are very much larger than any small hydro facility. These are the kind of challenges that we have in the tradeoff world.

Table 1. Suggestions for green energy trade-off analysis.

- Avoid a priori conclusions – like “small is beautiful” or “decentralized is better” or “large hydro is better than small hydro” (or vice versa).
- Establish clear objectives (economic, environmental, social) and evaluative criteria (cost, local environmental impacts, global impacts, local community interests, First Nations’ interests, provincial interests).
- Pay attention to cumulative effects. In the case of GHG emissions, this is easy. In the case of river basin usage, this is more difficult.
- Seek broad participation and consensus, but the latter may be difficult to realize, even with the best intentions. So central authority will still be necessary (BC Hydro acquisition planning, provincial environmental assessment, BCUC test of prudence, provincial cabinet).
- Don't confuse trade-off analysis with policy questions that, while critically important, are separate issues – energy efficiency versus new supply, domestic energy security, public versus private ownership.

We also have to pay a lot more attention to cumulative effects. In the case of greenhouse gas emissions this is easy, this is the focus of all that we do. But in the case of river basin usage, it is much more difficult. Although I have not studied the system closely in British Columbia my impression is that we need a much better river basin planning system. And it needs to be tied in to our energy planning and our larger environmental goals. How do we do that? In the 1990s I used to teach about a method that the Northwest Power Planning Council, a planning entity that covers the four states Montana, Idaho, Washington and Oregon, used for river basin planning as well as the techniques that they had developed. We need to do something like that here in BC. The Northwest Power Planning Council looked at the different key values including for example, native values, transportation corridors, fisheries, recreation, esthetics, and areas to leave pristine. They then tried to figure out which were the areas where there was the least conflict and where they might be able to

move ahead with small projects. Then they looked at the higher conflict areas and determined how to set up some kind of planning and tradeoff process that involved players at both local and global levels. This is an interesting model.

Finally, it is important to seek broad participation and consensus, although the latter may be difficult to realize even with the best of intentions. Therefore, central authority will still be necessary. It is also important, when you are dealing with all of these issues, that you try to make sure you keep separate some of those questions discussed above, such as private ownership, efficiency versus new supply and domestic energy security.

## DIALOGUE

### River basin planning

A representative of the ngo community commented: I was heartened to hear that you think that an integrated plan in river basin planning would be a good idea because from the point of view of many of us, there has been no real planning in this whole run-of-river gold rush. And there has been no opportunity for local government or local people to genuinely have input.

Where are the checks and balances in the system? Also, it goes beyond private and public ownership. We have virtually lost the Ministry of Environment and there is no oversight in any meaningful manner anymore. The BC environmental assessment process has also been diminished - they simply approve everything in the long run, and in the short run, too. So where are the checks and balances in the system? That is one of the major issues. We all recognize that there have to be trade-offs but we also have to look at the whole picture. For example, 75 percent of the power in Beijing, China comes from coal power generation and it is growing and there are also more and more cars on their roads. We have to look at all of these factors. We also have to look at what we subsidize in British Columbia – right now we are subsidizing oil and gas and there may be a new coal project on Vancouver Island. Where are we going to get this balance? For those of us who have been deeply concerned about run-of-river, we haven't seen any balance.

Mark Jaccard responded:

You made some strong statements such as there is no Ministry of Environment process and no planning. I think other people may have a different view on that but your point is well taken. And I think we both want to see the same kind of outcome.

Another representative from the ngo community commented:

I am interested in promoting wholesome dialogue. We have not yet had dialogue with the public on these issues. In fact, the public has been shut out of the process as mentioned previously. There is inadequate environmental assessment of these projects at all levels and there is a lack of publicly available information on impacts from these projects.

### **What is small?**

When it comes to the term 'small hydropower' and 'hydro projects', what is considered to be small? I think we are tainting the discussion by introducing that modifier. For example, is the diversion of 17 rivers as proposed through the Bute project considered to be 'small'? I suspect that many of us would have a hard time calling that a small project. Is a diversion of a river for seven kilometres into a pipe, as is happening in the Ashlou, a small hydro project? What is the threshold for 'small'? Perhaps we should lose that modifier and get into some serious discussion on the impacts of these projects. We could even say green energy is something that we should be debating at this meeting because a lot of these projects from our estimation are not green whatsoever.

Mark Jaccard:

I wouldn't debate that at all except for your final point where you said some of these projects are not green at all. All projects have impacts and risks and so we need to make comparisons. What are you comparing it to when you tell me it's green or it's not green?



### **Terms of Crown land 40 year lease**

Another representative from the ngo community asked:

You referred to 40-year energy purchase agreements reverting to the Crown. Have you ever seen an energy purchase agreement and the terminology that specifically reverts these contracts back to the Crown after 40 years? If so, could you produce some evidence, for example, of a contract?

Mark Jaccard:

I have only read synopses of these contracts and I have been told that they are 40-year licenses. Whether or not that legally reverts to the Crown I don't know. I do not have the legal expertise to tell you that.

Another participant responded:

I am the past president of the Independent Power Producers Association. In response to this question, the BC hydroelectricity purchase agreements do not cover the ownership of the asset. That is covered in the Crown land leases, because when IPPs set up on a given site, they need to get a lease from the Crown. That is where it establishes that at the end of the 40 years the lease ends and then the assets are there. I would be happy to send you copies of a Crown land lease that explicitly lays out the rules of what happens at the end.

### **What is green?**

I am a former manager from BC Hydro, now retired. I would argue that the energy that we currently enjoy in BC is largely green. It comes down to definition; however, hydroelectric energy of any sort is about as green as you can get. The issue around how green it might be is related to the total impact that it has, the implementation of it and then its utilization.

A participant referred to the current IPP approach as the 'gold rush'. The technology of run-of-river is in itself green – you cannot argue that point. Water is used to generate electricity. But the huge potential impacts that the implementation of the run-of-river projects, and the transmission of that energy to the load, are not green. So it is in those areas that you need to find the balance. That point is often missed - we look specifically at the project as being the generating source and not at the entire project in terms of delivering the product to the end user.

Mark Jaccard:

I didn't expect to convince everyone but I ask you on the basis of my presentation, to entertain the hypothesis that we can't say that hydroelectric is green and something else isn't. That is the point I am still trying to get across here, to get people out of this 'good guys/bad guys' designation, if possible.

### **Taking the risk and return on investment**

A participant asked:

With the public/private debate, a lot of people look at the potential and at what some might view as excessive returns that a successful project could have. My question is: Would there be, through the water licensing process, a pricing mechanism where the Crown should be capturing more of the resource rent with more benefits going back to the public? Is there a more equitable or more competitive way to do that?

Mark Jaccard:

The world of electricity generation is highly uncertain; for example, people may invent organic solar cells that we will put on our roofs and electricity prices could actually plummet over the next while or

two decades from now. In this uncertain world if you have a concern as a government that you might be giving some kind of endowment to a resource that will have rents, or associated windfall profits in the future, we have to ask: What if the people that made this risky investment lose money? Are we going to subsidize them when they make a bad investment? That is a basic argument that is out there. That being said, we still do come in behind the scenes. Governments did this when oil prices went up in the 1970s. They said, "Yes, we know we gave you the mineral rights in this area, but now you are getting windfall returns so we are actually going to come in later and raise an extra fee on you." That is a reality that has to be faced by the IPP investor; that is, there is a risk that society at some point might say that there is a real value there and they need to recapture some of it. There is nothing we can do to prevent future governments from doing that and there is nothing that IPPs can do to protect themselves from governments doing that. Right now, in the competitive world, my sense is that most of the IPPs will be losing their shirts and that this idea that they are making lots of money over the next few years is a myth, but that is based on my experience in looking at markets around the world with IPPs.



# FUTURE POWER NEEDS IN BC AND THE POTENTIAL FOR GREEN ENERGY

Cam Matheson, Director of Energy Planning, BC Hydro

## Do we need more energy? What are the challenges for BC Hydro?

### *The case study of the Vancouver Island gas pipeline*

The anecdote about the Vancouver Island gas pipeline is a good example to illustrate the often contradictory and sometimes very uncomfortable place that we find ourselves in as the Crown corporation responsible for delivering cost effective, reliable electricity to our customers. Although this happened before I joined the organization, I would like to walk through my perspective of what that case represented.

The first issue is the conundrum on Vancouver Island - not only is it a physical island, but it is also an electricity island. And on that electricity island only 20 percent of the electricity is actually generated on the island itself. The rest of it comes from off the island, which creates reliability and cost issues that utilities try to avoid. Generally, utilities don't want a large segment of the population dependent on far away resources. I would argue that our whole system in BC is a lot like that, but Vancouver Island particularly so. The first thing that the company and the provincial government were trying to address was how to deal with the reliability conundrum on Vancouver Island.

The second thing is that the government, as far as I understand it, was interested in pursuing a gas strategy for economic and political reasons, and they were working with the Crown corporation to try and effect that strategy. Again, because it is a Crown corporation, all of the options that would otherwise be available to us that might make sense from the standpoint of delivering electricity to the consumer, are not always the first things that have to happen, or that do happen. The corollary to that example was that the gas strategy on Vancouver Island was eventually abandoned after the Duke Point experience in 2005. It was abandoned in favour of building and revamping transmission lines that would go to Vancouver Island and continue to provide power to islanders from the Mainland. And that, of course,

led to the Tsawwassen experience. Most of you are familiar with the difficulties that Hydro, and the BC Transmission Corporation, have had in the siting and building of that transmission line to provide electricity to people on Vancouver Island. This is a very interesting case study, because it encapsulates a lot of the conflicts and inherent contradictory nature of the way in which we have to plan the system as the Crown corporation.

### **Making decisions and taking the risks when there is a high degree of uncertainty**

When we look at how we plan the system and the best things to add to it from a cost standpoint, and reliability and environmental standpoints, as Mark Jaccard pointed out, there is a wide range of possibilities, infinite almost. The question is: How do you decide which ones to choose? Inherent in that decision is tremendous risk. Billions of dollars are at stake in planning infrastructure of this size. And there is tremendous uncertainty. What follows are a few examples of that.

First, the demand uncertainty is fairly big. In addressing demand we need to know what British Columbia will look like over the next 20 years. Is it going to grow? Is it going to shrink? What is the economy going to do?

The water supply is another area of uncertainty. Our system is 90 percent hydroelectric and it is dependent on water which is dependent on Mother Nature providing the water, although we can store it in reservoirs for a couple of years. These water resources fluctuate up to 40 percent from one year to the next and so again there is tremendous uncertainty. This raises the question: Should we be adding water-based resources to the system given that we are already so dependent on them? We grapple with this question all the time.

Another issue of concern is the emergence of the carbon economy. We still don't know at this point whether the cap and trade system is going to emerge

and be the system that everybody will rely on in terms of developing the so-called carbon economy. The question is: What else or what subsidies will accompany that? Right now in the United States there are production tax credits available for producers of intermittent clean energy resources. How long will that stay in place? All of that changes the economic situation and influences us in terms of what we think the right answers are as we plan the system going forward. That is another area of tremendous uncertainty.

Also, there is the question of commodity prices. We are all interrelated when it comes to electricity, at least in western North America. We are interconnected through a common electricity grid and because of that the economics that go with electricity trade on a daily basis, drive many of the investment decisions that we make. The question is: When natural gas prices rise and fall and when electricity prices, on the heels of those natural gas prices, rise and fall, which ones do you rely on? How do you forecast the future?

Inherent, then, in making these decisions and the trade-offs that go with them, is the ability to try and predict what the future holds and how all these uncertainties and risks will be dealt with. This is a very important point and it should drive the kind of public dialogue that we as the Crown corporation have with the public about how we plan and operate the system that we all rely on.

### **BC Hydro and long-term electricity planning** *Consider the cost and reliability of the system*

Let us look now at how we do our long-term planning and the decisions that then flow from this planning. There are a number of key drivers. As I said, when you plan a system you really have the world of the infinite at your feet and then you have to go through the process of narrowing it down to the point where you put something coherent and logical together if you possibly can.

How do you narrow down what you need to do to add to the system or plan it in the long term? The first point to consider is how to maintain the low cost and reliability of the system. This is the mission for the company. In fact, the regulatory agency, the BC Utilities Commission, has a low-cost, reliable

mandate as it considers the applications that we put before them. So low-cost electricity and reliable electricity still is the foundation of the system we have and the one that we need to plan for.

### *Meet customer long-term needs*

We are also interested in meeting the long-term needs of customers. Sometimes there is a vision of what the world is going to look like and what everybody would like it to turn into. And then we, as forecasters of demand and many other things, have to figure out what we think will actually occur. This raises a conundrum.

For example, Mark Jaccard talked about electrification of our society. As we move away from fossil fuels in the industrial and transportation sector, we know that electrification, particularly in a region like ours where 90 percent of our electricity is not emitting GHGs, is green relative to other jurisdictions that have a lot of coal and natural gas. Increasingly then, it is quite logical to think that society will turn to electrification as it tries to reduce emissions in all of those other sectors and that electrification will pick up the slack. That is what people *think* is going to happen. But our mandate is to serve our customers' needs and interests. So when we conduct our demand forecast we look to see if there is evidence of those things actually starting to occur.

The debate about electric vehicles came up when we defended our long-term plan to the regulator in 2009. They noted that BC Hydro had not put any load in the future associated with the growth of electric vehicles. However, our view was that there is no evidence that electric vehicles are at the point where we could predict with any certainty the volume they would represent and when they would start to come into our marketplace in an appreciable way. It is that principle - needing to see evidence of these things occurring - that we rely on because we are not here to presuppose what is going to happen.

When we see evidence of things beginning to take place we will then put them into our load forecast and say, we need resources, we need them this year, and we need them in this volume in order to meet that additional electricity load. This is the difference between hypothetically thinking about the future and being able to attach something real to the plan

so that it is reliable before you spend billions building resources and transmission lines to meet new demands.

### Implement government policy

Our sole shareholder is the provincial government. Their job is to set provincial policy around issues like energy and electricity. And we, to the best of our ability, need to implement what they would like us to do in driving toward that vision. All of this sets us on a course. In the 1960s and into the 1970s, the government of the day wanted to use the building out of a large hydroelectric energy system to drive the growth and economic development of the province. That is largely what happened – there was the implementation of the modern system on the Peace and the Columbia Rivers with large hydroelectric facilities. Now we are working toward a very different vision of the future under the current government, which is to use private, independent power producers to build new supply and to use demand-side management or conservation to essentially effect the changes in the system that we need to make.

### Provide an open and transparent process

As we build our long-term plan for the system we are trying to be as open and transparent as we possibly can. We have been improving at public consultation, and we actively seek input from customer groups, stakeholders and First Nations.

### Engender long-term public understanding and support

Finally, we are engendering a long-term understanding and support about what kind of system we have in the province. In my opinion, the bottom line is educating the public and the consumer so they can actually better consume the product. This is something that is important and has been missing in the past. Generally speaking, as consumers, we know little about the product we consume but the way in which we consume electricity drives these important decisions and the debate that we are having here today. We need to change this if we are actually going to affect not only our conservation mandate but also make the right choices about electricity - for example, about how you add to the system and what kind of resources you want to have - until people generally understand that when they turn on their

lights they know where electricity comes from, what it really costs, what the trade-offs are, and what the value is. Until that happens, it is much more difficult to make coherent choices on behalf of the public.

### How do we do this?

The first thing we do is to try and establish what we think the long-term need is in the system. The left-hand side of the graph in Figure 1 shows historical data. The black line represents the load growth in the province from 1990 through to 2008. The blue line represents the supply resources that have been available to Hydro to meet that demand. On the right hand side of the figure are the forecast data represented by the yellow funnel. The dot in the middle is the load forecast, which we increasingly show as a set of probabilities, and the dotted line represents what we call the mid-load forecast, which is the 50 percent probability. The upper and lower bands on the yellow funnel represent the 90 percent probability and 10 percent probability, respectively. Below that is the load forecast when the demand-side management program is taken into account. Note that there is an appreciable difference. If we are effective in implementing this demand-side management program, we will take an enormous amount of demand out of the system. The blue also represents the supply resources that we anticipate having without the ones that we are asking the commission to endorse and the ones that we would like to build. This figure then summarizes the current system that we have forecast out for the next 20 years.

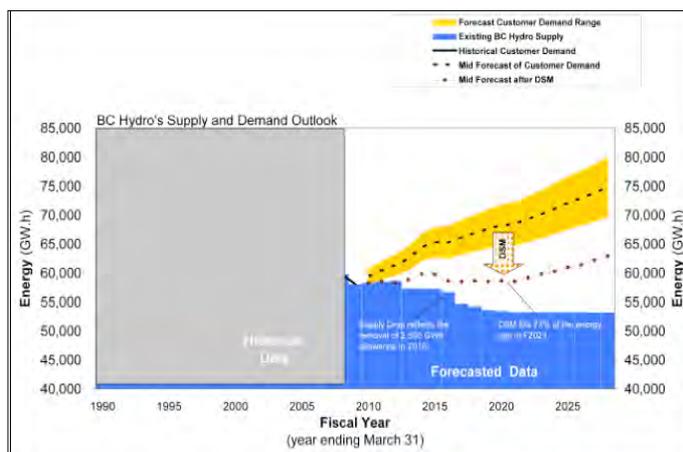


Figure 1. The electricity gap.

The graph in Figure 2 deals more precisely with the resources in the system and the way in which we view the demand forecast.

This refers to firm energy capability, which represents the annual amount of energy that the system requires and is capable of producing. This is different from the capacity in the system. It is the year-over-year amount of annual energy required. The dotted line is the mid-load forecast, in this case after DSM. We also show a 90 percent and 10 percent probability. The bars represent the supply resources that are available to us. As in Figure 1, there is a diminishing amount. The blue bar on the far left hand is related to heritage thermal market purchases. The provincial government recently made an announcement that we would no longer rely on the Burrard Thermal project for any annual energy. This comes out of our stack fully after the 2010 fiscal year. The second one is that in the 2007 energy plan the provincial government dictated that we would, as a province, become electricity self-sufficient by the year 2016. Up until now we have put about 2,500 gigawatt hours in our planning, what we call market allowance, which gives us the ability to go to the market and buy energy in the event that we have low water years on the hydro system and need to do that in order to meet the demand. After 2016 we will no longer have that ability. Therefore, these two things in the supply stack have decreased.

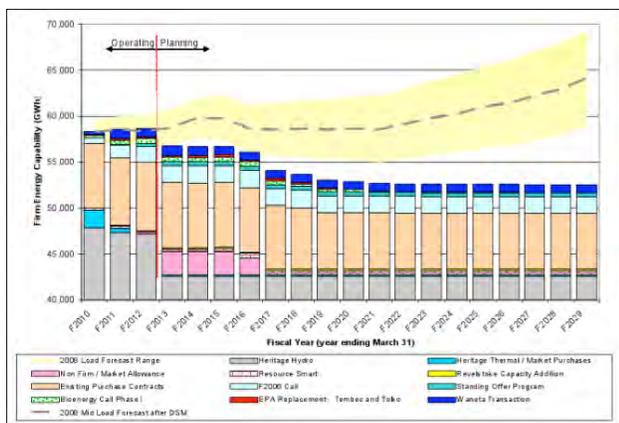


Figure 2. Firm energy capability.

### **Burrard Thermal**

With regard to Burrard Thermal, there is a lot of misunderstanding about the role that this facility plays in our system. In the last eight or nine years we have operated the Burrard plant minimally. It is a back-up plant. What we have struggled with is how

we calculate Burrard Thermal for planning purposes, not operating purposes. Once Burrard Thermal is eliminated it will have to be replaced in the planning stack in order to make sure that the resources are meeting the dotted line shown in the graph in Figure 2. Otherwise it will be in a deficit position and that generally is not a good thing for ratepayers.

In the last long-term plan, we proposed to the commission that we rely on Burrard for about half of its annual energy output, which does not mean that we would be running it to that degree. It is only the question of what you replace it with. The commission rejected that and said there wasn't evidence to support it and therefore the fallback was that it should go back in the planning stack at 6,000 gigawatt hours which would be tantamount to running the plant 24 hours a day, 365 days of the year.

There was never an intention to do anything like that with Burrard - it was all about the cost and the risk and the reliability of replacing it with other resources. This is what that debate centered around. The role of Burrard is in a hydroelectric system where there is a wide swing of water supply, ideally you would like to have a plant that is dispatchable, meaning that you can turn it on and off when you need to and you can run it in the event that you get low water years or in the event that you get a contingency on the system. One of the hallmarks of the system in BC is that the bulk of generating resources are very remote from a highly concentrated load or demand centre, the demand centre being the Vancouver-Victoria corridor and the remote resources, being on the Peace River and Columbia River. In between those two places is some of the most hostile terrain in North America. Therefore, there are large bulk transmission systems that interconnect those and a lot of things can happen that could interrupt service to our customers in the load centre. Ideally, you want to have a dispatchable plant that you can run if you need to in the load centre that can pick up the variation in water supply and the contingencies that do occur on the system from time to time. That is the role of the Burrard Thermal plant – and this backup role continues to be an important role. However, based on the provincial government decision, it has to come out of our system.

The importance of the capacity on the system is

that this is a peaky system, typical of other northern jurisdictions, where our demand spikes in December through February when it is cold. This is quite different from California, for instance, where the peak on the system occurs in the summertime when air conditioning load begins to occur. The capacity of the system is its ability to reach up and hit that peak. The graph in Figure 3 describes what capacity looks like. We have just added a new resource which we hope will be approved by the regulator. We bought a third of a hydroelectric power plant in the Columbia, the Juanita project, previously owned by Teck Corporation. We have now put an application in front of the commission to endorse that purchase.

Once we get the capacity from that, then we will be in relatively good shape. Again it is important to consider that when there is a remote resource and a concentrated load centre that is many miles away as there is in BC, even adding resources out in the hinterland does not alleviate all the risk. The additional capacity that we are trying to build that is available to us on the Columbia is also remote and far away from the load centre, so we will need additional transmission. The yellow bar is the Revelstoke Unit 5 project which will add about 500 megawatts of capacity onto the system when it comes into service in the year that is shown on the bar. Everything else will stay about the same. That is the picture of our current system.

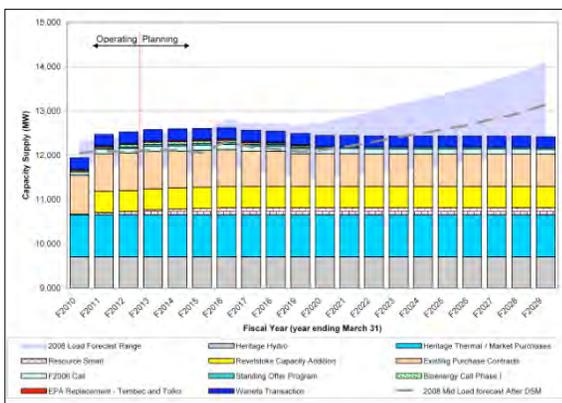


Figure 3. Capacity supply.

### Provincial energy policy

What are the energy policy issues that are so important to us when we plan and develop a system? The set of policies described in Table 1 comes from the 2007 energy plan. First is that we are meant to achieve self-sufficiency by 2016. A target was

set in that plan to have at least 50 percent of the new needs between now and 2020 come through demand-side management.

In fact, our long-term plan sets the bar much higher. We are proposing that by the year 2020, roughly 75 percent of the new need in the system will be met through conservation or demand-side management. Also, the system is meant to be 90 percent clean and renewable - it already is, so the policy is a reminder to keep it that way. Our system currently operates at roughly 93 to 94 percent clean and renewable. This refers to air emissions and does not get into the debate about whether large hydro has more impact than small hydro or wind or anything else. The energy policy says that for any new coal project, it would have to have zero emissions which essentially means that it has to be carbon sequestered - a technology which is not yet available commercially. Any new electricity generation has to have net zero GHG emissions, so in the event that anybody proposed a natural gas plant it would have to be fully offset in the year that it was put into service. Any emitting resources that are currently in the system will have to be fully offset as well, by 2016. That generally provides a description of the 2007 Energy Plan that the province has set out and our long-term plans to conform to that.

Table 1. Provincial Energy Policy.

- Achieve electricity self-sufficiency by 2016
- Set an ambitious target, to acquire 50% of BC Hydro's incremental resource needs through conservation by 2020
- Clean or renewable generation continues to account for 90% of total generation
- Zero GHG emissions from coal generation
- New electricity generation to have zero net GHG emissions
- Existing electricity generation to have zero net GHG emissions by 2016

### Legislative and Regulatory context

The BC government is implementing the 2007 Energy Plan through legislation and regulations. While the Commission needs to look at the provincial policy, unless those policies are put in such a way that the commission is bound to consider them, they do not have to follow it. The Commission can be advised by the policies but they are not legally bound to follow them unless they are specifically put into law.

An example of situations where this occurs is under Special Direction Number 10 which was issued by

the Province to the BC Utilities Commission in 2007, codifying the desire to be electricity self-sufficient by 2016 and each year thereafter. It also stated that sufficient energy and capacity must be solely from electricity generating facilities within BC.

Also, when considering new resources in our system, we can only count on the most critical water years, or adverse water conditions, in calculating what our hydroelectric system is actually capable of. This is important because the way we make these calculations is to look at the historical records going back about 60 years, and then only count on the most adverse conditions in that entire historic record. In that case, it comes to 42,600 gigawatt hours and therefore we cannot rely on any more than that. However, we know that we are going to get considerably more than that because there are average water conditions, not critical water conditions, in most years. This means that we will have an excess amount of power in our system generally speaking by 2016.

The government also amended the Utilities Commission Act in 2008, which breathes some life into the conservation effort.

In terms of our own regulatory context and what we have to do to satisfy the commission that our plans are in the public interest, again we go through the process of considering all the options, looking at the system we have, figuring out what we think the demand is going to be in the future, and figuring out what commodity prices are going to do and, therefore, the kind of trade revenue we can ascribe to the system. The test for long-term resource plan acceptance is now 'public interest' as opposed to 'in the interests of persons in British Columbia who receive, or who may receive, services'. We put all of this together in a large series of portfolios that we model and then we put in our plan the model that we think is in the best interest of our ratepayers and then take it before the commission. We then go through about a year of information requests and public hearings and eventually the commission agrees or does not agree with us in terms of what we want to do. In reviewing long-term resource plans under Section 44.1, BCUC must consider: the governments energy objectives, encourage public utilities to reduce greenhouse gas emissions, take demand side measures,

produce, generate and acquire electricity from clean renewable sources, develop adequate energy transmission infrastructure and capacity, and use innovative energy technologies.

### **How we consider environmental issues**

I would like to describe the way in which we consider environmental issues. We know that our projects and independent power producing projects have to go through the BC environmental assessment process. Generally, they do approve most things that come before them. My view is that in part it is successful in terms of the kind of scrutiny that a project undergoes in order to get an environmental assessment or project approval certificate. If the project is simply a dog from an environmental standpoint, then it will be stopped and there is absolutely no financial point in going through the whole thing. In that sense then there is a screen, even though it doesn't look like it because they seem to approve most of the things that come before them. There is a federal process as well that can be triggered for some projects. In addition, we have our own long-term environmental goals in the company and we try to make sure that whatever we put forward is reaching what we think are important environmental standards for our ratepayers and for the public in general.

Finally, I will leave you with an example of the long-term plan that we filed and defended in front of the regulator this year. In the plan 75 percent of new need is being met through demand-side management or conservation activities and the other 25 percent comes from clean and renewable independent power producers. This is what is called a clean call. We have already excluded emitting resources from bidding into the plan. We would like to think that before independent power producers ever get to the point of needing to file for an environmental assessment certificate, they have gone through our own company's policies regarding clean and renewable.



# INDUSTRY PERSPECTIVE ON HYDRO POWER

*Presentations by:*

*Harvie Campbell, Chair, Independent Power Producers Association and Executive Vice President, Strategy and Development, Pristine Power Inc.*

*Doug Little, Vice President, Customer and Strategy Development, BC Transmission Corporation*

*Cam Matheson, Director of Energy and Planning, BC Hydro*

## **Perspectives from the Independent Power Producers Association**

*Harvie Campbell, Chair, Independent Power Producers Association and Executive Vice President, Strategy and Development, Pristine Power Inc.*

Here are some points to consider before I begin my presentation:

1. 75 percent of British Columbia's energy needs are met through fossil fuels.
2. 75 percent of our electrical generation is renewable or green, which means 25 percent is fossil fired. That differs from what was said earlier based on imports. 15 percent of our power comes from imports and those imports are 100 percent coal.
3. IPPs are an environmental industry. We have to meet a higher standard of environmental performance than other industries; for example mining and forestry. For that reason, we wholeheartedly welcome this dialogue because it will help us understand what those higher standards need to be. And as further evidence, Pristine is a sponsor of this dialogue and will continue to sponsor similar dialogues as we try to figure out the right balance between what we do for a living and what we need to do for the environment.

In my presentation I will describe what IPPs refer to, the opportunities for IPP development in BC, the benefits we believe we bring to British Columbia and why we are on the right path, and finally provide some thoughts on future direction for IPPs in BC.

The some key points to take away from this presentation include:

1. Clean energy development drives economic growth, job creation and investment for First Nations and rural communities, for the benefit

of all British Columbians. We are in communities from one end of the province to the other. Pristine Power, for example, is working with 34 First Nations in the west. This is an active dialogue and is community-based.

2. Clean energy combats climate change by significantly reducing our carbon footprint. The first bridge we have to cross as a society is whether we believe we have to react to climate change. If we don't, then go ahead and build coal plants all over the province. If we do believe climate change is something we have to address, then we have to have a healthy dialogue about independent power and renewable power.
3. All independent power projects undergo rigorous environmental reviews under provincial and federal environmental legislation. This takes years sometimes and hundreds of permits; for example, for the Toba Montrose project to go ahead there were at least a thousand different pieces of paper that had to be signed. But we want to go beyond that. We want to see what the communities need in addition to standard environmental assessment, to make sure that this works for everybody.
4. BC's publicly owned electricity infrastructure, augmented with private-sector generation, delivers the most cost effective electricity to British Columbians. Every jurisdiction in the world pursues a level of IPP involvement because there are things we do better than a large corporation like BC Hydro where better means more cost effective and with lower risk. That is why we are here and why this is the case in every jurisdiction around the world.

## **Who we are, and what we do**

The IPP Association started in 1991. It is non-profit and volunteer driven with 330 members. All

members are clean energy. The association is led by IPP developers, but there are a lot of service providers and stakeholders that take part in the association including engineers, builders, equipment vendors, fuel suppliers, environmental firms, lawyers, financiers, consultants, First Nations, and others. We are a very diverse community and we are the voice of IPPs in British Columbia. We have 46 operating plants spread across BC. There are 36 small hydro at 10 megawatts (MW) each on average, four biomass facilities at 24 MW each on average, four biogas at 3 MW each on average, and 2 gas-fire generating plants, one at McMann and one on Island Cogen, each producing approximately 175 MW.

There was a discussion earlier on what is 'green' and what is environmentally acceptable. I have been active in this business for 20 years. When we started co-generation was the environmentally best standard you could reach. There were no run-of-river hydro facilities, wind power did not exist, and climate change was just beginning to become an issue. It has always been an environmental pursuit on the part of IPPs to use the generation technology of the day so we were doing a good thing by putting co-generation in at Island Cogen years ago. Today, that is not the best standard. The best standard now is with other technologies and, as Mark Jaccard mentioned, in 20 years maybe we will all have solar panels on our roofs and we won't be having this discussion over run-of-river or wind or other technologies. It is a changing metric but at any one point in time, we have to decide what is the right way to move forward.

IPPs supply about nine percent of BC's electrical energy. The oldest IPP began operating in 1992.

First Nations' involvement is at the core of IPP development today and it is an essential ingredient to any development project. There is a full range of involvement - some First Nations are content to have apprenticeship programs, others want revenue sharing. However, increasingly they are asking for equity participation and, in fact, more and more they are the developers. The First Nations' owned China Creek hydroelectric project is one example where they developed and own the whole project, and this now acts as a foundation for them to establish commercial capacity. I believe one First Nations partner has

been quoted as saying, "We used to manage poverty; we now manage opportunity." The new relationship is building from the bottom up instead of the top down, one project at a time. Wind projects in the Peace are another example as well as the Island Cogen plant in Campbell River, although not with an acceptable technology by today's standards. Williams Lake wood waste firepower project is another example; the value of that plant is increasingly showing up. In summer 2009 it was used as a capacity resource as the fires came through Kelly Lake.

### Opportunities for IPP development

We need IPPs to fill the BC Hydro supply gap (Figure 1). The province uses approximately 50,000 gigawatt hours a year. Present day demand is around 59,000 gigawatts. The gap therefore is around 9,000 gigawatt hours, and this gap could rise by about 20 percent within five years.

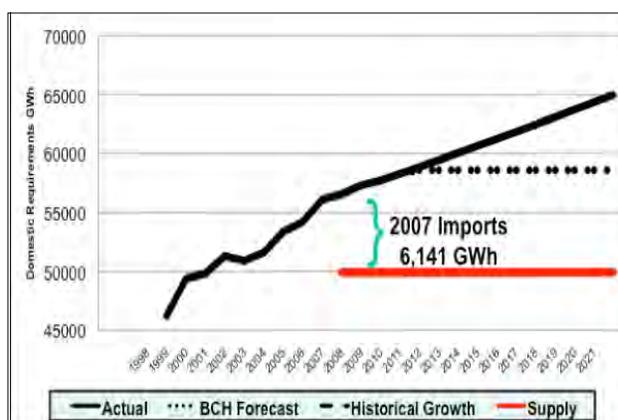


Figure 1. BC Hydro supply gap.

We are an electricity importer and that electricity does come from coal plants. We need to decide whether to address this, or not. The government has said that we need to be self-sufficient and to stop importing. That is the current policy.

I believe we are on the right path. There is no reason why this jurisdiction should be importing power. This is the best jurisdiction I work with in terms of the ability to develop and produce cost-effective, environmentally sound power. The demand-side management program in this province has, in my view, been the most robust of any in North America for the last 20 years. What they have just embarked on takes it many steps further. BC Hydro tends to talk about 75 percent but if you look at the actual

numbers for the next decade, they are trying to shut down demand in this province. We are 100 percent supportive of this – it is the right thing to do and the first thing to do. This is a huge task and we should not underestimate how truly remarkable what they are trying to accomplish is. It is not cheap, with a cost of at least a half a billion dollars, but it is money well spent.

BC does have a competitive advantage in clean energy. With an abundance of natural resources we are the only jurisdiction that has access to many of the key technologies including wind, biomass and run-of-river hydro. Ontario, for example, has quite a bit of wind but hardly any hydro. Very few jurisdictions have the amount of biomass necessary to have a sound industry. However, they are all here in this province. Therefore while we decide whether we need renewable power or we want coal plants, we also have the sub-decision within the renewable power category as to which technologies we want to pursue and our preferences. We have home-grown innovation and technology; BC has the third largest high-tech, clean energy cluster in the world. We already have a brain trust foundation that we can build on to become a world standard in the technology; for example, Day4 Energy and solar energy, Nexterra and biogasification and Lignol and ethanol development. There is a balance of publicly owned generation and transmission assets augmented with privately owned generation. BC Hydro owns the generation system and all the heritage assets and they will continue to own them. They will also develop and manage large projects such as the proposed Site C. The IPPs are simply augmenting these projects through competitive procurement on smaller projects that we do more cost effectively.

South of the border, Washington, Oregon, New Mexico, and Colorado are all racing to meet their RPS standards, usually through a combination of renewables and gas-fired backup for capacity because they do not have our dams. They are also pushing their coal out offshore, across the border, and guess where it is landing? We are on the right path.

### Benefits of IPPs

IPPs bring solid economic benefits that are spread through communities across the province and are very diversified. They foster First Nations and

community participation partnerships and revenue streams. In some cases new options can be available for families to stay in single industry towns. IPPs go through a rigorous process; but we are open to even higher standards. We are environmental businesses that tackle climate change by reducing Greenhouse Gas Emissions. That is the driver for this business. If you believe that the impacts of climate change will be significant and negative then you have to step forward and address fossil fuel consumption.

The photographs in Figure 2 show how far we have come in tackling climate change. It compares conditions in False Creek in Vancouver in the 1930s with 2000.



Figure 2. Comparison of False Creek 1930's to 2000's.

In the 1930s, conductors used to have to walk in front of the trams because of the thick smoke and fog. But by the 1950s and 1960s when natural gas was brought in, and the sawdust burners and coal burners were shut down, environmental conditions improved significantly. We can do that again. We have the technology, we have the drive and we have the creativity. We can meet the challenge.



**Perspectives from BC Transmission Corporation**  
*Doug Little, Vice President, Customer and Strategy Development, BC Transmission Corporation*

This presentation focuses largely on a variety of different forms of renewable energy generation. It seems that much of the public debate around new generation development in the province in recent years has focused on run-of-river hydro and whether the entity that puts up capital, takes development risks and owns the generation should be the public sector or the private sector. From my perspective it has been a heated debate at times, and one that has largely been light on facts and long on rhetoric. I believe that we need to take this in a different direction.

As Mark Jaccard noted, we need to focus on the generation choices that have to be made because all of the generation and associated transmission have impacts. I commend SFU for encouraging a rational discussion on what I think is a very important topic.

We are expecting tremendous electrical demand growth in the province. Figure 5 in the presentation by Mark Jaccard showed more than a doubling of electrical demand by 2030. This is very consistent with a number of the scenarios that we have run where we are seeing substantial amounts of fuel switching away from carbon-emitting sources in the transportation sector and in the home residential heating sector and a movement to much more electrical demand. This substantial growth will not only take place in BC but also in much of the world as we move to reduce the carbon footprint substantially, down to levels around 80 percent below current levels. Where is the demand for new electrical energy going to come from?

**The opportunities**

Figure 1 is a map of BC, showing the details of the potential for future renewable low carbon power generation. As Harvey Campbell noted, BC is blessed with a significant amount of almost every form of renewable generation that is known today.

There are about 38,000 megawatts or 150,000 gigawatt hours of potential renewable generation in the province from sources such as small hydro, large hydro, geothermal, wind, and biomass. This figure

was produced about a year ago for our submission to the Western Renewable Energy Zones Initiative, an initiative by the Western Governors Association in the US that included participation by BC and Alberta. Not every form of generation is represented here, for example, ocean energy, but these data are being added for the submission to the Utilities Commission long-term planning enquiry. The information in the figure also highlights the opportunities for power generation and demonstrates that it is geographically dispersed with significant amounts of generation opportunities in nearly every area of the province.

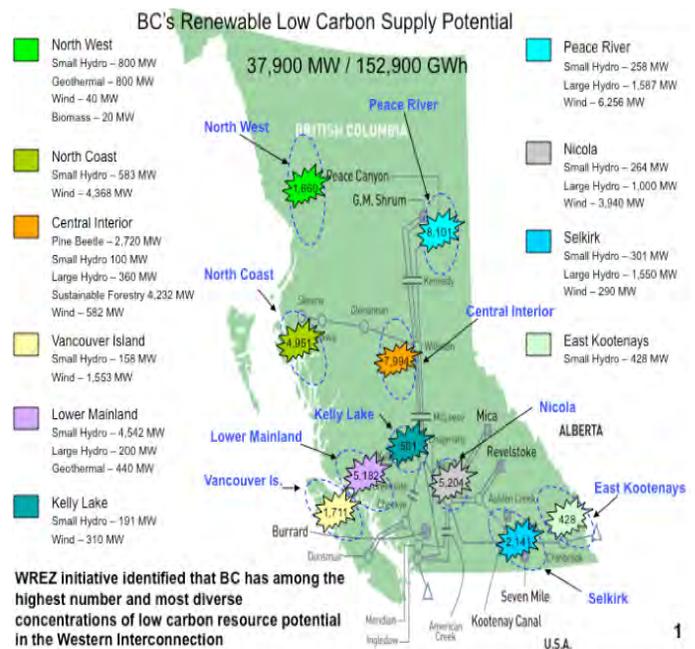


Figure 1. Potential for renewable low carbon power generation in BC.

Because of the geographic dispersion of resources around the province the social benefits can also be widespread. As Harvey Campbell described, this allows for First Nations participation in many parts of the province and it also helps to offset some of the problems of prior decades where one particular region of the province paid the price for a mega development for energy that was consumed in other areas of the province. There is also significant potential to develop substantial economic benefits for the whole province. The scale of the generation potential is around three times the size of the existing system.

Again, because of the size of the potential on the environmental side, it allows us to consider the

environmental impacts of the different types of generation in the different areas of the province and to carefully select which technologies, in which areas, will provide the best benefits for the province. Some of the other jurisdictions that are also focused on renewable generation are not as fortunate as we are. They have to rely solely on wind, for example, or completely on solar energy and their choices of where to locate the facilities are very limited.

### **The challenges**

The challenges are also very big. NIMBYism is alive and well in the province and it comes in many forms, in the guise of health or environmental or property value concerns, and sometimes it is tied into the specter of exported electricity. This appears to apply to all forms of generation; it is not just a run-of-river hydro issue. We are starting to see it with wind generation where in some of the other provinces in Canada that have developed more wind than BC has to date, they are seeing the full NIMBY assault on that form of renewable generation.

The NIMBY issue also applies to transmission. Of course, transmission is needed to connect all of this new power generation from the various areas of the province to the major load centres in the Vancouver and Victoria areas, and there will be a great need for more transmission over the coming decades to integrate all of this renewable generation. Transmission has very long lead times, it is very hard to site, and as we saw in the project through Tsawwassen over to Vancouver Island, it is not well received by most communities. That is a significant challenge for a renewable energy vision for the province as well.

Public perception is also a challenge. In my travels around the province and talking to community groups and stakeholders about the need for new transmission and electricity infrastructure I find that electricity is still taken for granted in many areas and there is not a good understanding that we are net importers of electricity. Frequently, the view is that there is a never-ending supply of electricity coming from the large hydroelectric facilities that were built in the 1960s, 1970s and 1980s. All of us in this sector know that we need to tackle this misperception and we need to encourage a well-informed debate and develop an understanding in the general population about the need for new electricity infrastructure.

### **Are we on the right path?**

The long-term transmission planning enquiry that the government put into legislation 18 months ago is a step in the right direction. It has been delayed although we fully expect that it will be on track and that the utilities will be making their initial submissions later on in 2009. The enquiry is looking at zones of high-potential, high-quality generation development around the province, and starting to do the early planning work for the building of a transmission system to access the generation in those areas. If you are not already involved in this process, I would encourage you to become informed - the information is available on the BC Utilities Commission website.

In terms of addressing the questions: What is needed for better decision making?, Do we need a strategic plan going forward?, and What is the best way to achieve a coherent vision on this?, I would like to follow up on Mark Jaccard's suggestions. Where we need to get to in this debate is not just to oppose individual projects, or types of generation, or even certain transmission projects, but rather we need a dialogue around what should be built. If the solution is not one form of generation, such as wind, biomass, or run-of-river hydro, then what is the recommended solution? We need to extend that dialogue into looking at what is required to connect that new generation including the transmission system, since transmission is clearly an integral part of this.

I don't think we need a strategic plan for the whole province on what generation should be built. Typically, governments around the world do not do well in dictating what form of generation should be built in which location. The IPP sector does a good job of putting up risk capital and looking to develop the projects. If they do not meet the environmental requirements or there is extensive public opposition, then those projects do not go ahead. An overall strategic plan or central plan for the whole electricity sector in the province is in my opinion not necessary. The big issue that we need to tackle, however, is how we deal with the cumulative effects or the cumulative impacts issue. As I travel around the province I hear that nobody wants to see a whole spider's web of transmission lines built in any part of the province to connect all the new generation that will be developed. How do we address this cumulative impacts issue? I hope to hear some good suggestions on how

we can move forward in tackling this.

### Summary

I would like to address some earlier comments on the efficacy of the environmental assessment process in the province. Many of our projects, certainly all the large projects, go through the environmental assessment process. The smaller projects do not go through the formal E.A. process but there is a whole series of reviews and permits and studies that need to happen. From the vantage point of my company, which is building hundreds of transmission projects of different sizes around the province, I would say that we have an incredibly robust and rigorous environmental assessment process in BC. We make hundreds of commitments on different projects to mitigate environmental impacts ranging from relocating frogs or transplanting needle grass to 'no access' to areas during the nesting season. From our point of view the province does a very good job of balancing the competing interests associated with project development and the environment.

### Perspectives from BC Hydro

*Cam Matheson, Director of Energy Planning, BC Hydro*

#### Net importer or net exporter?

In terms of trade, are we a net importer? If so, what does it mean? How do we relate that to the clean and renewable nature of the system we have and the one we would like to build? The BC 2007 Energy Plan requires that the generation of power in BC be at least 90 percent clean and renewable. It does not consider the amount of energy that we net import on an annual basis or even the energy we bring into the province on a daily trade basis, and that generally comes from emitting resources as coal.

Another point is that we do trade in the markets every day and we do that to breathe value for our ratepayers. One of the reasons why we are such a low-cost jurisdiction is our ability to use the storage reservoirs in the province to gain the market. We can store water in our reservoirs when prices are very low and we can import energy to serve our customer needs. When prices go very high we can generate out of those same reservoirs and sell into the market. That differential is roughly \$100 - 200 million most years for our ratepayers. That is one of the reasons

why rates are very low in BC. That is quite different from our net import position. Over the last eight years the only year that we were a net exporter was when we had a very high water year, two years ago. Other than that, we are generally net importers. What is the conclusion that you draw from that? The conclusion is that we need more power.

For the first time in a generation since the mid-1980s, we now require big, new resources to be built in the province. That is partly what brings all of us here together now - we have to grapple with what kind of a system we would like to have in BC. When the modern system was completed in its current form in 1984 with the in-service of the Revelstoke hydroelectric facility, the system went into a 20-year surplus. It took 20 years for the demand in the province to increase to the point where we were in rough load resource balance. The reason, frankly, that we are net importers is because we do not run the Burrard plant. If we ran Burrard to serve that extra need, we would be roughly balancing. We don't do this of course, in part because we don't want to emit and also because the Burrard facility is old and inefficient and you can usually buy energy from the market cheaper than using Burrard. We now have to grapple with making major infrastructure additions and the associated transmission is inherently important in that and, and, may have emerged as the key risk factor in all of this. When we move from the position that we are in now, of net importing, to a position of net selling, after we are self-sufficient in 2016, our ability to effect a transmission network that is capable of moving that energy out into the markets in an optimal way will go a long way toward assuring that we are doing things on a cost-effective basis for both the public and our ratepayers.

### DIALOGUE

#### Exports of power

Doug Little commented:

You have probably noticed that in the last three Throne speeches the government stated that it would explore the potential of exports of clean, low carbon energy from British Columbia as part of its overall climate change platform. And as part of that exploration, the government did include within the terms of reference for the utilities commission long-term transmission planning enquiry, a review of

the value of exports from the province. That will be undertaken over the course of the next year.

Cam Matheson:

If indeed BC does embark on an export-driven policy where we are either building projects or BC Hydro is acquiring projects specifically for the purpose of exporting, then California is inherently important. This is in part because of the size of California, as it is the number one load centre of Western Continental North America. Second, its loads tend to peak in the summertime whereas the loads in BC peak in the wintertime – so there is a synergy to be exploited from an energy development standpoint in that sense.

### **The economic growth and development model**

A representative from an ngo, addressed a question to Cam Matheson:

You said that BC Hydro has to consider all this with two things in mind - what does our society look like and what will it look like in 50 years and what does the economy look like? Then you said that the plan was put in place and executed and that up until the 1980s the focus was to drive economic growth and development. This is what is at the heart of this issue and the heart of the problem. Even though in this dialogue we are dealing with CO<sub>2</sub> and energy, it transects all spectrums including fisheries, wildlife loss, or whatever the unsustainable nature of our lifestyle is. This is the discussion that we need to have - no one is willing to talk about it but we have to talk about it.

The same comment was made in reference to the reason for IPPs – that is, to drive economic development. What does our society and our economy look like and what is the cost of the model that we accept? Where does this take us - another 20 years and then what? When does this end?

Cam Matheson:

When you ask “When does it end?” I don’t think it does. An electricity system is inherently critical to the economic wellbeing of whatever jurisdiction it happens to be in. Electricity is fundamental to the lifestyle that we live – I don’t think you will ever get to a point where you can separate the economic wellbeing of a population and its electricity system. They are inherently linked and they have to be. I

agree, however, that this question is the fundamental centre of what we are talking about here.

The participant responded:

I would suggest that we cannot afford the cost of an unending growth model.

Cam Matheson:

That is a comment on society and the sustainability of society as a whole. I would say that the electricity sector is only a microcosm of that in a larger sense. The electricity system you have is only going to be a natural reflection of the direction that society is going in.

Harvie Campbell:

I agree - economic development for the sake of economic development is not the right thing to do. You have to start with where we are in the province and what we need. Our choice right now is to either import power or generate it here. If we are importing power then that means jobs and employment are generated in the United States or in Alberta, rather than here. And we can do it better. But you have to start with a foundational need and that foundational need is not economic development in itself.

Another representative from an ngo directed a question to Cam Matheson:

The energy that we are talking about being produced here in BC would be more sustainable, certainly in the sense of not generating greenhouse gas emissions. The game is how to get that renewable energy to actually replace the many sources of greenhouse gas emissions that we produce. Certainly, my own organization works hard to achieve that. One of the things that we are very concerned about is whether the generation of the renewable energy will actually get linked to a reduction in greenhouse gas emissions.

Cam Matheson:

There are a couple of ways it could be linked, as the province moves toward what we call a ‘long portfolio’, which means that after 2016 our system will, in most years, be exporting – there will be a surplus in the system to the extent that it will now export energy into the United States. Obviously, if the province embarks on a build for export platform, that will even further contribute to the decline

in emitting resources in the US, as long as the cap and trade system or some system emerges that will penalize emitting producers. This would be coal first because it produces the most emissions. The coal operations will close and the increase of intermittents and renewables should have some bearing on that. However, we do not know what proportion BC resources will take in going in that general direction. However, as this province and its population begins to eventually make educated choices about fuel switching, increasingly that will be taken up by the things we are adding into the system which are, by and large, clean and renewable. Therefore, over time, there should be a linkage. However, how concrete it is and whether we can link it directly, is unknown at this time. What you are asking is: Will it actually work? We will have to find out.

### **Impact of demand-side management**

David Marmorek, ESSA Technologies, requested clarification on the contribution of demand-side management and also asked: What is it that Hydro is going to do differently from what it has been doing so far in terms of bridging the gap?

Cam Matheson responded:

In terms of the effect of demand-side management, we are going for roughly 10,000 gigawatt hours, about one fifth of our system as it is today, by 2020. That kind of aggressive target has not been set in any other jurisdiction on a relative basis, not even in California, where they are doing a lot. Therefore, the nature of the game has to change completely. I would argue that while we have been very successful with our demand-side management programs to date, they have been small in nature and relatively incidental to the overall system. However, that number is fundamental to meeting our growth and needs, over the long term.

The strategy covers three different areas: first and foremost, is the development of programs that will cause people to change the way they consume the electricity product; second, put in place codes and standards by working with governments at the provincial and the municipal level; and finally, the area of rates. We know that people are sensitive to price, as in the case of any other consumer product - the more the price goes up, the more they will think carefully about the way they consume that

product. In BC there is a potential conflict with the idea of a low rate jurisdiction. Typically electricity is low enough so that people do not really have to think about it. The question is: Does that have to change fundamentally or can we effect a lot of this conservation by convincing people that it is the right thing to do, as opposed to using rates like a giant hammer. We are going to try to do the former, rather than the latter, but rates still do play a role. Electricity rates in this province are going to go up – there is no question about that – and that will cause a certain amount of the conservation to occur naturally.

Mark Jaccard:

BC Hydro, in our estimate, has done a bit better on the subsidies than electric utilities in the rest of Canada. As Cam Matheson just mentioned, codes and pricing would be a critical part of this. Cam noted that this is perhaps the first jurisdiction ever to try this. However, in the 1970s and 1980s utilities had similar kinds of objectives. In hindsight, this is what we researchers are all looking at and we are trying to tease out the incremental effect of these various kinds of policies. There were \$25 billion dollars spent by US electric utilities over an 18-year period and \$3 billion in Canada, and the general notion is that the kind of graph that Cam showed is what we would call a wishful-thinking graph – we have had these kind of graphs for decades.

### **The potential of the California market – is this important to development of energy resources in BC?**

A representative from the California Hydro Power Reform Coalition asked: To what extent is the potential California market important to the development of energy resources in BC? California is currently going through a process to determine whether energy from BC should be renewable energy eligible in California. Also, all the speakers spoke to the need for the importance of rigorous public participation and environmental review. Could one of the panelists speak to how that plays out in regards to the context of Bill 32, and especially Bill 30? My understanding is that Bill 30 allows the provincial government to overrule local authorities.

Harvie Campbell:

With reference to the California market, that is a discussion that we, as a province, need to have and

we need to reach a conclusion. That is one of the reasons that I welcome this dialogue. Development of power for export is far from new. As a matter of fact it has been the norm for the last 50 years in this province. That is how the system got built. The process then was to build for the future. But this relates to the same question I asked before. If addressing climate change is an issue for BC and something we think we need to do, then helping other jurisdictions address their climate change and issues related to CO<sub>2</sub> emissions should be a good thing as well. That is the foundation of the discussion for me at least on the issue of exports.

Regarding rigorous public discussion and Bills 30 and 32, when everyone gets into the discussion about development there is the potential that a project for one reason or another has challenges with the local, municipal authorities. Often these are self-serving issues; for example, it may involve jurisdictions that want to use that development as a chance to raise their zoning rate and have a huge windfall out of a particular project. This happens in every jurisdiction around North America, China, Indonesia - it doesn't matter where you are. That kind of close proximity breeds greed and every single one of those jurisdictions has a mechanism to get around it. By way of example there is the Ontario Municipal Board and if a municipality gets greedy, it is taken to this agency for a balanced review. For most developers who anticipate that they are going to get into a challenge with a local municipality or the local region, they will, in fact, drop the project. In BC for the most part, developers will simply stop and go somewhere else. As a developer, the very first step is to go and talk to the municipality, talk to the First Nations and the community and find out if people are happy with what you are doing. If they are not, then usually you go somewhere else.

#### **Proposals that involve intermittent supplies**

Ray Pillman posed the question to Cam Matheson: On your calls for additional supply from IPPs, of the ones you received, are they mostly seasonal or intermittent supplies, which will require backup? If so, how do you fit these in to the hydro system?

Cam Matheson responded:  
As we have discussed here, we are primarily a hydro-electric driven system already and that means that

we get most of our water supply during the spring freshet period. So when we acquire new resources and they are run-of-river hydro, generally we are buying resources that are going to give us most of its firm energy in that freshet period, the time of year when we least need it. However, that is the beauty of the system we have - we can use our storage capability to actually integrate that energy into the system and store it and then utilize it when our demand dictates. Without question there is a finite ability that the system has in order to do that. When we reach that point, we are going to have to build new capability resources.

Ray Pillman:

Does that mean that the market for those large projects, particularly those that produce energy from snow melt and glacier melt in the spring and early summer, is in California?

Cam Matheson:

Again, there is a reasonable synergy there with the timing of the California-driven need. But you have to integrate them first into the system. You want to be able to sell them into the export market with a "firm product," and so you can't just think that you will be able to integrate that water right away and then sell it off into a marketplace. They have to be integrated here first - we are lucky because we really are at a competitive advantage position.

#### **Demand from electric cars**

A representative from a climate action program commented:

Measures such as the carbon tax or cap and trade were not discussed in BC five years ago and yet today they and climate and energy are now at the top of the list and people are taking some actions. When you commented that your demand projection does not include people shifting to electric cars, it made me wonder: When will BC Hydro take that into account considering that right now electric cars are not moving here, according to what your polling is showing? However, I think we will see a switch from fossil fuels to electric in order to deal with climate change and obviously BC Hydro needs to be ready for that in order for it to happen. Is there some policy, or a way of moving forward to include that demand, even though it doesn't actually exist right now?

Cam Matheson responded:

Hydro is not saying that electrification fuel switching and all the things that would move the consumer away from emitting products (e.g. combustion-engine cars and heating their homes with natural gas) is not going to occur. Herein lies the difference between what we do, which is forecasting demand, and then using that forecast to spend upwards of billions of dollars, to bring in new supply and build out the infrastructure versus scenario building.

Scenarios are a view of the future based on some assumptions. That will inform the Section 5 enquiry as it should. The principle we use is to say that we will not put it in our forecast until we see evidence of it actually occurring. Using electric cars as an example, many people expect that electric cars will be mass produced at some point. However, right now the major automakers around the world are not retrofitting their factories to be capable of mass producing electric cars in any meaningful way. Some firms are and there is some investment occurring, there is no doubt about that. But this is not happening to the point where electric cars could enter the BC marketplace in a way that would take up an additional electricity load. For that to occur here, it will have to be happening everywhere in North America to the tune of tens of millions of electric cars. That capability right now does not exist. Therefore, if we said, "We think electric cars are going to come into the marketplace by 2015 in this number," we would only be guessing. And unfortunately that guess is going to cost us an awful lot of money, especially if we are wrong. We are not saying that it is not going to happen – rather we are saying that we should wait and see how it is going to happen, when we think we are going to be able to predict with certainty that it is coming and the kind of volumes that it will represent. We will have time to see that and be able to build out the system to accommodate it.

#### **Are projects being evaluated in relation to anticipated changes associated with climate warming?**

Mark Jaccard directed a question to Cam Matheson: In your earlier comments you referred to some of the yearly variation that we see in precipitation rates and talked about the fact that BC Hydro with a lot of the heritage plants can store water for up to a couple of years, which gives you some flexibility. This year, I walked a lot of streams in the province where

we were having issues around low flows and high temperatures. Also there were other systems where I noticed possible first indications of change in seasonal flows, compared with what we have seen in the past. And recently I was in the Himalayas and there was quite a bit of debate going on about some of the issues around climate change and glacier melt and how people might think that would have an adverse impact on the long-term viability of some of the proposed electrical projects and big dams that they are looking at. In that regard, to what extent are projects here in BC, both existing and planned, being evaluated in terms of the projected impact of climate change and the possible changes in flow regimes that we might see and how that might impact project viability and production?

Cam Matheson responded:

There are a couple of points to make here. In large storage projects that is an important question because you have to assume the kind of water that you are going to see come into the storage project, other than the proposed Site C which I would argue has very little storage and is really a run-of-river project that makes full use of the upstream storage reservoir that is already there (Williston), we are not planning any storage reservoirs in the province. So it comes down to the building of run-of-river projects and whether you think there is a fundamental shift in climate such that the water that you could rely on through historical data is now fundamentally different and therefore puts at risk the viability of such projects. We do not have a definitive view on this so are not able to say yes or no to these things. We are studying it, however, in research ongoing with the Climate Impacts Consortium in Victoria. We have already seen significant glacial melt occurring in the Columbia Basin - going back in historical records we are looking at water supply numbers to find out whether, in fact, the figures from the 1980s and 1990s and this decade are skewed to reflect the result of those glaciers melting. This raises the question about whether or not those data are actually accurate and can be relied on for further planning. There are two questions. Are we getting drier - are we at the point where we have got so many eggs in one basket, a water-based system, that we shouldn't be adding any more to it at all because of the drying trend? I believe we don't have the answer to that yet. The second question is: Are we getting

warmer? Here, there are more data to suggest that we are, in fact, warming and what that means is that more of the precipitation that comes into our reservoir system will be spread throughout the year rather than coming as it has in the past in snowfall collected through the winter and then in the spring. Therefore, if it is a question of warming and not drying, it means that there will be the same amount of precipitation flowing into the system, it will just be coming in at different times of the year compared with what we have relied on historically. This means that we would have to operate the system differently than in the past.

The bottom line is that we are looking for the answers to these questions. We don't yet have definitive answers but it is important that we get the answers as soon as the data suggest there is concrete evidence to guide our decisions.

### **Financing public/private partnerships**

A representative from an ngo, commented: My understanding is that when the BC Transmission Corporation was split from BC Hydro, that was supposed to cost the people of British Columbia \$700 million. Is that correct? In terms of private-public partnerships, we supply the resources and you supply the finances. Why was Plutonic given \$72.8 million for the Toba Montrose Creek project by the federal government this last year? What was it for?

Doug Little:

When BC Transmission Corporation was formed (by making a separate company out of the previous transmission division of BC Hydro), the incremental cost to establish the company was really insignificant.

On the Toba Montrose project, I believe that they qualified for the federal government's Eco Energy contribution. That program was run by the federal government across the country where the government provided a payment based on the amount of low-carbon or renewable energy that was made available through the different projects. Several projects in BC qualified for that funding. This particular program was not renewed in the last federal budget earlier this year.

### **Why does the environmental assessment process in BC not take into account cumulative effects?**

Cam Matheson:

The province of BC is not set up to look at cumulative impacts in their environmental assessment process – that is probably one of the key issues that we have to grapple with.

A participant commented:

The environmental assessment process is a flawed process. It does not say whether a project can go ahead – it only says how it can go ahead. All we get is mitigation and compensation, which is nothing more than a lessening of punishment. Furthermore, no project has ever entered the environmental assessment process and been turned down.

### **On NIMBYism**

A consultant directed a comment to Doug Little: I work on behavioural change issues and find that human nature is one of the most incredible impediments to the work that I do. I was perturbed by the way you actually described NIMBYism as being an impediment to the process. It is actually a fairly important component of civil society. We are very lucky, I think, that we have the ability to be able to speak out against projects. Yes, it can be misguided and be a bit of a pain, but it is actually something that decision makers need to really work on embracing and learn to work with. It can provide for more positive outcomes if you can resolve those issues as opposed to just saying, it's not worth our time to deal with that and we should just ignore it.

Doug Little:

I would not want my remarks to be construed as saying we don't value public consultation, because we do. When we go out with all of our projects we have a good consultation program not only with affected landowners but communities, First Nations, and other stakeholders. We do place a high value on good, robust consultation. The challenges that we see are when the private interests of a few are an impediment towards developing something that is in the larger public interest. That is the balancing that has to occur through the public consultation process and the regulatory process. I completely agree that the ability to engage in public discussion when we have differing views is the hallmark of a democracy and we need to be able to do that in a well-informed

and respectful manner.

### **Measure of capacity or annual energy contribution**

Jeremy McCall, Outdoor Recreation Council commented:

In terms of the 46 projects described by Harvie Campbell with a capacity of 818 megawatts the gas plants account for 350 megawatts or almost half. That is approximately equivalent to adding one generator, at either Mica or Revelstoke.

A former president of IPPBC replied:

The natural gas plant at Campbell River was built in the late 1990s and produces about 265 megawatts. But that was a one-off plant and everything since 2001 has been run-of-river, with the exception of a few small biomass and biogas projects.

Cam Matheson:

You are describing a measure of capacity but the purchases that we are making these days with IPPs are not really about capacity. It is about the annual energy contribution that they have and that is a better measure of the overall contribution to the system that IPPs make. They don't have a lot of capacity as they are intermittent, generally. When the wind stops blowing or when the creeks freeze in the winter, they are not generating anything so in that sense they do not have a lot of capacity. So it is not fair to compare them against building a unit at Mica or Revelstoke which are pure capacity and don't have much energy at all.

Jeremy McCall:

That is my point. Thank you for bringing up the point about their intermittent nature because that is also important.

### **Disconnect between fossil fuel reduction and fossil fuel production**

A representative of an ngo commented:

I am deeply concerned about the disconnect that I see between a reduction of fossil fuels and fossil fuel production in British Columbia. How do we in the public have any kind of good feeling when we are seeing the promotion of fossil fuels? There are real subsidies being given to oil and gas, and promotion of coal bed methane and offshore oil. And some of our very precious places are being seriously impacted by these green energy projects? So we want to

actually see a movement on the part of the government to not subsidize fossil fuel projects any longer and take it seriously that they really do have a green energy plan and will move it towards the future.

Doug Little:

First of all, we are a very rare jurisdiction in BC, where more than 90% of our electricity supply comes from low carbon sources. Much of the rest of North America is not in such a favourable position. Therefore if the export of our natural gas to jurisdictions in the US can displace coal-fired generation then that is a very substantial benefit towards reducing carbon emissions from the continent. So from a big-picture perspective of reducing continental and global carbon emissions, natural gas exports out of BC to displace higher emitting activities in the US is a positive thing.

Also, we are currently working with BC Hydro and government to look at how to reduce the carbon footprint of the gas extraction activities that are occurring largely in Northern BC. Right now the focus is on Northeastern BC in the Dawson Creek and Fort Nelson areas where there are major gas activities. We are assessing whether or not to extend the transmission grid which does not go up to Fort Nelson, so that we can power those gas extraction activities with low carbon electricity so that the running of the pumps and compressors and all the other equipment that is needed for extracting the gas could be done with low carbon electricity supplied from the rest of the grid. Our preliminary assessment suggests that that will have a significant impact in reducing the overall carbon footprint of the natural gas activity.

Cam Matheson:

In the electricity sector we need to be looking at ways that we can reduce the footprint to extract those resources. This is where the rubber hits the road, because we know that building a transmission line into the Fort Nelson area to electrify those extraction resources will probably be incrementally more expensive than if we just build natural gas-fired emitting generation there locally. That is what we have to grapple with. This happens in the regulatory arena, and in discussions with government. Ultimately, this is where your principles come into effect, or not.

# AQUATIC ECOSYSTEM IMPACTS OF RIVER DIVERSION FOR HYDRO POWER

Jack Stanford, Jessie M. Bierman Professor Ecology and Director, Flathead Lake Biological Station, University of Montana

I have worked at the biological station at Flathead Lake in Montana for my entire career. This big lake is regulated by a dammed outlet so my career has involved, in large measure, researching the influences of hydro power operations on aquatic ecosystems and on how to ameliorate those influences.

I will share some of that experience with you in this presentation and try to develop a perspective about where BC might be headed in terms of the trials and errors that have occurred worldwide.

## Principles of regulated river ecology

There are several principles of regulated river ecology that have been developed during my career, and as far as I know, these are relevant regardless of the type of hydropower development. First, habitat diversity is always reduced and usually substantially, and native biodiversity almost always goes with it. These changes generally reduce the peak flows and elevate the base flows and allow non-native species to proliferate. In some cases conditions reset rather predictably downstream, particularly from big dams. We have been able to use this natural response in river systems to design environmental flows that, in many cases, substantially mitigate hydropower development. But it varies from place to place.

Second, floodplain rivers have high restoration potential if channels are not substantially incised and flood plains are not substantially encroached. Rivers that have big floodplains are a lot more resilient but unfortunately we have covered up most of our big floodplains by putting dams in the mid-points at the base of floodplains and filling the valleys with water. In many cases where the floodplains are still intact, we have been able to do substantial restoration by providing environmental flows.

## World's large river systems

Figure 1 describes impacts on river channel fragmentation and water flow regulation by dams on almost all of the world's large river systems. Note that the green areas begin near the Fraser River and extend north into Alaska and west to Siberia and Kamchatka.

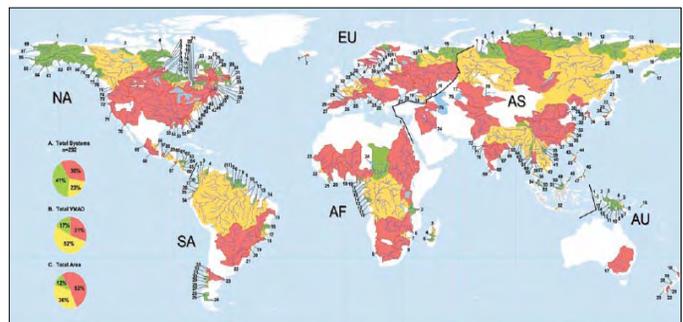


Figure 1. Impact classification based on river channel fragmentation and water flow regulation by dams on 292 of the world's large river systems. Source: Nilsson, C., C. A. Reidy, M. Dynesius and C. Revenga. 2005. Fragmentation and flow regulation of the world's large river systems. *Science* 308:405–408.

The point is that these rivers are largely intact and they are the large salmon producing rivers of the Northern Pacific Rim. Note that many of the red areas where the rivers are intensely regulated already, are also areas that we predict are going to have serious influences from climate change. Look for example at the Murray-Darling in Australia. It is very clear that that area is going to get drier and it has already been substantially oversubscribed. This map clearly shows that most of the big dam sites in the world are already taken. If you move to develop those that are not in the green areas, then you are going to run head-on into the kind of discussions that you are having in this meeting about whether the influence of the first principles of stream regulation are worth putting those systems in.

### How do dams and diversions influence river ecology?

Most streams begin as spring brooks up in the high country and as you move down they get bigger and finally coalesce on expansive floodplains. It is these expansive floodplains where we see biodiversity maximizing and it is always these expansive zones along rivers that we impound to create the storage that we need to generate hydropower. Figure 2 shows the structure of these floodplains. They have a great deal of habitat diversity generated by the peak to base flow regime that we see routinely in the temperate zones of the world. The snowmelt creates flooding in the spring and then in some coastal zones there is flooding in the fall and this moves the vegetation and sediments around in such a way that a wide diversity of habitats is created.

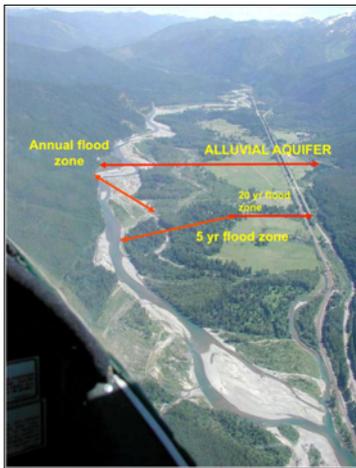


Figure 2. Flood plain structure. Nyack Floodplain Research Natural Area, Middle Fork, Flathead River, 5th order, Northwest Montana, SaRON reference site: ultraoligotrophic, protected, no salmon, Funded by NSF awards (Biocomplexity in the Environment; Microbial Observatory; Ecology program, Moore Foundation, National Park Service).

Figure 3 shows a LIDAR image of the same floodplain shown in Figure 2. Note that if you look at a coarse scale you can see quite a bit of diversity in the way that the river channel has been moving around. This is an unregulated river.

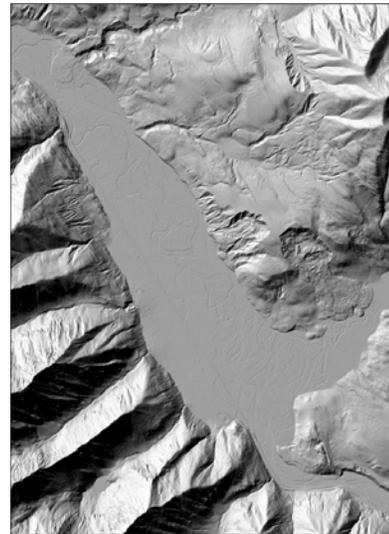


Figure 3. Lidar image of the Nyack flood plain showing the landscape features, including the channel network and the mass wasting on the GNP (right) side.

Figure 4 shows a portion of the image from Figure 3, and note here that you can really see how the topography has been diced up by the history of flows, creating this magical diversity of habitats that then allow many species to coexist. It is really hard

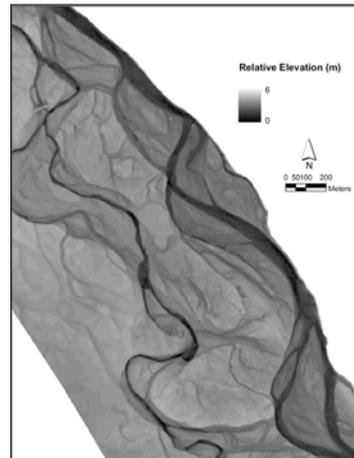


Figure 4. Lidar image showing the channel and bench topography. A portion of the LIDAR image in the previous slide that has been processed to finer detail using a GIS. Here the water is dark black and dry flood and paleo-channels show up as dark grey channels that bisect lighter-colored benches. These benches are covered by riparian forests.

to replace this structure once it has been regulated. Figure 5 shows a series of graphs that show that in this part of Montana the precipitation pattern is very much influenced by the Pacific Decadal Oscillation. Montana seems a long way away from the ocean, but we know that our weather is very much influenced by ocean conditions.

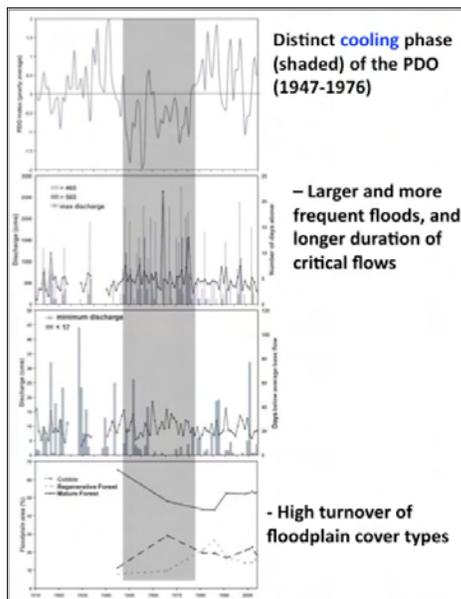


Figure 5. Ocean influences extend far inland, drive the SHM. Nyack Flood Plain, M. Flathead River, Montana. Flood intensity and duration varies with the Pacific Decadal Oscillation (PDO) – determines turnover of SHM, Whited, Stanford et al., 2008 *Ecology*.

During the cooling phase from 1947 to 1976, flooding was very common and this really increased the amount of scour zone along our rivers. The result of that can be seen in Figure 6. Here you can see the position of channels on this floodplain from 1945 up to 2004. That is exactly what the LIDAR image showed - the floodplain is being diced up by the river moving back and forth on the floodplain. This produces a dynamic patch mosaic that is constantly in change - some areas are stable for fairly long periods of time, then others are changing very rapidly.

What we all have to remember when we are talking about regulating a river is that the organisms that we are trying to minimize impacts on evolved under this dynamic habitat mosaic. What we do when we put dams and diversions on rivers or abutments or anything else that constrains a floodplain, is to take that dynamic out of the picture.

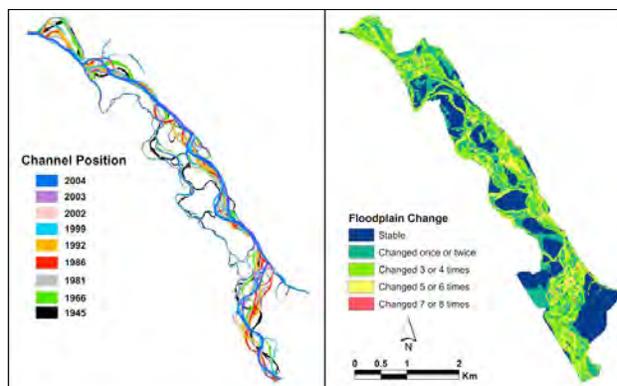


Figure 6. Habitat change at the Nyack Flood Plain of the Flathead River, Montana 1945 - 2004. Operative SHM Whited et al. 2008 *Ecology*.

Figure 7 is a conceptual diagram that describes the shifting habitat mosaic of river ecosystems. The arrows depict the interaction between the river channel and the upstream and downstream reaches on the one hand and the channel and its floodplain on the other and then finally the channel and the alluvial aquifers that are extremely critical aspects of the ecology of the ecosystem.

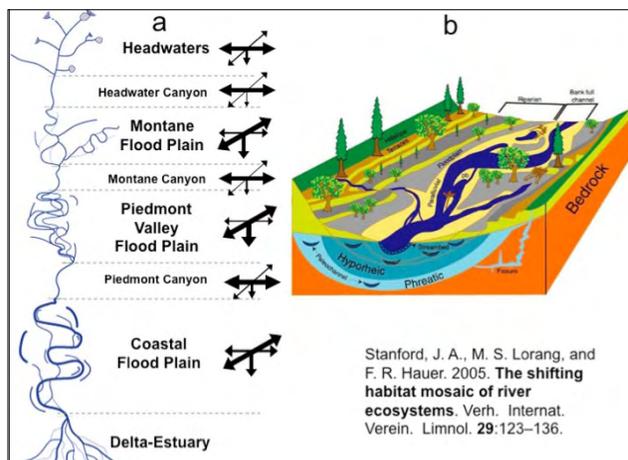


Figure 7. Idealized view of (a) the longitudinal distribution of flood plains and canyons within a river ecosystem from headwaters to the ocean and (b) the 3-D structure of alluvial the flood plains, emphasizing dynamic longitudinal, lateral and vertical dimensions and recruitment of wood debris. The groups of arrows in (a) indicate the expected strength of ground- and surfacewater exchange (vertical), channel and flood plain (lateral) interactions and upstream to downstream or longitudinal (horizontal) connectivity in the context of (b). Modified from Stanford (1998), Ward et al. (2002).

In each case, those arrows are constrained in various ways when we alter the flow to generate hydropower or abstract flow for irrigation or other purposes.

I would like you to keep in mind this picture of how river systems actually function in three dimensions and then the very important dimension of time that keeps all of these different habitats in motion. If you take that motion away, it is very difficult to mitigate in a way that maintains the attributes of river systems that we are very interested in maintaining, the goods and services that are generated by naturally functioning ecosystems.

### Examples of river system restoration

#### *The Gunnison River in Colorado*

Described below are river systems that we have studied to try to develop environmental flows to restore attributes of systems that are lost. The photographs in Figure 8a are of the Gunnison River in Colorado. You can immediately see that the river is regulated because of the band of vegetation along the side. This is a mountain river and it should have a relatively high varial zone there even though it is in a canyon. There is a relatively obvious scour zone because it's constrained and historically it would have been a high flood flow river.



Figure 8a. Gunnison River - Colorado post regulation.

If you go down on the gravel bars or the beaches by the river (upper right-hand photograph), you see that they are overgrown with vegetation. And when you move downstream to where it comes out of the canyon onto the floodplains, the floodplains are completely overgrown with vegetation and the gallery forest of cottonwoods are largely senescent, if they are not gone altogether.

The photograph in Figure 8b was taken in the 1950s prior to regulation. These nearshore environments were beaches of sand with naturally encroaching vegetation, which was constantly moved around by the river flooding.



Figure 8b. Gunnison River - 1950's pre regulation

In Figure 9 there is a graphic of this particular river system from headwaters to its confluence in Colorado. In the 1960s it was dammed in the middle reaches. Three dams were built, and prior to building those dams, the natural situation was a stream continuum in which there were native salmonid fishes in the headwaters. Then as the river wound through the canyon reach down towards the confluence of the Colorado River, there was great habitat for some of the native fishes.

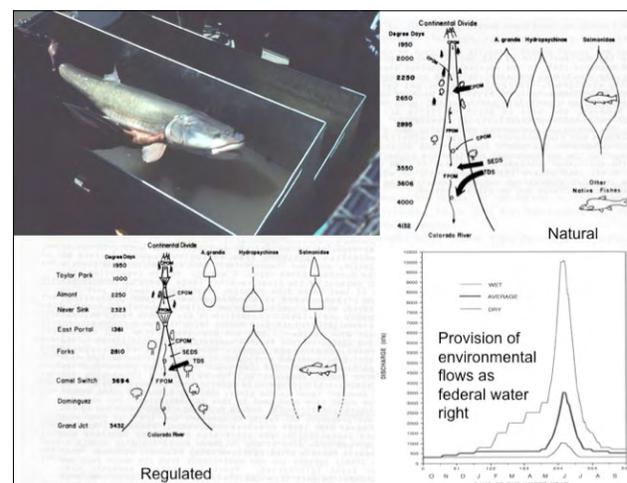


Figure 9. Distribution of selected biophysical attributes in the regulated discontinuum of the Gunnison River.

Note the photograph of one of the Colorado River minnows, a species of minnow that gets up to 50 - 60 pounds. That was the native fish and top carnivore

of the lower river. When the dams were put in, they were bottom-release dams. They let loose a lot of cold water and eliminated the peak flows for the large part and the salmonid fishes were immediately extended a way downstream. The future of the Colorado endemic minnows was also in high doubt. These minnows were flagship members of the Endangered Species Act, which was implemented quite a number of decades ago, and this population has still not recovered.

The graph in the lower right hand corner of Figure 9 is based on work we did in 1980. We generated what we thought would be a very good environmental flow that would ameliorate some of the impacts of the dams and allow these endangered fishes to persist in this system. The provisional flow is shown for an average year, a wet year and a dry year. This recommendation was provided in 1980 and various administrations came and went in the United States along with various suits from either side of the aisle on this issue. The gist of it is that it stayed in court until this year. Finally, in 2009 the court system decided that what we proposed in 1980 was, in fact, the right one and it was implemented, 30 years later. Now it is not really clear that this is the right environmental flow regime for the river, given the vast encroachment of vegetation that has occurred since.

### *The Palisades Dam on the Snake River in Idaho*

Figure 10a is a photograph of the Palisades Dam on the Snake River and Figure 10b is a graph of the flow duration curves prior to and after the dam was built.



Figure 10a. Photograph of the Palisades Dam on the Snake River.

As always the dam lops off the peaks and raises the base flow.

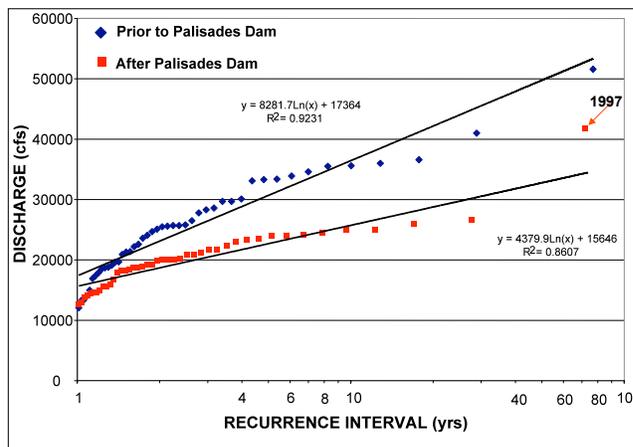


Figure 10b. Flow duration curves prior to and after the introduction of the Palisades Dam on the Snake River.

The issue here is maintaining the native Yellowstone cutthroat in the system, when there are regulated flows that have allowed a lot of exotic species, both plants and animals, to come into the system. In Figure 11, there is a photograph of the back channel (middle) and another photograph (lower left) of a particular lily that has been listed under the Endangered Species Act.

**GALLERY FOREST**

- Age Structure
- Cottonwood regeneration
- Maintaining Spatial Diversity

**ESA SPECIES**

- Aquatic
- Wetland
- Riparian

**EXOTIC SPECIES**

- e.g., reed canary grass

Figure 11. Photographs the Snake River, back channel and endangered species.

This lily persists in these backwaters only as a consequence of flooding that scours the backchannels, constantly creating new habitat for the lilies to grow in. In this case we used more modern techniques where we managed to demonstrate from remote sensing where the areas of geomorphic work would occur under different flows. Note that the various substrate sizes are influenced by flows as

flow changes flow competence. From this a provisional environmental flow regime was very quickly implemented.

We are in the process of monitoring this over the long term to see if the objectives in terms of the maintenance of these two endangered species are met. The world is full of examples of environmental flows that have been derived in various ways to try to ameliorate the rather pervasive effects of stream regulation.

### Suldal River, Norway

A case that I believe is most closely allied to the kinds of discussions ongoing at this meeting is the Suldal River in Norway. The Norwegians have built giant reservoirs up on the top of the plateau or the batholith, which you see in the background of the photograph in Figure 12.



Figure 12. Suldal River, Norway - regulated lake outlet river - S.J. Saltveit. Higher base flow; fewer floods; 5-8°C summer cooling.

The black arrow indicates what they do. They drill a tunnel up through the mountain to the bottom of this giant reservoir and they grab all of the cold water that is stored up there (which, of course, reduces the peak flow in the river) and then send it down to generators at the aggraded reach of the river near the mouth where the river joins the fjord.

This generates tremendous hydropower - many of these penstocks will be two or three thousand feet in head. However, as in all cases, this does a few bad things. The first thing is that it stabilizes the higher base flow - the river is basically banked full and it stays that way all the time. The former floodplain on the left side of the photograph is now a hayfield. Therefore, it doesn't flood as much and it is stabilized. The key point is that the water coming down off the Hardangervidda, the high plateau, is cold

water – it has reduced the summer temperatures by 5 – 8 °C. For all of the famous Norwegian Atlantic salmon rivers, most of the productivity is in the lower part right above the lower reaches of the river, and right above the confluence of the fjord up to where the rivers cascade out of the high mountain. This is very similar to a lot of places in BC. It is in the foreground of this photograph where the real productivity of the river is. Now we have a regulated river and also very cold temperatures in the summertime.

The composite graph in Figure 13a and 13b describes some parameters for the Surna River in Norway. Figure 14a includes the plot of the sport catch of Atlantic salmon - there is a very long record of this catch for this river, which was famous for very large Atlantic salmon. In the early records, from 1876 up through World War II in 1945, the inter-annual variation was the result of the ocean conditions varying. The exploitation rate during that early period, both by sport fishing and by drift netting in the fjord, was very low, maybe in the order of 10 percent.

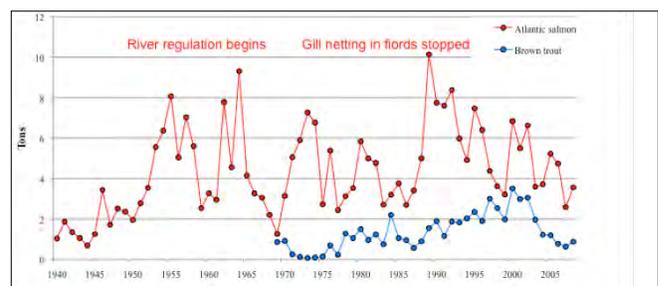


Figure 13a (top) and Figure 13b (bottom). History of atlantic salmon and sea (brown) trout fishery in the Surna River, Norway.

However, note what happened after World War II when the economy got going worldwide again and sport fishing ramped up with a significant increase in the exploitation rate from both sport fishing and drift netting in the fjord. We are currently in the

process of trying to back calculate the rate and we estimate it is above 50 percent and maybe as high as 80 percent. The plot in Figure 13b shows that in the 1940s, up to World War II, the catch was relatively low from all sources. There were probably 10 or 15 tons of fish in the river and only a small portion was taken. However, after World War II that increased very rapidly. And then they regulated the river with the pattern described above, where the cold water from the high mountains was brought to the salmon-producing part of the river near the fjord in 1969. By then, the exploitation rate on the fish was very high and there was the additional stress of the stream regulation protocol that dramatically reduced growth of the early life history stages of the fish. The result was that the numbers of fish being caught increased the exploitation rate even higher and the numbers of fish that were being brought to shore were larger and they were taking a much more substantial portion of the fish that were coming in. Recognizing this was a problem, the Norwegians stopped all of the gillnetting in the fjords. This elevated the (sports) catch, but from 1990, the catch has dwindled right on down to almost nothing. So here there is the strong interaction between the culture of fishing in which no fish is useable unless dead, and secondly, the stress of river regulation on this particular river system. This is basically the story for all of the major salmon rivers in Norway. Very few sport fisheries are really counted these days in Norway because there aren't many fish coming back and the ones that are are small.

How has Norway begun to compensate for that? First, they are spending many millions of dollars on scientists to do research to find a way to get the fish back, without taking the regulation scheme out or without implementing no-kill zones on their fish. That is simply not working.

### **Kol River, Kamchatka**

Now let's go to a river system that has a great number of fish coming back to it – this is the Kol River in Kamchatka (see Figure 14). This is a big, broad floodplain river in the Russian Far East. It is a tremendous salmon producer and the fish use the river floodplain from valley way to valley wall. When the river floods, juvenile fish are out in the riparian forest eating and during summer on down to base flow and into the fall floods, the river is full of some kind of spawning salmon. The expansive

nature of the floodplain in the riparian forest can be seen at our research camp on the river. Note the understory vegetation along this river. It grows to a height of three to three and a half metres in a period of about a month and a half every summer. The question is: How does this vegetation get so big? The answer is that there is some kind of anadromous fish coming into this river system every month of the year.



Figure 14. Kol River in Kamchatka, Russia.

Figure 15 shows the various salmonid species that come back to this river system. The run size in this river is between five and ten million fish per year, and this is a relatively small river of only about 150 kilometres total channel length. An intermediate sized river will have tremendous runs of salmon and this is typical for all of Kamchatka. Therefore the source of the nitrogen that feeds these riparian plants becomes pretty clear pretty fast.

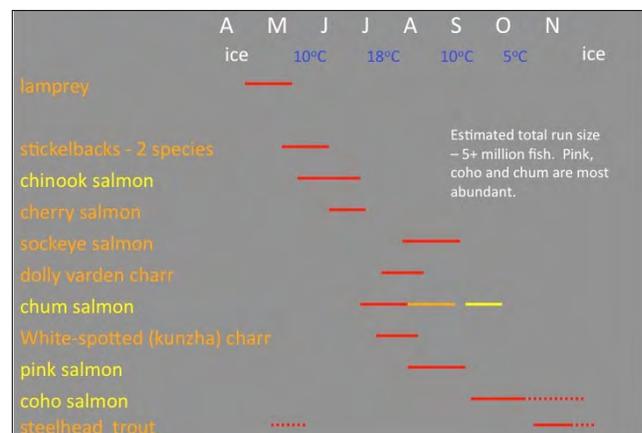


Figure 15. Run Timing by Species - Kol River in Kamchatka, Russia.

Figure 16 shows a plot of the dynamics of total nitrogen in the water column in the river.

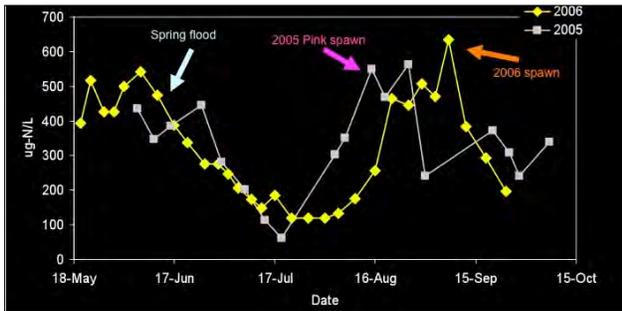


Figure 16. Kol River Mainchannel Total Persulfate Nitrogen.

Note that there is a peak during spring flood when the alluvial aquifers are flashed and then the river productivity pulls the nitrogen down to about zero. So there aren't a whole lot of background nutrients in this system. The river gets it all from salmon and most of those are pink salmon. Note that the curve increases again as the die off of the pink and chum runs ensue each year. At the time of the die off you would think that the river would be nearly polluted with nitrogen yet at the time, in the middle of the summer, it looks like a relatively pristine system.

Table 1 shows the C to N ratio of the leaves of the riparian plants. Note the very high nitrogen concentrations in comparison to temperate broad leaves or cottonwoods.

Table 1. Kol vegetation species are extremely N-rich versus the global average, C:N 8-14 versus 35.	
Results: Foliar N	molar C:N
Kol floodplain	
- Salix A:	13.7
- Salix B:	12.6
- F. camtschatica:	14.4
- Nettle	8.1
Temperate Broadleaf <sup>1</sup>	35.1
Nyack cottonwoods <sup>2</sup>	38.1

1: McGroody et al. 2004 Ecology,  
2: Harner and Stanford 2003 Ecology

This system is fertilized tremendously by the salmon runs and our research shows how all of this feeds back to the actual freshwater salmon productivity itself.

### Salmon ecosystems

In ecosystems you can expect that if you change

the flow conditions enough to generate significant hydropower, these things are going to happen. In the context of a big salmon river, the floodplain productivity will be compromised and in fact, the very things that you would like to maintain will be compromised. The question is: Can you have both your fish and hydropower? Table 2 summarizes the vital signs of salmon ecosystems that are needed in order to have sustained wild salmon productivity. It is very difficult to maintain these vital signs in a regulated river; for example, the need for natural and normative hydrology. You cannot have both natural hydrology and hydropower. You might have normative if the hydropower system is a low-head, run-of-the-river dam that fish can get through and aren't compromised so much.

Table 2. Salmon ecosystem vital signs.

- Sustained return of spawners to all spawning habitat in numbers that provide conservative accounting for environmental variation.
- Sustained habitat-specific density and growth of juveniles.
- High habitat connectivity and productivity in freshwater, estuary and ocean (shifting habitat mosaic)
- Natural or normative hydrology
- Natural or normative temperature patterns
- Productive, biodiverse food webs with strong riparian linkages and sustained MDN inputs (salmon carcasses, naturally deposited after spawning)
- High salmonid biodiversity (diverse life histories)
- Natural or normative water chemistry (minimal pollution)
- No cultured stock introductions or supplementations

Since they have compromised their rivers, Norway has started to turn to aquaculture through open net pens to provide their salmon. In many cases 30 to 40 percent of the fish that do return are escaping from these net-pen operations. They also put hatcheries on some of their rivers but unfortunately used Baltic River stock and so they brought the gyrodactylus parasite into the western Norwegian rivers. Then it became necessary to kill the rivers completely to try to control the parasite.

Figure 17 is a map of a ranking of the quality of all of the rivers around the Pacific Rim in the context of potential salmon productivity, ranging from high quality (yellow) to low quality (blue).

This is a physical assessment that was produced through our salmonid rivers observatory network. Note that many of the rivers of high quality are on the north slope of Alaska. Generally, the major



## DIALOGUE

### Hydropower development in fish-bearing streams

Aaron Hill commented:

Jack mentioned one proposed project in BC that was recently granted a water license. There is some sort of a myth that I hear propagated by industry from time to time that the majority of proposed run-of-river projects in BC are not for fish-bearing waters. That is not true. For example, of the 17 diversions proposed for the Bute Inlet project the majority are fish-bearing waters. Jack provided the example of a hydropower project proposed for a creek in the Skeena watershed that would divert water from a stretch of the creek that has adult spawning salmon. There are more examples of this across BC and along the Coast. We know that the Ministry of Environment has very low capacity to monitor these projects and there is poor monitoring to ensure that the project managers do not exceed the amount of water that they are allowed to withdraw. That is something that needs to be addressed.

California is looking at the possibility of importing energy from BC to meet their renewable portfolio standards. However, currently these projects in BC do not meet their criteria because they are above the 30-megawatt threshold and they cause adverse impacts to in-stream beneficial uses (fish) as well as changes in volume and timing of stream flow.

### Assessing the definition of run-of-the-river power

A participant commented:

I want to address the question of whether or not these are small, as opposed to large, projects. We also need to look at how run-of-the-river power is being defined. There are a growing number of projects that include applications for storage, which significantly changes the definition of run-of-the-river power. The idea behind run-of-the-river is that it does not shape the flow of rivers. However, a number of these projects, including some that are under construction, would use lakes and other bodies of water to store water for more than 48 hours, which would dramatically change river flows. A project on McNab Creek on the Sunshine Coast is currently under construction and it dams an alpine lake and uses it for storage. I don't think these can truly be considered run-of-the-river, regardless of their size.

I know that industry addresses the issue of trying to build projects above fish barriers. However, they are not looking at the overall health of the rivers including downstream effects on gravel improvement for spawning beds for salmon or whether or not there is food for the fry that grow upstream and then come downstream after a river is diverted and put through kilometres of pipe. They are also not addressing the impact on water temperature.

### How do bears factor into the fertilization effect?

Another participant posed a question to Jack Stanford:

When you talk about the diversity in the river and relate it to the impact of the fish coming up to spawn, do you believe that bears, taking the salmon out of the river into the undergrowth, contribute to that? In British Columbia you can see evidence of fertilizer from the bears all along the river.

Jack Stanford replied:

The answer is both. Flooding moves a tremendous amount of salmon biomass into the forest and entrains it into the sediment. In rivers where there are large numbers of animals that feed on salmon, such as bears, it has been shown that they can remove a large amount of fertilizer into the riparian system and the vegetation responds to it. The point is that all of this salmon biomass then nitrifies the vegetation and bugs that fall out of vegetation are also nitrified by feeding on the vegetation and more biomass and this feeds back to the salmon themselves as the salmon fry consume the bugs from the vegetation. Very often we tend to forget about the early life stages of salmon and how critical they are to the future generations. Hydropower is almost always negative on the early life history stage, no matter where or what type of system it is. When the flow is ebbed back or moved down to penstocks this will be significantly changed.



### **Assessing the trade-offs – salmon or hydropower**

A participant from California commented:

Figure 16 showed a map of high value and low value salmonid habitats. In California the rivers with the lowest values are located in the Sierra Nevada and Cascade regions. The reason why these areas are the lowest value is because every single river is impacted by hydropower dams. In your deliberations about how to develop hydropower in BC, I would say that this is not the way to do it. Nor should you do it the way that the Norwegians have.

The Director of the Atmosphere and Energy Program at Stanford University has completed a study that concluded that of various energy types hydropower has the most impacts, except for coal and nuclear, and in temperate climates river systems are amongst the most productive ecosystems.

The issue is that it is very difficult to have both healthy salmonid populations and hydropower production. The main question then for BC is: What is more valuable to people? Obviously, the answer will be different for different types of people. It is important therefore to also look at other types of renewable energy and to see how they figure into the mix.

Jack Stanford commented:

I meant to say that Norway has the highest standard of living per capita in the world. There is no question that hydropower has worked for them. However, they have traded their salmon culture for easy street and are now trying everything they can, including spending a tremendous amount of money, to get their salmon culture back. So far this is not working. The only thing that we as scientists can really tell them now is to take some of the hydropower systems out and try to put a few Norwegian rivers back together again. But that is not working either because they won't do it.

### **The situation on Sedan Creek**

A fish and wildlife biologist commented:

I am a biologist working on the Sedan Creek project. Jack showed some examples of impacts to rivers in the US and Norway which relate directly to impacts on rivers in BC that have been previously dammed, such as the legacy projects. I don't see that they relate as much to the run-of-river projects. The wide

floodplain-type of ecosystem that you described that are even moderate or high productivity for any fish in BC are not the ones that are being targeted for run-of-river projects, simply because those types of stream reaches don't have the head necessary to be economical and also they would most likely not make it through the regulatory process. As we know, run-of-river projects target the steep, confined high gradient reaches that in general are lower in productivity for most fish, especially for salmon. When the fisheries assessment for the Sedan Creek project came by my desk, and I reviewed what had already been done, one of the first things I did was to recommend that they avoid the floodplain of that creek altogether, which the proponent easily agreed to. This is not to say that there are no impacts, but some of them can be avoided.

Jack Stanford responded:

One thing I noticed about Sedan Creek is that it does have a high specific conductance compared to the Skeena River, and it also seems to be unusually productive for a high gradient stream like that.

### **How does altering a system affect adaptation to climate change?**

A participant directed a question to Jack Stanford: There has been a lot of talk about the need to reduce greenhouse gases and I don't think any of us would argue with that. It seems to me, however, that dealing with climate change has got two parts to it, the second part being adaptation to climate change. Could you explain how altering stream flows through diversions and dams will impair the future ability of these systems to adapt to climate change?



Jack Stanford responded:

My research group is in the process of downscaling the DCMs to river basin scale using complex modeling procedures and making forecasts on climate change for each river around the Rim, out to a hundred years. We predict that the Skeena, for example, is going to warm up and its flow will begin earlier into the spring. To answer your question, in all of the discussions about cap and trade and reducing greenhouse emissions, the umbrella of climate change is over the top. So we have to use our best predictions and get site-specific about how a particular strategy is going to play out in these river systems. For example, much of the Columbia River gets too warm for salmonids to begin with, so you might want to write off part of the Columbia and put your spear in the ground elsewhere.

How resilient are natural streams going to be to climate change compared with those that have been substantially dewatered or influenced by dams and diversions? The answer is obvious. When you have naturally functioning floodplain systems where there is a lot of groundwater/surface water exchange there is a tremendous buffer effect to warming and cooling or dynamic between higher runoff and flashier runoff compared with systems where most of that buffer capacity has been lost by the construction of dams. Furthermore, the reservoirs themselves were built under regimes that will not be met and a lot of them will not fill so well, and they will also act as heat sinks.

# WILDLIFE IMPACTS

Scott Harrison, Senior Environmental Specialist, BC Hydro



The first thing I always like to do is put things into a global perspective. BC is a very special place to live with abundant wildlife, including Spruce Grouse, Mountain Goats, Bighorn Sheep, and Mountain Lions. There also are many special places, such as the Tuchodi River watershed where the wolves will answer when you howl. Getting close to animals is part of the work that ecologists do, and it is a privilege. What it teaches me is to have humility about our understanding of ecological systems. When I was asked to make today's presentation about the impacts of hydroelectric development on wildlife, I thought about the various species that could potentially be impacted, such as Marbled Murrelets, salmon, or Grizzly Bears. However, I want to focus on the complexity of ecological systems because our society rarely focuses on this complexity when making decisions about individual projects. I think that the ecologist Frank Egler understood why we focus on the specifics of a single project when he noted that, "not only are ecosystems more complex than we think, they are more complex than we can think". A key point in discussions about environment and energy and the trade-offs is that BC is one of the last places on the planet where there are ecosystems that continue to function with little human influence. For this reason, we are afforded a wonderful opportunity to understand and do a better job of what it means to interact with ecosystems in a way that is sustainable.

When thinking about how humans can relate to

ecosystems in a way that is sustainable, I like to use the example of Bhutan – a magical Kingdom in the Himalayas west of Nepal. The Bhutanese don't focus on 'gross domestic product' as a measure of wealth; instead, they focus on 'gross domestic happiness'. Like all humans, the Bhutanese people need to use goods and services from the environment in order to live. However, Bhutan approaches their relationship with Nature in a way that reflects the need to use ecosystem services sustainably. For example, the King has decreed that logging plans must ensure that 60% of Bhutan forests remain in a state of old-growth so that both the rate of logging and the availability of areas for wildlife can be sustained.

## Ecological perspective on sustainability

Ecologically, the Earth is a finite, closed system – there are no biological inputs from outer space; life on Earth only exists because of ecological processes. For example, photosynthesis enables plants to convert sunlight into carbohydrates, and plants provide food and materials for animals, including humans. Most things in our lives only exist because of ecological processes: oxygen, food, lumber, cotton, plants, animals, and other humans. Even possessions, such as computers and bicycles, only exist because plastic and steel are manufactured by using compounds or energy from plant-derived products such as oil, natural gas, and coal to process inorganic minerals.

So, we have a fixed planet where ecological processes yield ecological goods and services that support thousands of life-forms. We meet our needs by using ecological goods and services. However, we are using these ecological goods and services at a rate that is greater than the rate that the life-supporting ecological processes can replenish these goods and services. In addition, humans impair the natural ecological processes with pollution, synthetic chemicals, and excessive discharges of CO<sub>2</sub>. I think most people know that humans are a dominant life-form, and we are undermining the ecological resiliency of natural

systems that support life. I think that we also know that, to survive, we need to begin using ecological goods and services in a way that is sustainable. The challenge is – how do we do this?

### How do we apply the concept of Sustainability?

Someone today mentioned that we can have our cake and eat it too. However, sometimes you can't. The crux of the question becomes – What cake do we want, and what is that cake going to cost? I think that we need to focus on achieving a concept of sustainability that includes the integration of social well-being, economic prosperity, and ecological resilience. Historically, we tend to ignore the costs associated with ecological resilience, and there are examples throughout the world that demonstrate what happens when you don't integrate all three aspects of sustainability. The collapse of the cod fishery in Newfoundland is one example: ignoring the ecological costs of overfishing cod lead to dramatic and long-term social and economic costs.

To explore options for achieving sustainability, it is necessary to recognize that we all bring assumptions and biases to these discussions. We sincerely believe certain things to be true, but, quite frankly, sometimes our beliefs are not supported by the data. For example, we all have a view of how we think that Nature works. We don't examine our assumptions about Nature; we just go on making management decisions. However, our view of Nature has big implications for our approach towards management of natural resources and for the likelihood of those decisions to achieve sustainability.

In their book, *Panarchy*, Gunderson and Holling provide different views that people hold about Nature (Figure 1). In these diagrams, the ball represents the state of the natural system. You can think of the ball as the condition of an old-growth forest or of a salmon population. The surface that the ball is sitting on represents the stability domain for the natural system. The stability domain is the range of environmental conditions where the ball (i.e., the salmon population) will be stable or unstable. For example, different ocean temperatures or river levels result in different population levels of salmon. The arrows indicate that there will be other forces, such as predation or human fishing, that can act on the salmon population to move the population around

the stability domain (i.e., to result in the population level being high or low and stable or unstable). In the first view of Nature, Nature Flat, the system can be stable with the ball remaining on the stability domain only if the external forces push equally on all sides of the ball. This view of Nature assumes that if we find the right level of management pressure, we can hold the system where we want to for our purposes.

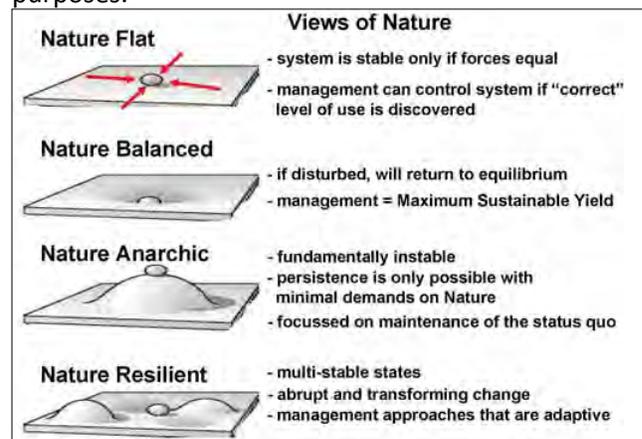


Figure 1. Views of nature (Gunderson and Holling 2002).

Nature Balanced is the view that most of us grew up with – it is the idea that if you push the ball from its stable state (i.e., at the bottom of the valley), the ball will move up the side towards the edge. If you stop pushing (i.e., stop fishing or logging), then the population will settle back to its stable equilibrium point at the bottom of the valley. If you believe the Nature Balanced view then you believe in management based on the concept of maximum sustainable yield. This is the way that humans have managed most resources.

Nature Anarchic views the state of natural systems to be precarious. The ball is sitting on an unstable peak on the stability domain. If we push the system too hard (i.e., catch too many fish), the population is going to shift and roll off this stability domain into a different system. In this view, the system is seen as fundamentally unstable, and the only way we can maintain the stability of the system is by minimizing our demands on the system. Those who believe in the view of Nature Anarchic support management that focuses on minimizing interactions with the system to avoid destabilizing the system. Historically, this view has been held by some environmental groups.

Nature Resilient is a view where the stability domain has multiple unstable equilibria (i.e., peaks) and multiple stable equilibria (i.e., valleys). Natural systems can move among different equilibria given different external forces. Importantly, our management actions can push the system among these equilibria – sometimes to states that we do not want. Data from many examples support this view of Nature.

Examining the natural world with the view of Nature Resilient enables understanding of the way that ecosystems function and how we can best manage these systems in ways that are sustainable. Figure 2 from *Panarchy* illustrates the relationship between ecological resilience and the adaptive cycle.

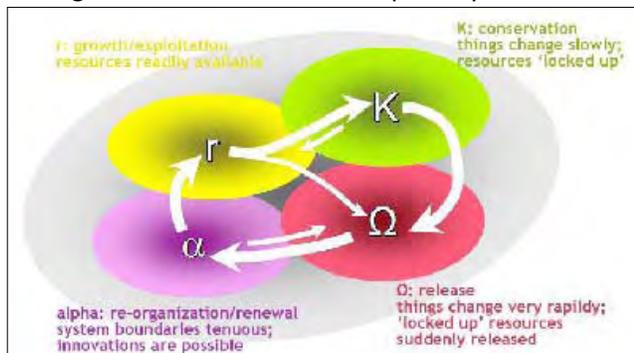


Figure 2. Ecological resilience and the adaptive cycle (*Panarchy*, Gunderson and Holling, 2002).

One can think of K as an old growth forest where there are many biological components and a great deal of energy held in the large trees. With the right conditions, such as a fire, the trees will release this energy, and the system will flip quickly to a different ecological state.

The system can flip to another system and to another, and then the system enters the r stage where we begin to recognize the system as a young forest. Because humans have such short lives relative to ecosystems, we get used to the idea that old-growth forests and high salmon populations are the only stable states for ecosystems. We have developed our societies and built our economies on this assumption, and our management of these natural systems has been ignorant of the underlying ecological dynamics. This is an error as we have seen with examples like the Atlantic cod fishery. Due to inappropriate management, the cod population, which had been stable at high numbers for hundreds of years, flipped to a new equilibrium with low cod

numbers. The system might recover, but it is unlikely that we will see a viable commercial cod fishery in our lifetime. Another example of a system flipping to a different ecological state is the Sahara Desert. Once an extensive forest, the ecosystem flipped to a stable state of a desert. Clearly, a forest is better for us in terms of supporting our life on the planet than is a desert, so the flip from forest to desert is seen as undesirable from our perspective.

Data from ecosystems regarding our use of natural resources support the view of Nature Resilient. This suggests that we need to examine our management decisions about our use of ecosystems goods and services. These data suggest that our management approaches, whether for fisheries, forestry, or electricity production, need to be adaptive.

### Millennium Ecosystem Assessment

To begin making better management decisions about ecosystems, it is useful to start with a baseline to build on. The United Nation’s Millennium Ecosystem Assessment was produced in 2005 after a four-year examination of global ecosystems by 1,360 scientists, economists, and business professionals from 95 countries. They examined changes over the last 50 years and highlighted the importance of ecosystem services for the well-being of humanity and business development.

### What are Ecosystem Services?

Table 1 shows different categories of ecosystem services examined by the Millennium Ecosystem Assessment. Along with three categories listed here: provisioning, regulating, and cultural, and there is an additional category of ‘supporting’ ecosystem services.

Table 1. Status of the world’s ecosystem services (Millennium Ecosystem Assessment 2005).

	Degraded	Mixed	Enhanced
<b>Provisioning</b>	<ul style="list-style-type: none"> <li>• Capture fisheries</li> <li>• Wild foods</li> <li>• Biomass fuel</li> <li>• Biochemicals</li> <li>• Freshwater</li> </ul>	<ul style="list-style-type: none"> <li>• Timber</li> <li>• Fiber</li> </ul>	<ul style="list-style-type: none"> <li>• Crops</li> <li>• Livestock</li> <li>• Aquaculture</li> </ul>
<b>Regulating</b>	<ul style="list-style-type: none"> <li>• Air quality regulation</li> <li>• Climate regulation</li> <li>• Erosion regulation</li> <li>• Water purification</li> <li>• Pest regulation</li> <li>• Pollination</li> <li>• Natural hazard reg.</li> </ul>	<ul style="list-style-type: none"> <li>• Water regulation</li> <li>• Disease regulation</li> </ul>	<ul style="list-style-type: none"> <li>• Carbon sequestration</li> </ul>
<b>Cultural</b>	<ul style="list-style-type: none"> <li>• Spiritual values</li> <li>• Aesthetic values</li> </ul>	<ul style="list-style-type: none"> <li>• Recreation and ecotourism</li> </ul>	

The Millennium Ecosystem Assessment revealed that of the 24 systems that were examined, only 4 were considered 'enhanced' during the last 50 years on a global scale. Nearly two-thirds of the ecosystem services were seen to be 'degraded'. Imagine the response if an economic report indicated that 66% of the economic indicators suggested that the economy was in trouble. We would do something about it – in fact, we have been making great efforts to fix the recent economic 'crisis', yet we do not see a similar response to the ecological crisis.

It is interesting to note that carbon sequestration was determined to be 'enhanced'. The reason for this is that over the past 50 years there has been an increase in global reforestation after earlier deforestation. All of the growing trees take up carbon, so the ecosystem process of carbon sequestration is actually enhanced globally. This finding does not diminish the fact that human activities continue to produce carbon at a much faster rate than the natural carbon sequestration can absorb the carbon, so the carbon enters the atmosphere adding to the green-house affect. However, the global enhancement of carbon sequestration does have implications for today's forum on electricity in BC and the distinction between 'clean' (i.e., low green-house gases) vs. 'green' (i.e., low environmental impact). In BC, most of our electricity is hydroelectric and has always been low carbon; instead, it would be useful to discuss ways of moving to 'green' electricity production because there are so many ecological issues that are globally unique to BC.

### **Energy priorities for true sustainability**

What does 'being sustainable' really mean? For these discussions, I like to distinguish among four levels of sustainability:

1. Ecological sustainability (closed-system approach for single planet)
2. Reduced consumption (lower human demands on global ecosystems and ecosystem services)
3. 'Green' (includes effects on ecosystems and ecosystem services with appropriate regulatory certification and monitoring)
4. 'Clean' (focus on GHG - ignores ecosystem aspects, such as biodiversity, cumulative effects, water quality, wilderness values, and others)

'True' ecological sustainability acknowledges that the

Earth is a closed system. If you have trouble thinking about this, when you go home tonight imagine that you have to get everything that you need (i.e., air, food, water) or want within the limits of your yard or apartment. You also have to dispose of all the waste that you create within these same physical limits. You cannot go to the grocery store, connect to the municipal drinking water system, or send your garbage or sewage to an external waste-treatment facility. Everything has to be contained within your yard or apartment. It seems extreme, but this is exactly what ecological sustainability means because the Earth is just a big yard that we all live in. So far, there have not been enough humans consuming resources and producing waste at the rate to cause enough concern to lead to real change; however, we all know that this change will soon be required as our unsustainable actions begin to affect more and more people in more and more places.

If we are going to use the same old economic and life-style arguments to avoid true ecological sustainability, then we should at least strive for the second level of sustainability of dramatically reducing consumption. Reducing consumption will slow the rate at which we use ecological goods and services and reduce the rate at which we pollute the planet.

The next two priorities clarify that 'green' is not 'clean', and that 'green' is higher up the sustainability scale than 'clean'. By this definition 'clean' has a focus on greenhouse gases, and that is what most people in government mean when they refer to 'clean' energy. 'Green' is about the broader spectrum of ecological issues. It is about plants, fish, animals, water, air, land and ecosystem services. Sometimes the two terms are interchanged – this is inappropriate.

### **The Three Pillars of Sustainability**

Although always hopeful that society will decide to pursue true, closed-system ecological sustainability, I have yet to see it happening, so to maintain momentum in a more sustainable direction, we should encourage true implementation of ALL three pillars of sustainability by any government or organization that claims to be operating sustainably:

1. Social well-being,
2. Economic prosperity,
3. Ecological resilience.

I list the three pillars in this order because the order reflects the value sets that many people and, therefore, governments currently seem to hold. People need to meet their basic needs (i.e., air, water, food, shelter) before anything else. In societies where most people have met their basic needs for survival, we encourage individuals to contribute to the economic growth of the society. When that economic growth begins to affect the environment in ways that dramatically affect social well-being (e.g., polluting the water supply), we begin to become concerned about the ecological resilience of the ecosystem. In a more insightful society, the desire to be sustainable means that decision makers recognize the need to address ALL three pillars in all decisions.

### **Adaptive Management**

One of the challenges for decision makers who want to truly include Ecological Resilience in their approach to sustainability is that it is difficult to determine when a decision is giving the desired ecological result. The answer to this challenge is Adaptive Management. Adaptive Management is not 'trial and error', it is 'learning by doing'. Adaptive Management uses everyday management decisions as experiments by structuring decisions with quantifiable objectives and an experimental design. Every time that we do something on the land base there is a chance to learn. To be sustainable, we need to start learning from our management successes and mistakes. For example, with independent power production, we should have an overall strategy to try different types of projects, manage the projects in different ways, monitor the projects, try some with private ownership, try some with public ownership, compare the results, document the results, learn lessons, and apply the lessons to future projects. Adaptive Management can provide insights into three aspects of sustainability.

### **Looking for Solutions**

BC Hydro has an Environmental Impact Goal that states that BC Hydro will have "no net incremental environmental impact by 2024, from the 2004 baseline". As you can appreciate, measuring the impacts is part of the challenge. BC Hydro is developing metrics for Air, Land, and Water. The land metric provides a way to quantify differences among different areas along a spectrum of ecological processes in a way that can link to the ecosystem services as

described by the Millennium Ecosystem Assessment. For example, it is readily apparent that a diverse river valley in northern BC is at a different end of the ecological spectrum than a parking lot in downtown Vancouver. One site is ecologically resilient, and the other site is ecologically impaired. The aim is to increase the number of sites that are ecologically resilient and reduce the number of sites that are ecologically impaired. The next step would be to use adaptive management to get us to compare management options for achieving this goal.

BC Hydro also is a member of the World Business Council for Sustainable Development and was involved with developing the ecosystem services review and other methods to help businesses identify their dependence and impacts on ecosystems. There are many more challenges coming regarding ecosystem services as defined by the Millennium Ecosystem Assessment. There is a real opportunity for BC to be out in front because many of our ecosystem services are relatively intact. These sustainable approaches will benefit the province on all three levels: socially, economically, and ecologically.

## **DIALOGUE**

### **Windpower in the Peace River area**

Ed Mankelov, Chair of the Land Use Committee for the B.C. Wildlife Federation made the following comments in an impromptu presentation.

One area of BC where wind power applications seem to be concentrated is the Peace River area, including the area around the Muskwa-Kechika. This is a special management area that we in the Wildlife Federation help to protect. The area is managed by the Muskwa-Kechika Advisory Board, and they are very concerned about possible threats to the area. These private power proposals were not on the radar when the LRMP processes were in place to supervise over planned and designated land.

The Muskwa-Kechika Board will have no more luck than any regional district or municipality if they attempt to stop these projects, as the government brought in Bill 30 to override them when Squamish turned down the project in their area. The people of the Peace River have good reason to be concerned. There is a proposal in the environmental assessment

process for more than 200 turbines for Hackney Hills.

This mountain ridge type of terrain is a problem; it is the habitat of species of mountain wildlife including mountain sheep, goats, grizzly bears, and red-listed mountain caribou. Another wind farm proposal is in place for Dokie Ridge, west of Moberly Lake. Apart from the obvious physical land disturbance once the towers are in place and the turbines are installed and running, the area could be subject to a constant sound of between 45 and 50 decibels. The figure of 45-50 decibels comes from the proponents' figures for the Bear Mountain proposal, which is now underway. As well, the flicker effect of the blades has been shown to have an impact on domestic stock and wildlife. I suspect that this area will not be wildlife habitat for long, once the project begins operation. The wildlife will likely be driven down to lower slopes where they will be more exposed to predators or will simply disappear and no one will be responsible for their demise.



### **On the order of the three pillars**

Guy Dauncey commented:

I was amazed that you put ecological resilience as deliberately and consciously third in importance after social welfare. The greater our social and economic welfare the more environmental damage we do. The more consumer goods we buy, the more we import from China. All the evidence is that the wealthier we are the more damaging we are. Ecological resilience should surely be top of the list and not the bottom.

Scott Harrison responded:

Ecological resilience is the top priority for a true closed-system approach to sustainability. However, I was suggesting that the reality of the world within which we live ranks ecological resilience after social and economic concerns. As an ecologist, I know that ignoring the environment will lead to social and

economic ruin. However, in an attempt to encourage institutional change, there is no point in me simply saying that ecological resilience is the main priority because the current decision makers will say that we need jobs and that trumps ecological considerations nearly every time. What I said was it would be at the top, and in terms of any sort of environmental ethic people are talking about that. But our reality is the way I ranked them. I don't like it but I know it represents the world within which we live and operate.

This is relevant to how we approach these discussions. There is no point in me saying that we have to live for ecological resilience, because someone will say that we need jobs, which trumps me every time.

### **On no-net environmental impacts**

A participant commented:

If I heard you correctly you said that BC Hydro has a policy of leading to no-net environmental impacts by 2024. I wonder how that would work in the Peace River country with the proposed Site C dam that would eliminate the best farmland in northern Canada and result in a genetic blockage for the Yellowstone to Yukon ecosystem.

Scott Harrison responded:

That statement comes from our public web page outlining BC Hydro's Environmental Impact Goal, and there are people working to achieve that goal. BC Hydro works at the whim of the government. We can suggest and cajole, but at the end of the day, BC Hydro is a Crown corporation.

A participant posed a question:

Would the document that was referred to in terms of the environmental impacts also apply to electricity purchases from IPPs?

Scott Harrison responded:

As far as I understand it, the goal was going to apply to direct hydro resources that BC Hydro has control over rather than Independent Power Projects. I have not been involved with the impact goal planning for some time, so the scope of the environmental impact goal might have changed. There continues to be a lot of discussion about how wide the goal should be. Again, the reality is that you get into some very difficult political questions very quickly, which is why we are all here today.

# FRAMEWORK FOR CUMULATIVE IMPACTS

Presentations by:

Aaron Hill, Biologist, Watershed Watch Salmon Society

Tanis Gower, Fernhill Consulting

## Introduction

As many have said here, all forms of electricity generation have direct or indirect environmental consequences to aquatic and terrestrial ecosystems and cultural and recreational values. Different types of renewable energy whether wind, hydro or geothermal energy will have unique environmental impacts, but all of them will require similar types of support and infrastructure, such as roads and transmission lines, and all projects are assessed under the same regulatory processes.

This presentation is centered on the impacts of hydropower projects. What we will discuss is applicable to other forms of energy development as well as other forms of land and water development. We are not going to go into detail about fish and wildlife impacts, but instead will show you how we are failing to account and manage for cumulative effects in BC. We will also suggest how we might start doing that in a way that is meaningful.

## Background information

First we will provide some background to explain why it is so important that we manage for cumulative effects. Since 2002 the province has required that new sources of electricity come from the private sector. The majority of the projects being planned or built are run-of-river projects. The main reason that we are all here today is because of the way this has been unfolding – it has essentially been a frontier-style rush of claim staking on BC's streams and rivers by developers and speculators. We now have over 700 streams and rivers in BC with water license applications for hydropower development (Figure 1).

At least 80 projects have been approved in one form or another and dozens more are well into the permitting process, while new applications are coming up all the time. BC Hydro and various researchers have

done a lot of work in past years to identify the thousands of BC waterways that have the best generation potential, but there has been no strategic planning process at either the regional or the provincial scale to determine which potential sites would yield the highest quantity and quality of power with the least environmental impact. Further, there have been no serious attempts to determine if certain regions or watersheds outside of parks and protected areas

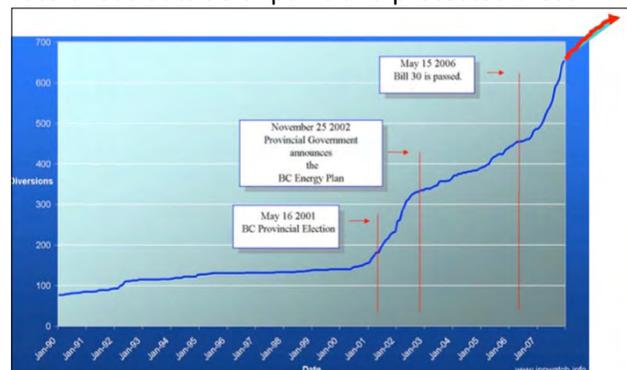


Figure 1. Independent power projects in BC.

should even be considered for development.

## How run-of-the-river power is produced

Every river diversion or conventional impoundment hydro project starts with a dam or a weir that backs up the water into a reservoir or a headpond, and the stream flow, in many cases up to 95 percent of it, is then diverted into one or more pipelines known as penstocks, often leaving just a trickle in the original stream bed (Figure 2).

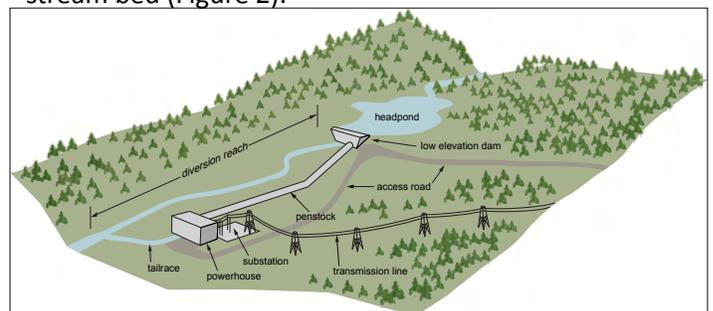


Figure 2. A typical river diversion hydro project. Drawing by Soren Henrich.

Up to 95 percent of the flow can be diverted in these projects, less if there are fish present. The diverted water is put through turbines in a powerhouse before flowing back into the original waterway. Substations are often required. Transmission lines are always required and so are access roads right up to the reservoirs.

When talking about cumulative impacts it is essential to remember that the vast majority of these projects are geographically clustered within the province with by far the highest concentration in the south coast region. Contrary to claims otherwise, the majority of these projects are for fish-bearing streams, including salmon. The map on the right of Figure 3 shows that on the south coast there are over 250 water licence applications for hydro projects. The map on the left shows several of the proposed transmission lines and diversion reaches from the Sunshine Coast up to Knight Inlet, along with several other water licence applications, shown by the small purple triangles.

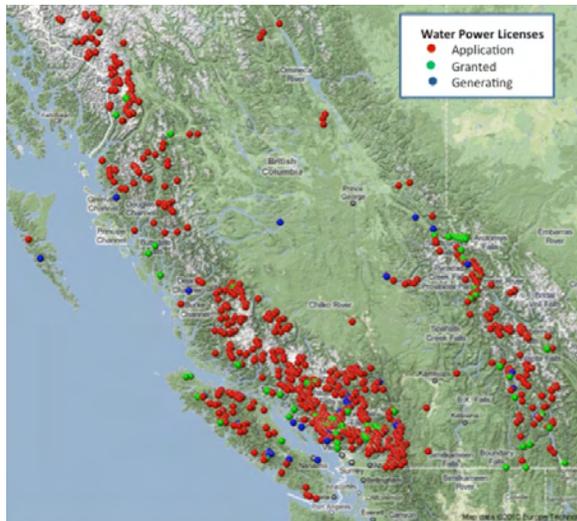


Figure 3. Current and potential IPPs in BC.

Even without new development, this is already one of the most heavily impacted regions in the province and this region is also impacted the most heavily by other factors such as logging, urbanization, fish farms and poor freshwater quantity and quality and marine conditions as a result of climate change. That is why it is so important to take into account cumulative effects. The photograph in Figure 4 is of an IPP at Rutherford Creek, south of Whistler. It is located in the middle top of the picture next to highways. There is an existing rail line and high capacity transmission lines, and in the foreground you can see a gravel

mine that was re-opened for the project and then kept open afterwards.



Figure 4. Rutherford Creek IPP.

While it made sense to take advantage of the proximity to existing infrastructure when this project was being sited, the effects of the IPP undoubtedly created adverse effects in a watershed that was already contending with many other negative effects. This goes back to what Scott Harrison described in terms of maintaining resiliency in our watersheds. Right now these sorts of cumulative effects are not being considered and it is hard to make a well-informed trade-off decision.

### Review of IPP impacts

It is hard to talk about trade-off decisions without considering cumulative effects. Figure 5 describes how IPP impacts are currently reviewed. There is one level of approvals by BC Hydro and one by government regulators.

Most projects also require consultation with affected First Nations, which is a third and very important level of approval. All projects are reviewed by various provincial and federal agencies to determine how a proponent will mitigate or monitor the project's environmental impacts. Some projects go through official environmental assessments by the province; however, since 2002, projects under 50 megawatts, like the Ashlu River (photograph in Figure 5) have not had to do this. They may still go through a federal EA under certain circumstances; for example, if anadromous fish are present. Separate from all of that, BC Hydro determines which projects can be constructed to supply power

to the grid.

- 3 levels of approval: Government, BC Hydro, and First Nations.
- BC Environmental Assessment Act does not apply to IPPs, 50MW (threshold was 20MW until 2002)



Ashlu River, 49MW

- All IPPs are reviewed by MOE, DFO and other government agencies
- BC Hydro decides which projects it wants to buy power from
- First Nations are consulted and accommodated to the perceived degree that they may be adversely affected
- BC currently has no strategic planning process to assess or manage the cumulative effects of these projects, or to ensure that development avoids sensitive areas with high environmental values
- BC Hydro does not appear to differentiate between IPP locations based on environmental criteria
- The merits and risks of individual IPPs are evaluated without consideration of their broader context

Figure 5. Review of IPP impacts

All IPPs are considered potentially green by BC Hydro, which makes them eligible for an independent certification referred to as “Ecologo”. BC Hydro pays a premium for energy from these certified projects. To the best of our knowledge BC Hydro is not involved in the various environmental approvals and studies that are done while the project is in the planning phase for IPPs. That means, then, that they are not involved in determining how to mitigate a project’s environmental impact. On the flipside, the provincial and federal government staff are not really keyed into BC Hydro’s green criteria and they do not rely on this when they are giving advice and requiring studies and issuing approvals. Further, First Nations are consulted and accommodated to the perceived degree that they are affected, and it is not uncommon for BC Hydro to actually sign contracts with IPPs before getting approval from First Nations and DFO and MOE. It is also not uncommon for DFO and MOE to issue approvals without ensuring that everything is satisfactory with BC Hydro, and whether they are actually going to buy the power.

Clearly, the process is uncoordinated. Furthermore,

BC Hydro appears to only consider project locations in the context of power production and project feasibility and they do not differentiate between the IPP locations. They also do not consider the project density based on any environmental criteria, let alone cumulative effects. And there is no regional based planning processes. What we have, then, is a process where the merits and the risks of all the individual IPPs are evaluated without consideration of the broader ecological context. This can be referred to as a project-centric approach (Figure 6).

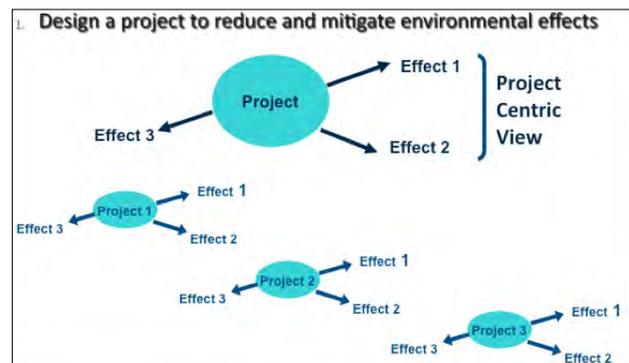


Figure 6. The project-centric approach (what we are doing now).

This approach proceeds without any strategic planning and the speed at which a project moves through the various stages of approval seems to be dictated more by things like corporate finance rather than whether or not the project is environmentally appropriate. In this project-centric approach analysts use the project as the frame of reference and examine the details of how the project may directly affect different components of the environment. That sort of analysis is very helpful in determining how to design the projects in order to reduce and mitigate direct impacts. But in this traditional approach to environmental impact assessments, each project is considered in isolation and the mitigation measures are also prescribed in isolation. You can’t properly assess cumulative effects doing it that way.

If you want to have a meaningful environmental assessment process then you need to center it on what is known as valued ecosystem components (Figure 7). The components could be a Marbled Murrelet population or a fish population or a riparian community. It could be an entire ecosystem or a social value.

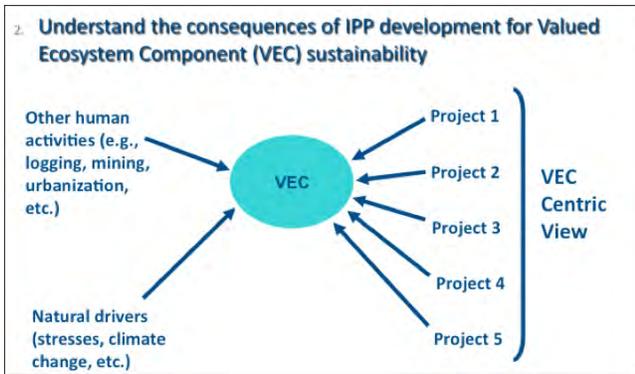


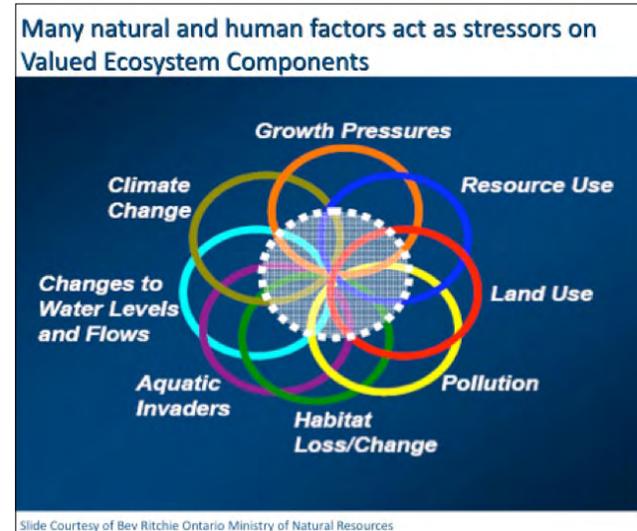
Figure 7. The VEC-centric approach (what we should be doing).

Understanding how an individual project will affect the status of valued ecosystem components requires careful evaluation of all of the different stressors that are impacting it; things such as climate change, logging, mining, and urbanization. Conducting an environmental assessment that way can lead to very different conclusions as to whether or not the project is appropriate. The project-centric environmental assessment might find that a project conforms with all the environmental regulations and that all the impacts can be mitigated. However, even in the very few cases where cumulative effects are considered for new IPPs, it is still done on a project-specific basis and is often just tacked onto the original EA as a sort of addendum. That is useless because the main thrust of the project-specific environmental assessment is to find a way to minimize and mitigate the impacts, and so it is very unusual to simply turn down the project because it is inappropriate. They always try to find a way forward. However, if the environmental assessment looks at the cumulative effects on the various valued ecosystem components it may show that the local ecology is already so highly stressed or sensitive that the risks from further incremental impacts could be significant and unacceptable.

If we want to ensure that our future renewable energy projects are truly clean and low impact, then we need to take the second approach, with an overall view of all the aggregate stressors that are acting on the ecosystem and these ecosystem components (Figure 8).

That only emerges by moving away from project-specific assessments and it only happens if we start tackling the necessary planning exercises instead of avoiding them. That said, understanding all of

the different stressors like habitat loss and climate change poses a very serious scientific challenge. Also, each stressor represents a cumulative effects management problem in its own right and so it does present a challenge.



Slide Courtesy of Bev Ritchie Ontario Ministry of Natural Resources

Figure 8. Cumulative impacts.

But there are ways to deal with it. The one thing that you want to stay away from is the mechanistic assessments described in Figure 9. Using this sort of a framework you can very quickly get bogged down trying to explain all the effects of the different projects on the valued ecosystem components. The critical point is that we need to take our best shot at understanding at what point all of the effects and stressors acting on a valued ecosystem component are going to push it past a threshold where it cannot recover from a 'degraded' state. Tanis Gower will suggest some ways that we might go about doing that.

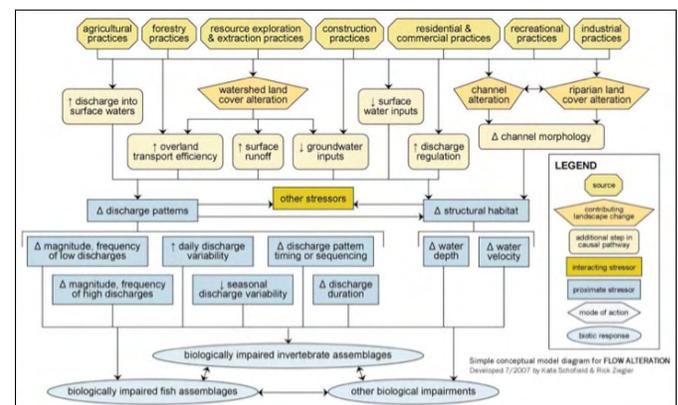


Figure 9. Mechanistic assessments.

### The way forward – the valued ecosystem components approach

The way forward is to take a step back from the project-by-project approach and focus cumulative effects assessment at a regional level by assessing the sustainability of valued ecosystem components. We have to do science that is focused on cumulative effects assessment rather than individual project assessment. As a central part of that, we need to assess the status and threats to valued ecosystem components; for example, populations of salmon that we want to manage, riparian communities or ecosystem or habitat types. We choose specific ones because we can't manage for everything at once. We also have to detach the project environmental impact assessment from the cumulative effects assessment. Rather than tacking on cumulative effects assessment in a more or less token chapter, we need to regard them as distinct, with the important exceptions of mitigation of large projects and the important role that individual projects will continue to have in providing information at a regional level.

The centrepiece of this approach is to determine thresholds and limits on valued ecosystem components. We have to maintain valued ecosystem components within a range that is acceptable to us. Bill Rees summed it up: "Cumulative effects assessment has the low practical value unless it's in relation to allowable limits within regional carrying capacity." Let's not forget that the best management of cumulative effects is to avoid them in the first place. Dealing with impacts after the fact, as many of us who try to do restoration projects know, is either impossible or prohibitively expensive.

### The tools for this approach

The various tools that can be used for this approach are listed in Table 1, provided by the federal government.

The first few tools will have to be used in almost all cases. The first tool relates back to land use planning - regional land use and environmental sensitivity mapping or databases. Second is the identification of valued ecosystem component thresholds. Formal risk assessments and individual project mitigation and monitoring will always have a very important role. Any time a project is planned we want to be sure that we plan it in such a way that the negative

effects are minimized. For those that we do not entirely understand we will put in place monitoring that will help in the planning of future projects once the data start coming in. Information sharing from individual projects will also be important for overall cumulative effects management. Joint development plans and combinations of infrastructure are also critical. This is not happening currently in BC, with parallel transmission lines and competing companies. Working together is one way to minimize cumulative effects. Traditional knowledge is another tool in the toolbox and regional access management control; that is, managing cumulative effects by managing how people get onto the land. A different sort of tool is linear corridor control; this is another potential tool where there can be predetermined limits on how much linear fragmentation is allowed in a particular landscape, and controls on linear corridor density. Species management plans and habitat conservation plans are tools that we are more familiar with in BC. We manage certain specific species and those plans can inform projects that are ongoing where we manage specific habitat.

Table 1. Cumulative effects management toolbox\*

- Regional land use and environmental sensitivity mapping/databases
- Identification of VEC thresholds
- Formal risk assessments
- Individual project mitigation and monitoring
- Information sharing from projects EIAs (regional databases)
- Joint development plans and combination of infrastructure
- Incorporation of traditional knowledge
- Regional access management/control
- Linear corridor controls
- Species management plans
- Habitat conservation plans

\*CEAA 2009

Which of these tools do we have in BC? What we do have is regional provincial mapping focused on energy potential. What we don't have are the first three tools on the list. However, there are examples from other jurisdictions where they not only map out energy potential but also ecological sensitivity.

Figure 10 is a map showing a series of data collected in Scotland to guide them in siting wind farms. They looked at areas that were suitable for wind power strictly on a technical basis and overlaid that with areas that were acceptable for wind power on an environmental basis. That then gave them an

overlay that showed areas that were appropriate to develop.

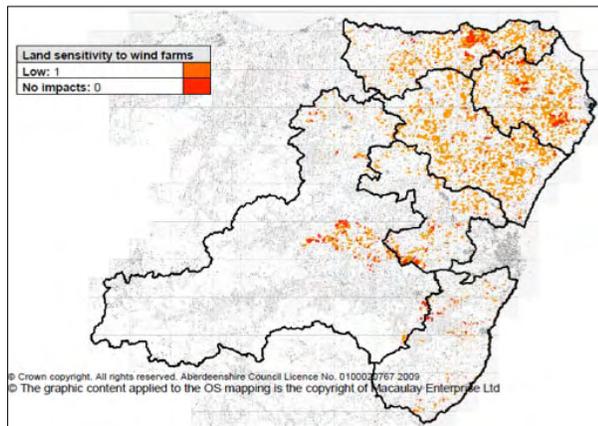


Figure 10. Scotland siting of wind farms.

This type of tool is something that many people in BC have been asking for for quite some time; that is, some level of planning to determine where it is acceptable to site things.

Another example comes from the Alaska Tongass region where they have mapped some valued ecosystem components, including salmon, forest conditions, estuaries, old growth, and deer and bear habitat. They were able to combine these into one map that was used as a guide for environmentally sensitive regional development and they combined that information in other ways for another map that ranked watersheds for ecological importance (Figure 11).

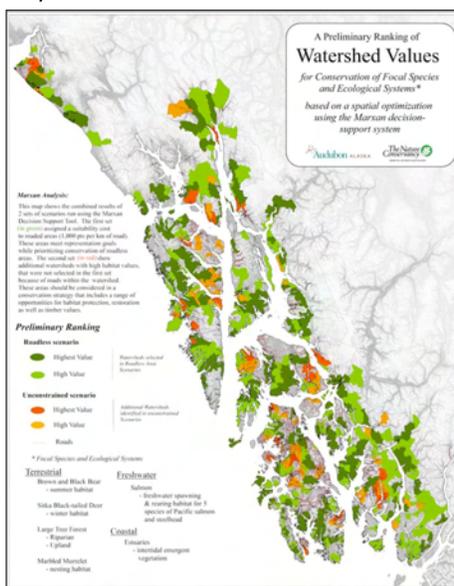


Figure 11. Ranking of watersheds for ecological importance.

The graph in Figure 12 helps to explain the meaning of valued ecosystem component thresholds.

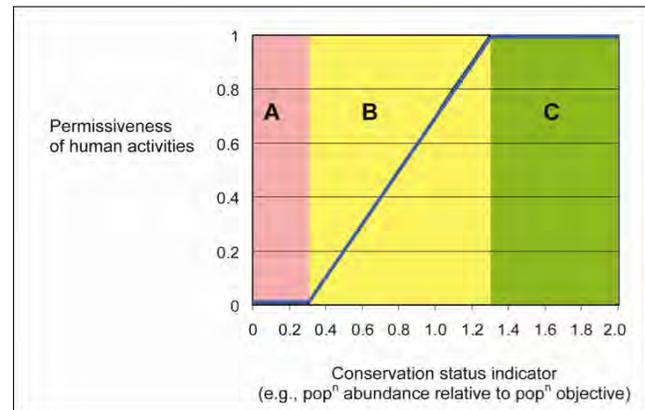


Figure 12. Thresholds for defining zones of concern as related to VEC indicators.

This graph is conceptual in nature and describes the conservation status of any valued ecosystem component; for example, it could be the health of a spawning salmon population or the health of a group of watersheds. The area marked “C” represents the healthy zone, and the area marked “A” a zone that is quite degraded. In the degraded zone human activity would not be permissible because further degradation is going to be unacceptable. The yellow zone (B) ranges from a threshold of unacceptability to total acceptability of human impacts. That is the zone of caution where we would want to do careful planning. This is where almost all of our projects will fall in British Columbia.

The diagram in Figure 13 describes a real world example. The Department of Fisheries and Oceans is applying this approach through the Wild Salmon Policy. They are developing thresholds or benchmarks for salmon conservation units. This is a threshold approach for determining salmon abundance and distribution.

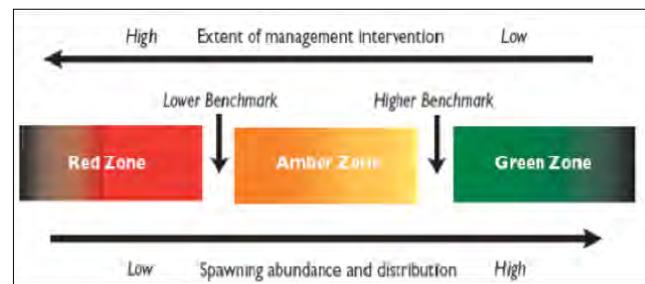


Figure 13. Three status zones for salmon stocks differentiated by measurable benchmarks, source DFO.

Their management goal is to have populations in the green zone, the higher benchmark, which they refer to as a target. They want to avoid getting into the red zone or below limits where salmon would be seriously impaired. This is the third tool on the list in Table 1 - a qualitative way of describing risk categories where 'risk' is defined as probability times consequence. If something is likely to happen you want to make sure that the consequence is not large; that would fall in the categories of unacceptable impacts or high impacts. This is a theoretical framework that can guide managers to think about risk when they are determining whether or not an impact to a valued ecosystem component would be probable and what the consequence would be if it were to occur.

The chart in Figure 14 describes another way of looking at the same thing. If there were a number of ongoing and planned projects they could also be grouped by risk category and that could give managers an idea of the suite of risks to a particular valued ecosystem component.

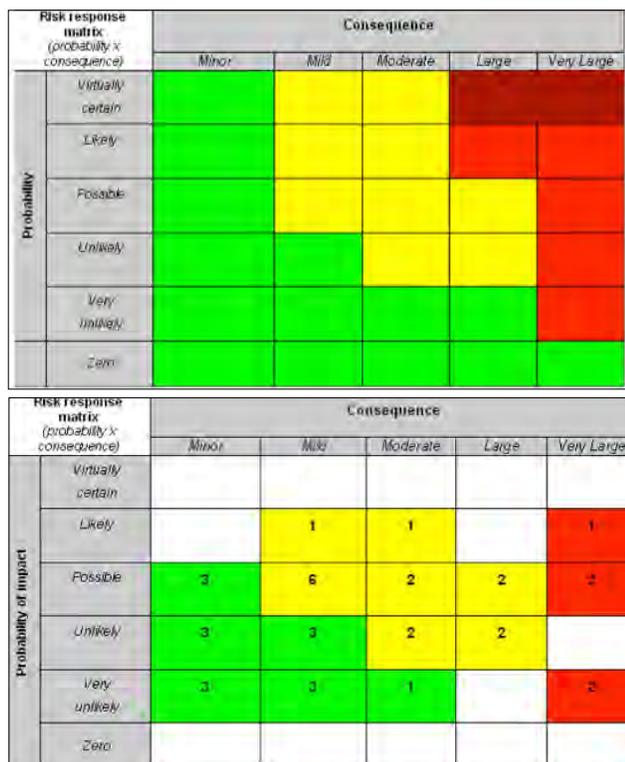


Figure 14. Risk Assessment.

### Implementation requires a new management approach

It is also important to note that actual implementation of this approach requires a new approach to

management. Adequate management of cumulative effects requires the coordinated efforts of multi-agencies and increasingly the involvement of local stakeholders who depend on the resources. No one agency can do this by itself. The current approach of relying on individual IPP project proponents to deal with cumulative effects is bankrupt. Having reviewed the terms of reference and the projects themselves it is quite obvious to me that the individual proponents have limited ability to deal with cumulative effects in any meaningful manner. Nor is it possible sometimes for them to find out the plans of their competitors and identify or control other actions in a region. Moreover, sometimes a proponent's own plans might not make it into the mix. I saw this when I reviewed the Plutonic East Toba Montrose Project. They did not mention the other three sites that were part of their Phase 2 plan. It came out shortly afterwards and was tacked on noting that it was a wonderful addition with minimal extra roads and transmission lines. However, they were not included in Phase 1, which enabled them in the first place.

Implementation of this different approach requires the coordinated efforts of multiple agencies and stakeholder involvement. This is more of a revolution than an evolution. Some individual projects have cumulative effects as a focus and that will probably continue. It is possible to improve that to some degree but it is not possible to do it well enough to do a good job. What we need is regionally focused cumulative effects assessment. This would become the responsibility of governments at various levels and it would have to happen in the context of comprehensive land-use planning and integrated resource management.

A survey of the literature shows that there are four themes for regional management of cumulative effects: constant dialogue; shared access to accumulated data; clear thresholds to manage valued ecosystem components; and, consistent environmental practices.

There are some promising starting points for moving forward with this approach but we have a long way to go. Places where the possibility exists for this approach are in the Skeena River watershed and the Copper River in the Tongass in Alaska.

## Conclusion

The concept of cumulative effects assessment or environmental stewardship in general should safeguard those parts of the ecosystem that we care about, that we want to manage and that we want to see persist into the future. It is unrealistic to achieve a regional level of analysis to deal with cumulative effects simply by making it a project requirement, as is the practice currently. Instead, our suggestion is to replace the currently reactive, project-by-project process, with proactive regionally based planning. We also suggest that it is governments who need to take responsibility for cumulative effects identification and management. While it is not necessarily easy we really need to go ahead and identify those value ecosystem components that we want to manage and to identify objectives for them and thresholds. Finally, we need to pursue a broad-based focus instead of a project-specific focus to cumulative effects assessment.

From a practical perspective, the costs of this could be at least partially recouped from project proponents who benefit from this work. The lack of an overall approach is an issue right now in BC. The IPPs have acknowledged that they would prefer to see a regional level of planning and they are frustrated with their competition and the fact that they cannot plan as a group.



# RESPONDENT PANEL — SCIENCE PERSPECTIVES ON HYDRO POWER

## *Respondents:*

*John Reynolds, Tom Buell Leadership Chair in Salmon Conservation, Simon Fraser University*

*Dave Marmorek, President, Essa Technologies*

*Tom Pedersen, Director, Pacific Institute for Climate Solutions*

## **First Respondent**

*John Reynolds, Tom Buell Leadership Chair in Salmon Conservation, Biological Sciences, Simon Fraser University*

I will briefly summarize three themes that I have heard so far. I want to begin with the elephant in the room, which one participant identified, and that is the whole question of where we are going with our consumption and population growth which underlie the increasing needs for power and many other resources.

It is clear to me that some of the speakers have very different values. And as long as these values are in different currencies we are going to have a very difficult time to bridge some of the gaps that we have heard about. However, there are three things that I have identified that I believe we do agree on.

## **What we agree on**

### ***Energy has a cost***

We all agree that energy has a cost. Mark Jaccard laid that out and we heard about some of the costs from Jack Stanford and Scott Harrison. I did not hear anybody disagree with this. I think it is a failure on the part of many of us that the public doesn't necessarily agree with us - either they don't know or they might actually disagree. The Grand Coulee Dam in Washington State bills itself as the second biggest tourist attraction and you can go and see the story of how it was built. It is the largest concrete structure in North America. People who see that are probably not getting the message about the cost of their electricity. So we have to do a better job to convey the information about these costs.

### ***Greenhouse gases are a problem***

We don't like greenhouse gases - nobody here has



spoken in favour of them and by default that means that we don't seem to like fossil fuels, although as Vicky Husband pointed out, that is not true for everybody, certainly, in the province and the oil and gas development industry. We have made it clear that this is one of the bad guys that we're trying to deal with.

## ***Climate change is happening***

The third thing that we seem to agree on is climate change and that climate change is a challenge and it is going to make our lives a lot more difficult, both to deal with questions of resiliency of the ecosystem and to assessing the impacts of water diversion projects. Of course, it may also make it difficult for these projects to deliver on their promises to meet their own objectives of power production in the future. This is a problem that overarches a lot of these issues.

## **What we do not agree on**

### ***The environmental review process***

One of the areas of disagreement I heard was about the environmental review process. We heard clearly from Doug Little and Harvie Campbell that it is an extremely rigorous and robust process with a huge amount of paperwork that the companies are forced to go through. We also heard very clearly from some people that the process is fundamentally flawed - it doesn't include cumulative impacts and the track record of the Environmental Assessment Office in turning down applications is pretty close to nil.

### **The issue of NIMBYism**

Then there is the issue of NIMBYism. When I think about the question of the private interests of a few of us against the larger public interest, as Doug Little described it, I wonder that if we don't worry about what's in our own backyard then is it better we worry about what is in somebody else's backyard? Are we then sticking our nose where it doesn't belong? Many environmentalists have had that accusation leveled at them. I think that this term does not help us at all – basically, it is an insult. It does not really raise the level of the conversation and if we are concerned about the private interests of a few versus the larger public interest, or about words like “greed” and “self-serving” as we heard earlier, then we are not going to get anywhere. Obviously it is very easy to deflect those sorts of accusations back on the proponents of the various developments. That is not a helpful area and I am glad that was pointed out.

### **Green versus Clean**

An interesting point was made by Scott Harrison to do with the ‘green’ versus ‘clean’ distinction. The definition of ‘green’ clearly rankles a lot of environmentalists. We have all heard the commercials about green energy – it is certainly green in some respects, and cleaner than most of the alternatives. We don't disagree on that. But we need to be clear about what we mean.

### **Where is the evidence?**

As a scientist I always like to see evidence and data. For example, what exactly are the impacts of a diversion? This was addressed by a participant in response to Jack Stanford's presentation. You can't necessarily extrapolate from a large floodplain diversion to a small, upper level stream headpond. We don't actually know how much we can make these extrapolations. In the Central Coast area and Bella Bella, where I conduct research, most of the streams look like the one we saw in the Gitanyow Territory -- this is the standard type of stream, at least in the Central and North Coast regions of BC.

### **Adaptive management**

One topic that grabbed my attention was to do with the need for adaptive management. We are certainly going to learn sooner or later how to do this. The question right now is: Are we ready to look at the cumulative and other impacts after construction

occurs and not just to stop it beforehand? That is not part of the proponents' environmental impact statements usually, but I think it is absolutely critical.

### **Conclusion**

If we are going to continue then at least we can do a better job of it. Watershed level planning is key. We talk about the interests of a few for the greater good, as one of the speakers said, in that we want to reduce greenhouse gas submissions and we're doing that in part because this is for the greater good. However, in fact this is for the planetary good. I am certainly in favour of that but we do have to ask: At what cost? We also have a responsibility for stewardship of some of the unique and special attributes of our own backyard where there is a temperate coastal rainforest and a desert and chaparral territory as well. For some of these habitats, for example, coastal Douglas Fir, we have 70 to 80 percent of the world's habitat of that nature. Hopefully there are not too many IPPs proposed for these areas. I believe that we have a responsibility to these too. We have to ask whether making a permanent change to the wild qualities of 700 rivers and these types of habitats is actually in the global interest. Is our responsibility only to make these changes within house or does it also apply to the bigger borders?

### **Second Respondent**

*Dave Marmorek, President, Essa Technologies*

There are two points I want to make. First, there are at least five different scales at which we have to think when we consider what sources of energy we want. There are individual projects and there are individual watersheds and cumulative effects of whatever is going on there, including energy production. There is also the provincial scale and tradeoffs amongst different locations in the province, whether in the Peace region or the Squamish region. There are also national scales and there are national policies. And finally, there are global concerns. Therefore, there are these different scales and there are tradeoffs within these scales amongst competing objectives and there are also tradeoffs across the scales.

### **Think about different scales**

What might be helpful and instructive would be to think about the different scales and identify two different things that need to happen at each scale.

First, we need scientifically defensible information and tools for exploring the social-economic and environmental impacts of alternative choices. The IPCC is an example of a group working at a global scale. This kind of method needs to make all the assumptions explicit and all the data available. Second, there is a separate process, a participatory process for setting objectives for whatever scale is appropriate and for creating alternatives, and then for evaluating those alternatives – this is the political process. As Mark Jaccard said, it is a trade-off process.

There are some precedents for this. I think it would be useful to look back at the water-use planning process which happened with 25 BC Hydro projects across the province. In each case, it involved stakeholder consultative groups. There were also technical groups that looked at hydro operations, hydrology, biological impacts, and ecological processes. For the most part this process appeared to work very well. However, the gap that was there was that each of those individual roundtables came to a consensus for each hydro facility independently. So nobody actually looked at whether it was worth spending more money, for example in the Cheakamus or in the Bridge, given the value of those resources. This comes back to the presentation by Aaron Hill and Tanis Gower, about trying to take a broader perspective and identifying the win-wins. For example, we could identify the economically most advantageous locations for run-of-the-river hydro and other facilities and the environmentally least disruptive and then construct a map of the red, yellow, and green zones where red is no development, yellow is possible with some mitigation and green is okay to proceed. There is a map like this for the Fraser estuary and some of the red zones are places that are already badly degraded. There may actually be some value in concentrating development in places where there isn't much left, so to speak. I think it is worthwhile thinking about each of those scales and what we have.

There is also a gap at the watershed scale as was noted and there are some things that might work at that scale. Certainly there are precedents from the water use planning process - although it wasn't explicitly a watershed planning effort it did look at watershed scales.

### **Trade-offs across regions**

What exists in the province for looking at tradeoffs across regions? What exists nationally for looking at how much should be located in British Columbia versus other locations? Provincially the BCUC could possibly be enhanced to add on other attributes that relate to environmental and social issues and impacts. Maybe they could provide more guidance. One of the things that I have observed from my work in the Columbia Basin over the past 16 years, is that very large-scale things are very difficult. I think that the North West Power and Conservation Council is a very poor example because as far as I can see it is an intractable morass. However, when you get down to smaller scales, like an Okanagan Basin or Wenatchee or Yakima Basin you find that there are things that can happen on a sub-basin scale. There are 62 sub-basins on the US side of the Columbia and is in place a sub-basin planning process. It is not perfect but there are real things that happen and cumulative effects are considered. Something like that could work in BC, although I am not sure who would fund it.

### **Establishing thresholds**

Adaptive management has been mentioned. One of the things that you need for adaptive management is some contrast in your actions. If you want to know what flow is best for fish populations, as Jack Stanford was talking about, then you have to actually change the flow to create some contrast. You have to allow some places to have less flow than might be ideal if you want to establish these thresholds. The only way you can get at a threshold is by having some contrasts where you can say: Yes, here it is okay, there it is not okay, and here is the tipping point. Establishing thresholds is going to require accepting some risk because in a lot of cases we do not know the ecology and where the thresholds are. They can still be fail-safe experiments in small places. You can also learn which are the areas where we have not done very well, historically. To date, we haven't learned very well from the projects we have done before.

### Third Respondent

*Tom Pedersen, Director of the Pacific Institute for Climate Solutions, University of Victoria*

I am an oceanographer and I do not know much about aquatic ecology or run-of-river effects or impacts so I will offer a slightly different perspective. In terms of the science perspectives on hydro-power, I think that what we are hearing today goes far beyond that particular issue. Even if you focus on any given river, what you start to run into is that it is not the science perspective so much as it is the combination of science, engineering, economic, sociological, ecological, psychological and legal perspectives. We need to keep all of those things in mind all of the time - I would encourage us all to keep our perspectives quite broad.

#### **Focus on the big picture**

An observation in relation to what I have heard so far is that we seem, as a group collectively, to be thinking on the small side and I not sure if we might be missing the big target, the big target being the greenhouse gas issue. We have to eliminate carbon emissions from our fossil fuel diet. The scientific community speaks as one voice on that, although there is still a small amount of resistance to the truth. In thinking about how we are going to eliminate carbon emissions from going into the atmosphere we have to think beyond the scope of British Columbia because, in fact, we do not emit an awful lot of carbon per capita. If we think more broadly and include Washington State or Alberta and Saskatchewan, for example, then the perspective changes rather dramatically. I want to illustrate the point I'm trying to make here with one simple example.

#### **Example of wind power in BC and Alberta**

In BC we have a 12 gigawatt electrical grid. One of the figures in Doug Little's presentation had a map showing the potential for alternative energy sources that we can add to that. In fact, if you tally-up the wind power shown on that map there is 16 gigawatts of power. And we have 12 gigawatts of capacity right now in British Columbia. Alberta has 12 gigawatts of capacity in their grid, but 6 gigawatts of that 12 comes from burning coal. They currently have sitting on a bureaucrat's desk in Edmonton 13.4 gigawatts worth of wind turbine applications awaiting approval

- but they can't approve them because the grid in Alberta can't handle them. It is too small and not interconnected enough. So we as a society could start to think about removing a barrier to allow Alberta to put its wind power in place so that they can actually produce excess power and export it to a much broader constituency than their current provincial jurisdiction allows.

Here right next door in BC, we have a tremendous capacity to store potential energy behind our dams. We should be thinking jointly about removing the barriers that are preventing Alberta from putting their wind power in place. The same thing applies in a small way in BC. 16 gigawatts of wind power is a lot of power; that is about 8,000 2 megawatt turbines. And we need to be thinking about building lots of sites similar to the one proposed for Dokie. We would do our very best to minimize their ecological and environmental impacts. The overall target is to put wind power in place and get rid of coal.

#### **Dealing with risk**

Another of the key words that I heard today was risk. Tanis Gower showed a figure (Figure 14, page 55) with a simple risk matrix. We always need to keep that in mind. But there is an aspect of risk that is important and that is that you can sometimes undertake a high-risk project, even something that might be ecologically potentially damaging, but the risk of it having a long-term effect diminishes if it is a reversible issue. Some projects are potentially reversible. For example, if wind turbines did cause a big problem at the Dokie site you could always take the turbines down. Not every change that we make is necessarily going in the wrong direction. Sometimes we can turn things around if we have to.

#### **Interconnectedness**

Another key word that is very important is interconnectedness. We cannot get away from recognizing that everything is connected to everything else in terms of the energy distribution and energy generation systems. An example of that coming strictly from the ecological side was the impact that changing the flow rate of a river could have on salmon. It subsequently affects the entire ecosystem by constraining the nitrogen flux into the riparian area near a river. This is potentially a big issue and we are seeing the impact of that this year with respect to

the bear populations in British Columbia that depend on sockeye stocks. In the case of the disappearing sockeye in summer 2009, for which there is no explanation as far as I know yet, if it turns out that there is a relationship between the missing sockeye and big scale changes that are happening in the Northeast Pacific as a direct consequence of global warming, then that brings us right back to the big target.

## DIALOGUE

### Cumulative effects

A participant posed a question to Tanis Gower: My question has to do with cumulative effects. One of the things I am doing is managing an intervention of environmentally minded groups into the Utilities Commission enquiry on BC's 30-year transmission needs. The enquiry will not only look into transmission lines, but it will also be providing a province-wide assessment of renewable energy potential. I am trying to persuade the government to bring in mapping information on environmental sensitivities - the evidence layered into the data along with the resource potential mapping. If this happened would it, in some sense, meet your criterion of providing some kind of a cumulative effects screening? And if so, do you have any good ideas as to how the data should be applied?

Tanis Gower:

It would be very good to see some overlay of environmental sensitivity or values on top of the resource values that you imply are already being considered. Of course, that is the challenging part. There are many ways this can be done. One way would be to involve people at a regional level in the way that land use planning has traditionally been done in BC. Another way would be to simply include provincially available data based on things like forest cover and biogeoclimatic ecosystem classifications.

### Is the big picture about an unsustainable way of living?

A participant directed a question to Tom Pedersen: You said that we are missing the big picture and that we should be talking about greenhouse gas emissions. I disagree with that. Greenhouse gas emissions and associated climate change is only one of the impacts of an unsustainable way of living. If we want to preserve all the ecosystems that keep us living why

should we damage pristine watersheds in order to fight climate change?

Tom Pedersen responded:

I may have misled you. I certainly would not advocate damaging pristine watersheds at all. My point is a different one. It is that we have a jurisdiction immediately to the east of us that is unable to take positive steps to limit their greenhouse gas emissions by installing wind turbines because their grid is getting very near capacity for the intermittent nature of wind power. Here in British Columbia we have the prospect of storing Alberta wind energy behind our dams. Right now we can't do that because our grids aren't connected. So instead of thinking on the scale of our watershed and putting in a few megawatts here and a few megawatts there, I suggest that we need to think a lot bigger. We could see a dramatic increase in wind power in Western Canada -- not British Columbia, but Western Canada - if we were to integrate our grid systems to allow greater buffering capacity that would allow us to deal with the intermittency of wind.

### Making choices – develop in areas that are already degraded, or in healthy habitat

The participant then directed a question to Aaron Hill:

In terms of cumulative impacts, you presented a grid that showed if the ecosystem is quite damaged you would suggest to not do any further development because it could just break down everything that is left, but then if the ecosystem is healthy maybe you could develop there. I don't really understand that. For me, since we have so few healthy rivers in the world why should we go to them? Why don't we just do development where things have already been damaged?

Aaron Hill responded:

If you engage in the planning exercise based on sensitive ecosystems overlaid on top of high value energy potential and you are involved in those trade-off decisions, it is going to be based on what your criteria are. A pristine ecosystem may be able to absorb more impact from a hydropower development but that might be a place that a community, a First Nation, or the province as a whole, has decided should be off limits because of other values. On the flipside of that it does make sense in a lot of cases

to focus development on areas that are already degraded for a number of reasons, but you also have to consider what you are giving up. In the case of hydropower development in BC, for example, it might be that the places that are being proposed for some of the highest concentrations of development are also some of the last bastions of good habitat for sensitive species like Marbled Murrelets. Therefore, it might make sense to stay out of more pristine areas further north and focus the development in a place that already has logging roads. However, if whatever it is will be driving your valued ecosystem component past a threshold that society has deemed unacceptable, then you should not do it. It is complicated and the only way that we are going to address it effectively is through a comprehensive planning process that is based on rigorous science and is transparent and includes stakeholder input from all the people that are affected.

Scott Harrison:

BC has a proud heritage of land use planning so it might be useful for this group at this time to not worry so much about how the planning takes place but instead to ensure that the planning needs to take place under the Land Use Resource Management Plans throughout the province. In forestry, for example, we learned a lot by doing those plans and they were very successful. BC Hydro has a water use planning process that is globally renowned. Planning processes are complicated and they are problematic, but we have a long, proud history of doing them in BC. Energy is not being set into that planning process.

### **Impacts of wind turbines**

A student from Chilliwack High School, directed a question to Tom Pedersen:

You said that the big problem we should be addressing is carbon emissions and we could eliminate that in part by using wind turbines, and we have a lot of capacity for wind turbines in Western Canada. Earlier a participant talked about the negative impact that turbines would have on just one area in northern BC. If we picked up on your idea, wouldn't the cumulative effects be huge, and also, wouldn't it be spending a lot of money just to replace one problem, the carbon emissions, with another, the damage that we would be doing to those ecosystems with the wind turbines?

Tom Pedersen:

First, I would ask you what the damage is to those ecosystems. Yes, there need to be access roads during the construction phase but once a wind farm is in place the activity radically diminishes. A bigger question is something that came up in the dialogue earlier where someone asked: What is your Option B? I would ask you, what is your Option B? You know that society is not going to stop using electricity, so how are you going to generate that electricity if you are not going to allow wind turbines to be installed?

Student:

I don't have an Option B.

Tom Pedersen:

Therein lies the problem, I think. We need to think about how we can put an Option B in place with the least ecological and environmental damage. That is the issue that we are all grappling with.

### **How do governments do cumulative assessments?**

A representative from the Environmental Assessment Office, directed a comment to Aaron Hill and Tanis Gower:

You gave the most constructive, forward-looking, solution-oriented presentation I have seen in a long time, if ever. There are a lot of tools in the toolbox and a lot of suggestions that should be implemented at the EAO. People said that in the past the province did not do cumulative impact assessment but that the federal government does. That was true in the past. We had harmonized processes then - basically we piggybacked on the feds to do that work. We have now shifted and we are going to be doing cumulative impact assessments based on VECs at the scale that is appropriate for each VEC. It is on our website and in our user guide - but how do we do it? We are not a planning agency. I am glad to hear that BCUC has a process that is inclusive and will look at power generation in addition to transmission lines. What we can contribute to the EA process is limited in scope. Our mandate is limited to evaluating the projects and focusing on the cumulative impacts of all the activities at a scale that is meaningful to each VEC that is being identified and assessed.

In some cases, there have been very courageous scientists from government who have said: We don't have all the answers and we do not have all the data,

but based on our best professional judgment this is where the threshold is. That is often the conundrum; that is, how much information do you need to be able to set that threshold.

The question I have for you is: How do we do it? You say it should be multi-government levels, multi-ministries/agencies. In the EA process the regional scientists are at the table in our technical working group and we have federal agencies, as well as local government participation, and First Nations contributing their traditional ecological knowledge. And we are trying to define ways of setting those thresholds. But any advice you can give us on how to go about that in a better way is welcome.

Aaron Hill responded:

We are definitely putting a lot of thought into making those suggestions and we are just getting started. We will certainly keep this going and elevate this dialogue. We are working with ESSA Technologies who are helping us design a framework for assessing and managing for cumulative effects.

The representative responded:

I will be contacting you and ESSA Technologies to bring some of the work you are doing into our office and into our process.

### **Option B**

Ed Mankelow commented:

What would my Option B be? The Columbia River dams weren't built for power, but for flood control for the United States. The power came later. Many of the dams didn't even have engines until afterwards and they are still getting engines now. That power belongs to us. We have the ability, and the right, to take the power and use it but instead we sell it to the US and import cheaper energy from Alberta.

Tom Pedersen:

We have exported a lot and we have done very well out of that over the years. But right now the growth in BC has been such that we are a net importer of electricity.

Ed Mankelow:

The other reason that I am against wind power, and IPPs may well be the same, is the cost. In Germany utilities are forced to buy renewable energy at more

than ten times the cost of conventional power, and in France three times. In the UK they pay £50 per megawatt hour compared to £15 if they did it themselves; they also get bonuses and there are incentives for the companies. That is not cheap power. I don't think that with the way BC Hydro is buying IPP power at the cost they are paying that they could produce it themselves.

Tom Pedersen:

I would disagree. I think that power is too cheap here and if we are going to be successful in our society at limiting our ongoing growing power demand we will have to price it more responsibly than we currently are. We should discuss this together further.

### **The big target**

A participant commented:

I want to thank Tom for getting the debate going. When he identified the big target in terms of greenhouse gases. I too felt that that was not the big target, it is just 'a' target. In fact, some of the silliness in BC in the last few years about identifying greenhouse gases as the only target or the main thing we have to work on is at the expense of our ecosystems, endangered species and rivers. Globally there is unprecedented species extinction caused by us, and there is loss of habitat and many other impacts of human activities - all of those things together are the big target.

### **Should we have lots of Dokies?**

What really concerns me is your suggestion that we should have "lots of Dokies". With friendly respect, the potential extinction of caribou in our country is a huge issue all across the boreal forest, of which the Dokie is part. That is not reversible. The impact on the caribou is likely going to be huge, possibly leading to the extermination of that particular herd. It is unacceptable for people to simply look at the energy requirements of the province and at greenhouse gases. It is the same thing with losing biodiversity in river systems.

### **A case study on adaptive management**

There is a lot of talk about adaptive management. Many of you may not know about the Muskwa-Kechika, which was supposed to be BC's gift to the world in terms of its 16 million acres in Northeastern

BC and the world's leading model for conservation management, which means applying the principles of adaptive management. The caution I have for everyone here is that if adaptive management is done properly it is tremendously expensive and time consuming. It means a real commitment by government and industry and by everybody in this room. Also it implies that baseline data will be established before projects proceed, and requires looking at cumulative impacts and setting targets and thresholds, and a lot of work in terms of experimentation. The BC government basically eliminated the dollars, the staff, and the support for that adaptive management process in Northeastern BC, possibly because they were kowtowing to the oil and gas industry that didn't really want it. I spent several years of my life in the process, trying to work with some of the more enlightened members of the oil and gas industry who actually wanted to have this happen. Unfortunately, this process was torpedoed by government.

The lesson is that we all need to be extremely wise and aware that there are tremendous energies out there not to proceed with adaptive management because it costs money and time and slows down development.

Finally, you challenged the young gentleman to suggest Option B. Recently, the BC budget allocated approximately \$300 million for money of one sort or another to go to the conventional oil and gas industry, and a total of \$25 million for the development of all other sustainable energy technology including tidal and geothermal power. There are some companies in BC who need the money to move forward and develop these kinds of energy. Let's change the budget priorities and get on with it.

Tom Pedersen responded:

I appreciate your comments and I don't think we are that far apart in our viewpoints.

Again I come back to the big picture. I think that oil and gas exploration and exploitation are causing a lot more environmental damage than wind farms, and I would single out the Barrenland Caribou on the north slope as an example of a point of real concern. So we have to be cautious in where we are pointing our fingers.

In terms of the climate change impact from global warming induced by carbon dioxide on the northern high latitudes in the northern hemisphere, we all know that they are absolutely immense. That is a much bigger long-term hazard for caribou, musk ox, polar bears and other northern species.

Third, tidal power is a wonderful option but it will only provide 1 gigawatt of power. This finding has been thoroughly modeled at the University of Victoria and is published in the open scientific literature; that is, there is a maximum of only 1 gigawatt of extractable tidal power in the inland waters of British Columbia. That is not enough to meet our ongoing demand. Wind will produce 16 gigawatts. In terms of geothermal power, we saw in the map that Doug Little showed earlier that 400 megawatts of power could be produced at Meager Creek. The ground source heat pumps could add to that if they were included. However, in terms of volcanic-type geothermal it is not that big a resource in British Columbia. Again, I come back to: What is your Option B? We are going to need more electricity to meet the demand, there is no argument with that. Our demand-side management objectives are fantastic but they are going to be extraordinarily difficult to reach. We need to keep thinking about how we are going to get there to produce the power we need to propel our society in the way we want. It is a big problem and there are no easy, ready answers.

The participant responded:

The point is to develop a whole bunch of alternate energy options. To me, we should be making our decisions about wind farms, for example, on the basis of not just whether it is a better option than oil and gas but on what the impacts will be on the ecosystems. I don't see that happening. Doike Ridge is a ridiculous project, which isn't to say that all wind farms are ridiculous projects. We have to get site-specific. That is the whole idea behind adaptive management.

Tom Pedersen responded:

I absolutely agree that they have to be site-specific.

# CIVIL SOCIETY (THE PUBLIC)

## PERSPECTIVES ON HYDRO POWER

### Panelists:

*Gwen Barlee, Policy Director, Western Canada, Wilderness Committee*

*Tzporah Berman, Executive Director, PowerUp Canada*

*Guy Dauncey, President, BC Sustainable Energy Association*

*Jeremy McCall, Executive Director, The Outdoor Recreation Council of BC*

*Elaine Golds, Vice President, Burke Mountain Naturalists*

### First Panelist

*Gwen Barlee, Policy Director, Western Canada, Wilderness Committee*



My presentation will address some of the issues in regards to concerns that we have heard from the public and that the Wilderness Committee has expressed about the BC Energy Plan and the gold rush to stake our rivers and creeks. When we were first introduced to this issue about five years ago, we didn't really think anything of it. Some private power producers arranged meetings with the Wilderness Committee and when they described their plans, we thought they were good. It wasn't until about three years ago when we started scratching beneath the surface that we realized there were some problems in the process. That is when we started speaking out and, as people are aware, things have become somewhat heated over the last 18 months.

### Problems with the BC Energy Plan

The Wilderness Committee does not believe that we are on the right path with the BC Energy Plan. We have a number of concerns. There is an inherent discrepancy between what you are hearing from the

IPP industry and the provincial government and what is actually happening on the ground. You often hear that there are robust, stringent or high environmental standards. However, anyone who actually works on the ground in British Columbia realizes that is not the case and that the Ministry of Environment was cut by 30 percent in 2002, with another 10 percent cut in September of 2009.

The Environmental Assessment Office was weakened fairly substantially with the introduction of Bill 38. Here is an excerpt from the Westcoast Environmental Law Association: "Bill 38 and the new regulations are a dramatic step backwards for environmental assessment in British Columbia." Some of the points they specified included: "The Act is not open, accountable or neutral. The application of the Act is discretionary and subject to significant political interference." Then there are the lower thresholds, which means more projects escape analysis and don't go through the process. And as some people know, independent power projects that are below 50 megawatts do not go through a provincial environmental assessment process. That means that roughly 90 percent of projects are not assessed.

The Wilderness Committee has made quite a few Freedom of Information requests on different environmental assessment projects and we have also visited a lot of the projects. Often IPPs are considered minor tenures, meaning that regulations that would apply to the forestry industry, for instance, do not apply to IPPs. If there is logging in old-growth management areas, you are cutting into stream banks, and there is a litany of problems associated with impacts on endangered species' habitat.

One thing that really concerns me is that there are not enough people on the ground to monitor these projects when they are up and running. However, even when government biologists provide their opinions on these projects, oftentimes they are ignored. For example, there is a Freedom of Information request in regards to Miller Creek, a 32-megawatt project that is in the Sea to Sky corridor, that shows that government biologists were very concerned about the amount of water that was going to be diverted from the creek. One of the biologists said, "In my professional opinion if this water license is fully implemented it will have a disastrous effect on the aquatic ecosystem in Miller Creek." Another biologist (there were four different biologists from two different ministries in the provincial government), recommended that minimum water flows were critical for maintaining fish habitat values. At the end of the day the advice from those four biologists was ignored. And Miller Creek has had incidents. One of the incidents was when they had a malfunction at the plant and the creek nearly went dry. We received a copy of their own environmental monitoring report which said, not just based on the creek going dry, but based on oil spills and on extirpation of endangered species at the plant and a host of other problems, "In my professional opinion this plant isn't producing green energy."

There has been discussion about the fact that there is currently no assessment of cumulative impacts although it is very interesting that the government is now saying that they are going to assess cumulative impacts. Also, there is no regional or provincial planning. There are 120 creeks and rivers that are staked on the Sea to Sky corridor, another 200 creeks and rivers on the Sunshine Coast, and about 75 to 80 staked in the Kootenays, and again, each one is being approached as a one-off.

You will often hear industry and government say that there is good public consultation. But, of course, we all know that Bill 30 was passed in 2006 and that removed the rights of local governments to have a say in the process.

You also hear that run-of-river projects are above fish habitat or they don't impact fish habitat. But if you look at Bute Inlet, most of the creeks that are proposed for diversion are fish habitat. This is also

true for the Upper Toba, Jimmy Creek specifically, the Upper Pitt, Glacier/Howser, Upper Harrison, Miller Creek, many others proposed for run-of-river projects. There are also problems with in-stream flow requirements. There is consistent pressure on the Ministry of Environment to go below Hatfield standards, which recommend leaving a precautionary amount of water in the creek.

Another issue that the Wilderness Committee is focusing on is the private versus public debate. Some people say that it is ideological and it is – and it was ideological when the provincial government banned BC Hydro from producing new sources of hydro-electricity. I often hear the IPP industry saying that this is not the case. However, in the 2002 Energy Plan for BC it says, "The private sector will develop new electricity generation with BC Hydro restricted to improvements that exist in plants." Clearly, when the government introduced the 2002 energy plan, climate change or global warming was not as big an issue as it is today.

Deregulation and the slow motion privatization of BC Hydro have also been taking place. An interesting article was published in the Vancouver Sun where the writer said: "BC Hydro must be broken up and private sector companies given better access to the Crown corporation's assets so British Columbia can participate in a rapidly evolving continental market for electricity." It went on to say, "The Fort St. John MLA said that the government now considers the proposed breakup of BC Hydro, British Columbia's largest Crown corporation, as a matter too urgent to be delayed until the release of the government's entire energy policy." It is clear that people were concerned about the government's intent when they introduced the 2002 Energy Plan. That concern was justified.

A 2004 DSF report described the Energy Plan in this way, "The BC Energy Plan: the wrong direction for BC's electricity sector. And the BC Energy Plan's main themes are increased privatization and deregulation of BC's electricity sector and ill-advised restructuring of BC Hydro. And a movement towards greater electricity exports rather than securing provincial electricity security." Among the recommendations in this report were, "First the breakup of BC Hydro should be reversed and then following that BC Hydro must

be allowed to invest in new generation to supply the province's projected energy needs. The government's current policy which entails major subsidies to IPPs must end." In retrospect, it seems that the energy plan was part of a move to privatize BC Hydro.

Some people suggest that if you are opposed to poorly planned private hydro projects then you don't care about green power and that there is a blanket opposition to green power. To me that is like saying, I am opposed to privatized healthcare but it doesn't mean I'm opposed to healthcare. The Wilderness Committee is strongly supportive of green energy and we realize the critical importance of tackling climate change. But there is a right way and a wrong way to do it, and we are doing it the wrong way in British Columbia. We support green energy that has provincial planning, strong environmental standards, is acceptable to First Nations and local governments and is publicly owned. And, again, that public ownership is about accountability and transparency, long-term energy planning, energy conservation and energy security.

### **Second Panelist**

*Tzeporah Berman, Executive Director, PowerUp Canada*



You may know that I have been strongly supporting the expansion of responsible clean energy in British Columbia and, in fact, across Canada. I want to set the context for why I have been doing this and then address what I think are the key points.

I spent the past 17 years working on forest conservation and the trade of wood and paper products, and came late to the focus on climate change and energy

issues. Like many of you, I was watching the reports from the IPCC and others and was glad that someone else was working on it. It wasn't until I was invited to Bali to the UN Climate negotiations to speak on the impacts of climate change on forests and of logging on global warming that I really started to understand the threat that we are facing. Understanding that the threat that we face as a result of climate change is, in fact, the greatest threat to endangered species and wild systems today, is essential to looking at how quickly we design clean energy in this province.

For the first time in my life, I saw scientists, people who sit on the IPCC, crying at Bali when they talked about the predictions, because climate change is no longer just one of the environmental issues that we need to weigh. It is the moral challenge of our age. And as Dr. James Hansen, the chief scientist of NASA, said to me in Washington, DC several months ago, we have about 3,000 days (a little less than eight years) at current rates of emissions to ensure that our atmosphere stays under 450 parts per million.

At the point that it gets to 450 parts per million, climate change will be out of control and we will have reached a tipping point. By then, we could ban all the cars on the planet and introduce every run-of-river project we want and we would not have an impact on stopping climate change. The next eight years are absolutely critical and we need to do everything we can to focus environmental debate on reducing emissions as quickly as possible and scaling up solutions and green jobs in a responsible manner.

This is not to say that I think all run-of-river projects and all clean energy projects need to go forward. Rather I think we need all hands on deck. And in the research that I have done since I started working on climate change, I have yet to see a single jurisdiction around the world that is not harnessing the entrepreneurial spirit and, in fact, the capital and willingness to absorb risk of private companies in order to do that.

### **Private versus public power**

In terms of the debate about private and public power, I think it would be wrong to sell off our rivers or give private companies full control to develop power. But I agree with giving social contracts where the private companies have to abide by certain rules

and then sell the power back to BC Hydro, akin to other tenures that we have had in this province. An enormous number of these projects do not go forward. Therefore, whether or not it is public or private is really the wrong question. We need both - we need all hands on deck, because Canada is lagging behind.

### Canada is lagging

Canada is being outspent right now by the US administration 14 to 1 on green stimulus, and 6 to 1 on clean energy. Even China with their \$600 billion investment in clean energy over the next five years is outstripping Canada. We are being left behind in the race to create a low carbon economy and some of Canada's best entrepreneurs and companies are leaving the country in order to take up those other opportunities. I think Canadians deserve those green jobs and we deserve the creation of a low carbon economy.

There is no question that we have the creativity and the capacity and the knowledge in BC, not only to harness those opportunities, but also to do it right. How do we do it right, is the key question that we are here to discuss.

### How do we do it right?

I frequently hear issues around, "we don't need the power," or that British Columbia's power is already green. There is constant debate about whether we are importing or exporting, in any given year. It is important for us to remember that two thirds of the energy consumption in this province still comes from fossil fuels. Climate solutions require that we look at that whole energy picture. Our task in order to address climate change in the current timeframe is to dramatically decrease our dependence on fossil fuels as quickly as possible. And what that means is fuel switching. It means getting our ports and airports on the grid, our houses and our cars on the grid and more electrified transportation.

It also means reducing the gap that we have right now with about 163,000 gigawatt hours of fossil fuel energy coming into the province. To illustrate this, PowerUp did some modeling as shown in Figure 1. This provides a general understanding of the challenge ahead and how the current proposed clean power call, and energy projects that are on the table,

barely even touch it. It describes our projected needs by 2030, recognizing that British Columbia is growing very quickly, and the solutions that we have at hand so far. BC has a clean power call for 5,000 gigawatt hours. The model considers everything that is on the table, our capacity for all renewables, and how much fossil fuel reduction we would see if we did it all. I would argue that we could even double the energy production if we followed the lead of other countries with tools such as amortizing energy efficiency and retrofits and lower property taxes.

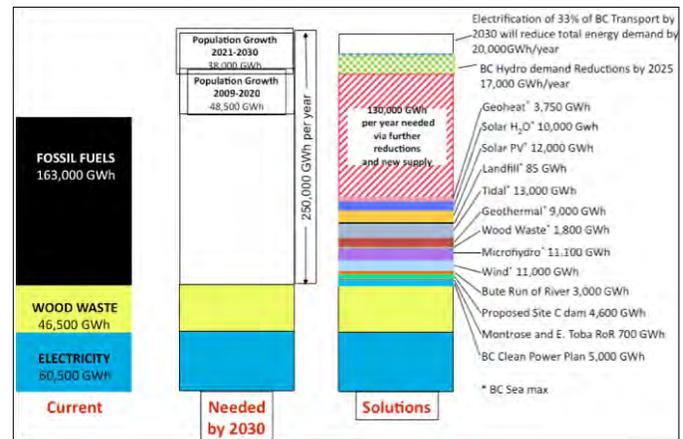


Figure 1. British Columbia energy use.

My point is that we have an enormous challenge to build a low carbon economy. That does not mean that we should not be questioning the environmental restrictions in the planning process around clean energy. We need to be doing that. And as civil society groups, that is our role. There is not a single jurisdiction in the world that is showing that they can successfully scale up clean energy without relying heavily on the private sector to shoulder that risk. The blanket opposition to all run-of-river instead of run-of-river that is poorly designed, and the blanket opposition to a cost rise in power production and supporting the importance of cheap power, are issues that I believe are pulling the public dialogue in the wrong direction. We need to build social license for climate solutions in this province.

I have now visited 12 run-of-river projects. I admit that I was terrified to go to the first one, Toba Montrose, because having worked for years to protect British Columbia's valleys and rivers, I fully expected to hate it and that I would be putting it in the category of unfortunate but necessary in the climate era. However, in large part because of

the influence of First Nations and many biologists who have been working on this project, I was very impressed with the Toba Montrose project. They have increased salmon habitat by 33 percent by reopening tributaries and bridges and dammed culverts left by the logging industry. Yes, there are projects that are planned in salmon habitat and they should not be allowed. And, yes, there are projects planned in intact and old growth and they should not be allowed. However, I think we should be working together to identify the environmental principles, and to argue with the government for first past the post principle so that we do not get all of these projects that are planned poorly. And we should be ensuring that we scale up clean energy as quickly as possible in British Columbia.

### Third Panelist

*Guy Dauncey, President, BC Sustainable Energy Association*



In this room there seems to be a number of people who think that the issue of greenhouse gases is one among other issues such as protecting the wildlife habitat and rivers and these issues have all got to be put in balance. Then there are others, like me, who have seen the seriousness of climate change and realize that this trumps all of the other issues. We are on a track right now for a 6.4 °C temperature increase by the end of this century. That will bring, among other things, a two-metre sea level rise. Every single river estuary on the planet is at sea level and will lose its current ecosystem under two metres of salt water and be rearranged according to where the new sea level will be. The British Hadley Centre for Climate Impacts recently put out a report saying that it makes no sense to plan for 2 °C, we are heading for 4 °C, and we will have to plan for that. On one

of their maps, Canada is predicted to get an average of 7°C increase across the country and in the Arctic there will be a 10 – 15 °C increase. This will wipe out all of the ecosystems in the Arctic. Our forests will end up in flames and the salmon spawning habitats will be too warm for the fish to spawn.

If you want to protect the salmon then you have to deal with the predicted impacts of climate change. This is the kind of issue that really makes you stay awake at night if you are not engaged in doing something about it. One of Germany's top climate scientists recently looked at the scientific facts and the current predictions of what it takes, and what we can do, and noted that there needs to be a 100 percent reduction in fossil fuel emissions by 2020 in order to stop the slide beyond two degrees. After that there will be too many negative feedback factors, such as melting permafrost, to allow us to be able to regain control. As Tzeperah said, after that point in time you are going to lose it all, regardless of what you do. And so we are in a 1939 type style global emergency to maximize the transition out of fossil fuels as quickly as possible.

That leads to the questions: **What is the best way to do that? How do we get people on board?** Here are some ideas on how to do this. Two thirds of our energy in British Columbia comes from fossil fuels, but the future for transport is electric. With a move to electric transport there is a two thirds reduction in energy needed compared to fossil fuels. And the future for heat in buildings is heat pumps, which require electricity.

### Energy cost

People often say that efficiency is the answer. However, the single biggest thing that drives efficiency is a higher price. Germans pay 32 cents a kilowatt hour, and Ontarians pay 6 to 7 cents a kilowatt hour. The average German has a lower electricity bill than the average Ontarian because the cost of energy has driven their efficiency so high they don't waste it. We are the most wasteful province in Canada. So when we face the argument that we must keep energy prices low, we are sabotaging the best and cheapest thing we can do to generate new energy.

There are other aspects to that. The reason we are getting more run-of-river projects than wind energy

projects is because it is cheaper. If we were willing to pay more for the more expensive power, we could wipe out all the cheapest power and not do it at all. We would not do any run-of-river because we would be paying for the other approaches that are more expensive. However, you can't have both. You can't compare the price of new power against the price of power from dams built in the 1960s, and say that it is 20 times more expensive. In fact, it is 5 times more expensive. This is the kind of thinking that causes complete mental confusion instead of clear minded dialogue and it gets people up in arms and outraged. We need to be honest with the facts about the cost of energy. All new electricity in North America is costing in the range of 8 to 12 cents per kilowatt hour, whereas nuclear is costing 20 cents per kilowatt hour, and efficiency costs 1 to 3 cents per kilowatt hour.

There is also a great deal of misinformation around the fact that run-of-river power comes during the freshet and therefore it is for export. In trying to get the facts straight on this, I met with people at Plutonic and asked them if they looked at their projects collectively, how much would be driven by freshet and how much would not. They explained that 50 percent of the energy comes during the freshet and the other 50 percent is firm power that comes only when BC Hydro needs it. You have to do the analysis - take every creek and, specifically, in looking ahead, assess the melting snow pack. With warmer temperatures in the future you are going to get more energy during the winter because the snow will come down as rain and not freeze. When you look at the power needs of BC you have to remember that there are really no regional boundaries. Our bioregion includes the coal-fired plants of Washington State, Oregon, Saskatchewan and Alberta. And it is those coal-fired plants that make the greatest contribution to climate change. We can do nothing better than close down those coal-fired plants by getting green energy into the grid. If we don't do this now, climate change overruns the world.

In preparing my book *The Climate Challenge: 101 Solutions to Global Warming*, I have been in a number of places and have seen what the best policies are. One thing I notice is that in almost every country in the world, it is the private sector that is developing energy. This is the group which can take the losses and the risks and come up with the best

plans.

### **How do we improve the actual process?**

The idea that projects under 50 megawatts are avoiding scrutiny is completely wrong. They are going through as many detailed sets of assessment as the larger projects. The problem is that they are not doing it in one place and it is impossible to find out where the data are. It is not transparent and so it lends itself to distrust and people don't believe what is going on. The single solution is a website for all projects under 50 megawatts, where you can follow the process, and also have something similar to the environmental assessment process where if a project was unable to get through the hurdles it would have to be rejected from the process. Since we don't have that for under 50 megawatt projects, we never know whether or not a project is going through.

In addition, we need good regulations to keep the business people on track, and this is true for run-of-river as well. Every business in the world knows that if there aren't good regulations then people will behave in a corrupt and antisocial manner and in answering to their shareholders, they will maximize the gain if they can get away with it. We need the regulations. Bill C30 did not remove the right of local governments to have a say. It removed their right to have a vote on it but they are fully engaged in the process. They can have a lot of say, and they are heard and listened to and their concerns are taken into account.

Also, BC Hydro should have its own screening process. Right now they are giving contracts to companies that have not entered the environmental assessment process. For example, they might give a contract to a company where it is known in advance that the water is not going to go back in the same river and in this case there is bound to be watershed loss. It does not make sense that BC Hydro should disassociate itself from the actual assessment process scientifically and that is one thing that has to be looked at.

Furthermore, the monitoring for long-term assessment is absolutely critical. We should not be allowing the situation where the Ministry of Environment has lost funds, and therefore can't do monitoring follow up. There is an easy solution. A levy can be

attached to every single water license, where the project proponent is obliged to put the money into a targeted fund at BC Hydro to pay for the necessary monitoring assessment. And if BC Hydro finds they are shortcoming, then they should be allowed to bring charges or withdraw the water license.

Finally, we need a proper planning framework with regional planning. This is going on in the BCUC process at the moment, which is very obscure and not publicly accessible. There is a lot of work we need to do around getting a good regulatory process so that we get the best green energy coming into the grid and not energy that is going to get everyone upset and irritated and cause damage. We do it for food, we do it for farming, we do it for forestry and we should do it for energy as well.

### **We are facing a global emergency**

An increase of 6 °C means the total collapse of human civilization. A 4 °C increase by 2050 means 40 percent of all species on the planet will be gone. That is the risk we are taking and every year we delay will allow the oil companies to say that since there is no renewable energy coming on they will have to drill more wells and have more coal mines. The oil industry likes the thought that you can't get renewables more than 20 percent by 2050 because that gives them the excuse to do more tar sands types of operations. The less we do on renewables, the more tar sands we will get. That is the trade-off and we have got to accept these difficult choices and come to terms with it.

### **Fourth Panelist**

*Jeremy McCall, Executive Director, The Outdoor Recreation Council of BC*



On my way here today I passed by a building with a very interesting inscription, "Unlimited growth increases the divide." Someone said earlier today that we need to think big. I suggest that if we think bigger at one end, at the other end the resources end. I wonder why we have to spend time beating our heads against the wall to expand the container port and to expand the airport, and to increase the number of people coming into the province, which when combined builds up a huge demand for energy.

I am convinced that we don't price our energy at the rate we should. If we are going to get effective conservation, then we have got to price power at higher rates than we do today.

There are a few points I want to highlight:

- I am against the amount of mislabeling and spin on a lot of the energy issues.
- I think clean energy is probably a little better but everything is being labeled green and some of the things that are being labeled green are not.
- Run-of-the river are really river diversion projects and they should be labeled as such. A large percentage of the public has no idea what these projects involve.
- The business of export sales is a very confusing but it is certainly not something that is high in the public eye.
- Planning has been absent in many ways. First, the provincial government has given up on land use planning. Most of the LRMPs were finished without energy issues or even oil and gas issues being incorporated into them. Perhaps some of them should be opened up again. There simply is not enough planning.
- BC got onboard with the Western Renewable Energy Zone plan late in the day. They did not commit staff who could have made good contributions. It was a good concept.

I am pleased to hear about the cumulative impacts assessment now being included in the EA process. It will be good to bring the provincial procedures in line with the federal procedures. But I still think that the social aspects of environmental assessment procedures are not taken into account nearly enough. For example, when 1,000 people piled into the community hall in Kaslo recently, the Glacier/Howser project was stopped dead in its tracks.

I would like to open the scope of the discussion at the other end as well, not only the demand side, but also the supply side. It seems crazy for this province to just have a one-liner in our energy plan saying, “No nuclear.” At the end of the day I believe that we have to consider nuclear power. I think we should open our minds to at least have pros and cons of nuclear listed so that people can understand why there isn’t nuclear or maybe why there could be.

Finally, I go back to where I started about the development thrust in this province, which I really disagree with - it is a pity when our energy needs and planning, to the extent that there is planning, are dictated by what I regard as an ideological bent towards development.

#### **Fifth Panelist**

*Elaine Golds, Vice President, Burke Mountain Naturalists*



The Burke Mountain Naturalists are comprised of 100 percent volunteers and we are NIMBYs - we try really hard to take care of our backyard. When someone said earlier that NIMBYism was alive and well in BC, I viewed this as positive because frankly that is what ends up getting governments to make the right decisions in taking care of the environment. What we are concerned about is that the government with its present policies is not making the wisest and most sensible decisions about meeting our energy requirements. The real challenge with regard to power production is to reduce our greenhouse gas emissions and to minimize global warming. At the same time we also have to make sure that we are not compromising other important resources, such as wild salmon.

#### **BC has a flawed green energy plan**

Are we on the right path right now? No, we definitely are not. We have a very flawed green energy plan. If you read through the plan you will find that 90 percent of it is about electricity and yet electricity is one of the cleanest energy sources that we have in BC – we heard earlier that it is about 93 percent green or clean. So if we have an energy plan we should be dealing with the other aspects that are resulting in massive uses of fossil fuels - cars. We don’t have a green energy plan that is delivering a public transit system in the population centres of BC. That is a big flaw. We have a green energy plan that is not very focused on conservation. And we have blatant gaps in the policies; for example, the government is putting money towards funding the Gateway project and building more highways, and towards exploiting fossil fuels at higher and higher rates. That is not a green energy plan.

I think that it is foolish for all of us to get stuck on the electricity issue when we really should be trying to get this government to take action on those other issues and that would be far more effective in terms of reducing our greenhouse gas emissions. In terms of meeting our future electricity needs, we need a strategic plan. And we also need a public dialogue, because people are not going to understand electricity issues in BC until we have that dialogue.

#### **Need for a strategic plan for electricity**

Ever since we started to worry about a run-of-river proposal on the Upper Pitt, we have been asking for the government to develop a strategic plan for electricity. That has never happened and I don’t think we are going to see it happen based on what the premier announced yesterday. He wants reports on his desk by January 2010 but I don’t think any of them are going to be the kind of strategic plan that we really need. What we are seeing instead is development of run-of-river and wind power on a first come, first served basis and it has turned into a valley-by-valley battle across the province.

We have been there before. We know that doesn’t work and we have to get beyond that. We can only do that by going back to land use planning. We also need better regulations - we can’t move forward unless there are regulations in place that create a level playing field, whether it is private industry or

public power. We also need plans that will allow us to avoid multiple impacts on one valley. We saw that with the proposal in the Upper Pitt. It is also happening in the Pemberton Valley where power proposals are moving up one valley after another. Where are the grizzly bears going to go? There won't be a valley left for them and there won't be a valley left in a natural state for public recreation.

### **Problems with private power**

We have heard a lot about the problems associated with the way that private power is being developed in the province today. It is not that we are necessarily against private power but we are certainly against the way that we see it happening. The process is fundamentally flawed. One of the things that we dealt with in the Upper Pitt was a proposal to build a transmission line through a Class A park which would prohibit transmission lines. But that did not stop the government from proposing to consider allowing it to go ahead. It also did not stop people having to go through months of a public process and on the other side the company that wanted to develop, having to undertake a lot of expense to develop the proposal. It never should have been considered in the first place. That proposal isn't dead yet. It has been submitted to the Clean Power Call; we are still waiting to hear the results. We may end up seeing them come back with a proposal to drill a transmission line under the park.

### **Understanding the impacts of water diversion**

As a scientist I would like to know if the Hatfield in-stream flow requirements will really be adequate to protect stream ecosystems over a long period of time. Those studies have never been done and they need to be done before we unleash this massive experiment across the province on water withdrawals. I sat as a member of the BC Hydro Consultative Committee for the Coquitlam River Water Use Plan. Our committee could not come to a consensus – we could not choose between two water flows for the lowest part of the river - and so BC Hydro agreed to undertake an experiment that will continue well beyond 15 years that will allow us to determine which of those two water flows are best for fish. That is the kind of commitment that I want to see in trying to understand the water diversions being proposed for run-of river in order to determine their potential impacts on streams. If BC Hydro is willing

to do that, then that makes me believe that we can get a better deal for our rivers if we have public power development rather than private.

### **The environmental assessment process is flawed**

We know that the environmental impact process is fundamentally flawed. With the Pitt River proposal, we were not even successful in being able to get a public meeting in a convenient place and we had to get people out to Pitt Meadows, which was a very difficult area to get to. Last summer exactly the same thing happened out in the Kootenays where the people in Nelson wanted a public meeting in Nelson and they couldn't get it. They all had to drive to Kaslo. So while we are trying to conserve greenhouse gases, we have an environmental assessment process that is forcing people to get into their cars and drive kilometres out of their way to go to a public meeting to have input into a run-of-river development. There is something very wrong with that.

### **We need a process for public involvement**

Once the environmental assessment process is completed we also need to have a process for continued public involvement. The streams that are being diverted are a shared resource and they have salmon in them. They also provide recreation for kayakers and for fishers and the forests around them. The transmission lines are located where there is habitat for species at risk and land for public recreation. Therefore, the public needs to have a way of being continually involved. We need to be sure that the water is not withdrawn at rates greater than what is allowed in the permits. Right now we have no guarantees that that will happen and there is no way of monitoring that. It is quite possible for us to know real-time water flows for all of these streams. Why is that not a requirement of the Environmental Assessment Office? Better information needs to be posted on websites so that people can go back and see that the rivers are being managed appropriately. Rivers are a public resource.

## DIALOGUE

### On green jobs

A participant directed comments towards Tzeporah Berman's presentation:

You made the statement that Canadians deserve green jobs. I agree with that; however, there is an insidious communications strategy of equating green employment opportunities exclusively with the private sector and I think that is inaccurate. We know that these same jobs would or could be available under the umbrella of our Crown utility, BC Hydro.

Tzeporah Berman responded:

In terms of the green jobs issue, what we have seen in Ontario is with the new Green Energy Act, is that there has been significant support from the environmental community and unions for the feed-in tariff legislation and the dramatic escalation, of the build out of clean energy. The unions that I have met with have said that they want to stimulate the economy and they want to see the new projects and they are going to go in and unionize them. In fact, this is the same attitude you hear in Denmark, Germany, and in California. So I don't understand the opposition to private companies doing the build out from a green jobs' perspective. I do think they should be unionized. BC Hydro doesn't have a hold on being the only one that can provide good jobs or union jobs and I think they should be building out green energy projects. We need all hands on deck and we need both private and public projects. But there is no assurance that just because it is built by BC Hydro it will have stronger environmental regulations or be more in the public good. I have seen a couple of projects that on the ground aren't necessarily more environmentally responsible.

The participant continued: I heard you say that blanket opposition is pulling this dialogue in the wrong direction - I think that puts a pejorative spin on vital social values. It surprised me that you said so because you have been so publicly passionate about your own social values around environmental issues, specifically. I have some blanket opposition to many things like injustice and poverty and other issues. But I don't think that is the kind of thing that needs to be justified and there is a lot of spin that goes on around ideology. For some of us the entire ideological discussion is about the public good and I think

that we need to be mindful of that.

### Benefits of crown utility

Finally, we can all agree at the end of the day that we support authentic green energy; some of the key benefits of a Crown utility are that they can (a) establish and work towards ambitious conservation targets, (b) be a leader in green energy generation and (c) maintain fair pricing for ratepayers.

### Oil and gas industry subsidies

Another participant commented:

In response to the figure that Tzeporah Berman presented, it showed how little the clean power, or green energy, is going to make a difference.

With respect to Guy Dauncey's impassioned pleas, let's broaden the picture. If we don't shut the Tar Sands down, we are in real trouble. If we are really serious about what is going on, then let's identify the major target. In the Province of BC, we do care about a lot of things and I have often heard my friends say that if we don't look after our own backyard, who will. We as British Columbians, and as Canadians, have to look after our own backyard. Let's put that into context. We don't need to rush over the edge of the cliff. We are running over the cliff with climate change but let's see where the priorities are. That is why I asked the question earlier today and made a comment: Why are we giving subsidies to oil and gas, to coal-bed methane, to promoting offshore oil and gas, and to coal? We need to look at the whole picture. We can't just take these projects out of context. Canada will never reach any targets without doing something about the Tar Sands.

Guy Dauncey responded:

The subsidies to oil and gas are a curious trap that the government is caught in because the oil and gas revenues bring about \$2 billion a year and that supports schools and hospitals. In the run up to the last election John Horgan, the NDP Energy Critic, said that if they were in power they wouldn't stop them. This is because they can't find any way to manage the budget without that \$2 billion. Our response is that the government at least needs to plan a phase out of that dependency. It is like being dependent on tobacco income and trying to phase out tobacco at the same time. You are absolutely right - as long

as we are hooked on that income from oil and gas and our budgets depend on it and we are not paying enough taxes or road pricing, then we are not going to do anything.

A Member of the Legislative Assembly and the NDP's Environment Critic, responded:

On that point in particular, if I understood what was said, there is a royalty regime that our government does not choose to put into a heritage fund that would fund the development of green energy or green infrastructure in the urban areas of the province. Not only do we not have that, which Alberta has to a certain extent, as do Norway and other countries, we also have a fairly perverse cross subsidization happening in BC, and it is growing. You may recall in the middle of last summer, when people were distracted with other things, subsidies were increased for the oil and gas sector by \$200 - \$300 million. It is interesting that that was accomplished despite all the other priorities that have fallen by the wayside in this budget cycle. You are right - the discussion around pricing has to focus on fossil fuels. It can't just be focused on the electricity utilities and rates paid there.

#### **Need for longterm government commitment**

A point that I would like to make is on climate change, and on an energy plan in BC, and having a task force that will deliver a report in two months - I don't think this is going to be satisfactory to anyone. What we need are institutions in British Columbia that commit governments long term, whatever their political stripe is, beyond an electoral cycle or two or three or four, to meeting targets on greenhouse gases, some of which we now have in legislation. We don't have that and I don't think the government is interested in that because of the direction they announced yesterday. There are institutions and there will be actions that the province needs to take, that Canada needs to take, that are going to require some all-party agreements and toughening our laws and making those kinds of investments.



A participant commented:

There have been some allegations that either you are for doing something about climate change or you are against private power, and that you can't be both. I have the pleasure of working for an organization that is both of those things. Not only have we taken a lead in fighting that private power project here in this province, we have also taken the lead in fighting climate change. And we are really proud to be part of the recent action here in Vancouver as part of the International Day of Climate Change.

Going forward, what we need to do in meetings like this is try to find a way that we can get past the hysteria about climate change and come up with some real solid solutions. We live in a province where our government speaks out of both sides of its mouth. In the same budget where it introduced the carbon tax, it increased subsidies to oil and gas. While it is talking about green energy, it is extending an energy corridor into the North to bring on coalmines. It is also looking at approving a new pipeline to connect the Tar Sands to Kitimat and the Pacific Ocean. We need to have a serious look at how we are fighting climate change in this province. But it is not going to happen if we rush headlong into the first solution that is offered and that is what some people are doing right now. We have talked a lot about long-term planning for private power or for alternative energy. We need to do that. We also need a real climate change action plan and we don't have one right now.

I also want to deal with the public-private issue. Guy made an impassioned plea for a 1939 kind of effort and I have heard many people say that the state isn't flexible enough and they are not as nimble and further that everywhere in the world that it is the private sector that is taking a lead on this issue. I don't agree - I know that the state can step up and solve this problem.

#### **The need for public input and respect for land use plans**

Another participant commented:

Comparisons to California, Germany and Denmark have come up a number of times. Until we mature as a society and we are okay to put tolls on every bridge and pay a few dollars a litre for gas and pay a dollar or two for a kilowatt hour for electricity, we do not

have the population to support the rates that we do pay. We need to mature a bit.

There has also been some discussion on land use plans and public input opportunities. One of the examples that we are working on in the Kootenays is the upper Wood River, which is over 100 kilometres as the crow flies from Golden. There are three proposed IPPs put forward by the same proponent, all of which fall under the 50 megawatts umbrella. Collectively, they are over so they sneak in underneath the requirement for environmental assessment by separating them into different proposals. This is an area that has been set aside by local land use plans as a complete reserve with the support of the local forest licensee to protect intact, old-growth forest and heritage values. Yet the system as it stands now allows these three proposals to theoretically slide right in there with minimal public input. The question is: Where is the opportunity for public input in a situation like that and where is the opportunity to respect the locally sourced land use plans that people put a lot of time and effort into?

Guy Dauncey responded:

The public input process fascinates me because I've worked on both sides on hearings on land use development and have seen how entirely dysfunctional a public hearing process can be. For example, redesigning the process of public meetings with a jointly agreed facilitator, when both sides or all three sides including the local government say, "These are the



10 issues on which we have differences," and systematically work through them with the facilitator saying, "What needs more action? What facts are true and what's not true?" In this way, using dialogue, agreement can be reached so that people can move forward collectively. It would be quite possible to frame that into public meetings and public hearing processes for all projects and to guarantee that they are held in the nearest major population centre to encourage public input. Because this is a positive process, people learn things. The public process at the moment lends itself to divisive, myth spreading and it doesn't generate good information. Without good information, we can't have a proper debate on what needs improving and what needs changing. I am totally supportive of a reshape of the whole public input process.

### Impacts of climate change

A Chilliwack High School student addressed a question to Guy Dauncey:

Regarding your statement about the temperature increase associated with climate change, you said that the sea level will be increased by two metres. Does this also apply to rivers?

Guy Dauncey responded:

The rivers will have a temporary increase in flow as the glaciers melt and then they'll diminish to nothing with no glacial flow. The areas of the world that have monsoon rainfalls as in China and India, will have rivers that will be empty. It is the estuaries of the rivers around the world that will see that sea level rise and the estuary ecological system will have radical degrading.

Another participant commented:

I also had a life-changing moment at a climate change meeting but it was in Montreal where I spoke on a panel after Sheila Watt-Cloutier. What she said was that the entire conference, much like most international conferences, was full of a lot of people with a lot of resources, primarily from the North, primarily white, primarily male, and congratulating each other a lot. And then she explained, "I'm here to tell you that climate change actually has a pulse. And it has a human face," and she proceeded to give a very moving presentation of the livelihoods that have been lost in the North. For me, then, climate change is the most important issue of our time, but I

still think of the impacts on humans.

### Evaluating the trade-offs

I have also visited the sites of some proposed IPPs. The people that live close to the proposed project in Bute Inlet are very concerned about their livelihoods and very concerned about the tradeoffs of carving up this very spectacular wilderness area and they are asking: What are we going to lose in carving that up to transmission lines and this massive project? The Bute project is really beyond the scale of most of the other ones on the table. My question is: When we are racing to get more green energy on the grid, what are we giving up and is it worth it? And what do wild rivers and strong trees have to do in the fight for climate change? What about the ecological goods and services that we are losing by sacrificing some parts for other parts?

Tzeporah Berman responded:

I think that the public-private debate is obscuring what is actually a lot of common ground. And it is obscuring some of the pieces that we need to move forward with a conversation about transparency and better process and about stronger first past the post ecological principles and no new projects in old growth or projects that don't use existing road networks, and no projects in intact areas and no projects in salmon habitat. Those are the kind of principles that we should have and that we don't have. 900 projects are proposed and many resources will be going into analyzing them, when many could not be proposed if they were designed poorly in the first place. The EA process and the other permitting processes do catch a lot of the bad projects, so to a certain extent, the way that the government has set up the system creates public hysteria because they see these bad projects being proposed. We would hope that they wouldn't even get through the EA process, but they are already proposed.

I agree that we need better planning and we need more monitoring and enforcement. We need to strengthen or restrengthen the Ministry of Environment – there is no question about that.

However, there is a general sentiment that run-of-river projects, all of them, destroy salmon habitat. Yet every one that I have seen is where the diversion of water is at the glacial level and not anywhere near

salmon habitat and is increasing salmon habitat in some way, either through restoration or rehabilitation. Therefore, we need to be clear about the bad projects, but we also need to be clear about the good projects.

When we talk about people, we need to be very clear in looking at the other impacts on local communities because, for example, there are people in Bute who have concerns around recreation and aesthetics and transmission lines. But there are also people who would benefit because of green jobs and there are also First Nations whose traditional territory is in Bute and who want the project to go forward. So it is not quite as easy as saying "we need to think about the people," because there are a lot of people involved. With respect to the Bute, it is an incredibly beautiful place. But it is not old-growth. It has an existing road network and it is not an intact forest. It actually does meet a number of the criteria and 15 of the 17 diversions proposed are at the glacial level and not in salmon habitat. I have some deep concerns about 2 of the proposals but 15 of them are not a problem for me. I am not saying that Bute is a good project - it has not gone through the EA yet and I don't think anyone should be saying yes or no to a project until we see what the environmental assessment process has to say about it.

If we were really going to look at clear first past the post principles, we would be looking at the transmission lines because if ecological impacts are your primary concern, then I would argue that the transmission lines are the biggest concern in a lot of projects. Also, we should be saying that every project should be assessed on megawatts produced versus



length of transmission line. That would be one way to look at the benefit of how much it is producing versus the ecological impact of how long it takes to get to the grid.

### **The role of the private sector**

Gwen Barlee commented:

The debate regarding public versus private is polarizing and some people are saying that there is no room for the private sector in green energy development. Of course, there is. But a lot of people do not feel comfortable with the thought of General Electric and Plutonic Power owning the means of generation in Bute Inlet. In some ways it's fundamentally an issue about democracy. BC Hydro has made mistakes but at the end of the day they are accountable to the people of the province and they are accountable to this government. Who is General Electric accountable to? It is very important to the people around this province that at the end of the day General Electric and Plutonic Power are about generating a profit for their shareholders. And at the end of the day BC Hydro is about responding to the public good about energy conservation, long-term planning and energy security. People are asking: Do we want to have a corporate model? Or do we want to have a public model that better includes democracy?

Tzeporah Berman responded:

They have criteria and there is a social contract. General Electric is an investor. It has no say in the design of that project and they are not on the ground. I would argue that the Klahoose and the Homalco have a lot more say over what that is going to look like and what happens in Bute and Toba than General Electric would ever have. This is one of those trigger issues. We can talk about some big faceless corporation and it is going to sound like it is really bad. But these are real people, and a lot of them are from BC and they aren't just out there to make a buck, like a lot of the private industry are BC. They are citizens who are doing this because they want to develop renewable power because they think it is green. They are real people making real decisions and working with local communities. And they are under a social contract to BC Hydro to not only provide the power but to abide by certain laws. If we want to strengthen those laws then I agree. But to say that they are going to own the water or own the power is not correct. They are not going to

own either.

### **The case study of the Glacier Howser proposal**

A participant from the Nelson area commented: I think that there is a lot of commonality and I am happy to hear from all panelists that there are concerns with the process because I think that is a key piece to this. I want to use the Glacier/Howser project as an example of how flawed the process is. The issue was raised about no public meeting in Nelson about the project. It was not just environmental groups that had requested the meeting, it was also the mayor and councils of three communities, Nelson, Rossland, and Trail. Their agenda was to allow voice to their community members. There were a number of other groups as well, including a local chapter of the BC Wildlife Federation, to offer voice to their members, and yet the Environmental Assessment Office ignored those requests. We received no response whatsoever.

The meeting was held in Kaslo and people went. Some people drove for hours in some instances because they felt so passionately about the potential environmental implications of this particular project. Again, this is to do with the environmental assessment process.

The vocal opposition to the project has cast a much-needed spotlight on the potential environmental implications. The Environmental Assessment Office stopped the timeline on the process. And they did assure us that they were going to be scaling back and just doing the bare minimum until the proponent provided the information that they requested. But there are constant meetings happening, regular meetings with the entire working group and the proponent. The proponents have stated that they plan to come back. The major impact or primary concern was to do with fish. There is now talk about an experimental approach to stream flows - an experimental approach because there are threatened bull trout in those rivers. Again, a flawed process. We have so much invested in an environmental process that is so flawed and that is just one piece of it. There is also the transmission line, the old growth, and endangered species habitat not to mention the fact that this one company has submitted a number of other water license applications. The transmission line that is being proposed has a

significantly greater line capacity than the one project that is going through the process right now, the Glacier/Howser project. But they are not considering any of those potential future projects in the cumulative effects. The Jumbo Glacier Resort proposal is huge, and again, the area where this particular project is proposing has been identified as key habitat in mitigating impacts to the other one, but that is not being considered. So cumulative impacts are also really lacking.

### **Instream flow requirements**

Aaron Hill:

Elaine Golds raised the issue of the in-stream flow recommendations in the guidelines written by Hatfield for the government. Those are excellent guidelines but the problem is that they are not routinely followed. The in-stream flows that are set for these projects, especially for fish, are routinely lower than what the Hatfield guidelines call for. That is an issue that needs to be addressed.

### **Structure of the electricity system in BC**

A member of the IPPA of BC commented:

With respect to the privatization of BC Hydro and the BC electricity system that Gwen Barlee mentioned, and to give you a sense of the context, the electricity system in BC falls into three areas: the generation side, the transmission side and the distribution and customer service side. They are about one third each in terms of size. You will recall the fact that IPPs are only 10 percent of the power generation. BC's electricity system is only three percent of that. An additional point is that when IPPs build their projects today invariably they do it based on a contract with BC Hydro, and today at least 95 percent of their power is committed to BC Hydro for the 40 years or thereof of their project. So they don't even own the output of their facility. They have pre-sold it to BC Hydro. Another point is that at the beginning of this so-called gold rush, as it's been repeatedly called since 2001, IPPs have gone from seven percent of the electricity generation in BC to ten percent – so they have gone from barely two percent of the overall electricity system to not quite three percent. This threat of IPPs somehow privatizing the electricity system is far overblown.

Gwen Barlee responded:

The Ministry of Environment IPP team handled a

phenomenal 1,140 percent increase in IPP applications in the last five years so there are a lot of IPPs that want to come on line. A question that begs asking is: What impact does this amount of power that is being purchased from IPPs at many times above market rates and sold at a loss, have on the viability of BC Hydro which is one of our best tools against climate change? A report from a meeting sponsored by IPPBC, noted the losses that BC Hydro would be incurring from purchasing IPP energy and then selling it at a loss on the open market. It estimated that the yearly loss would be \$408 million, which jeopardizes the financial viability of BC Hydro. There is also the issue of environmental standards. The bottom line is understandably important to private power companies and sometimes environmental standards can be seen as red tape. According to documents that we have received through Freedom of Information requests, the IPP industry and individual companies have been putting pressure on government to lower environmental standards, particularly with respect to in-stream flow requirements. A precautionary principle is the Hatfield standard which leaves about ten percent of the mean annual discharge in the stream. IPPs are constantly pushing for below that standard and virtually dewatering the streams because it is good for their bottom line to squeeze out every bit of water.

A participant responded to Gwen Barlee:

BC Hydro's purchase of power from independent power producers is paid for through the rate base. It is charged to the ratepayers so it does not affect BC Hydro's bottom line. The subsequent sale of that power, I agree, in some instances may well be sold at lower than the price that BC Hydro acquires the power for, but it does not, in any way, hurt BC Hydro's viability as a company and it does not enter as a deficit on their books. One might say that the BC Hydro ratepayers are paying too much to acquire the power that is then perhaps being sold at a lower price, depending what the future price is. But it is incorrect to say that BC Hydro would suffer a loss.

### **Providing direction for the government**

A participant commented:

I want to thank the organizers of this worthwhile dialogue. Frankly, I think there is more agreement in this room than there is disagreement. And some of the things that there is disagreement on we

don't have to agree on; for example, whether or not climate change is one of the imperatives. However, we do have to agree on how to move this agenda forward. The government is not going to solve this for us. Many of us here have been involved in land-use planning for years and years. We cannot afford to spend that amount of time to make some of the necessary decisions. There is a lot of wisdom that was gained from that process; thus, the question is: How do we in BC actually move this forward? How do we start sending a clear and collective message from a broad array of voices and voices that in the past did not always agree? Can we actually come together in agreement and find a path forward to drive the government? The government is likely not going to solve this in a way that makes everyone happy. But perhaps they could if we collectively gave them clear direction. What is the next concrete step?



# OVERVIEW OF DAY ONE

Michael Harstone, Compass Resource Management

This dialogue is particularly topical, given that the premier announced yesterday that there is a recommitment to green energy and producing green energy and alternative forms of energy for export. He announced that there is going to be a new clean energy call in spring 2010 and that there is going to be a revision or an update of the energy plan. Furthermore, he formed four new task groups that would fall under the Green Action Advisory Committee Task Group that was formed after the 2007 Energy Plan.

I would like to provide a reflection and a summary of what was talked about yesterday in terms of some points of agreement and some points of disagreement.

## Points of disagreement

Table 1 describes the list of points of disagreement. It seemed clear that different people had different takes on whether or not the environmental assessment review process was working. There were some comments that it was adequate or it seemed to be working, but there were a lot more comments about how it could be improved or that it was flawed from the get-go and it needs revisions and a major overhauling.

Table 1. Points of disagreement.

- Environment assessment review process - *flawed or rigorous enough?*
- Private versus public power
  - BC Hydro's long-term viability
  - Issues of transparency, accountability and responsiveness
  - Belief that concerns related to private companies cannot be adequately regulated (e.g. social contracts)
  - Belief that the commercial sector has to be relied upon to scale up green energy in any meaningful way
- What is Plan B?

There was a lot of discussion regarding private versus public. At the root of the divide between those different viewpoints were concerns about BC Hydro's long-term viability, issues of transparency

and accountability and responsiveness, in terms of the general local government and whether or not there is a difference between those two methods of delivering power options, and a belief that concerns related to private companies cannot be adequately regulated. Discussions focused on the whole idea of setting up social contracts that try to address some of the concerns people have about private power development, and the belief that you could not do it, and that the Crown corporation is much better at delivering that. There was also discussion around the belief that the commercial sector has to be relied on to scale up the green energy in any meaningful way. There were many conversations about specific projects and it always returned to the earlier conversation about trade-offs, and if you don't like a particular project, what is the alternative? There were really no answers although, there were some ideas. We need to be thinking about that as we move forward.

## Points of agreement

It is nice to see that there were a lot more points of agreement than there were points of disagreement (Table 2). Most people agreed that climate change

Table 2. Points of agreement.

- Climate change is a significant threat to society and ecological services;
- BC requires new, clean sources of electrical power to meet anticipated demand;
- Every power project has impacts and trade-offs;
- BC would benefit from economic opportunities associated with the alternative energy sector;
- BC would benefit from open, transparent, and participatory energy planning;
- First Nations involvement and support is essential;
- Requirement for broad public participation;
- Clean (no net GHG) is not necessarily Green (socially acceptable and ecologically compatible);
- Better science and a commitment to adaptive management;
- Better monitoring and enforcement;
- Better access to information;
- Phase out dependency on oil and gas = fuel switching;
- We are lucky to live in BC.

is a significant threat to civil society and ecological services.

Also there was agreement that BC requires new, clean sources of electrical power to meet the anticipated demand and that every power project has impacts and trade-offs. There was general agreement that BC would benefit from economic opportunities associated with the alternative energy sector and also from a more open, transparent and participatory energy planning process. Also, better and earlier screening of potential green projects would serve everyone's interests. There are a number of ways that were mentioned about how you could do that. One is proactive regional planning - identifying the greatest power potential with least impacts. In terms of our case study of potential hydro projects, I assume that what that would mean is there would be an overview such as a protected watershed strategy, so that it would be known in advance which areas could be developed and which areas couldn't be developed because of the associated potential environmental or social impacts.

There was a lot of discussion around how some of those projects could be screened better earlier, with the idea of cumulative impact assessments and a VEC-centred approach rather than a project-centred approach, VEC being the valued ecosystem component approach where you identify the things that really matter to you from an ecological perspective. We also discussed the concepts of ecological resiliency and ecological services.

There was also agreement about the need to identify better projects through improvements to the environmental assessment process and the potential for an increased role for BC Utilities Commission, in terms of their oversight, and what that process currently entails.

A number of priorities about what people considered important continue to surface and these are listed below in no particular order other than the number of times that they were mentioned during the dialogue.

- the emphasis on reducing greenhouse gases and concerns about climate change;
- ecosystem resiliency and biodiversity;
- taking into account the local impacts, the people

living in the area, given some of these new projects;

- the importance of actually integrating those into the planning cycle;
- the idea of low-cost and economic development;
- the importance of First Nations involvement and support with alternative forms of energy and new potential power projects and also a requirement for broad public participation in that process.

It was also noted that 'clean', or no net greenhouse gases, is not necessarily the same as 'green', which was defined as socially acceptable and ecologically compatible. Yet in society, we seem to use those terms interchangeably. Green was obviously the higher benchmark.

A lot of people talked about the need for better information gathering, better science and a commitment to adaptive management and better monitoring and enforcement as well as better access to information during the whole review process including project development, environmental assessment and implementation. There was also discussion about the phasing out of dependency of oil and gas and fuel switching, which nobody really seemed to object to.

Finally, from all the conversation yesterday, it seems like we are very fortunate to be living in BC and the watersheds and the ecological diversity that we enjoy are rare and unique in North America and the rest of the world. There was a lot of interesting dialogue about how you might deliver something, but in terms of where we are heading relative to a vision for green energy, there was a lot of convergence in terms of what people were thinking about, their objectives and what is important to them – here, it became very clear that everyone was more or less on the same page. The challenge is how you go about implementing that strategy or that vision. I was struck with a comment from a participant about the next steps. She asked: What are some concrete things that we can do? and noted that we can't rely on government to do this entirely. The challenge for us today as we engage in dialogue is to think of some real, concrete, tangible things that we can actually identify that we might reach agreement on and as we try to answer those questions.

## DIALOGUE

### **Demand side management - conservation**

A environmental consultant offered the following observation:

One of the things that was briefly mentioned was the pricing of energy or electricity specifically. That may be an interesting question when you bring it into the public versus private discussion. We did talk about the fact that higher pricing is one of the best ways to reduce your dependency on it and to increase your efficiency.

A concerned citizen added:

I'd like to see, as a point of agreement, the huge importance of focusing on demand side management; that is, reducing consumer demand for electricity as well.

Another participant commented:

I am with the Friends of Bute Inlet and I was actually quite shocked yesterday with respect to plan B that noone mentioned the "conservation" word. All we talked about was increased demand and servicing that demand for energy and how we were going to squeeze all this energy out of the land base and harness rivers and put wind farms on hillsides. I think that we need to give the issue of conservation a little more attention. We know from the European experience that we could easily reduce our energy consumption by 50 percent with hardly any impact on our quality of life. I think this is a major place where we can begin to reduce our impact on the environment and on greenhouse gas emissions, while we are sorting out getting more energy out of the land base. And we could do that relatively quickly just by implementing some simple tax shifting techniques.

### **The big picture**

Another participant commented:

One of the messages that I took away was that the green energy component is really a small part of the whole GHG issue and without a broad suite of other initiatives in oil and gas, urban planning, and other things coming on soon, I don't think we will get there. We are making some significant trade-offs of a number of other values and if you are asking the people to put aside their NIMBYism for the greater good, then people want to see that whole suite of

activities.

Jeremy McCall commented:

I want to reiterate the point I made yesterday about the pro-development society we live in. I think we really need to step back. The amount of energy we need is just one outcome of our society and we need to decide what kind of society we want in BC.

Another participant commented:

I want to echo that in the context that climate change is a symptom and the problem is what we are not really addressing. We can do this and we can address climate change, but we still haven't addressed the fundamental problem of our unsustainable nature.

### **The EA review process**

A representative from the BC Ministry of Environment commented.

I am speaking as someone who has reviewed a lot of development plans, at least half the ones that have been approved in the province.

To follow up on Michael's summary, I have several observations or recommendations relating to the EA review process. There has been some discussion that the reviews that we undertake as the technical staff and civil servants, is somehow not detailed enough and that we may not be focusing on the right things. If anybody believes that the reviews that we undertake are not detailed enough, they should take a look at some of the reviews in the EA inventory via Google. Some go on for dozens of pages with extensive technical detail. I suggest that the deficiency is not in terms of the technical detail that goes into the review but rather often in the constraints that we are placed under in terms of the scale and what we are able to look at in our specific review. The constraints that we have are related to availability of data; for example, what we can say and what we can't say about impacts related to specific proposed extractions are often data deficient in terms of baseline inventory information. How much of that onus should be placed on the proponent? How much should be placed on government? How much should be placed on BC Hydro?

I couldn't agree more with the suggestions that we

should be doing regional planning at a larger scale, and cumulative impact assessment. But I personally have tried on a number of occasions and we are often lacking basic fundamental data making this very challenging to do. For example, with large integrated projects such as the Bute Inlet proposal, it would be good to take a VEC-centred approach. That is an appropriate planning scale for multiple projects over scales of thousands of square kilometres. But when you are looking at individual projects adjacent to one another, sometimes coming in under the standing offer program of ten megawatts or under, it is very difficult to review these proposals in a meaningful way in terms of cumulative impacts.

We can't lose sight of the message in the presentation yesterday that referred to it not being an evolution, but rather a revolution. It is looking at things in a slightly different manner but the structure is not yet in place for government to do this. There is no single agency that is responsible for the overview of these types of reviews. We are all focused on our own small review, depending on what your agency is and what your focus is.

### **Where do we go from here?**

We have got to find a way to connect these dots and make it into a vector and somehow have some direction, because on the front line where I am, in terms of reviewing these things, it is very difficult to try and structure things on a regional basis. We are often very constrained by what we can say and how we can say it. Please think about that in terms of how we can structure recommendations coming out of today.



### **Importance of incorporating traditional knowledge**

A member of the Namgis Band, Alert Bay, North Island shared the following:

I see one flaw in the way the province or proponents are proceeding and that is mention about lack of data. In our territory, we have extensive traditional knowledge, yet the province has not come to us to access that knowledge to assist them in understanding where to put proposed IPPs. We rejected half of the 30 IPPs that were proposed for our territory just by looking at the map. We know that there are salmon-bearing streams and archaeological sites, homesteads, and fishing sites in our valleys. There are another five proposals that we are reviewing. I am not for or against IPPs. If it is done right without damaging the environment and fish, I think it might benefit some, but not all. But the traditional knowledge studies have to be incorporated, not just looked at, in the decisions.

### **More specific information on impacts is needed**

Another participant added:

We did not hear many individual details about impacts of these projects yesterday. We did hear some general comments on wildlife and resiliency, but if we really want to learn more about the impacts, we would have to have another couple of days in this workshop and we would have to bring in some people to talk about the impacts, for example, to bears, which are fairly substantial. This would entail, for example, bringing in the hydro coordinator for the Seton Indian band. They are very worried about grizzly bears and they have very few un-impacted watersheds in the Lillooet territory. They refer to this as suffering from 'hydro stress' and they are worried about conserving the last couple of pristine watersheds they have for bears as a cultural issue. We would also want to bring in a Marbled Murrelet specialist to discuss his concerns about the impacts of Bute projects and others like that in terms of fragmentation and power lines which are possibly going to be quite devastating for murrelets. We did hear yesterday, perhaps not in enough detail, that a lot of the proposed run-of-river and river diversion projects are for areas that do have fish and we have serious concerns about the impacts on fish. They are not all located in alpine areas.

# VISUALIZING GREEN ENERGY POTENTIAL AND ENVIRONMENTAL PERFORMANCE IN BC: A SNAPSHOT OF TOOLS TO ENGAGE CITIZENS AND STUDENTS

Nick Hedley, Associate Professor, Geography, and Director, Spatial Interface Research Lab, Simon Fraser University

## Introduction

I am a specialist in geographic visualization, geospatial interface research and environmental perception. I am not an expert in green energy. In this presentation I will introduce you to some of the technologies that we (in geovisualization courses and at the Spatial Interface Research Lab) are using to visualize environmental variables. These emerging technologies might provide platforms to help groups engage in dialogue, build consensus and come to shared understandings about inherently complex and sometimes hidden environmental variables and infrastructure options.

## So how do we engage BC citizens in understanding some of the challenges that confront us?

There is an incredible amount of expertise and experience in this room, but how can we make the environmental challenges that are being identified, visible to all stakeholders? This presentation: explores examples of SFU student visualization projects, which look at energy potential in BC; considers some of the persistent challenges (to represent and visualize complex phenomena); and examines some recent technologies that we have been developing to visualize geographic phenomena at the Spatial Interface Research Lab.

## Perceive environmental variables and visualizing green energy potential in BC

BC is fortunate to have spectacular natural environments. But in such incredible surroundings we must avoid complacency. We can all see how beautiful BC's landscapes are, but in order to protect and sustain them, we must continually monitor and consider how 'super' and how 'natural' they are. Any proactive society must ask these questions as both scientists and citizens, in order to sustain these resources. A key theme of my research is to explore ways in which we may be able to visualize and reveal day-to-day environmental conditions and citizen performance in BC, using contemporary and emerging 'geovisualization' methods and geospatial interface technologies. Could we estab-

lish methods to provide more frequent and detailed citizen information systems with which to report and communicate the environmental performance and accountability of communities and regions on an everyday, or real-time basis?

Earlier, there was discussion about NIMBYism in identifying, proposing and agreeing on environmental impacts and green energy development potential. What if our 'backyard' could be better understood, so that a larger proportion of stakeholders were better informed before entering discussions?

Key challenges when informing stakeholders and citizens include: making environmental variables and phenomena that are often invisible (e.g. air quality), perceivable; enabling stakeholders to view and explore inaccessible locations (e.g. underwater) in order to comprehend issues and options; and, enabling citizens to view and explore everyday spaces at the multiple scales and levels of abstraction needed to understand factors that include environmental context, green energy engineering options, and implications of all types.

For example, there are several options for implementing tidal and coastal energy production. These include seabed-mounted devices such as the Oyster and the Pelamis floating boom wave energy technologies (see references for URLs to images, descriptions and movie clips of these technologies). Examples are shown in Figure 1, below.

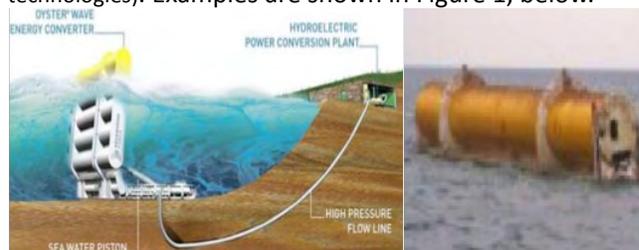


Figure 1a: Oyster seabed prototypes.



Figure 1b: Pelamis prototype floating boom technology.

This province has been used to seeing log booms floating down the Fraser over many years. What if a 21st century 'log boom' could be generating 750 kilowatts of power?

Even before we consider specific engineering solutions in this context, we must address two practical challenges. First, the sheer size of BC can also mean that citizens, taxpayers, legislators and others cannot easily get to remote location-specific sites of potential green energy development. Secondly, coastal and ocean energy solutions involve geographic spaces that are often underwater, offshore, or difficult to see. Clearly we need to enable citizens to perceive every aspect of these sites, in order to understand their potential and challenges. If we cannot achieve this, potential green energy development opportunities and associated environmental issues that must be overcome, will remain out of sight (underwater, or remote) and out of mind.

### Opportunities to improve communication of environmental conditions and complexity

So how do we begin to communicate environmental contexts, power generation infrastructure options, power delivery infrastructure, as well as a complex arrangement of social and cultural needs and values? Instead of simply seeing explanatory diagrams of the hardware and technology, we need to be able to 'transport' stakeholders to these challenging locations and remote regions, and enable them to perceive all visible, invisible and abstract variables.

There is much that we could do to change this and similar challenging situations. There are a number of real-time sensor systems and data sources that could be better leveraged to inform and educate stakeholders about real-time and cumulative environmental conditions, as a basis for sound decision-making. Flagship research and development projects such as VENUS and Neptune at the University of Victoria have extensive seafloor sensor networks deployed in coastal and deep-water environments, delivering real time information from seafloor instruments via fibre optic cables. These and other sensor networks and data sources represent examples of data that could (and should) be leveraged to provide powerful environmental visualization systems to better inform citizens and communities on an everyday basis.

A range of non-profit, provincial and research organiza-

tions currently produce a variety of simple environmental data visualizations for public consumption. Some are archived, some are aggregated by week/month, and some are 'real time', updating every minute or hour. A quick search for visualizations of air quality in the Vancouver region resulted in simple website-based maps that can be browsed to view hourly air quality measurements, such as the BC Ministry of Environment's 'BC Air Quality' web page (see Figure 2).

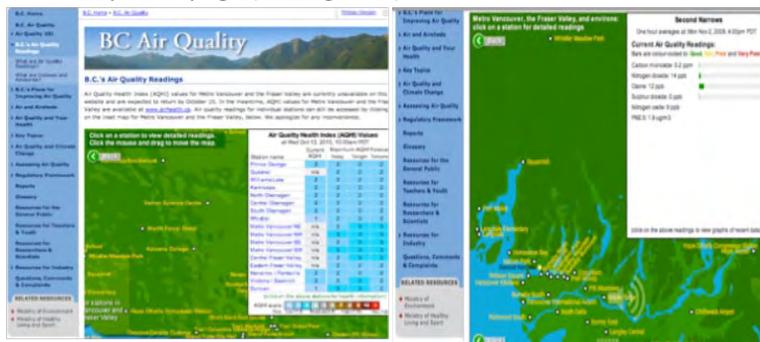


Figure 2: Examples of 'real time' environmental monitoring data delivered by the BC Ministry of Environment's 'BC Air Quality' web page. [See: <http://www.bcairquality.ca/readings/index.html>]

These examples are a step in the right direction – to deliver information to citizens to support everyday environmental awareness using existing data. But how should (or could) we translate all of these dispersed information sources into shared citizen perception and comprehension of these complex phenomena? Much work needs to be done to develop environmental communication systems that help citizens understand (sometimes abstract) 2D web map-delivered sensor readings, and link them to/situate them meaningfully in everyday 3D geographic spaces, and if possible from a human perspective.

### Visualizing environmental phenomena and future scenarios with virtual environments

Recently, interesting work has been done to help communities understand the implications of environmental change, by visualizing future scenarios. An example is work by UBC researchers in the Collaborative for Advanced Landscape Planning (CALP) which uses 3D visualization and simulation environments to show communities future scenarios, such as the effects of climate change. One of the advantages of using virtual environment (VE) simulations is that they allow us to perceive and experience phenomena (or moments in time) that we would not otherwise be able to see, or places we wouldn't otherwise be able to physically go. If, for example, you were trying to communicate a new offshore ocean power farm, how would you get people

in cities and communities to understand what it is like, the environment in which it is being built, and the challenges in implementing that technology? Virtual environment-type interfaces, whether a movie on a desktop computer screen or wearing helmets and goggles, allow you to see those futures and the infrastructure that you would not otherwise be able to visit or perceive.

When teaching several courses in 3D geographic visualization and geospatial interface research, I encourage students to design visualizations that are both phenomenon-centric (i.e. are tailored to the characteristics of the phenomenon) *and* user-designed (i.e. taking the audience and venue into account). It is not enough just to visualize these scientific variables in a vacuum and assume that our diverse audiences are able to access and understand all of the subtleties that we are trying to communicate.

In one student project, for example, several years of wind data for BC were visualized for a part of southern BC. The visualization (implemented as a 3D Google Earth mashup) allows users to browse through what would otherwise be a dense, abstract dataset, in a way that links the relative wind energy potential to 3D geographic spaces (where elevation and surface geometry are key). Geographic information science (and visualization) is moving beyond conventional mapping tools and into new territory. Although there is still a very important role for analytical tools such as GIS, we must integrate and leverage more widespread social geographic computing technologies (Google Earth, game engines, mobile devices), if we are to engage citizens and students, and also to develop the next generation of participant citizens. We need to be thinking about platforms that can engage, and be accessed by, a very wide cross section of society.

To this end we have been exploring the use of 3D game engines as platforms to implement non-linear exploratory geographic visualization interfaces. Unlike 3D GIS visualizations, these prototypes can support non-linear, multi-user collaboration with first-person perspectives, and include 3D physics models.

We have developed prototype interfaces using these technologies to support a range of applications and user types. One such interface is a virtual 3D version of Vancouver's North Shore mountains, as a tool to simulate missions and changing environmental and weather

conditions during search and rescue training activities. Another example, is an interactive 3D virtual version of the Bowie Seamount (West of Haida Gwaii). Like some of the ocean power examples, the Bowie Seamount is in a remote location. Even though remote, it has economic value as a fishery, at the same time as having cultural and social significance, to the Haida. In this case we took a 3D game engine, removed all the guns and sci-fi, and replaced fictitious content with real bathometric data. Imagine engaging students, and members of the public with these sorts of platforms, but incorporating the kind of content that you want them to understand.

One of the big challenges with 3D animations, movies, or virtual environments, is that we still typically have to go to a computer to see such visualizations. We are putting the burden on the individual or the dispersed communities, in the case of energy development in BC, to 'connect the dots'. The question is: How do we leverage all of that and put it in a form where we could allow citizens to perceive these challenges in situ? Is there a way to benefit from this strange and wonderful technology and leverage it in ways to make environmental challenges perceivable, tangible and immediate?

### **Augmenting geographic spaces with emerging technologies**

One of the emerging technologies that I have worked on for more than a decade is 'mixed reality'. Mixed reality interface technologies enable us to augment our everyday spaces with (digital) information of different types. This can be as simple as text annotation on views of the real world, location-triggered audio clips, or placing 3D virtual objects in real spaces. This is not just a novelty. If you think about it, we are already augmenting every day spaces and have been for a long time, whether in heads-up displays in aircraft, or the first down line in football on TV. What if, instead of first down lines and heads-up display information, we augmented real spaces with real-time environmental data and information (indicators)? What if we could draw upon the wide range of geospatial data that are available to us and put it in the hands of citizens, so that we could enable them to see the world through our eyes, to take into account not just the dimensions and infrastructure costs of energy development, but also social and cultural values too?

Using interface technologies such as (mobile) augmented reality ((M)AR), there is an opportunity to make

abstract and complex phenomena that are typically impossible to perceive, perceivable in situ; in other words, in the spaces where they matter. Figure 3 shows one type of technology that I have been building prototypes with for this purpose. Imagine going out into the real world with a device (in this case a tablet PC with a camera and GPS) and being able to see digital data attached to geographic locations in real time. The result is the ability to perceive data-driven visualizations of them in situ in real geographic space.



Figure 3: An augmented reality (AR) prototype used to visualize subsurface geology from soil-pit dig information. Conceptual design on left, tablet PC-based prototype (middle), live raw view captured from prototype system (right). All images copyright © 2007-2010 Nick Hedley. (Images from Hedley, 2010).

Figure 4 shows conventional GIS data (in this case a digital elevation model) being used with a MAR prototype in a field location on Mount Seymour, BC. Note that I am able to walk around in the real world, look through this device and in real time have the digital GIS data registered directly to the real world at my feet. A view captured directly from that device is displayed in the right image of the figure.

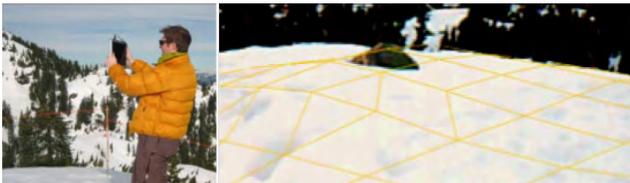


Figure 4: An augmented reality (AR) prototype used to view digital elevation model (DEM) terrain data in real time, during field activities in BC. Prototype MAR systems in use (right). Raw live view of real geographic space enhanced with wireframe GIS data (right). All images copyright © 2007-2010 Nick Hedley. (Images from Hedley, 2010).

We can use this technology to leverage and visualize live environmental data sources or interpolated air quality models. With the correct available data, we could walk to the shoreline in downtown Vancouver or Victoria, ‘switch the water off’, and see the bathymetry of Burrard Inlet or the Strait of Juan de Fuca. Better yet, we could place situated data visualizations of current variables (such as salinity, water velocity by location) in the view. With this geovisualization interface technology, we are able to combine real views of the geographic spaces with abstract environmental data visualizations.

Essentially we are implementing a kind of geospatial x-ray vision.

The tablet-based MAR research described above began before the iPhone 3GS existed (the significance being the addition of GPS capability in the 3GS), and has allowed me to identify and develop key MAR-based geovisualization design methods that we can now use with widely adopted GPS-enabled smartphones and other ubiquitous devices. We are now developing environmental visualization tools for iPhones using real-time data sources. They will have game-like serious environmental education applications for high-school students so that they, collaboratively, can discover and build conceptual models of complex environmental variables and phenomena.

I hope these examples, challenges and ideas provide you with a snapshot of ways we may communicate environmental data and sustainable futures in BC in the near future. At the Spatial Interface Research Lab, we are already engaged in developing and implementing these systems. We hope to provide tools and visualization systems that inform and educate BC’s citizens about environmental phenomena, and to enable all stakeholders to make sense of complex environmental challenges.

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# GOVERNMENT PERSPECTIVES ON HYDRO POWER

*Presentations by:*

*James Mack, Head, Climate Action Secretariat, Province of BC*

*Adam Silverstein, Manager, Environmental Assessment, Fisheries and Oceans Canada*

*Randall Lewis, Environmental Coordinator, Fisheries Project/Environment, Lands and Resources, Squamish Nation*

*Glen Davidson, Director and Comptroller of Water Rights, Management and Standards Branch, BC Ministry of Environment*

*Stephen Olmstead, Director of Planning and Development, Squamish Lillooet Regional District*

*Shelley Murphy, Executive Director, Electricity, Electricity and Alternative Energy Division, BC Ministry of Energy, Mines and Petroleum Resources*

## **Climate Action Secretariat of BC**

*James Mack, Head, Climate Action Secretariat, Province of BC*



## **Introduction**

What is focusing people's attention on the climate action agenda right now are the ongoing discussions both in the US and in Copenhagen. My presentation will provide a perspective on the discussions that are going on locally in BC.

The problem with climate change is that it isn't dispersed evenly around the globe. We do know that BC will experience larger than normal rates of warming and increases in precipitation and it will be impacted more than many other jurisdictions, and we also know that these impacts will not be evenly

distributed throughout BC. Experiences from the mountain pine beetle infestation have resonated on the international stage as a concrete example of how climate change can aggravate natural disturbances. This highlights the importance of dealing with the climate change issue on a global level. Not only does BC have an international profile in terms of the impacts of climate change, but it is also recognized as having taken leadership in terms of moving ahead with action on a global problem.

## **BC Climate Action Plan**

We are taking a number of approaches to address the problem of climate change through the BC Climate Action Plan. One approach is the carbon tax which puts a price on carbon in recognition of the environmental costs associated with greenhouse gas emissions. Another is carbon neutral government where hospitals, school boards and government ministries are all taking measures to reduce their emissions and purchase offsets. There are also what we call 'actions' in every sector, to know where the emissions come from in the province, and apply measures to deal with them; for example, in agriculture and forestry, how we produce energy, and how we do transportation.

## **The Western Climate Initiative**

We are also trying to get broader international action. For example, the work we have done with the western states in the US and Canadian western provinces on the Western Climate Initiative has lead

to broader economic measures, most of which are focused on cap and trade, but also other initiatives related to fuels. This initiative has shown, within North America, that you can actually do something positive to address this challenge and you can move the file forward in advance of getting a consensus from federal governments in the US and Canada.

### **International initiatives**

Right now we are seeing a lot of promise in the US to have climate change legislation in place that would put a cap and trade regime into effect. There is also a lot of momentum leading up to the meetings in Copenhagen in December 2009 and anxiety about whether the international agreements are going to meet expectations or whether they are going to be less than what we need to deal with the problem. Either way, whether there is a good deal or a bad deal coming out of Copenhagen, the focus will immediately shift back to local jurisdictions. There is an enormous inertia to wait for global agreements to solve the problems, as an excuse for inaction. After people leave Copenhagen, the focus will come back to jurisdictions like British Columbia to figure out this global problem, which British Columbia has already experienced through the pine beetle infestation, for example.

### **Connecting international and local initiatives**

How do you reconcile the international initiatives with very important and legitimate local issues? I believe that people will look to British Columbia as an example of tackling the problem and figuring out how to solve it. They will look at our local power projects, which are fundamental to bringing more electricity online, and larger initiatives such as the implementation of electric vehicles or higher energy efficiency in houses, and also increased electrification.

How are we going to struggle through the local and the global approaches? I would challenge, that if BC cannot figure it out, then the globe will not be able to figure it out and effectively address the climate change problem. BC has an abundant resource of clean electricity and all the forms of potential renewable energy and can be a very significant contributor on the global stage. These discussions will contribute to the global dialogue on this urgent and important problem.

### **Fisheries and Oceans Canada**

*Adam Silverstein, Manager, Environmental Assessment, Fisheries and Oceans Canada*



### **Introduction**

As the Regional Manager of Environmental Assessment and Major Projects for DFO, Pacific Region, I have seen a number of IPP development applications for hydro and other forms of renewable energy. My current focus is on panel-level reviews under the Canadian Environmental Assessment Act (CEAA) for major developments in the Province of BC.

DFO generally becomes engaged in IPP and hydro projects through our responsibilities under the Fisheries Act and the CEAA. My comments, therefore, will be focused mainly in the context of these two important pieces of legislation and our role under this legislation.

### **The role of DFO**

In general DFO is very supportive of the IPP concept. Anything that will lead to reductions in greenhouse gas emissions is in the long-term interest of fish and fish habitat, particularly in relation to hydro IPPs and the original concept of these projects being located in steep systems, above fish-bearing water bodies. However, that isn't the nature of many of the developments we are seeing today - there is some cause for concern and it is good to see a lot of those issues being debated here. In particular, what I have noted is that many of these developments are becoming larger and the number of developments is increasing rapidly. That increase, both in size and number, has led to an increase in potential impacts to fish and fish habitat. The primary concern that DFO has in relation to these developments is fish entrainment; that is, loss of fish habitat due to diversion and footprint impacts of the developments and expansion into watersheds that support sensitive fish populations, including salmon and some species at risk.

In addition, there are concerns about impacts associated with access construction and transmission lines as well as long-term impacts from sediment and nutrient transport, which we believe have not yet been fully characterized. The discussion around cumulative impacts has been very apt. It is a very challenging measure, not only for DFO but also for all agencies, to review cumulative impacts in all development projects.

### Scale of impacts

It is also important to note that the nature of the impacts associated with IPP hydro projects is different from many other development projects that DFO reviews, such as docks or bridges or things of that nature. These impacts are usually in remote locations and involve large geographic areas. They will have long-term impacts, with diversions expected for a minimum of 40 years, or possibly longer. Also, they are challenging to monitor. Further, given the large amount of development in BC, not only in this sector but in all sectors, the review of these development projects has been challenging for Fisheries and Oceans Canada and other federal and provincial agencies as well.

We have been working with proponents and encouraging them to provide us with their complete build out plans and long-term development plans so that we can review these developments as one assessment process, rather than via multiple assessment processes.

### Wind and tidal power projects

In terms of wind power, as it relates to terrestrial wind farms, DFO's primary concern relates to access and transmission lines. However, cumulative impacts are a key concern. The individual project site impacts are something that DFO has quite a bit of experience in managing, but assessment of offshore wind farms is a large and very challenging area for DFO and other agencies. However, we are working with proponents and our scientists and local groups to address those challenges, in particular through an environmental assessment process for a major offshore wind farm in BC (see Matt Burns presentation, p. 106). Tidal power is also a challenge - to date it has largely been experimental and most of that experimentation has been focused on the east coast of Canada where DFO is working with industry to resolve challenges around

fish entrainment.

Overall, I would say that we are very supportive of these types of dialogue events to explore the challenges with all concerned parties. DFO is also very interested in contributing to broader planning processes, as has been discussed, as one of the next potential steps, in addition to new methods to address cumulative impacts. But in the interim we are still obligated under existing legislation to manage individual projects.

### Squamish Nation

*Randall Lewis, Environmental Coordinator, Fisheries Project/Environment, Lands and Resources, Squamish Nation*



### Background on resources management in the Squamish Nation territory

A delegation of our chiefs went to England in 1906 to talk about the same types of things we are concerned about today including trees, fishery, shellfish, and logging. The Dominion or provincial entity of the day was not listening to us. The three chiefs in the delegation were received by King Edward and Queen Alexandra. Chief Joe Capilano of the Squamish Nation talked to them about our plight. He said, "Your people are doing some really bad things to the land and the resources that have sustained us for thousands of years. Why would you do that to Mother Nature? Why would you destroy the resources that have sustained us?"

So it isn't a lack of us trying with regards to talking about the resources in our territory and the protection of them. We have done this diligently and

vigorously with all governments - federal, provincial, municipal, and regional governments - for a very long time.

### **IPP proposals in the territory of the Squamish Nation**

There have been a number of proposals for IPPs within the territory of the Squamish Nation. One project is now complete. We worked vigorously on that project with respect to environmental protection and fisheries with the federal and provincial governments, particularly with the Department of Fisheries and Oceans. We looked at wildlife and grizzly bear corridors, and told the governments that we needed to have meaningful participation in anything that would have socio-economical impacts on the resources of the land that sustained us for thousands of years. The same resources or attributes that used to sustain us no longer sustain us. We can't fish and hunt anymore. Why? Because the resources are gone. Look at Vancouver. Only 200 years ago we were still fishing and hunting here.

Now we are talking about the rivers in the Squamish Valleys - the Mamquam, Chekamus, Fulton and the Ashlu Rivers. 152 hydroelectric projects, run-of-river, have passed over my desk since 1992. We signed off on one agreement in 1993. At that point in time it was the best deal of the day, but the proponent was not willing to look at fishery habitat compensation and/or monitoring. I am the President of the Squamish River Watershed Society and am on the board of directors of the Squamish Environmental Conservation Society. We now get funding from the proponents to provide the monitoring of the fish habitat compensation work we are doing, such as on the Ashlu. We have done about half of the 5,000 metres involved with that system, and that has resulted in putting in another 60,000 metres of channels. Now we are seeing fish in areas where they have not been seen in 80 years or 90 years.

When we talk about doing projects we know you can do it right. If there are going to be impacts on the fishery and wildlife, there will also be potential impacts on our aboriginal rights and title, as described by Section 35 of the Constitution of Canada. We will be very vigorous in taking the governments, whoever they may be, to task to ensure that this com-

mitment is met. We have that capacity. When I was in Denmark, Sweden, and Norway examining their technologies, they said that we are making the same mistakes they made 400 years ago by allowing our governments to be controlled by industry. We need to resolve this issue. We can step up to the plate and take a stand on this; in the end the political will of the day can only be exercised by the people of the day. People have got to get up and vote. These are the choices that we need to make.

### **BC Ministry of Environment**

*Glen Davidson, Director and Comptroller of Water Rights, Management and Standards Branch, BC Ministry of Environment*



### **Introduction**

I have read a lot of the discussion in the media about IPPs and the private/public mix and what strikes me is how much misinformation is out there. I think the discussion needs to happen and this is a very useful forum. I am always happy to try to clarify or inform the discussion.

As the comptroller of Water Rights, my comments do not necessarily reflect all IPP development but rather hydroelectric development in BC, including run-of-river and storage projects. We license both. One of the questions posed for this panel is: What are the opportunities and challenges in developing IPPs in BC? The opportunities are huge and they always have been. Someone noted earlier in this discussion that we are blessed with many resources, so as James Mack said, if we can't do it, then nobody can, in terms of achieving a carbon-free environment.

## The challenges

How do we go forward or develop and protect those resources, which are also part of the opportunities that we have in BC? That is the real challenge. We have been in the water licensing business in BC for a long time - the Water Act is about 100 years old. There are more than 50,000 water licenses in the province. Of those, several hundred are related to hydroelectric development and of those about 120 are what I would consider to be IPPs. So there are currently around 120 licensed IPPs in the province and of these about 42 are actually operational. There are some that are under various degrees of construction or trying to get an energy purchase certificate or financing - some may go ahead and some may not. The last time I checked there were about 570 applications for power in the province and that number has been increasing in recent years although it now seems to have leveled off. We had only around 10 come in this year for whatever reason, whether it is related to the economic situation, or access to energy purchase agreements or the possibility that the good sites have all been spoken for.

There are about 570 applications, but they are only applications. They convey no rights whatsoever. An application can be viewed as a placeholder. Applicants have a place in line as they hope to pursue projects. There are no rights.

## Power development in BC

BC has a long history of both private and power development as well as institutional or non-IPP power, such as Teck Cominco or Fortis BC which supply a lot of power in the Kootenays. There are also some small producers such as the City of Nelson that have their own power plants. These are the more regulated. There are also a number of older power projects that have been selling power to the grid over the years; one of the bigger examples is Alcan. The point is - we have had a mix of IPP and non-IPP for many years in BC.

What is new is that there are a lot more small projects potentially coming on line, or that have come on line, in the last 10 or 15 years. There are also a lot more applications and more activity. However, in terms of the overall mix, it has been similar.

Are we on the right path? The majority of our energy in BC is clean energy and it always has been. That goes back to the sort of resources that we have had to work with. We are certainly on the right path in terms of clean energy, relative to some of the other developments in the rest of the world. How do we make it cleaner and how do we move forward with that in mind?

## Squamish Lillooet Regional District

*Stephen Olmstead, Director, Planning and Development, Squamish Lillooet Regional District*



## Introduction

From a local government perspective, specifically with Squamish Lillooet Regional District, a lot of my comments will be in relation to events that happened in the past. Since 2005 and 2006, we have been significantly disengaged from the process of the green energy discussion. At the present time we are a referral agency for power projects and have opportunities to participate in the environmental assessment process, where it is triggered. However, as was mentioned earlier, a number of years ago our vote was removed with Bill 30.

In terms of challenges and opportunities and whether or not we are on the right path, a forum like this and the type of discussion we are having suggests to me that there is definitely an opportunity to re-engage. There has been recent awareness in a number of different areas around the province

about the scope of energy developments. One of the fundamental issues is the assessment process, on a project-by-project basis.

### **Earlier initiatives on power planning in BC**

We were on the right path about eight to ten years ago. In September 2003, there was a memorandum of understanding between the province and the Union of BC Municipalities to create a means through which local governments and the province could cooperate and collaborate on the planning and development of independent power projects, specifically water power projects. This emanated from discussions in the Sea to Sky corridor largely around the significant number of applications that had been considered in the late 1990s and early 2000s. Around 60 applications in the region were under one level of consideration or another, and at the time there was concern that there was a gold rush mentality.

Under the memorandum of understanding, a working group was created. It was a fairly broad cross-section of provincial agencies and local and federal representation. At the time the departments were Land and Water BC, the Ministry of Community Services, Energy and Mines, Sustainable Resource Management, and the Ministry of Environment. There was also regional participation specifically from the Lower Mainland and Sunshine Coast Regional Districts. Later on the BC Transmission Corporation and BC Hydro came to the table. This group worked on coordinating a process. We worked with Land and Water BC at the regional level in Vancouver to develop a harmonized process that involved local government representation. A number of years ago, under the auspices of the Fraser Basin Council, a two-day forum was held to scope out issues associated with water power project developments.

So we had a framework in place that was intended to foster cooperative inter-governmental relations, recognize the jurisdiction and accountabilities of all orders of government and facilitate responsible development of clean renewable energy sources that would meet the needs of all British Columbians. That was the essence of the protocol agreement that was signed by three provincial ministers and the president of the UBCM. I think that we can rewind to that, on some levels.

### **Regional planning by the Squamish Lillooet Regional District**

Regional planning has been discussed here on a number of occasions. This is something that the Squamish Lillooet Regional District has supported since the outset – we felt it was imperative to take a planned approach to regional energy development. Right at the start we saw that by working on a project-by-project basis, energy was going to win in every instance. This was supported with the comments from Guy Dauncey earlier in this program.

On a case-by-case basis, that energy imperative was very dominant. In our region there are a great number of streams where there are competing values - there are very high values for energy and also very high cultural values. Through the First Nations plans over the last eight or ten years, we have seen that those cultural values are recognized and that has had an implication for water power project development. The Lillooet plan has identified areas that are culturally important where water power projects are no longer being considered. There are also high recreation values around tourism and backcountry recreation. For example, for us one of the aspects of the Ashlu project that was totally unexpected was the issue of whitewater kayaking with international participation. At the public hearing 25 or 30 people from the US talked about the international significance of the recreational amenities. In our region along with energy and forestry, tourism is a huge part of the economy - we want to see some of those values recognized.

It really demands, in our view, a regional response that takes those values into consideration and perhaps reserves some streams in their natural state for recreation, wildlife or environmental values. To a certain degree, we felt that local government was not well-positioned to be leading that discussion. We have local interests and we work with local communities and we felt that the province should take the lead. Unfortunately, we did not find a lead agency to take that over.

In provincial land and resource planning, both in our local regional growth strategy and our Land and Resource Management Plan (LRMP) we looked to

see if we could come up with some kind of energy strategy. We did not get what we wanted, which was a targeting and assessment of opportunities, to identify areas where we could take advantage of clustering potentials, transmission coordination, and so forth. What we did get, however, through the LRMP process was a designation of wild land covering 27 percent of the planning area, which was set aside to recognize some of the cultural, recreation, tourism, and back-country values and excludes IPP consideration. In that sense there has been a start towards recognizing some of those values in balance with the energy development values.

### **BC Ministry of Energy, Mines and Petroleum**

*Shelley Murphy, Executive Director, Electricity, Electricity and Alternative Energy Division, BC Ministry of Energy, Mines and Petroleum Resources*



### **Introduction**

Our branch of the Ministry of Energy, Mines and Petroleum Resources deals with electricity policy and utility regulation. I was pleased to hear earlier discussion focused on the big picture as well as the recognition that electricity is one piece of the whole greenhouse gas and energy picture.

### **Policy governing electricity supply in BC**

Where is the future for British Columbia? I will describe some context on the electricity supply for BC and the policy governing that. The policy speaks to

several sources of supply for British Columbia including energy conservation and energy efficiency.

In 2008, changes were made to the Utilities Commission Act to require utilities in their planning for new supply to first do as much on energy efficiency and conservation as they can before considering new sources of supply. Then, when considering new sources of supply, they can think of energy supply contracts or their own development. This applies to all utilities, not only to BC Hydro but also to Terasen and Fortis BC.

### **BC Hydro perspective**

From the perspective of BC Hydro, government policy speaks to this organization continuing to make improvements to its existing facilities. They have \$1.5 - 2 billion per year in generation and transmission investments. In terms of upgrading facilities, it will potentially add four units in its Mica and Revelstoke facilities - one has been approved, Revelstoke 5. The three additional units are under consideration and are in BC Hydro's contingency plan. That represents 2,000 megawatts of new capacity, just under 20 percent of their currently owned capacity. This is a significant addition. BC Hydro is also investigating potential for the development of the Site C facility on the Peace River. It is wrapping up the second phase of the process and will be seeking the view of government on whether it should proceed to the third phase.

Beyond that, Hydro has been asked to consider IPPs or other suppliers for electricity for clean and renewable supply - not only run-of-river or small hydro, but also wind, biomass, and possibly in the future geothermal and ocean energy. As some people have noted, of course, in terms of opportunities BC is very lucky in that we have a variety of different renewable resources that we can draw from, whereas other jurisdictions are often specifically focused on one or two resources because that is all that is available.

What is challenging with that kind of variety is to try to figure out what to acquire and how to plan so that the electricity resource meets the needs of the customers in a cost-effective manner. BC Hydro's role is to figure out how best to do that.

### Strategic energy plan

In the context of strategic planning, not specific to land use planning, but energy planning, there is a strategic energy plan for the province, the 2007 BC Energy Plan, which followed on from the 2002 Energy Plan. The Utilities Commission Act requires specific energy planning for utilities so that each utility must develop long-term resource plans that they then submit to the BC Utilities Commission. The commission reviews these plans and that involves a significant public process. The Utilities Commission Act also requires a long-term transmission enquiry to be conducted every six years. The first one has started - that is a process whereby the commission is asked to look at BC's long-term energy needs and consider where government is heading in terms of greenhouse gas policies, its clean and renewable energy goals, and the plans of neighbouring jurisdictions for clean and renewable resources. They will consider what the future long-term needs are, 30 years out, consider what resources we have and where they are concentrated, and think about the best transmission plan to access those resources over the long term.

In terms of future process, it was mentioned earlier that the government has established four task forces to look at various aspects of future policy and improvements that can be implemented with respect to regulatory reform, procurement, resource development and First Nation and community involvement. That is something to look forward to and we'll see where that takes us.



### DIALOGUE

#### The Navigable Waters Protection Act

Craig Orr directed a question to Adam Silverstein: Has the gutting of the Navigable Waters Protection Act changed the review process for DFO?

Adam Silverstein responded:

The Navigable Waters Protection Act was modified. It is now administered by Transport Canada and is no longer overseen by Fisheries and Oceans. For the most part, this has not impacted DFO's environmental assessment process, other than representatives from Transport Canada may or may not be present during the process. The Act is still a CEAA trigger - if a Navigable Waters permit is required, then Transport Canada will be engaged in the environmental assessment process. For more details you would have to contact Transport Canada.

#### Mitigation

Craig Orr directed a question to Adam Silverstein: I have spent many years reviewing mitigation proposals and being involved as a proponent and I have my own views on how well humans can create habitat, compared to nature. I would appreciate your view on mitigation of potential impacts through the creation of spawning channels and other measures.

Adam Silverstein responded:

It is important to note that from DFO's perspective there is a clear distinction between mitigation and fish habitat compensation. For DFO, mitigation, as it relates to fish habitat, is avoiding impacts or providing measures that reduce impacts. In general, those are our most powerful tools; relocating and redesigning projects such that the impacts are reduced, allowing for appropriate flow levels, and things of that nature. These tools can be very effective, provided that the planning process is carried through to the implementation phase, which is a challenge.

Fish habitat compensation is considered mitigation under the Canadian Environmental Assessment Act, but in the strict sense it is not mitigation but rather fish habitat conservation that serves to replace something that has been lost. There is a lot of literature on this subject, not just personal opinions, and the evidence is mixed. Sometimes it works

phenomenally well and other times it is a disaster - I have seen both things happen in a number of development projects and also in our own enhancement activities. DFO has an enhancement branch that works to enhance fish and fish habitat and sometimes we have been very successful and other times not, and proponents have had the same experiences. Even so, it can be a valuable tool, especially knowing, as we have discussed several times in this forum, that there are always impacts to these and all development projects. There is some level of impact that can't be mitigated and compensation is a valuable tool to try and offset some of those losses through other measures.

### **Bill 30 and the voice of local government**

A participant commented:

I want to congratulate Stephen Olmstead because he was put in an impossible position at local government, as all local governments have been, with the passing of Bill 30. This essentially trampled on all local government rights and local citizens' rights to speak out on this issue, and that is an abrogation of democracy.

### **Mandate for water flow and budget for monitoring**

I would like to pose a question to Glen Davidson: I understand that there is no real law to mandate flow and also that there does not seem to be a budget to travel to and monitor projects. When I visited Bute Inlet, I was told by a spokesperson for one of the proponents that they were going to take as much water as they possibly could in order to make enough return. The water-flow issue is very significant – the project may be taking 90 - 95 percent of the flow of the river, and there is nobody there to monitor what is going on. Is there nothing more than guidelines and if not why don't we have laws to mandate water flow? Secondly, what is the capacity of your department to actually see what is going on in these projects and be able to visit them at critical times?

Glen Davidson responded:

There is no specific law that says what kind of flow has to be left, assuming you are talking about the in-stream flows or the water that is left in stream that is not running through turbines. The legislation that oversees the water removal is the Water Act and as part of that every new license going out the

door has some sort of minimum in-stream flow, if it is required. There might be cases where there is no in-stream flow required. Every license that I have signed has had some sort of minimum in-stream flow – this is determined on a site specific basis with DFO, our Fisheries people, and environmental consultants.

When there are those kinds of conditions in the water license, there are also conditions around measuring and reporting the numbers, and that information has to be delivered to us for our review. We also make use, during construction, of engineers who are independent of the project design, and environmental monitors and in addition we have staff on site from time to time auditing what is going on. Together with a number of staff from our Surrey office, I have visited the Plutonic sites. However, budgets are very challenging. This is not the only game in town – there are a lot of water licenses out there.

We tend to visit those sites where we know there are issues or where there is active construction. We do not inspect every site on a daily basis – we rely on reporting from the proponents and our confirmation of those reports.

The participant responded:

Is the in-stream flow information on every project publicly available?

Glen Davidson:

It certainly is. In many cases, it is right in the license document and all water licenses in BC are online. You can search the database and get copies of any water license in the province. Where it gets a little tricky is sometimes there are subsequent orders and other pieces of supportive information and that information might not be readily available, but you can track it down. It would be best to start with the license –that is the fundamental document.

### **Issues related to planning and monitoring of projects**

Tzporah Berman addressed a question to Adam Silverstein:

I am curious about some of the concerns that you mentioned. I assume because you mentioned these as concerns that you are not seeing them caught in the permitting process or the EA process, depend-

ing on the size of the project. If there are issues that are not being addressed in either the planning or the monitoring of projects, then what needs to happen, from your perspective?

Adam Silverstein:

Perhaps what I said was misinterpreted. My intention was not to say that the issues were not addressed as part of the environmental assessment, or the Fisheries Act review process, but rather that these were the challenging elements that DFO was experiencing in the reviews. It comes back to the broader discussion about trade-offs and risk management and different risk tolerances. The intention of my comments was to highlight the issues that DFO is looking to manage in these review processes.

### **Setting a standard for the projects**

Tzaporah Berman:

Earlier I mentioned the idea of taking some of the primary concerns around the design of projects and identifying them as criteria or first past the post principles that could be used to set a standard for the projects. Part of the problem, both with public concern around the projects and some bad projects being proposed, is that they may or may not be caught in the EA permitting system. I don't think there are clear enough principles out front. Some of these issues may be addressed by the Green Energy Task Force, specifically the Resource Management Task Force. We need to have better criteria to assess ecological impacts of projects; for example, megawatts produced versus length of transmission line. Another of the criteria that we need to consider is size. We hear a lot of the small is beautiful concept. If we marry the need to produce clean energy as quickly as possible and create a low carbon economy, I am not sure whether small is really beautiful. Even from an ecological perspective, in terms of fragmentation and transmission lines, I question this concept. The issue of size should be on the table as a key ecological and design consideration in discussions about green energy. Do we actually need fewer larger projects in areas that can handle them, instead of so many small projects? In the environmental community, do we tend to defer to smaller, assuming that small is necessarily going to have less of an ecological impact?

Adam Silverstein responded:

Criteria have value but I think you need to also think about a broader application of those criteria, because establishing criteria is about creating policy and policy has impacts beyond just IPP projects. For example, I am not advocating this but I'm going to raise it as a counter-balance for people to think about, and that is the principle of not allowing independent power projects in salmon habitat. That is a very challenging issue for DFO – but please note that I am raising this as something to think about and not as a position of the department. We authorize impacts to salmon habitat for uses of other industries such as log sorts, aquaculture, shipping, and things of that nature. The IPP industry might argue, why not for their industry as well? DFO is concerned about the impacts from all of those industries and we have to manage all of those challenges. When you set criteria, I think you need to take that broader perspective.

### **Size of projects**

Glen Davidson responded:

Size is something that I have been thinking about too and I haven't come to any personal conclusions. Are we better off with a lot of small projects or one or two large projects? Generally, the large projects are storage projects. When I look at a potential large project like Site C, it strikes me that it is far away from the load centre, and would require a lot of transmission. Is that better than a number of small projects with a lot more transmission lines of a smaller scale, potentially closer to the load centre? Some of the large storage projects operate at fairly high efficiencies, around 90 percent; that is, 90 percent of the water going through the turbines at any one time. Smaller run-of-river projects have no storage and operate in the 40 - 50 percent range, so you have to build a lot more of them to equal one large storage project. This is the trade-off we have to consider in terms of size. We have to ask: Where is the load? How much power transmission do you build? and Do you build a lot more of the small projects to support you in low flow times of the year?

## Assessment of projects in the Squamish First Nation territory

Randall Lewis:

I remember going to watersheds as a young boy hunting with my late father and uncles, where glaciers used to be, but there are no glaciers there today. Size is important – especially if you are relying on the amount of snow pack with these watersheds.

In the case of the Ashlu development, we required that they move the powerhouse 174 metres up the river so as to clearly get out of the fish riparian zone. We went to the site which was large cobble boulder and the proponents noted that it was not fish habitat. But we said, “Not now, we just had a freshet, but let’s come back here in July.” Of course, when we came back in July it was clear that this was fish habitat. These impacts obviously have to be assessed on a seasonal basis.

We made a weir that can inflate and deflate, with water coming over the weir, on top of that watershed. Because of concerns for safety measures for some of the kayakers going down the rivers, we can hold back some water and control the flow regime going down the canyon. There is another watershed just below the Ashlu with a fee-simple landowner. We inspected the site and thought that it was too small for this type of a project. Also at the bottom, there is some old growth habitat and there are fishery channels and grizzly bear habitat as well as traditional medicinal plants. The developer and the private landowner told us that they would proceed with the project with or without our consent. At the end of the day the Squamish Nation acquired that land for the fair market value, plus a bit more, and we placed it in the land’s trust to protect it in perpetuity.

We have said no to other projects in our territory including Fries Creek, where there wasn’t a water diversion going back into the main system, and there is a resident steelhead population – it is unique and described as a Conservation Unit under the Wild Salmon Policy.

We look at these different aspects of potential power generation projects in our territory and we are diligent in reviewing them. In addition to the review process through the Canadian Environmental Assess-

ment Act by the federal and provincial governments, we are active in ensuring that they do their job.

## The expected changes associated with climate change and impact on BC glaciers and river flows

Tom Pederson:

Randall Lewis touched on something very important and I want to reiterate the key point in terms of the rate of climate change. He pointed out that the glaciers that used to be there in his territorial homeland are no longer there. Keeping in mind that the big picture is that the rate of carbon emissions are driving the changes that Randall has been seeing and that the changing context in which we have to consider everything is happening within a single human lifetime, we have got to get a handle on this rate of change.

In terms of river flows in British Columbia, we are going to see large scale changes in the future. James Mack briefly alluded to this in his opening comments. We are going to see more extreme weather events and more rain on snow events as well as earlier snow melt, in some jurisdictions. We are going to see relatively rapid change over the lifetime of the projects that we are discussing here in terms of run-of-river, for example. And we need to get a much more rapid handle on the changing context in which we are putting carbon into the atmosphere. This brings us back to the big picture. We have got to stop putting carbon into the atmosphere.



### **Concerns about the Peace River valley and Site C**

A participant commented:

My comments relate to the discussion about size, Site C, and the historical experience of the Squamish Nation. I have been asked by the Peace Valley Environment Association and the West Moberly First Nation to come here to speak about Site C. I will begin by recognizing that we are in Squamish territory and thank Randall for the perspective that he presented.

I would like you to visualize what is really going on in the Peace River country, especially the river. The Peace River is one of the largest, most important rivers in North America and the only river that transects the Rocky Mountains going from west to east, anywhere. It goes from west to east and because of the warm weather regime coming through from the Coast, that does not exist in the mountains. It is the only place that has the warmth in the winter that is critical for the survival of animals. At the same time, the river, as it carved its way over millennia through the mountains, created really rich soils. In fact, the river has the richest farmland in Northern Canada - class one and class two agricultural lands - in the bottom of a relatively wide valley. The river has already been impacted by two massive dams, which provided most of the hydro for British Columbia for years, the WAC Bennett Dam and the Peace Canyon Dam. Among other things, these dams have eliminated the habitat for 4,000 moose and some people there traditionally survived by eating moose.

What is left of the river in British Columbia is the narrowest point in the Yellowstone to Yukon ecosystem. This is the connecting point for the maintenance of wildlife populations up and down the Rockies, connecting the rich ecosystems to the north and Muskwa-Kechika to the Rocky Mountain systems further south, and this is the place where the animals survive in the winter. This warm connection is important for wildlife to move east and west and also north and south and it is also where the moose, deer, and various ungulates survive in the wintertime and the wolves and other predators survive by eating them.

The class one agricultural land has the potential to feed all of Northern British Columbia. Hydro is billing this as a green project. However, the transportation costs to bring those agricultural products from the

south alone is not a friendly, green process. The methane gas that would be released from the rich soils into the atmosphere will also have an impact on climate change. Further, the reduction of the remaining timber in that place, which stores carbon, will not be a green process. In addition, the potential economic cost could be from \$7 - 10 billion.

The same thing is happening now in the Peace River country that the people of the Squamish Nation experienced. People feel that the deck has already been stacked against them by Hydro and the government, and there is no support from the southern residents of BC. The media will not cover it because it is too far away and some people say that it has already been damaged so why not proceed.

However, this is a place where wildlife survive and where people gain their food and livelihood and where they recreate as the West Moberly First Nation has been doing for 10,000 years. Please pay attention to the details and be aware that up in the north there are people and wildlife who need this river to survive. Imagine putting dams on the Fraser River? It is the same kind of thing for those people in the Peace River region. It is not just an either/or - let's do a whole bunch of smaller run-of-the-river projects or let's whack the Peace River one more time. It is an extremely important issue for the survival of folks in the North and for climate change.

### **Dealing with trade-offs**

Michael Harstone:

We continue to return to this topic about trade-offs. I don't think that there are any options out there that don't have trade-offs associated with them. Our challenge, as a collective group, and if we are ever to have a vision for green energy as a province, is to think of ways or the ingredients that would actually move towards that vision for green energy, recognizing that these different projects have different impacts that affect people in very real tangible ways. How do we build a vision that everyone can live with?

### **Energy conservation measures**

A Chilliwack High School student, commented: How many of you drive to work? And the rest of you walk to work or bicycle, car pool or bus? How many

of you own multiple TVs and computers? How many of you take five-minute showers or less? And how many ladies used a straightener, curler or blow dryer today? We are just a tiny percentage of the human population, but I think that if we work together and take the leadership, we can reduce our ecological footprint significantly. We can achieve higher success if we all work together.

In our leadership class at school, only about half of us dressed up for Halloween. We were supposed to say, "Hey school, dress up for Halloween," but how were we going to get everyone to dress up if we were not dressing up ourselves? If I was not a leadership student and I saw leadership students just walking around with their normal clothes, I wouldn't want to dress up. There needs to be a role model for leadership.

If we don't take initiatives ourselves, then how are we going to expect big differences? The climate change we are seeing is not going to change by itself - we, as humans, need to start in a small way and work higher and then we can accomplish bigger goals. If we can all cut down on what we use, in the long run, it will work.

### **On the feasibility of tidal power**

Ed Mankelow posed the question:

We have been discussing a variety of green energy projects, and it seems to me that there is one alternate that hasn't yet been discussed – that is tidal power. Recently, BC Hydro announced that they will reject tidal water power in their alternate energy quest, calling it "new and unproved power technologies". This is a technology that I believe we should pursue. It is not scenically obtrusive, as some of our alternates are. It relies on the tides, which will be consistent and reliable, far more reliable than wind power and possibly even run-of-the-river. The reason that it has not been accepted is that it is, to some extent, unproven technology and as such, finds it difficult to attract investment. Without investment, the technology cannot be proven. Do you believe that we should be considering tidal power in our alternate energy quest?

Nigel Protter responded:

I invented wave energy technology and started a company called SyncWave. I am also a founding member of OREG, the Ocean Renewable Energy Group in BC. I am quite familiar with tidal power and will be addressing it later. Tidal power is one of a basket of new, unproven technologies. The big problem with tidal power is that the permitting cycles are going to be similar to large hydro. It is very complicated ecologically and technically.

Shelley Murphy responded:

From a government policy perspective, ocean energy is a future resource that could play a strong role in BC. You are right that it is a relatively new and developing technology and the cost of energy from that technology is higher than conventional alternative energy options. The press release for the Green Energy Advisory Taskforce on Resource Development specifically noted that they will invite input from solar, tidal, wave and other clean energy sectors, to develop strategies to enhance their competitiveness. It is definitely an issue that is on the agenda.

### **How much energy is generated during the spring freshet compared with other times?**

A participant directed a question to Glen Davidson: Do you know what percentage of power is generated during the spring freshet and what percentage is generated at other times?

Glen Davidson:

I don't have an answer to how much is generated in the spring - it really depends on the load. I would not expect that to be the highest generation because the load is highest in January and February and that is when BC Hydro is running flat out on the big facilities and taking as much as they can from the other facilities. They would certainly back off in the spring when there is much more run-of-river and snow melt going on. But the load is also lower then.

The participant responded:

Do you know how much power is generated from hydro in general during the spring freshet, as compared to other times?

Glen Davidson:

I would expect it would be very high, close to 100 percent of the load.

### **In stream flow diversion for the East Toba Montrose Project**

Another participant posed the question:

I understand that the proponent for the East Toba Montrose project wanted to divert 95 percent of stream flows. The proponent's response to the Ministry of Environment said that the project would not be economically viable if the flows were less. The project was then approved by the Ministry of Environment. Could you please comment on that?

Kathy Eichenberger responded:

The proponent was suggesting lower flows than in the guidelines and in some cases in the past that has been acceptable. In this case, DFO and the Ministry of Environment raised concerns (a) around insufficient information and (b) around the potential impacts resulting from the lower flows. As a result, we approached the proponent and said that we would likely not recommend that a certificate be issued unless they agreed to in-stream flow guidelines that the agencies felt would protect fish habitat. That was what was certified. With respect to whether or not the project is economically viable, that is a business decision for the proponent and does not factor into our environmental assessment. It is a risk that they take. They have to meet these strict standards and for their own sake they have to have a project that is economically viable.

I don't know about the East Toba Montrose project. Is that the one you were referring to? The one that was certified several years ago?



The participant replied:

I was confused because I read the EAO and it said that the project proponent wanted 95 percent and it went back and forth and then the EAO approved 95 percent.

Kathy Eichenberger:

I was thinking of a different, subsequent project.

Adam Silverstein:

From the perspective of DFO East Toba Montrose waters were not fish bearing, so DFO was not involved. The proponent came in with in-stream flows that were much less than our guidelines, exactly as you have described it, based on economical reasons. In the end, the negotiation that was completed adopted a flat rate proportion of mean annual discharge (MAD). Therefore it isn't that 95 percent of the flows are allowed, it is that what remains in place is a proportion of the mean annual discharge over the long term. In terms of 'on an annual basis', the percentage that might be diverted is going to vary from year to year. All the communications are on the public record.

Guy Dauncey responded:

I asked Plutonic specifically about how much of their energy came during the freshet and they told me that an analysis of their project showed 50 percent during the freshet and 50 percent at other times.

### **Proposal for a levy for monitoring attached to water licences**

Guy Dauncey directed a question to Glen Davidson:

The issue of the Ministry of Environment not having the resources to do proper monitoring and follow up studies because of budget cuts is a serious concern. We proposed that a levy be attached to every water license as soon as it enters the approvals process, and then for those monies to be put into a special dedicated fund for the Ministry of Environment to do those studies. Then should there be budget cuts at a high provincial level, they will not impact these studies. Is that a reasonable suggestion or is there some reason why it is not considered?

Glen Davidson responded:

I would need to defer to the Minister of Finance to determine if this is a reasonable suggestion or not. Government has used levies similar to that in the past, so I wouldn't say that it is unreasonable. Where the money goes is another issue. In terms of budget cuts, there is a variety of different budgets. We are going through the budget process right now. The water stewardship division of the Ministry of Environment has come out reasonably well. I don't want to leave people with the impression that there has been a massive budget cut – it is tight all around, but we're not doing too badly.

Guy Dauncey:

This would provide a new, guaranteed, reliable source of income, independent of any government budgeting. The proponents would pay the equivalent of a job development cost charge, specially earmarked to ensure that the ongoing monitoring happens, without which, we have no reassurance that what a proponent says is true.

Glen Davidson:

Similar types of measures have happened in the past. The trick is to make sure that money stays focused on that issue.

### **Criteria for awarding water licenses**

Ray Pillman posed the question:

When awarding water licenses do you check into the soundness of the proposals; that is, the engineering soundness so that they will actually stand up for their 40-year life or more? If you don't, who does?

Glen Davidson responded:

There is a series of authorizations. The primary authorization is the water license which grants rights to divert water. After a water license has been granted, there is some technical design that is required and that must be done by professional engineers. In addition, in most cases, an independent engineer is hired to have another look at the plans, to provide an independent view. We have dam safety people and engineers on staff, so we look to these professionals to ensure that when the project is built it can meet the terms and conditions of that water license. That is the responsibility of the water rights branch.

Ray Pillman:

Is it not BC Hydro's responsibility?

Glen Davidson:

BC Hydro does do a bit of due diligence because they want to make sure that power can be delivered as part of their energy purchase agreement. If they see something that shows that the project was not as reliable as they expected, the conditions in their energy purchase certificate about the quality and the reliability of the power that they buy could apply. However, in terms of public safety and ability to meet the water license requirements, that technical responsibility lies with us in the water rights branch.

A past-president of the Independent Power Producers Association of BC posed a question to Glen Davidson:

You mentioned that you are always amazed and perhaps a bit disappointed in the amount of misinformation that is out there about some of the released statistics and other facts to do with water license applications; for example, there are allegations that all projects get approved. Can you describe, in terms of your earlier comments, the number of projects that are either voluntarily withdrawn from the water licenses applications or rejected by your group or the various reviewing agencies? A sense of proportion would be helpful if you don't know the exact numbers.

Glen Davidson:

In the past when I have been asked this question I have said that on average one third of the applications are approved, one third are refused and one third are abandoned. This may not hold true right now because a lot more applications are in the process, but not proceeding. Over the long-term, however, I would expect that number to hold relatively true. We are not actively pursuing applicants. They may have been sitting around for ten years and in some cases they might even be pipe dreams. I have refused many applications and even with active licenses where they have not made beneficial use of the water I have refused the license or cancelled it.

### **Size of projects, system capacity and climate change**

A retired former manager, BC Hydro, commented: My comment is stimulated by the question that came

up earlier about size of projects. There are some fundamentals that need to be considered in any strategic planning process with regard to any of these projects, whether they be IPPs, run-of-river, or hydro. The issue is around system capacity. BC Hydro engineers used to say that they would pay \$1 for energy, but they would pay \$10 for capacity, where capacity is the ability of a system to deliver energy continuously over a period of time, normally measured over a one-year period. As an example, not that I am in support of Site C, the proposed project in Bute Inlet is rated at around 2,989 gigawatt hours and that is a 900-megawatt plant. The Site C project is also a 900-megawatt plant, but just one powerhouse as opposed to 17 and it is rated at 4,600 gigawatt hours - roughly 50 percent more energy comes from that plant. This is because it would sit below a very large reservoir behind the Bennett Dam. This is something to consider - whether we propose impoundment power projects, hydroelectric projects, or run-of-river projects. There is a clear advantage to one over the other. Also, snow fields and glaciers are in fact reservoirs. They have been reservoirs for millennia, but now they are disappearing. Perhaps a strategy is to think about bigger hydroelectric projects with dams behind them. Those are reservoirs that we can manage - we can't manage the reservoirs that are melting.



# FEATURE CASE STUDIES

Feature Case Studies include:

Taku/Atlin - *Peter Kirby, President and Ceo, Xeitl Limited Partnership and Taku Wild Products*

Kokish River, Kwagis Power - *Ray Pillman, Senior Advisor, The Outdoor Recreation Council of BC*

Sechelt Creek: Beyond Compliance - *David Carter, Regional Power Inc., and Sid Quinn, Sechelt Indian Band*

Initiatives Under Consideration in the Chehalis Traditional Territory - *Chief Willie Charlie, Chehalis First Nation*

NaiKun Offshore Wind Energy Project - *Matt Burns, Vice President Operations, Naikun*

## The Atlin Hydro Project

(presented by Michael Harstone)

One case study is a small power project in Atlin, BC. Peter Kirby, the President of the Xeitl Limited Partnership and Taku Wild Products, was going to make a presentation on the Atlin Hydro Project but unfortunately was unable to participate due to illness. The Atlin project is an example of a First Nation community that went through a bidding process on a request for proposals from BC Hydro and then successfully developed a small hydro project, which took their community of 500 people off the diesel generation grid. It was completed in 2003 - 2004. It is entirely owned by the Taku River Tlingit First Nation and I understand that they are now in discussions about the terms of taking over the generation grid. The diesel generator is no longer used except as a backup system in case there are any problems with the small hydro project. Figure 1 shows a map of the area.

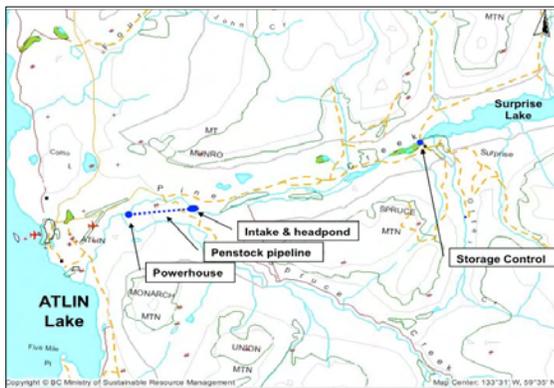


Figure 1. Map of the project location.

Figure 2 shows the results of the Atlin Diesel Generating Station and the Hydro Project included in the Community Energy Plan.

The Atlin CEP (Community Energy Plan)	Hydro Project
<p>A joint TRTFN and BC Hydro consultation initiative for the whole community of Atlin, completed in 2003/04:</p> <ul style="list-style-type: none"> <li>• Electricity Demand Assessment</li> <li>• 20-Year Demand Projection</li> <li>• Energy Efficiency Recommendations</li> <li>• Power Supply Options Assessment:                             <ul style="list-style-type: none"> <li>• Wind study (wind towers)</li> <li>• Connection to Yukon power grid (YEC)</li> <li>• Hydro (pre-feasibility study, 3 scenarios)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• 2.1 MW Hydro project on Pine Creek to replace diesel generators and supply Atlin.</li> <li>• \$711,000 feasibility/licensing phase (in 2005/06)</li> <li>• \$900,000 design, tender and finance phase (06/07)</li> <li>• TRTFN did much of work in-house &amp; have secured an experienced development team</li> <li>• Very high government interest and support</li> <li>• Positive community support</li> </ul>

Figure 2 Diesel Generating Station and Hydro Project results.

## Kokish River, Kwagis Power

*Ray Pillman, Senior Advisor, The Outdoor Recreation Council of BC*

This is a potential project and has not been completed. It is at the advanced study stage. I am speaking mostly from the perspective of the stakeholder interests, the recreation interests principally, and to some extent on the environmental perspective.

## The Nature of the Project

The project is located on the East Coast of Vancouver Island near Port McNeil. It is a 45 megawatt project so did not need to be submitted to the EAO or CEEA. However, the proponent chose to do so. The Kokish River rises on the western slopes of the Vancouver Island mountains and flows through a few lakes, the biggest one being Bonanza Lake. The last lake is Ida Lake and from there the river flows down to the northern extreme of Johnstone Strait, near Port McNeil. It is a very flashy river meaning that it fluctuates within hours of severe rainstorms. It has considerable flows in the late fall, from November through the winter rainy season, with much lower flows in the summer season. From late May until August the river is often very low.

There are three fairly distinct reaches to the river: the upper, the middle or canyon, and the lower reach. Each of these reaches can be used by kayakers in certain flows, the middle one only by experts. The range that is considered safe for kayaking the river is between 10 and 30 cubic metres per second. It is not a major fishing river but there are steelhead and salmon in the river and although until recently it was thought that coho couldn't make it up the falls to Ida Lake, it is now known that they make it all the way to Bonanza Lake, Tom Mountain.

### **The history of the project**

This area was logged and has logging roads on both sides of the river, with the major one on the right bank. BC Hydro studied this river several decades ago with the objective of possibly raising the level of the lake for storage.

The present proponent is Brookfield Renewable Power in partnership with the 'Namgis First Nation. Both partners have expressed the intent of doing the job right, and respecting the input of other stakeholders such as recreationists and fishermen as well as the fisheries and DFO. The project is nearing a point where a final application will be made to the EAO and the federal agency.

### **Details of the proposed project**

There would be an intake structure a short distance below Ida Lake and water would flow from there through 10 km of pipeline, the pipeline being buried underneath a logging road, so there would be minimal additional impact. From there it would flow to a powerhouse that would be located a short distance upstream from where the river flows out to the saltwater. The installation would have five relatively small pelton-type turbines. The transmission line would be less than one kilometre long, connecting to BC Hydro's system.

Overall, the project would have minimal impact on the environment, compared with other projects I have reviewed. It would provide energy to the Vancouver Island grid at the time when it is needed, in the rainfall season. The recreation uses are kayaking - the Vancouver Island Whitewater Paddling Society is involved in negotiations with the proponent as to the windows of opportunity that they will be allowed. Since the flow can be either too low or too

high for kayaking, these windows are not there all the time and are not very predictable. This presents some difficulty in those negotiations.

There are several concerns. The fisheries have not been studied comprehensively. A study has been conducted by DFO and all the other fish interests but not yet by the sport fishing sector, and that is the number one user. Other concerns are navigation and the use of the river for kayaking. There are also aquatic ecosystem concerns. However, because the river is so flashy the freshets would be there quite often. It wouldn't be a question of a completely different stage of regulation for the river. I also have some engineering concerns, including questions about the nature of the designs, but I am told that those designs are preliminary and that there will be good designs produced later. My view is that this has the potential to become a model project. Whether or not it will depend on how the negotiations go, how the fishing interests are met, and whether they obtain a certificate from EAO.

### **Sechelt Creek: Beyond Compliance**

*Nigel Protter for Dave Carter, Regional Power Inc and Sid Quinn, Sechelt Indian Band*

I have been working with Regional Power for the past seven years in my specialty of sustainable electricity development. Regional Power developed the Sechelt Creek project that is described in the following video. Sid Quinn, Manager of Resource Management for the Sechelt Indian Band and David Carter, founder and Executive VP of Regional Power cannot participate in this meeting because they are meeting with the National Director of the Aboriginal Skills Employment Partnership at Sechelt to create a training program for First Nations hydroelectric workers. In their absence, they provided a video about the Sechelt Creek project in Salmon Inlet, which won the 2005 UNESCO International Hydro Association Blue Planet Prize for the world's best example of sustainable hydro power at the time (<http://www.sfu.ca/cstudies/science>). The project was completed in 1997.

The following are excerpts from the Video Presentation:

"We need to change the way we do things. The Stone Age didn't end because we ran out of stone. It ended because we came up with better ideas. Fossil fuel

use should end because there is a better way of doing things, not because we have run out of them. We did this because we believed it was the right thing to do. We needed to enhance the area and have a project that we could be proud of, together with industry and other levels of government. Not everybody was on side at first. We had been studying the area and discussing our options. ... We felt that with the impacts that had happened on the stream in the past - the stream more than likely had breaks at the bottom and it had been channelized - we needed to put back in some off-channel habitat. With this off-channel habitat, even though it is manmade, we have tried to mimic nature as closely as possible. We have created spawning pools and alcove areas.

How did we actually build the channel? We used an excavator and then added gravel and also put some boulders in place. We started with the concept in the early 1990s and by the time we were through the permitting process, it was 1997. They talked about whether or not it would be best to do a satellite program with the hatchery in Sechelt, or to build a small hatchery facility here. Once we visited the site and saw where we could build a spawning channel we favoured the natural channel restoration rather than the hatchery.

There was groundwater but we felt that it would be better to augment the channels. We didn't necessarily want to tie it right into the raceways of the hydro plant so we built an intake to get the pool just on the upside of the channels. We also wanted to be sure that there were no negative impacts on the natural area of the stream. This was something that we literally had to fight for.

The project that we built before this, the Wawatay Generating Station on the north shore of Lake Superior, was exactly the same. We put in an enhancement area and it became a tool for us to go back and say, "Have we improved what was there before?" This has been very good in convincing people that small hydro isn't all bad and that you can actually have net gains in development, particularly where there has been manmade impact, and where there has been channelization destruction of habitat. Rivers are very dynamic and sometimes they have suitable spawning areas and sometimes they don't. What we have done here is create a habitat that is ideal. And the

salmon use it.

We are not in and out. We are the same people who built the facility in Dryden, and at the Black River on Great Slave and at Dease Lake - a total of six projects built in those towns and communities. There aren't too many projects that can be undertaken where you actually get a net gain but I think we have achieved that here. This tail race has been specifically designed to provide what we hope will be spawning facilities for a wide range of fish that frequent the area."

### **Initiatives Under Consideration in the Chehalis Traditional Territory**

*Chief Willie Charlie, Chehalis First Nation*



I want to share my perspective, which is probably the same as many First Nations, on how to go forward. I tend to be a storyteller according to the culture and the traditions and that seems to be the only way that I can give the First Nations' perspective. I congratulate you, the professionals and scientists, for the commitment that you've shown to developing an understanding of the field that you've chosen to work in. But we need to pay respect to the traditional knowledge of the land as well.

Traditionally, historically, I would have been the storyteller. I can go to almost any part of my traditional territory and tell you stories that go back to the beginning, that talk about all the different eras that we have come through as a people. I'll share with you the story of our creation.

They say before the world was created the sun and the moon had fallen in love with each other. But they were at such great distances in space that what they did was to send their emotions and their feelings toward each other. And where those feelings met was where the world was created, out of the love between the sun and the moon. At the beginning of time we were all the same. And it was through evolution that some took different shapes and forms. Some became the winged and some the four-legged furbearing. Some became the plant and the root people and some became the ones that swim in the river and the ocean, and some became human. There was an agreement in time that all our relations, all living things, would give themselves to us as the human because we were the weakest. They would give themselves for food, shelter, clothing, utensils and medicine and all the things that we need to survive. All they asked for in return was to be remembered and be respected, and for us to only take what we needed and if we were fortunate to get more than that, to share with those that were less fortunate.

The laws of life were that simple - how we were supposed to pay respect to all living things and how we were supposed to share with those that were less fortunate. When I talk with my relations and we talk about being stewards and about all living things it is because of those laws of life. We still practice that and it is still passed on to our children. Our straight translation of ho-muck means "the people" or "the real people", people of the land. We look after the best interests of Mother Earth.

There are a number of projects going on, or proposed for, or under development in the Chehalis Traditional Territory. We try to look at the whole picture and recognize that everything affects everything else. Whatever you do in one area is going to have some effect somewhere else. There are many examples of resources being extracted without giving thought to the whole system.

We know we need to come together with all interested parties. One of the really important laws that I try to follow as a chief, as a parent and a grandparent, and as somebody from the land, is the one that says we are supposed to look after all things so that at least seven future generations will have the same

things. I don't want to be remembered as the generation that lost the fish. Fish is who we are. We're the river people. Our greatest resource after our children is the salmon. So whenever anything goes on in my territory, I ask about the potential impacts on the salmon. Salmon are the main source of food for us as a people, not just physical food but also spiritual food. When we can't have that first salmon ceremony to pay respect to the spirit of who we are, to cut through that food that's been the mainstay of our diet for so many thousands of years, then it's like we are empty.

### **NaiKun Offshore Wind Energy Project**

*Matt Burns, Vice President Operations, NaiKun*

Thank you to Chief Charlie for a profound message and perhaps a segue into my presentation about our partnership with the Haida Nation. I'll provide a brief background on our project and then describe some of the specifics of our partnership.

#### **Who are we?**

We are a small BC based developer and we have a single project that is offshore. We have offices in Vancouver as well as in Skidegate and Masset on Haida Gwaii. We have bid into the current clean power call and if successful we would become Canada's first offshore wind project.

#### **NaiKun Wind Project**

The proposed wind farm is for Hecate Strait between Haida Gwaii and the mainland. This is a world-class wind resource with an average annual wind speed in excess of nine metres per second, which would produce 396 megawatts, enough to power 130,000 BC homes. There is a critical mass required for an offshore wind project and ours is sized to meet the capacity constraint between Prince Rupert and the Skeena substation on the mainland. There will be 110 turbines spaced approximately one kilometre apart. The wind farm will be located eight kilometres off the east coast of Haida Gwaii and about 90 kilometres from Prince Rupert. We are also proposing to build HaidaLink, which would take power off the wind farm and provide both wind and grid power to Haida Gwaii, connecting Haida Gwaii to the provincial grid. This will take them off the diesel fueled power that they currently use and that produces 26,000 tons of GHGs annually. Figure 1 shows a map of the

project.

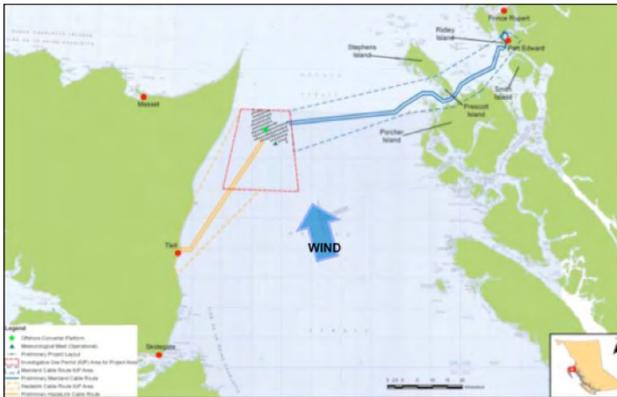


Figure 1. NaiKun wind project site.

The large box is our investigative use permit. The ‘blob’ as we refer to it is the 110 turbines and it occupies a space of about 100 square kilometres. To the west is the HaidaLink cable landing at Tlell, with the mainland export cable to Port Edward, south of Prince Rupert. The main wind resource comes from the southeast.

Figure 2 shows a graphic representing the various project components.

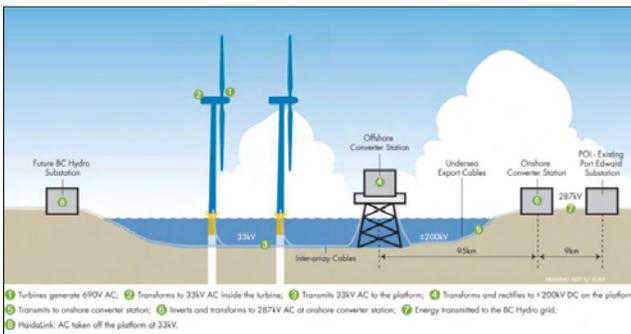


Figure 2. NaiKun project components.

The power will be gathered and then shipped to the mainland where we will have a converter station joining at Port Edward and there will also need to be a substation on Haida Gwaii.

### Project timelines

Our proposal was submitted to the Clean Power Call in November 2008. We are now working on environmental assessment on both the federal and provincial tracks as well as through a separate and distinct

Haida process. We expect to be out in the water in 2011 or 2012, and fully operational by 2014.

### Haida Nation partnership

In addition to the Haida Nation, we are working with other Tsimshian Nations, the Laxkw’alaams and the Metlakatla, in addition to the Gitgatla. The Haida Nation is a united government under the Council of Haida Nations with two tiers and two band councils. We liken it to the Haida Nation being the federal government level and the two band councils being the provincial level or local level. One of the good things about working with the Haida Nation is their clarity around their traditional territory. There is no overlapping traditional territory. As well there is a very visionary leadership and a strong awareness of and participation in our process. From having participated in many public meetings I can tell you that there is a lot of involvement in our project.

What follows is our perspective of the relationship. We have presented this many times with Haida representatives and I hope it is reflective of their opinion as well. People often ask what our motivation is for having what we consider to be a deep relationship. In addition to simply being smart business, we also think that it taps into the local knowledge of the Haida Nation. It leverages their existing relationships and as anyone who is developing a project knows you need to ensure tenure and social license. We think that the best way to do that is to bring the Haida Nation to the table as equal partners.

Ian Gill’s recent book chronicles our false start with the Haida. The discussion went something like this: “We are coming to build a power plant here. What do you think?” We were met with a response that we didn’t like and we left shortly thereafter. But we came back and, over a number of years, have built what we believe to be a foundation of trust. Central to our philosophy is the assumption of tenure. We assume, like the federal and provincial governments, that the Haida Nation has tenure over their lands and as Chief Charlie alluded to with his nation, they see themselves as the rightful overseers of that territory and we respect that. Importantly, we spent the first five years getting to know one another, and it was only recently in our relationship that we formed actual agreements. A lot of that has to do with understand-

ing the leadership’s vision and their priorities. The relationship was established in 2002, and an MOU was signed in 2007. A commercial relationship was established in 2009 and there is ongoing continued engagement.

**Aligned interest**

It would be very easy for us to simply write a royalty cheque to the Haida government, but we want to do more than that. We want to build capacity. They share that vision. We want to make sure we provide local economic opportunities and ongoing engagement, and ensure that they have the capacity to deal with what is a very sophisticated project. Something else that we share is to provide opportunities locally for employment. At the top of the list is environmental and social sustainability.

**Lessons learned**

We talked about the foundation of trust. That means having the same faces at the table and understanding cultural differences. Where a mechanism to advance collective interests does not exist, you have to invent one. The Haida did not have a permitting process, so we worked with them and modeled it based on other examples, and we now hold a Haida permit in line with our provincial permit. We worked together to establish this. It is an ongoing relationship – the project is going to last 40 years or longer and we have to keep working together. In the past the Haida have seen a lot of non-native people from Vancouver show up and promise lots of jobs and training.

There are two important aspects to our commercial arrangements. We have established the Haida NaiKun Wind Operating Limited Partnership. Our company will operate the wind farm once it is built. It is a 50/50 partnership. The second point is that we have made an offer to the Haida Nation to purchase 40 percent of the project itself. It is a \$2 billion project so that is a large amount. They had expressed a desire to own and hold the actual physical assets. The issue with that, of course, is having the capital to build this project. If you can’t come to the table with money, you can’t participate, because money is needed to buy the turbines and pay for the vessels to install them.

We have got through that and think we have a way to move forward. It is similar to what the Inuit are

developing with the Mackenzie Valley pipeline - a loan guarantee. The Haida are working with the federal government to establish that and if successful that will give them the capacity to borrow money to invest in this project. That will keep the equity return in the community. An alternative would be to sell 40 percent of the project to a big bank in Europe and all of the equity profits, which as everybody knows are the best kind of profits to have, would end up in Belgium or France or the UK. Allowing the Haida to participate ensures that those profits stay on the North Coast and that is certainly desirable for both of us.

Figure 3 describes the project structure. There are three main entities: the Naikun Wind Groups, Enmax, which is the Calgary City organization similar to BC Hydro, and the Haida Nation.

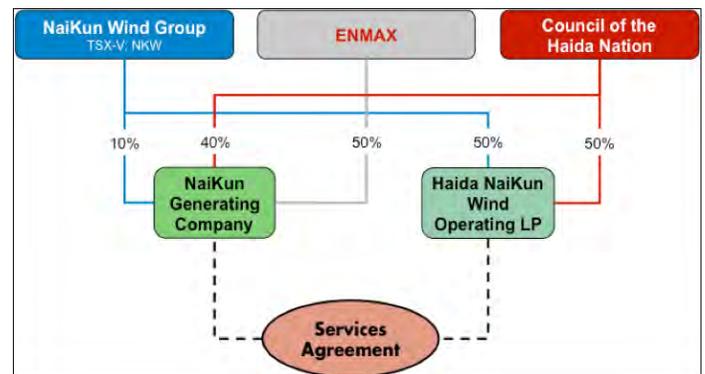


Figure 3. NaiKun project structure.

Assuming that the Haida would exercise their option, they would be 40 percent holders in the generating company that holds the plant. We are partners in the operating company and we would have an agreement to provide services. That is how the cash flows and the job benefits get to the Nation.

**The triple bottom line**

Figure 4 describes the triple bottom line that the Haida have presented to us. Environmental stewardship is always number one and the Haida view themselves as the protectors of the earth and the water. There are some initiatives that we have undertaken to address that.

We are on the ground in Haida Gwaii this week talking about employment and training and how we will

deliver on that - it is all about setting reasonable expectations. What is a reasonable goal and one that we can achieve? At the end of the day, what is the revenue to the Haida Nation?



Figure 4. The triple bottom line.

## DIALOGUE

### Monitoring in the Sechelt case study

A representative from the BC Ministry of Environment directed a question to Nigel Protter with respect to the Sechelt IPP:

In the spirit of the holistic approach described by Chief Charlie, what is your opinion about the assessment of impacts and the compensation work for salmon below the powerhouse? I have done a number of operational monitoring reviews of projects, not only in my region but also throughout the province. When you look at the project itself and the obligations for monitoring in-stream flows and fish habitat in the diversion reach and in the reach upstream of the dam, you may find that it is an old project that was licensed over a decade ago and there isn't anything in place in the way of requirements for submitting monitoring results. All it takes is a review of historic air photos, before and after, to see how the diversion reach and the reach upstream are changed basically through challenges in getting sediment past the dam. The diversion reach is essentially devoid of sediment while the reach upstream for several kilometres is filled with sand. There is also a lot of anecdotal information suggesting that Dolly Varden populations have been negatively impacted. How do we balance the review and the assessment of the impacts for all species - not only fish but also species

that might be affected by these projects - when typically at the front of peoples' minds, including review agencies, are often the big things that taste good?

Nigel Protter:

I don't have the answers to your question but will remind you that David Carter is a person who is always looking for a better way to do things. So that you understand the context relative to the information in the video, Dave Carter built and developed Canada's very first private hydro project. He is a forward thinker and probably the first one to say that there is always a better way and we can always improve. If you examine the work since the beginning you will see continuous improvement in the operations. At that time it was certainly the best and it is still quite a remarkable project. Also, the Sechelt Band has been engaged from day one in monitoring.

The ministry representative responded:

The concern is moarly to do with the monitoring of the salmon populations and the compensation works downstream of the powerhouse. Again, that is typically how monitoring is focused.

Nigel Protter:

The point that you are making is a lesson; that is, we can always do better. You are saying that this is something that should be looked at as well.

Michael Harstone summarized:

A message then to keep in mind in terms of measuring the success of hydro projects is the notion of an adequate monitoring program that gets built into the project as it unfolds.

The ministry representative responded:

There also needs to be some sort of an adaptive component such that you not only monitor but also review the monitoring reports and integrate the results into subsequent decisions.



Another participant directed a question to Nigel Protter:

With respect to the Sechelt Creek project, I went to a hearing for the Ryan River project, another project being proposed by Regional Power. They spent more time talking about the Sechelt Creek project than the Ryan River project because they are so proud of it. I made some enquiries on the Sunshine Coast about the project. I heard that there were a number of landslides involved in the early phases of this project and the restoration work that was done below was part of the no-net loss policy for fish habitat. Do you know anything about that? If not, could you get somebody to clarify that for me?

Nigel Protter: I don't know anything about it, but I will follow up with you.

### **The Kokish case study**

A participant directed a comment to Ray Pillman:

In your description of the Kokish case study it was good to hear that the proponents now know that there are salmon right up to Bonanza Lake. However, I think it is also worth sharing the fact that there has been a salmon enhancement facility on the Kokish, the Kokish hatchery, which has been operational for more than a decade. As an IPP case study, it should be noted that there is First Nations' involvement, that it is salmon bearing and also that there is a long standing salmon enhancement facility on the river.

### **The Naikun case study**

Ian Gill directed a question to Matt Burns:

In your presentation about the wind farm you talked about community involvement. Where did that take place and what was their reaction?



Matt Burns responded:

We went to the UK, and visited wind farms. One visit was to Scroby Sands, which is off Great Yarmouth on the East Coast, ironically in the natural gas port for the southern North Sea. Another site visit was to the Robin Rigg farm in the Solway Firth between Scotland and England. We took six people there and our intent was for them to talk to the project developers and to give them some time in the community to talk to people. My perception was that they heard all of the same issues that have come up through our consultation and environmental assessment process. That gave them some comfort because these were established operations - in the case of the Scroby Sands wind farm it has been operating for seven or eight years. Without exception, I think they came away seeing this as being a real alternative to other methods of developing electricity, namely the diesel on the islands. Overall, my interpretation is that it was a positive reaction.

A student from Chilliwack Secondary directed a question to Matt Burns:

I am really glad to hear that you are going to take Haida Gwaii off of the diesel and that this will reduce the carbon emissions. But you did not mention anything about the environmental impacts that the wind farm will have on the ocean floor. You noted that the wind turbines would take up to 100 square kilometres of marine space. I am concerned that the ocean life, which is mostly on the ocean floor, is not going to be as abundant as it was before, due to erosion.

Matt Burns:

We have undertaken a comprehensive environmental assessment. The major component of that assessment was on the marine life and ensuring that we undertake this project in such a way that it will have minimal impacts on that sea life. I can provide some additional numbers about the footprint of the farm itself. Dogfish Bank is where it will be placed. The footprint would be about three percent of that entire area. The towers are approximately one kilometre apart and the tower itself is about five metres in diameter. We provided two cases for erosion in the area and the worst case of the two is about one tenth of a percentage point of the overall footprint. All of the information is available on the EAO website, including the potential adverse effects on

marine mammals, pelagic and benthic fish and macro invertebrates. The conclusion of our assessment was that there are no potential significant adverse effects. This process has been underway since 2003 and there is a lot of information available.

A participant directed a comment to Matt Burns: Like many people here I share both a sense of urgency around climate change and concerns about the impacts that it would ultimately have on the wild salmon systems of the North Pacific, as well as specific concerns about what might happen as we try to address that with new forms of development and come to understand the associated complexities. I am interested in your earlier false start with the Haida and your struggle to determine how to proceed. It seems that when we tackle project-by-project or place-by-place issues without a strategic approach we often think we will get there faster but, in fact, we learn that it takes longer if projects move forward without the social license. In the period of time that you described there was also the development of a sophisticated land use plan by the Haida Nation, which I assume would address to some degree the ability to put in and locate infrastructure. How much influence did that strategic level planning have in enabling the project to go forward in a way that was acceptable to the Haida, if at all?

Matt Burns:

There is a process under way called PNCIMA, the Pacific North Coast Integrated Management Area. Quite independently, we have both expressed our support and intent to participate in that process. Our organization and the Haida Nation see the benefits in spatial planning and having a strategic approach. Therefore, although there was probably no overt effect on the relationship, I think it underlies where we are both coming from. In terms of whether we discussed with the Nation where they wanted to have certain things, that did not really come up. But we both share those types of concerns and the need to look at the big picture.

Ed Mankelow directed a question to Matt Burns: What was the average wind speed that you said was perfect?

Matt Burns responded:

At our site it is in excess of nine metres per second average annual wind speed.

Ed Mankelow continued:

One of the problems with wind power, according to studies in Australia and Europe, is that it is unreliable, and when the wind doesn't blow, it doesn't turn and then when the wind blows too much, you have to shut it down. The wind blows very hard at your proposed site, possibly at velocities where it would have to be shut down. What would you say would be the efficiency in an average year of that proposal? I have seen this on the Thames River and it is the same problem.

Matt Burns responded:

When you are building an offshore wind farm, you want to see a capacity factor in the neighbourhood of 40 percent. Ours is slightly in excess of that. What you are referring to is called spillage, when the wind blows too hard, and we have assessed that. The turbines that we are talking about cut out at 25 metres per second, and that corresponds to a wind velocity of about 90 to 100 kilometres an hour. We have a meteorological mast in Hecate Strait and we have been collecting wind measurements for over two years. In addition there are a lot of previous data that are available to us. When you are building an offshore wind farm you need three things: wind, a shallow sea floor and access to the grid. The most important thing is the wind resource and we have done an extensive analysis of that, including issues like spillage and annual profile. One of the good things about wind, particularly offshore wind in BC, is that it complements hydro very well, especially in our case. There was reference to this earlier with respect to the freshet. Our project is winter peaking - the wind blows hardest in December through to February, which works well with the existing profile of the heritage resources.



A representative from the investment community directed a question to Matt Burns:

I assume that you are developing the first of multiple phases for this particular project. Your footprint shows a fairly large area over and above the current footprint of the project. Did the environmental assessments by the federal and provincial governments and the Haida Nation cover the overall long-term vision of the project? Second, does the equity participation on the 50/50 deal as well as the generating company deal reflect the entire project or just the first phase of the project?

Matt Burns responded:

We have contemplated additional phases, but the amount of work put into anything beyond the first phase is minimal. We have talked about the approximate size but that is about it. The Haida Nation agreements with us very clearly have to do only with the first phase. With respect to the environmental assessment, we did look at cumulative effects. The cumulative effects section talks about a number of projects in the region including an additional offshore wind project. We are very clear that in developing this project we have to prove and demonstrate both the economic and environmental sustainability. Any future phases would have to undertake a separate and distinct environmental approval. With each additional wind farm in the area, the relevance of the cumulative effects gets greater. We understand and acknowledge that.

An environmental consultant directed a question to Matt Burns:

You discussed the issue of the environmental assessment impact review for marine species. What was undertaken for shorebird interception and adaptive management for mortality and unseen disturbance to migratory pathways?

Matt Burns responded:

With respect to marine birds, we undertook both aerial and marine studies of the populations and these have contributed to the overall knowledge that this is a very important bird migration area. As an overarching statement in our application we have committed to practicing adaptive management. We recognize that this is the first offshore project in North America and as much as we have gained a

lot of understanding and knowledge from some of the European projects it is important, for us and the regulators, to understand the specific local effects. Our certificate is on the website and you will see that we have developed a comprehensive framework for adaptive management as it relates to marine birds. That was at the request of the regulator and it will be available for people to review.

Another participant directed a question to Matt Burns:

You mentioned that there was a separate Haida environmental assessment review. Can you speak to that and how it might have differed from the provincial or federal assessments?

Matt Burns responded:

The Haida had a desire to have their own separate and distinct process. They consider themselves the government. We respect that. They wanted to make sure that there was a process that focused on their priorities as those priorities may differ from the federal/provincial mandates. We made an application to them at the same time as the federal/provincial governments and they retained some experts to undertake a peer review of our documents. Much as we did with the agencies from the federal/provincial governments, we sat down with their experts and went through the follow up and monitoring and mitigation plans and made sure that those were developed to the satisfaction of the Haida Nation. There are some differences, mostly with respect to the emphasis on the results. Again, that is reflective of the priorities of the Nation.

### **The Environmental Assessment process for small power projects and public consultation**

Guy Dauncey directed a question to Steve Davis: For projects that are 49 megawatts and under would there be willingness by proponents, as a standard operating practice, to publish all of the studies they do on their websites, and show clearly both the studies and the public feedback? That would provide full transparency with projects that are not going through the EA process. Or is there resistance to that? Secondly, would proponents be willing to follow a new protocol for public meetings and hearings so that if there is a request from the nearby town the meeting will be held in that town? Also, if there is a

request for a facilitative process including opponents, proponents and the local community, is there a protocol so that you would systematically work through the issues with the intention of reaching agreement? And is there a protocol for dialoguing on the issues on which there is confusion so as to make progress instead of public hearings being either gong shows or people coming out more confused than they were before?

Steve Davis responded:

Obviously I can't speak on behalf of many proponents. But I have raised that concept and you have raised it before. On the idea of trying to get greater transparency for the under-50-megawatt projects, the integrated land management branch is working with the IPPBC to specifically address that. We don't have anything to hide - it is a matter of getting the information out and making it more digestible. The information is highly accessible for the over-50 megawatt projects because there is a specific website, and the concept of doing one for under-50s is appealing. One caveat that was mentioned has to do with how soon you would display the information. I know there is a general sentiment to get it all out there and get it out early. However, engineering design and environmental issues require a fair amount of iteration. This is generally what we're thinking about - at first it may well be a bit of a trial balloon. The concept of getting greater transparency for the under-50s is certainly supported and we are working with the government on that side.

On the issue of holding meetings closer to the people, I can't see why any rational IPP would differ. Complaints about being too far away from the people that matter are legitimate and that is something that no developer wants to be stuck with. It is a matter of practicality but I don't see anybody rationally opposing going in that direction.

Guy Dauncey asked:

What about the facilitative process methodology?

Steve Davis responded:

We are open to whatever system works. Obviously we are businessmen and time is money, so we want to have something that is functional. In some cases, the proponent takes the lead and in others the gov-

ernment takes the lead. We know that we have to get a social license from a variety of different audiences and we will be supportive of whatever process is efficient and functional.

A representative of an ngo commented:

To follow up on Guy Dauncey's point, there is no replacement for public meetings and public education; for instance, I traveled to the public meeting on the Bute project held in Campbell River but was told I was from Victoria and shouldn't be speaking. I was also told that we could only talk about the terms of reference for the environmental assessment; we couldn't talk about whether that project should even be considered. There needs to be much more public process.

Matt Burns commented:

Steve said that you do need a social license and that means investing the time. As far as having a right time, we have legislated two rounds of public meetings in the community and we have undertaken four in addition to that as well as an additional two rounds of meetings with the Haida Nation. We have never left a meeting without a good idea that contributed to the project. There is a point where it becomes unrealistic but we are certainly of the opinion that doing more is better and in our opinion the project has benefited from that. Also, we have stretched that out over two years so as we develop the project the ideas continue to come in and this has been a positive experience. It's not easy but it's something worth doing.

Adam Silverstein commented:

A quick informational note for projects under 50 megawatts. Some of those projects do undergo the federal environmental assessment process and information related to those projects is available on the Canadian Environmental Assessment registry.

Steve Davis responded:

In terms of trying to make things more accessible, the IPPBC's website, [www.ippbc.com](http://www.ippbc.com), has a section which lists all of the IPP projects that have gone through the environmental process and they are organized into categories, hydro, wind or thermal. This information is very detailed - you will be amazed at the degree of thoroughness and breadth of the stud-

ies that are undertaken. Clearly we need to focus on doing many things better, but at least we should see what is already there so we can focus on the things that truly need improving.

# CLIMATE CHANGE AND POTENTIAL HYDROLOGICAL CONSEQUENCES

*Dan Moore, Professor, Department of Geography and Department of Forest Resources Management, University of British Columbia*

## Introduction

The issue of energy is one of the most critical that we have to face as a society in British Columbia and I hope to shed some light on some of the underlying issues related to hydrology. In part, I will draw on research that I have conducted with collaborators and students over the last few years. I would like to recognize the Canadian Foundation for Climate and Atmospheric Science, who have funded our work on the Western Canadian Cryospheric Network, as well as BC Hydro, who has provided funding for the glacier related work. This presentation will first address climate change and hydrology, and the ways in which climate change influences hydrology, and then will address stream flow regimes in British Columbia. In dealing with run-of-river hydro, the timing of the stream flows is very important because you can only generate power when there is flow in the stream. I will then address climate change scenarios, in a general sense, and also with an emphasis on the uncertainties associated with them and then look specifically at what some of the scenarios suggest for the future in British Columbia. I will translate that into the likely hydrologic consequences and finish with some key points and take-home messages.

## Effects of climate change

There are two key variables that represent direct effects of climate change: changes in precipitation, which is the driving variable of the hydrological cycle, and changes in air temperature, which, among other things, determines whether the precipitation falls as rain or snow as well as the timing and rate of snow melt and glacier melt.

However, we also have to deal with indirect effects. For example, when the climate changes, it will influence the mass balance of glaciers and cause them either to grow or retreat, which will, in some cases,

have very large effects on stream flow. There are also changes in vegetation patterns, through shifts in the dominant species or increased frequencies of forest fire, for example. Although I will focus mainly on the direct effects and the changes in glacier extent, it is important to also be aware of changes in vegetation patterns, particularly changes in disturbance regimes in the forest, such as with the mountain pine beetle infestation.

## Stream flow regimes

Hydrologists tend to classify stream-flow regimes into four main types based on the source of flow (Table 1). We distinguish between rain-dominated, which are typically low elevation basins in the coast, snow melt-dominated, which are in the mountains and the interior of BC where most of the winter precipitation falls as snow and doesn't run off until the spring and summer, glacier-fed streams where there is more than a couple of percent glacier cover on the watershed, and finally, hybrid where because of the elevation range there is a mix of rain-dominated and snow-dominated zones.

Table 1. Streamflow regimes in British Columbia.

- Rain-dominated (pluvial)
- Snowmelt-dominated (nival)
- Glacier fed (pro-glacial)
- Hybrid (pluvio-nival)

What follows are some examples of what these regimes look like. The plot in Figure 1 represents three years of stream flow data for Carnation Creek, a small catchment on the west coast of Vancouver Island. This is the site of the world's longest running fish forestry interaction research project.

The key thing about Carnation Creek is that because there is no snow storage, there is no seasonal shift in the timing of run-off, relative to the precipita-

tion. Note that around the autumn-winter there is a lot of variability in the flow. Every time it rains, the flow goes up. When it stops raining, the flow drops. There is also a tendency to lower flows in the summertime when there are long periods of dry, warm weather. Obviously, if you were going to run a project in that kind of environment you would have to be prepared to manage for high variability in the flows.

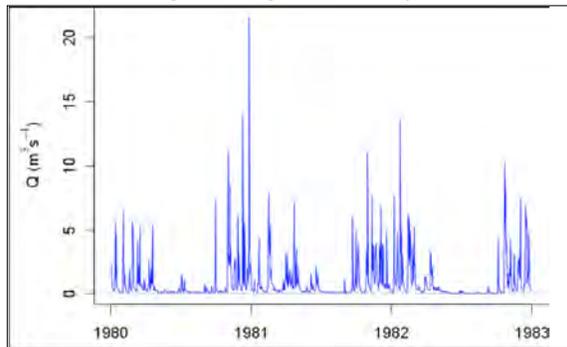


Figure 1. Rain-dominated regime: Carnation Creek.

A lot of regimes, particularly in the coastal mountain areas, are ‘hybrid’ regimes. The plot in Figure 2 describes an example of this type of regime, the Capilano River. Similar to Carnation Creek, in the wintertime and the fall, there is a lot of rain influence at the lower elevations, but at the higher elevations, a significant amount of the precipitation falls as snow and melts off in the spring and summer. Note that 1982, in particular, was a very heavy snow year followed by a large bulge in the spring and summer.

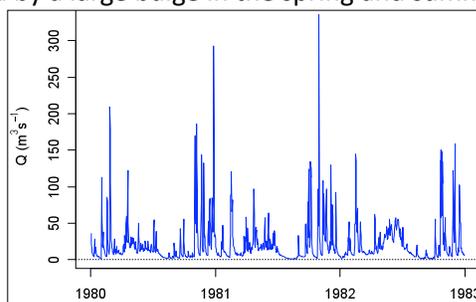


Figure 2. Hybrid regime: Capilano River.

The plot in Figure 3 shows an example of a snow-dominated regime, the Coquihalla River, where most of the catchment is at a high enough elevation that most of the winter precipitation falls as snow. The main run-off event is the spring-summer snow melt period with low flows in the winter. Note however, that occasionally there are very intense winter rain on snow events, such as occurred around Christmas, 1981. That huge event influenced the catchments throughout most of British Columbia.

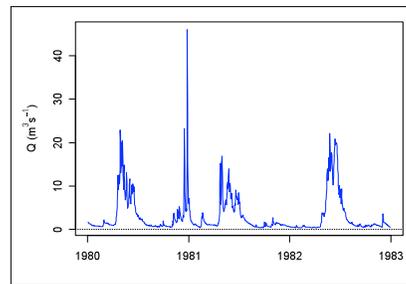


Figure 3. Snow-dominated regime: Coquihalla River.

Finally, Figure 4 provides an example of catchments that have a significant amount of glacier cover, in this case, the Lillooet River at Pemberton with about 15 percent of its basin covered by glaciers. Note that the main effect there is to extend the period of high melt flows into August and September. It tends to have low flows in the winter, and it also has occasional autumn and winter rain events that actually produce the highest peak flows on record. In fact, those are the types of events that Tom Pedersen described earlier, where there is a potential for more frequent and more intense events associated with climate change.

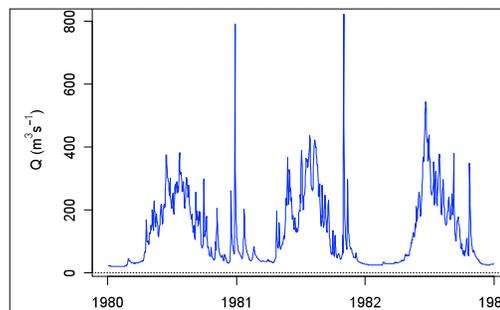


Figure 4. Glacier-fed regime: Lillooet River.

### Future climate scenarios

Some people talk about predictions and predicted climate regimes. I would say that the use of ‘scenarios’ is a better approach. Scenarios are plausible future climates that have been constructed for determining the impacts of climate change on environmental and resource systems. They are distinct from predictions, because they acknowledge and embrace uncertainty. We generate a range of scenarios to accommodate the fact that we do not really know what is going to happen in the future. The term ‘predictions’ tends to suggest a higher level of certainty. I normally use the term ‘projection’ rather than ‘prediction’ when I am talking about possible future states.

As part of the third assessment report of the International Panel on Climate Change, a special report was commissioned on scenarios to generate future timelines of likely carbon emission scenarios. With-

out those, you can't run climate models to look at effects. They developed four main storylines that represent different assumptions about how our societies and economies will operate into the coming decades. They used different assumptions relating to the intensity of fossil fuel usage and then generated the carbon emissions time series. The four main storylines are: A1, A2, B1 and B2. The 'A' scenarios tend to be more energy intensive and are associated with greater emissions. The 'B' scenarios tend to be more conservative in the amount of carbon produced. The 1s and 2s represent the extent to which the world is either integrated, socio-economically and culturally, or fragmented.

Figure 5 provides examples of two of the main scenarios: A2 is a scenario that represents a divided world, high rates of population growth and very little attempt to harness carbon emissions; the B1 scenario, on the other hand, represents an integrated world system, which is eco-friendly, with much greater effort to minimize carbon emissions.

SRES A2 (Divided world)	SRES B1 (Integrated, eco-friendly)
<ul style="list-style-type: none"> <li>• A world of independently operating, self-reliant nations</li> <li>• Continuously increasing population</li> <li>• Slower and more fragmented technological changes and improvements to per capita income</li> </ul>	<ul style="list-style-type: none"> <li>• Rapid economic growth as in A1, but with rapid changes towards a service and information economy</li> <li>• Reductions in material intensity and the introduction of clean and resource efficient technologies</li> <li>• Population rising to 9 billion in 2050 and then declining</li> </ul>

Figure 5. Future climate scenarios.

By having a range of these scenarios, we can predict a range of possible futures. We are not saying that any one scenario is right; in fact, things could happen in the future that we don't understand right now. These carbon emissions, along with other information, are put into general circulation models, large scale computer codes that simulate the energy exchanges and atmospheric circulation on a global scale. There are a large number of these around the world (see Figure 6). In Canada, there is the CCCma or the Canadian Global Coupled model. There are several models in the United States, such as the NCAR model and GFDL, and in Britain the Hadley Centre models. When the scenarios are run through these models, different outputs are generated in terms of global mean temperature; this is represented by the four sets of lines in Figure 6. They all have the same emissions scenario.

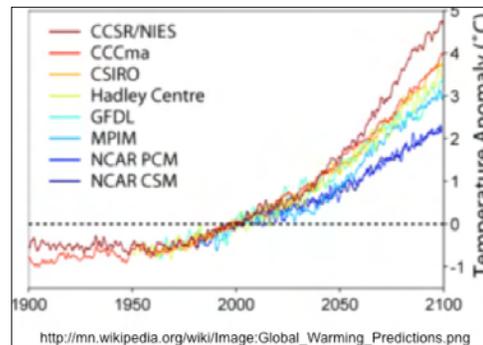


Figure 6. Global warming projections.

Note that the NCAR model (the blue line at the bottom) is the most conservative in the types of warming that it predicts, whereas the CCSR model projects the highest levels of warming.

Right now, in terms of uncertainties, there are two levels. There is uncertainty in terms of the future carbon emissions and there are uncertainties related to the climate models themselves – they are not perfect. Figure 7 describes the outcome of combining these two levels of uncertainty – this diagram is taken from the IPCC fourth assessment report showing a range of scenarios.

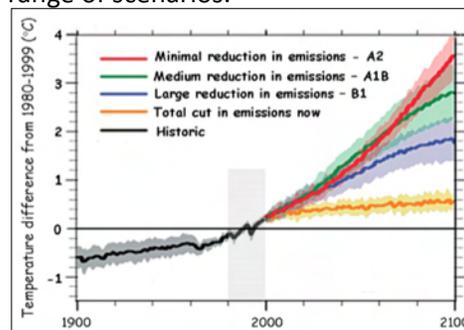


Figure 7. Range of scenarios.

The black line represents the historic global mean temperature as a difference from the 1980 to 1999 reference period. Then into the future, there are five scenarios shown. The yellow orange line describes what will happen if we just cut carbon emissions now. That scenario shows that there is still a slight amount of warming occurring because of the inertia in the system. Therefore, even if we could cut carbon emissions right now we would still experience further warming into the future.

The A2 scenario, probably the most intensive in terms of carbon emissions, has the greatest amount of warming. The other scenarios are intermediate. The light bands, such as the pink band around the red

line, represent estimates of the uncertainty associated with the different models. This diagram combines the uncertainties associated with the emission scenarios and the uncertainties associated with the models themselves.

We can't use these global scale outputs directly if we are trying to assess the hydrological consequences at a regional scale. The general circulation models operate on a very coarse-scale grid at the global scale and do not represent well the conditions in a place like British Columbia, which has many mountains and valleys and very complex land surfaces. So we have to use different schemes to take the output from this coarse grid and create information that we can use at a local scale, for example, at the scale of an individual glacier or watershed. Figure 8 describes a range of approaches that can be used.

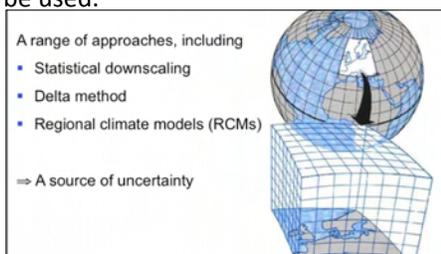


Figure 8. Downscaling from GCMs to regional scenarios. [http://www.uib.nc/Peaople/gbsag/climate\\_model.jpg](http://www.uib.nc/Peaople/gbsag/climate_model.jpg)

What I want to emphasize is that this is another level of uncertainty. All these different down scaling approaches will yield different forcing times series for the hydrological models. Again, we are adding level upon level of uncertainty. Because there is a lot of uncertainty we have to look at a consensus of the models.

Figure 9 is one set of outputs published in a report by the Pacific Climate Impacts Consortium, a very comprehensive overview of all the science that has been done over the last few decades. This is one particular scenario that they have extracted, the Canadian Global Coupled Model Three, the general circulation model. Then they have used the Canadian Regional Climate Model to downscale that to a more local scale.

The map shows annual mean temperatures. The darker the colour, the greater the amount of warming. The darkest colour represents warming at about 3 – 6.4 °C, relative to a baseline period. Note that generally there is warming over the whole province. The warming tends to be more extreme the further north you go and this is consistent with the general understanding that the warming will be amplified in the northern regions.

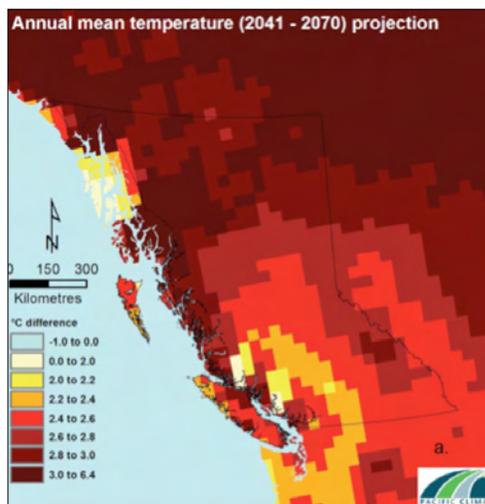


Figure 9. Air temperature anomaly projections from CRCM4 forced with CGCM3 and A2 emissions scenario. Rodenhuis et al., 2009. Hydro-climatology and future climate impacts in British Columbia. Pacific Climate Impacts Consortium, University of Victoria, Victoria BC, 132 pp.

The map in Figure 10 shows the projections and changes for mean annual precipitation.

The grey colour represents a 0 - 10 percent increase, the white colour about a 10 - 12 percent increase, and the shades of green greater than 14 percent increases. This map suggests that by the 2050s there should be slightly wetter conditions in the Coast Mountains and the Rockies and a significant increase in precipitation through the interior and into the north. However, it is important to look not only at the annual values, but also at how these values vary seasonally.

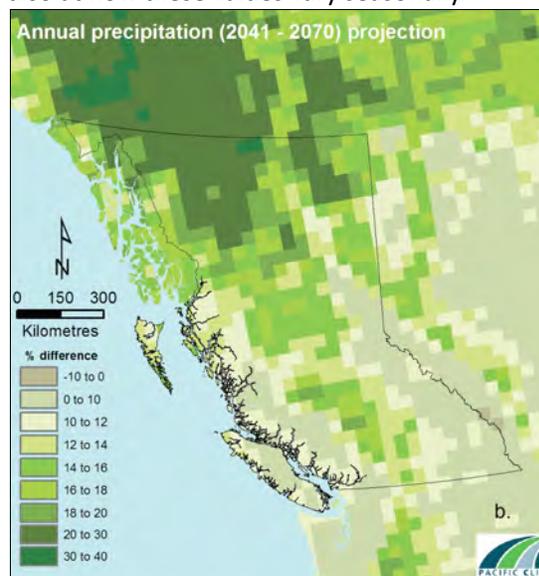


Figure 10. Precipitation anomaly projections from CRCM4 forced with CGCM3 and A2 emissions scenario. Rodenhuis et al., 2009. Hydro-climatology and future climate impacts in British Columbia. Pacific Climate Impacts Consortium, University of Victoria, Victoria BC, 132 pp.

The data in Table 2 were compiled by Dave Spittlehouse, a climatologist with the BC Ministry of Forests. This is extracted from a report that four of us wrote that is currently in press.

Table 2. Climate change projections for southern BC (Moore, Spittlehouse, Whitfield and Stahl, in press).

Values are changes from 1961-1990 normals, based on 7 GCMs and 8 emission scenarios.

	2020		2050	
	T (°C)	P (%)	T (°C)	P (%)
Winter	0 to 2	-5 to +15	1.5 to 3.5	0 to 20
Summer	0.5 to 2.0	-30 to +5	1.5 to 4.0	-35 to 0

By the 2020s, the winter temperature in southern BC is projected to increase from 0 - 2 °C. These ranges represent ranges from different GCMs and scenarios and the estimates attempt to capture the two sources of uncertainty. Note that there is a consensus that there will be warming in both winter and summer in the 2020s. The warming will be more intense in both seasons in the 2050s. There is not as much agreement in terms of precipitation, at least for the 2020s scenario. In the wintertime, there is a range from a possible slight decrease in precipitation to a modest increase, depending on the model and scenario combination. In the summer, however, the models seem to be in more of a consensus, suggesting that there will likely be a decrease in summer precipitation. Certainly by the 2050s, the model and scenario combinations all agree that there will be drier, warmer summers.

### Impacts on stream flow

What does this mean for stream flow and by implication, run-of-river resources? The higher fall/winter/spring air temperatures mean that more of the precipitation will fall as rain and there will be less snow accumulation. The onset of spring snow melt will begin earlier and there will be an earlier disappearance of snow. With the earlier disappearance of snow, we will go into the later summer base flow earlier and there will be more extreme late summer and early autumn low flows. This will be exacerbated by the fact that there will be higher summer temperatures, therefore greater evaporation and transpiration and less summer rainfall. The consensus suggests, then, that there will be an advance in the timing of snow melt, possibly a decrease in the size of the snow melt freshet, and earlier disappearance of snow at lower flows through the summer and

early autumn. For those who are concerned about fish, this is a significant concern, because the late summer/early autumn period is very critical for many salmonids. Our current research suggests that there will also be higher stream temperatures, which will again add stress to fish species. Also, as Tom Pedersen mentioned, there is the prospect that we might have a greater intensity and frequency of mid-winter rain on snow events that can generate very high floods as well as landslides and this is another factor that we have to consider as a risk into the future.

A few studies have tried to take the downscale outputs from general circulation models and then run hydrological models. This represents another level of uncertainty. The hydrological models are not perfect and we are simply putting together what looked like our best guesses.

The plot in Figure 11 comes from a study conducted by colleagues at the University of British Columbia, focused on the Okanagan basin.

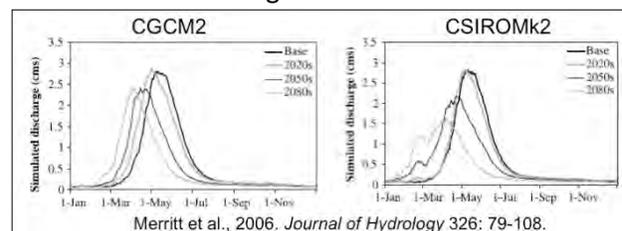


Figure 11. Projected streamflow for Whiteman Creek (Okanagan valley) based on two GCMs.

The left-hand panel shows hydrographs that are based on the CGCM2 scenario. The right-hand panel is driven by an Australian GCM. The dark line in each case is the base case; that is, using the current climate. The various shades of grey represent the three time slices: the 2020s, 2050s and 2080s. In both cases, the outputs driven by the two different GCMs show a similar pattern, whereas when we go further into the future we get an earlier snow melt, a lower snow melt peak, and an extended period into the summer when there are low flows. The models are consistent in terms of the qualitative results, but they are quite different quantitatively. This is an important point. Depending on which GCM is used you can get qualitatively similar, but quantitatively different, results.

Another way that we can gain some insight, although it's not perfect, is to use the historic period of data as

an analog. The plots in Figure 12 are for the Capilano River and the record has been split into three time periods.

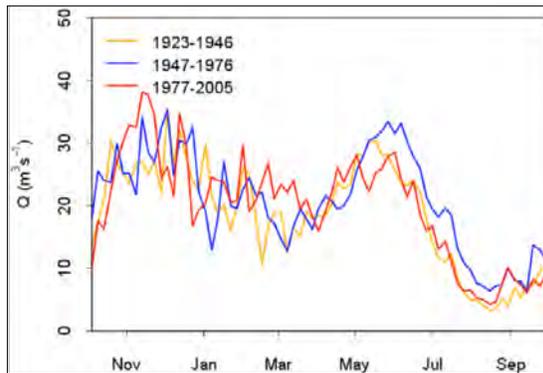


Figure 12. Historic streamflow patterns for Capilano River during warm and cool periods.

The orange and the red lines represents time periods that were relatively warm. The blue represents a period that was relatively cool - when many glaciers were advancing, or at least stopped retreating. Although it isn't a perfect analog for future warm conditions, the key point is that from May into August, the cool years have higher flows. That is because more snow pack has accumulated and it melts later in the season and maintains higher flows through the summertime. The warmer scenarios have a lower snow accumulation, earlier melt and, hence, lower flows through the spring/summer period.

One of my main research focus areas is climate change and glacier run-off. Figure 13 is a photograph of Place Glacier, near Pemberton. I have been doing research there since the early 1990s. It has been an official monitoring site since 1965. This photo was taken in 2005 – if it had been taken in 1965, the bottom half of the slide would show entirely ice. It has lost about 25 percent of its area and about 50 percent of its mass over the last 40 years. There are traditional knowledge, photographic records, and land form records that tell us that throughout North America the majority of glaciers have been retreating, or at least losing mass, over the last century.

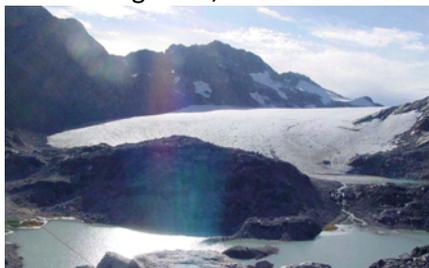


Figure 13. Climate change and glacial runoff.

Figure 14 shows the Illecillewaet Glacier in 1889 (top) and 2004 (bottom), again showing a dramatic retreat. The Vancouver Sun is publishing articles that take the point of view that the earth has been cooling for the last eight years and those who deny climate change are standing up and saying, “Maybe we’re all wrong.” I work with a number of glaciologists and I have yet to meet a glaciologist that questions global warming. When you work on glaciers, whether it is in North America, Greenland, Antarctica or the Arctic Islands, you know that they are all changing and at a very rapid rate.

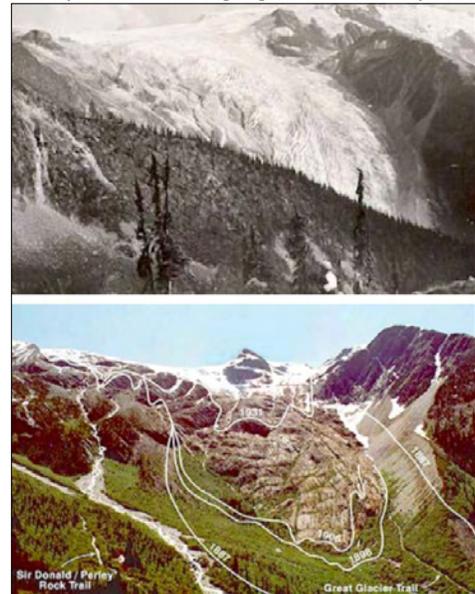


Figure 14. Illecillewaet Glacier in 1889 and 2004. [http://faculty.geog.utoronto.ca/Harvey/Harvey/harvey\\_images.htm](http://faculty.geog.utoronto.ca/Harvey/Harvey/harvey_images.htm).

### Glaciers and stream flow

The plots in Figure 15 are from two catchments that I have monitored near Pemberton; the blue line represents stream flow from Place Creek, which is fed by Place Glacier, and 25 percent of the catchment area is covered by glacier ice. The red line represents Eight Mile Creek, which has one percent glacier cover. The two watersheds are side by side and at same elevation and they face in the same direction. The main difference between them is the amount of glacier cover.

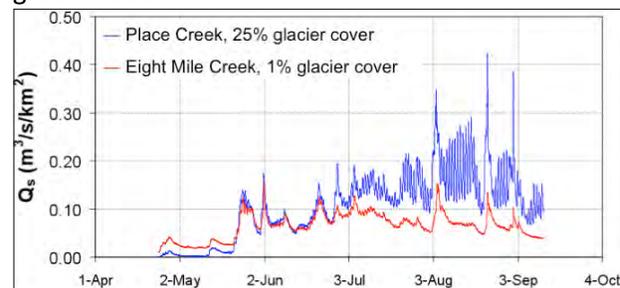


Figure 15. Streamflow per unit drainage area - Place and Eight Mile Creeks, near Pemberton, BC.

Note that during May, June and early July, the two stream-flow records are very similar. This is because they are both responding to snow melt. In July and August, the snow is disappearing and that is when the glacier melt really kicks in. Therefore, glacier ice catchments are very important for maintaining flows in the late summer period, particularly in years of low snow and very hot weather.

Figure 16 shows the pattern of glacier run-off in response to climate warming, where the blue line represents a glacier that is in equilibrium with the climate, moving up and down around near 100 percent.

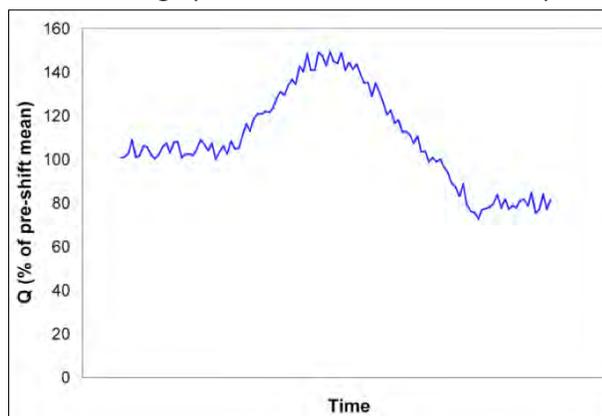


Figure 16. Glacier runoff response to climate warming

With the onset of climate warming there will be a period of increasing flows initially as the warming drives an increase in the melt rate. However, what tends to counter that is that eventually the glacier will begin to retreat and get smaller. There is a kind of trade-off between the melt rate increasing and the glacier getting smaller and eventually it will move into a phase where the flows are declining through time and possibly reach a new equilibrium, perhaps after the glaciers disappear entirely.

Some of our research suggests that in the north-west of BC, southwest Yukon and southeast Alaska, the glaciers are in the first phase and we are seeing increasing flows. Through most of the rest of British Columbia, our data suggest that we are in the second phase and a period of declining late summer flows from glaciers.

Our first attempt to look into the future and what is going to happen with glaciers and run-off is a project for BC Hydro on the Bridge Glacier, which feeds into the Bridge Seton system. The top-right photo in Figure 17 shows Bridge Glacier in 2005. The map

on the left shows the glacier extent based on 1995 satellite imagery - the light blue is the glacier, brown is bare, and green is forest.

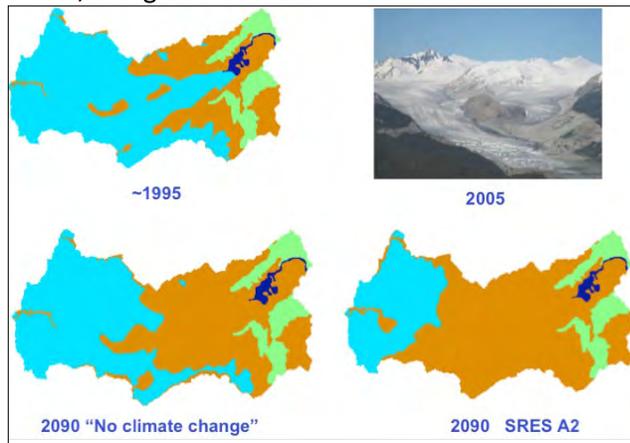


Figure 17. Bridge Glacier – now and projected.

We developed a relatively simple model, the state of the art at the time, based on the snowshed geometric scaling, to predict how the glacier will change through time. We decided to do a no-climate-change scenario. We ran them all in the future, assuming the current climate persisted. The results are shown on the bottom left graph - we find that the glacier is so far out of equilibrium with the current climate, even if there is no climate change, that the glacier will continue shrinking and lose about 30 percent of its current area by the year 2090. Along with that projection will be a very similar change in the stream flow with a 30 percent lower stream flow in the summertime. If we assume a climate change scenario, in this case, the A2, the bottom right graph shows what we project the glacier extent to be by the year 2090.

Note that it loses a lot of its mass and at that point it is nowhere near equilibrium with the new climate. The model suggests that the glacier is continuing to retreat, but we did not run the scenario any further.

We are also collaborating with colleagues in Earth and Ocean Science at UBC doing more detailed work. Figure 18a and 18b show the most recent results using a model that can predict glacier dynamics at a 200 metre grid scale, showing some simulations for an area in the Columbia Ice Field area.

The goal is to run this for the whole province. Note the 2002 ice cover. The Athabasca Glacier is near the upper right of the plot, and Peyto Glacier is towards the lower left. Then note the projection for the year

2100.

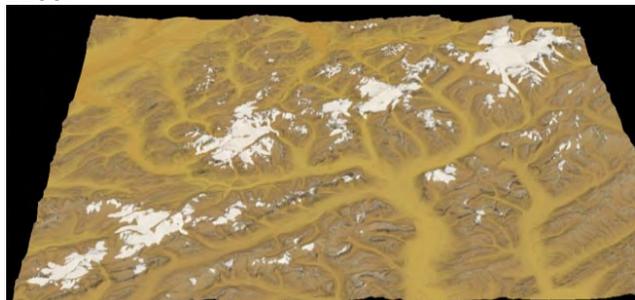


Figure 18a. Columbia Icefield Area, BC-AB Border - 2002.

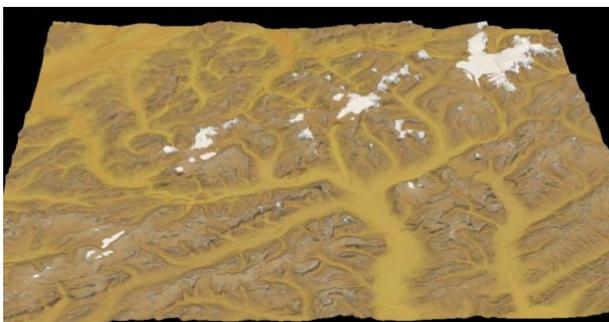


Figure 18b. Columbia Icefield Area, BC-AB Border, 2100 – CGCM3.1 A1B Scenario.

We are developing these tools and working with BC Hydro to apply them to the Columbia River Basin, because they are very concerned about the effects of glacier changes in the context of potentially renegotiating the Columbia River Treaty. We also want to start looking at the role of the glaciers in a number of proposed run-of-river catchments, because a lot of them do have significant amounts of glacier cover.

### Key points

I want to conclude by describing several key points. The first is that when we consider future climate scenarios, we should think about scenarios and projections, not predictions. We should bear in mind that there is quite a bit of uncertainty in the actual quantitative values. Having said that, however, the models suggest that there is a fairly strong consensus that we will have warmer summers and winters. The projections are variable for precipitation, but we will likely have wetter winters and drier summers, particularly by the middle of this century. It is almost a certainty that unless there is a dramatic cooling of the climate, the glaciers will continue to retreat. I believe that the qualitative changes in the hydrographs that we project are robust. It is fairly certain that if the climates go the way we think they will, that we will have an earlier timing of snow melt and all those other patterns. The quantitative projections

are subject to considerable uncertainty. Modelling groups around the world are trying to improve our predictive capacity and we expect to be able to make better projections as time goes on.



### DIALOGUE

#### Climate change and BC river systems

A participant asked:

Have you done any work on the Fraser River? I have heard various predictions and what that may mean for salmon and fish travelling up the river, and to the whole system.

Dan Moore responded:

I have not personally worked on the Fraser, but the Pacific Climate Impacts Consortium based at University of Victoria is in the process of doing a major modelling study, looking at the whole Fraser system. In fact, they are now extending it to the whole province. However, the model that they are using doesn't incorporate glaciers which is why BC Hydro has engaged my colleague and me to get a more detailed understanding of the role of the glaciers. This is not a very big issue, except for some of the tributaries.

Another participant asked:

I know that you have done some research on the Peace and Athabasca River systems. Can you make any comment about the possibilities in terms of the future for the water supply behind the Peace/Wil-liston?

Dan Moore responded:

I have not looked specifically at that in detail, but again, the Pacific Climate Impacts Consortium are in the process of conducting a major modelling study on the Peace River system.

### **Percentage of BC rivers that depend on glaciers**

A graduate student asked:

What percentage of rivers in BC depend on glaciers?

Dan Moore responded:

Glaciers currently cover three percent of the land area of British Columbia and in the Coast Mountains a large number of the third-order streams have a low percentage of glacier cover. Our research findings suggest that only about 3 - 5 percent glacier cover in a watershed will have a significant effect on the late summer flows, particularly when there is a dry summer following a low snow pack year. For example, I was hiking the southern Chilcotins this past summer and found that crossing streams in the morning wasn't bad, but crossing them in the evenings was very hectic.

### **Calgary's water supply**

Tom Pedersen asked:

Would you comment on the future domestic water supply prospects for Calgary and Edmonton?

Dan Moore responded:

A study was conducted showing that the rivers draining the eastern slopes of the Rockies had decreasing flows in the late summer/early autumn period. They call that the decline to base flow period. I am not sure about what was happening with the main spring freshet, but the glacier contributions are dropping off dramatically as the glaciers are getting smaller.

### **Impact on fisheries:**

Tom Pedersen asked:

Could you elaborate on what you anticipate might be the impact on British Columbia fisheries, particularly from the late summer decline in flows at the same time as the water gets warmer?

Dan Moore responded:

We are just starting to do more research specifically looking at that question. The work that I have done to date suggests that the stream temperatures will get higher as the glaciers get smaller. If the flows get lower and the water gets warmer, it's not going to be very good for fish. We are in the process of developing models to get more quantitative projections for that.

### **Climate change and long-term prospects for run-of-river projects**

Tanis Gower asked:

I understand from the literature that many BC streams are in a phase of increased melt. How will this affect the long-term prospects for run-of-river hydro power in south coast streams? Also, can you add any comments about how this is included in the planning processes. I find this to be a weak link and it could be because the science isn't there. It is my suspicion that it is more out of the planning time-frames - I think the melting is going to be ongoing for the next 40 years.

Dan Moore responded:

Our analysis suggests that many BC streams are currently experiencing declining trends in August flows. For many of them, it is not a particularly strong relationship and you have to use careful statistical methods to tease out the data. There are other ones where it is fairly obvious. However, you also have to keep in mind the snow melt part of the signal. The key message is that the timing of flows may be changing and that could influence the operations of run-of-river projects.

Tanis Gower continued:

My worry is that we are relying on a temporary phase of increased water availability. I know that the resolution of data is not very focused but perhaps you could elaborate on that possibility?

Dan Moore responded:

In catchments that have five percent or more of glacier cover, I anticipate that in many there will be some declines in late summer flows. I want to develop a simple decision support tool that would provide ways of calculating what the potential effects are; for example, if you have five percent glacier cover, is it going to shrink to three? And what marginal effect is that going to have on August flows? My feeling is that if you have a ten percent glacier cover and it goes down to five, that would have a fairly significant effect on late summer flows.

I am part of the Western Canadian Cryospheric Network and we are planning to apply for a PICS post-doctoral fellowship to work on this specific issue; that is, to take the tools that we have developed for the Columbia and the Bridge systems and apply them

to a number of smaller catchments that are being proposed or developed for run-of-river projects.

A hydrologist commented:

I am an hydrologist and I also do energy and power modeling for a lot of the run-of-river projects. Many of these projects in the Lower Mainland are of the hybrid type, so there is a fairly large and significant rainfall run-off as well as a freshet component. Many of the projects that I have reviewed are spilling in the freshet. Therefore, with warmer temperatures and an expected increase in the fall and winter run-off, you will likely see more power generation during the fall and winter and a more regulated power generation profile in the summer. From an energy perspective, the increased temperatures are expected to increase the amount of energy that the typical project will generate. The glacier type of projects tend to be more in the BC Interior. Again, you will most likely see more winter run-off, which will increase the energy in the winter. In terms of modelling, Dan probably knows better than all of us that it is incredibly complicated and time intensive and this prohibits a lot of detailed modelling. I would welcome any kind of tools Dan might have to offer in that respect.

#### **Relationship between glaciers and aquifers**

Ed Mankelow posed a question:

Is there any relationship between glaciers and aquifers?

Dan Moore responded:

This is an important question, but one that has not been researched very carefully. A colleague and I applied to get some funding to look at that question, but were unsuccessful.

Ed Mankelow:

I was told that the reservoir for the town of Williams Lake has dropped 50 feet.

Dan Moore responded:

I know that in Williams Lake they get a lot of their water from groundwater. I am part of a project that is examining water supply issues in Williams Lake, related to land and forest cover change.

#### **Climate change and reliance on electric systems**

Michael Harstone asked:

Cam Matheson, the Director of Energy Planning at

BC Hydro made a presentation earlier and a participant also commented about how BC Hydro, given their heavy reliance on hydroelectric power and the dependency on a lot of those systems on glacial water, is responding to or planning for climate change? What struck me is that although they have an integrated system in some ways in terms of the diversity of the hydroelectric systems, it is not integrated in other ways in terms of the different types of power sources. Cam Matheson pondered about whether they have too many eggs in the hydro baskets, in terms of their reliance on electric systems, in the backdrop of climate change.

Dan Moore responded:

As a hydrologist I can talk about the stream flows, but I would defer to people that are qualified to speak to issues such as reservoir management or other energy sources. This is one of the areas that BC Hydro is very concerned about and why they have been funding our research on glacier modelling over the last few years and next year. My research network is putting together a poster for public education – it is called Glacierscapes. We would like to find a photograph of fish, for example a spawning sockeye, in a glacier-fed stream.

# GREENER VISION FOR HYDRO PROJECTS: OPEN DISCUSSION

Panelists include:

*Ian Gill, President, Ecotrust Canada*

*Josh Paterson, Legal Counsel, West Coast Environmental Law*

*Ray Pillman, Senior Advisor, The Outdoor Recreation Council of BC*

## **First Panelist:**

*Ian Gill, President, Ecotrust Canada*

### **Introduction**

I want to step back and reflect on the fact that we should be grateful that we are able to have a session like this around these issues at a time like this. If you think about how the forest industry was planned and prosecuted in this province over the last 100 years, there weren't many opportunities like this for people with diverse interests to come together and have a dialogue on how the industry was going to unfold. Also, there weren't too many First Nations in the room when we were trying to figure out what to do with our forest, fisheries and mineral resources. So we should step back and realize that, in relative terms, we are very fortunate to have opportunities like this to have informed dialogue and to have it without the risk of being punished in some way.

### **Ecotrust partnership in run-of-the-river projects**

A specific area that Ecotrust has been working on recently is run-of-the-river hydro projects. Peter Kirby, from the Taku River Tlingit First Nations was not able to be here today, but he was going to describe the Xeitl project in Atlin. Ecotrust Canada helped to finance that project as well as the China Creek project outside of Port Alberni together with the former Chief Judith Sayers and the Hupacasath First Nations.

Ecotrust has gone on to set up the First Nations Regeneration Fund with the assistance and partnership of two aboriginal capital corporations. Our aim is to finance participation on an equity basis of First Nations in run-of-the-river hydro projects in their territories. We have made the decision that some run-of-river hydro projects are environmentally, socially, and economically viable and acceptable. In the case

of the Atlin project, that community used to buy 1.5 million litres of diesel fuel a year to run generators and they no longer have to do this. They have taken the equivalent of 4,500 cars off the road in terms of greenhouse gas emissions. They own 100 percent of the project and they are providing power to their community and the rest of the community of Atlin. The only complaint we have had about that project is that the elders can't sleep at night because they were used to the noise of the diesel generators and now they wake up thinking that there is something wrong with the power system because there is no longer any noise. We are very proud of our association with that project.

### **Can we move forward with a green energy future for BC?**

We are getting to a point of having dialogue but I am not sure that we are at a point of the deep listening that is required to really move into a better understanding and possibly better outcomes for a green energy future for British Columbia. We have heard about the valley-by-valley battles that were fought, predominantly over forestry, and that are going to be fought again over run-of-the-river hydro. These are also opinion-by-opinion battles. What I fear the most is that history is repeating itself around this issue in the way that the wars of the woods were fought for 25 or 30 years in BC, with not particularly satisfactory outcomes.



### **The urgency for action on climate change**

I also want to reflect on what I have heard about climate change; that is, climate change is urgent and that makes a narrow debate about the efficacy of independent power projects somewhat irrelevant. The IPP debate is such a small fragment of the debate around the generation of power for industrial societies like ours, that we can get too easily and perhaps wrongly focused on that. According to Mark Jaccard's analysis, there is going to be a dramatic increase in the demand for electricity. IPPs can contribute in some way to the production of electricity. However, the statistics that we saw on climate change were dramatic and alarming.

### **Land use planning and climate change**

Ecotrust has been involved in land use planning since its origin almost 20 years ago. We are now beginning to understand that a lot of the land use planning that we were involved in, especially with First Nations, is being rendered somewhat irrelevant by climate change. So we are now working on land use plans, for example, with the Taku River Tlingit First Nation and the Cheslatta First Nation, that look at climate change adaptation. The enormous effort that we have put into land use planning and increasingly marine use planning in this province risks being rendered redundant by climate change.

Someone noted that they thought that watershed impacts from climate change are going to be far more dramatic than any single impact from an IPP or anything else that is going on in a number of these watersheds. We need to pay attention to this.

### **Energy pricing**

I have heard that energy pricing is absolutely key. I also heard from the BC Hydro representative, Cam Matheson, that the mandate of BC Hydro is to provide reliable and cheap power. Perhaps we need to have a debate about whether BC Hydro's mandate should be to provide reliable and really expensive power. If energy pricing is what is going to motivate us to think more carefully about what we do with electricity, maybe we should tell BC Hydro to go out and make energy as expensive as possible, and that will get people to pay attention. That is, expensive, not for the sake of being expensive, but by actually providing power through a full cost accounting method that fully reflects the true value of what that power is.

### **Is hydro power 'green' energy?**

A former BC Hydro representative also claimed that hydro is green energy, by definition. Tell that to the Cheslatta people or the Kwadacha or West Moberly people. Hydro,

large or small, has dramatic impacts and I would not necessarily call any of it 'green'.

### **Private versus public power**

I have also been intrigued to hear the debate about whether private power or public power is cleaner, greener, or better for the province. And I heard a lot of faith being placed in the capacity of BC Hydro to deliver power for the public good. However, I don't think that BC Hydro is a benign force in this province, any more than the Ministry of Forests has delivered a public benefit in terms of the management of our forests over the years or that the Department of Fisheries and Oceans has delivered a public good in terms of the management of our fisheries. Frankly, it is very delusional to think that BC Hydro is going to do the public's will. I don't think private power producers necessarily are any more or less trustworthy than BC Hydro. It is important that we have a combination of interests working for the public good and there are ways to bring that about.

### **Suggestions for a process**

Here are my suggestions for a useful way to think of the process going forward. We have heard about environmental assessment processes and peoples' dissatisfaction with them. The projects theoretically get weeded out before they even get there and then they all get approved when they go to environmental assessment. I think that environmental assessment in Canada generally is shameful and I don't think companies or governments should be hiding behind environmental assessment, as they are currently constituted.

Many of us are somewhat alarmed about the government's recent announcement that a green energy task force is going to be set up. In principle that is a good idea. However, I am not particularly sold on the notion that a green energy task force is going to deliver a great deal of public benefit to this province. Governments, by definition, are centralized, command and control systems, whose operations are essentially inimical to respectful local wisdom or local knowledge. So while I am pleased that this task force will surface some issues, I don't think it is going to be a panacea, at all.

We have heard a lot about cumulative impacts and localized impacts as well as regional and provincial planning. When I distil this and think about what we need, to my mind it is not a quick and dirty energy task force. It is not a valley by valley battle about a particular run-of-the-river power project or a wind project. I believe that we almost need something of the probative value of the indepen-

dence and urgency of a Berger Inquiry. That is, we need to have someone who is independent of government, is well-regarded, and has a budget to travel the province and listen to the concerns of the local people and then come up with a process and an urgent response to a tremendously fractured approach to green energy development in this province. For me, at least, anything short of that risks not being trusted by the public and in the end not having the support of the citizens of BC.

## Second Panelist

*Josh Paterson, Legal Counsel, West Coast Environmental Law*

### What we have learned so far at this forum

Near the end of Day One, a participant from Forest Ethics made a comment that I thought was very important. She said that we agree on more than we disagree – I agree with that. In fact, we agree on far more than we disagree on and if we move back from our positions to more abstract principles that underlie our positions, such as public interest and public benefit, and the best environmental protection and sustainability values, we will find there aren't that many things that divide us. As Mark Jaccard noted earlier, we might be able to move from hard prescriptions and conclusions and find a lot of common ground.

At West Coast Environmental Law we think that there is probably a set of law reforms that can be found to drive this forward and bring people together around common ground. The law can be used to protect the things that we value, just as indigenous laws have protected and continue to call for the protection of the land in BC. We also heard earlier about the need to preserve the world's best salmon rivers, about the fight against climate change and even the need to help our neighbours get off coal and dirty power generation. Whatever the positions on the issues that may divide different groups, communities and industries, what I clearly heard in Day One and earlier today was an emerging consensus that we need to do better planning for green energy.

We heard from Tanis Glower that even IPP proponents are calling for regional planning, to avoid public outcry. As Aaron Hill told us earlier, right now there is no strategic planning to identify which sites provide the most power for the least environmental impact. We know that IPPs are not judged based on their sustainability in the broad sense, according to interdependent ecological, social and economic objectives. However, we also heard about the

urgency of climate change and that we need to act fast and not take many years to decide on all of these questions.

### How do we move forward?

How do we make sure that the right decisions are made, that they are broadly acceptable to the public, and that we make them relatively quickly? The way forward could be an overarching strategic energy assessment process, or a regional cumulative process to identify appropriate sites and set out clear no-go zones. This could be done either province-wide or it could be regionally targeted, perhaps starting with high intensity IPP areas like the South Coast. This could be done within existing environmental assessment laws and it should be done as quickly as is reasonably possible. In many cases, a lot of the baseline data may already exist to speed up the process. And since these projects are, in part, a response to climate change, and as Scott Harrison described yesterday we are a province of intactness, the consideration should be similarly holistic and sustainability centred, recognizing the interdependence of ecological, social, cultural and economic objectives. It should also include a weighing of First Nations' and local knowledge, in tandem with conventional scientific knowledge. Also, with trade-offs between different sustainability objectives, whenever they are required, the rationale for the decisions should be explicit and open and the focus should be on maximizing sustainability and avoiding significant adverse environmental effects. Hard rules could be established, as Tzeporah Berman has mentioned; for example, no old growth development and no developments in fish bearing rivers. There should also be rules around the distance of transmission lines relative to the generative capacity.

### The process and need for public insight

A participant from Wildsite spoke about the need for public insight and that in the current process it is very weak, and often the role of communities is overlooked leading to frustration and misunderstanding. By the current process, I mean where there is no EA, just the regular licensing and tenure processes. Any planning process should have meaningful opportunities for public participation and for the participation of local government in addition to the constitutional obligation to undertake consultation and accommodation with First Nations. This is critical to ensure that the government makes the best decisions, but also to achieve broad community support so that we can move forward. It is critical that the government deal honourably with First Nations in a way that respects their constitutionally protected aboriginal title and rights and the authority of First Nations as decision makers in their own territories.

Planning for the distribution of economic benefits could also reflect title and rights and along with First Nations, consideration should be given to the right way to ensure that economic benefits are shared in the region as a whole. We have seen some examples of that where the benefits of the projects flow back locally. Once those plans or frameworks are in place, they could guide decision makers going forward and they could be appended or super-imposed on existing LRMPs, with modifications being made where necessary.

After these plans were done, we would still need to decide on individual projects and site-specific environmental assessment would still make sense and be subordinate to these wider plans. As was pointed out earlier, a lot of IPPs do not undergo environmental assessment because they are below the capacity threshold. Contrary to the suggestion that we heard earlier, at West Coast Law we do not think that the licensing and tenuring system alone is adequate to review these projects because it does not offer the opportunities for public participation, among other reasons. Instead, they are confusing, and this can stoke opposition to projects that might otherwise attract support. The first in time first in right system also encourages proponents to apply for more licenses than they intend to use. This means that the public has no real way of knowing what is a real project and what is not, and where to focus their attention and energy. Broad planning with project-specific environmental assessment underlying it would be preferable to this system in order to ensure transparency, public participation and foster public buy-in.

To make sure that this happens for more IPPs, it is possible that the threshold for environmental assessment could be reduced to a lower level. I believe that it used to be 20 megawatts - it could be reduced to 10 megawatts. Although that would increase the number of environmental assessments that were done, if there had been a broader cumulative effects process already done, the site specific reviews wouldn't necessarily take that long. They could be done more quickly because they would only be taking place in areas that had previously been green-lighted. They could focus on mitigation and getting the individual projects right. From our perspective, and we have had concerns about the terrible weaknesses introduced into the EA process for a number

of years, this kind of process, at least for IPPs, could address a lot of those weaknesses.

After approval, whether we are going to have the private sector or the public sector or some combination of these, there is a need to heavily regulate the operations to ensure that they serve the public interest and the values we want as a society to have protected, and to stop profit maximization at the expense of environmental responsibility; for example, no taking more water than the guidelines suggest in order to increase your profit. Conditions imposed on IPP developments should be expressed in mandatory, enforceable language. Wherever practicable, we should avoid the language in these guidelines, because it allows too much wiggle room. There could be increased penalties for breaking these conditions, such as strict in-stream flow requirements, including the revocation of the certificates and licenses. There would also be a good role for periodic auditing to ensure compliance with environmental protection regulations and licensing conditions.

Of course we would need to provide the resources for this enforcement and Guy Dauncey has mentioned the idea of a monitoring levy which makes proponents pay. That would be a very useful tool to explore. Follow-up monitoring, we think, should also include cumulative impacts on a watershed basis, rather than focusing narrowly on specific project impacts. You could also see a world in which follow up and monitoring paid attention to human and community effects alongside environmental considerations. Indeed, if the original plans included some of those broader considerations it would make sense that the monitoring would also include those values. Again, local knowledge and First Nations' knowledge should be valued and weighed in that process.

### **Conclusion**

In conclusion, we think that there is a lot of agreement about core values on clean, renewable energy. I have heard this consistently throughout this dialogue. Where we have areas of concern, we can have tough laws to address the concerns no matter who runs the project. And while perhaps we will continue to have differences of opinion about some issues, we all recognize the need to make thoughtful plans. Urgency should not mean throwing all caution out and taking a haphazard approach that we will regret later.

As was noted earlier, our province could be a model of good planning and clean energy and we should not delay in making that happen.

### Third Panelist

*Ray Pillman, Senior Advisor,  
The Outdoor Recreation Council*



### We need large scale changes to address climate change concerns

I agree that the development of small projects around the province is a good thing, but this is not going to solve the climate change problem. It will take much more than that; climate change is upon us and if we don't act immediately on a very large scale, it will be too late. However, it is not possible to act on a large scale quickly. You would have to convince too many people that they are going to have to change their lifestyles very substantially and you would have to provide transportation and other services quickly on a massive scale. So you can't solve this problem in that way. The only way that you can reduce greenhouse gas emissions quickly is to shut down the Tar Sands, stop mining coal, and shut down many of our oil wells. What we do in a small way all counts, but this is not big enough to bring about the huge change that is needed.

### Need for planning

There has been a fair amount of agreement at this forum that there is a need for much better planning. Who is going to do that planning? Josh Patterson described various ways of addressing this but it is a dispersed approach. You have to get many organizations and people involved. The IPPs cannot do it - they are looking after their own projects and interests. The organization that could do this is BC Hydro. They have had that mandate in the past and they have the tools and the know-how to get this done. They would have to not only consult with, but get the participation of, the people that Josh Paterson

mentioned - all the organizations and the communities - and they do have systems for that. They need to expand those systems to really get going.

### Public versus private power

I have worked on power projects for many public organizations, including Hydro Quebec and Manitoba Hydro, and in many countries around the world, and in my opinion public power has the great advantage because they can borrow money cheaper than the private sector can. In one of the BC Utilities Commission reports, I read that BC Hydro is allowing interest rates of 4.6% for their own projects, 8% for wind power projects and something slightly less than that for run-of-the-river projects. However, there is a big difference in the pay-out period and the sums are extremely large - billions of dollars and pay-out periods of 40 years or more. Think of the difference if you have a mortgage rate of 5% or one of 7% on your house, how much longer or how much more you are going to be paying out over the long term. That is a very large difference.

The other difference is that with the number of competitors answering BC Hydro's calls, no competitor or bidder has a very good chance of being successful. The bids are very varied, they are not consistent in terms of the site or place and very often they have sketchy designs. I have seen a number of proposals and often they are not adequate for making a proper cost estimate that you can live by. So, what do they have to do? They make the best estimates they can on that basis, but they haven't done all the sub-service exploration, and other testing that has to be done in order to be confident about what they are going to build. So they have to add a very substantial contingency to their price. It is at that stage they agree with BC Hydro on what price they are going to get for the energy. If the worst case happens and their contingency is all used up, they don't lose their shirts if it doesn't go ahead, and they may make a huge profit. That is another way that lack of planning costs more at the metre when you are paying for your power.

These are two reasons why public power is cheaper, and you can't escape that. There is discussion and risk taking, but in the end the risk taking is taken by the purchaser of the power. BC Hydro has been successful. They could have put more money aside for

new projects, but instead the government grabbed that money and put it to use in their annual budgets to pay for hospitals and other things. As a result they have to borrow money as well, but they can do it cheaper. I believe that BC Hydro is the logical organization to be given the ongoing task of planning and they should be made more accountable to the public and involve the public more. The planning is spread all over the place with nobody being responsible for the whole thing and there is no central organization going to actually make it happen. From my engineering background, I know that having a vision is very important, but the vision has to be put into action and then the practical problems have to be met. I think Hydro is the organization that can do that.

**Michael Harstone:**

I want to return to points made by several participants and my review of Day One, with respect to the fact that our areas of disagreement are far out shadowed in terms of number by our areas of agreement. In terms of points of agreement, the first is that climate change is a significant threat to civil society and ecological services within the province and even beyond. Climate change is a symptom with the underlying problem being our unsustainable nature. As a result, we need to embrace a conservation ethic as a starting point, such as through demand-side management and consuming less. BC requires new, clean sources of electrical power to meet anticipated demand and this represents only a portion of the whole climate change and carbon reduction equation. BC would benefit from the economic opportunities associated with the alternative energy sector and also from open, transparent, participatory energy planning. There was also a lot of agreement that First Nations involvement and support is essential in any new potentially proposed projects.

**How do we actually move forward on this?**

What follows are some recurring themes:

- Resolve areas in the province that are suitable for, sensitive to, and restricted from, alternative energy development, based on clear environmental and social criteria.
- The ideas of first past the post or clear understandings of being able to pre-screen potential projects, where there are acceptable local social impacts and maintenance of resilient ecological services, could be things such as some of those

environmental and social criteria that are used.

- Establish and implement a cumulative impact assessment framework for the evaluation of energy projects.
- Work to establish community involvement; protocols for informing and soliciting input on projects less than 50 megawatts, for example.
- Make energy resource planning and environmental assessment data freely and readily accessible.
- We are paying too little for electricity and therefore it is not going to inform the conservation ethic. Phase in some sort of market pricing for electricity to decrease energy demand at peak loads.
- Build long-term funding for monitoring and adaptive management into project approval certificates.

Next we want to explore what a greener sort of hydro project environment would look like, and what are some tangible things that we can move forward on? What are the next steps? What are factors that we have observed that seem to be associated with more successful initiatives and how would we build those into a vision for green energy as we move forward?



## DIALOGUE

### Will these developments really lead to a reduction in BC's carbon emissions?

A participant commented:

It might be time for a reality check on the benefits of developing river diversion projects in British Columbia. To put things in perspective, I will relate some published research and number crunching that I have done. Most of you know that British Columbians consume about 50,000 gigawatts of electricity per year and according to the Kerr Leidal report put out by BC Hydro, if we develop the very best, most cost efficient river diversion projects in BC, it will be about 661 sites and we can produce an additional 16,500 gigawatts of energy per year. What that means is about one third more electricity than BC Hydro produces now and only about an 8 percent decrease in British Columbia's overall carbon emissions. So we are not talking about a lot of carbon. I wonder about the wisdom of going into our coastal watersheds and impacting 661 watersheds for what amounts to only a 7 – 8 percent decrease in British Columbia's carbon output.

If we are to move forward, I believe that we have to look at conservation. We can develop run-of-river and other renewable energy projects, but that will take years and decades. However, we can implement conservation in a matter of months. The evidence of that was when gas prices went through the roof in 2008, from \$0.96 to about \$1.35. Those are the kind of measures that we need.

Michael Harstone responded:

To follow up, we have heard BC Hydro in terms of their energy planning. They are proposing that three quarters of all new electricity demand will be made up through conservation. We heard from

Mark Jaccard that based on his review of 20 different jurisdictions over a 20-year period of a lot of the demand-side management effectiveness in terms of the uptake and in terms of providing people with subsidies, there is no evidence to suggest that it is all that effective, aside from doing market price; in other words, if it is rates. Are you saying that BC Hydro should be doing more than what they are already committed to doing? Or are you proposing something more specific that we should consider or grapple with, in terms of how we move forward?

The participant responded:

I am proposing that BC Hydro could, for example, raise rates and take that money and reinvest it in renewable energy technology or conservation measures like solar thermal in public and domestic buildings. Those things would work. Raising gas prices is extremely politically unpopular but it has to happen. We are not going to develop our way out of this greenhouse gas mess. Conservation is going to have to be a major part of it.

Another participant commented:

I would like to suggest that such a process is actually taking place now, although perhaps not as perfectly as some people would like. The Utilities Commission is carrying out an inquiry into BC's long-term transmission needs. It goes well beyond transmission because it is also looking at renewable resource potential all across British Columbia and that includes the run-of-river and the wind potential projects among others. It also includes demand forecasts running for the next 30 years and that includes the other things we have been discussing, such as energy conservation and demand-side management, and what we can do to reduce the curve for demand. It is also expected to be addressing exports, a hot issue no doubt, and is currently bringing in quite a lot of participation with over 100 people registered



including a couple of dozen First Nations groups. It has regional sessions going on around the province and it provides participant funding. I would certainly recommend this as a forum that does exist at the moment, where we could bring forward these ideas in an orderly manner.

Ian Gill responded:

I invoked the name of Thomas Berger deliberately. The BCUC is doing an inquiry and I appreciate the complexity of that and the fact that it does invite citizens to participate. I question, however, the moral authority of the BC Utilities Commission and the moral authority of a commission that can be summarily overruled by the provincial government when it produces a ruling that the government doesn't like. That is the problem.

What we need is some kind of inquiry that has the moral authority of somebody who is independent of government and who can get the public behind them so that if you are overruling that person or that process, then you are overruling British Columbians. Frankly, the BCUC fails the test in terms of its credibility there. I also want to make it clear that I was not suggesting that we have a Berger Inquiry into IPPs. I think we need a morally authorized, publicly supported inquiry into climate change adaptation and resilience, province-wide. It is not only about IPPs and it is not just about wind power or Site C or energy pricing. It is also about what is changing the ecology of our rivers and lakes and what is happening to our forests and fisheries. The downstream consequences of climate change are so dramatic, it seems to me, that leaving it in the hands of a provincial government or climate change secretariat, which is trying to do good work but has budget limitations and which is at the behest of cabinet ministers, is not enough.

I believe that this province needs to show global leadership in terms of a response to the threat of climate change. The threats to BC are very different than they are to my former home, South Australia, where we have given up on even having water. The threats in different parts of the world are very different, but we have a civil society here and a stable democracy. We have the ability to gather the resources and put together the kind of inquiry that would show global leadership in terms of how a jurisdiction begins to move through the very real questions and

responses to what is happening with climate change. If that sheds some light on what we do about IPPs along the way, then that is good, but I think it becomes a minor consideration in a much more major endeavour.

Adam Silverstein commented:

In response to comments that Ian Gill made around environmental assessment and to echo some of the discussion that the environmental assessment process is fundamentally flawed, I would acknowledge that there are certainly challenges with the different assessment regimes that exist in BC, and across Canada, and that there is a lot of room for improvement. However, I would suggest that the environmental assessment processes do have a very valuable role to play and agree strongly with Josh Paterson's advocacy for both the broader planning process and site specific environmental assessment processes.

#### **Planning processes and triggers for action**

A participant commented:

I find the discussion on inquiries intriguing considering that there have been several calls for inquiries for trying to find out what happened to 130 million sock-eye smolts that went to sea and disappeared in 2007. It smacks as a lack of faith in government processes and ability to plan and also to act in a precautionary manner. It would be interesting to see where this could go.



One big issue is planning and the fact is that it is a real struggle with government, this one in particular, to get them involved in planning processes. They don't like land use planning but in that they are not distinct from a lot of governments. You heard earlier about how slow Norway was to react to their problems. In fact, a quote from yesterday's edition of the Vancouver Sun was that the Norwegians have traded their salmon culture for easy street – that is a telling statement and it scares me. The farmed salmon now outnumber wild salmon by 50 to 1 in Norway because they have not acted in time.

My question to the panel is twofold. What do we have to use as a trigger to get government to act? Is it to agree to an inquiry or a planning process or the idea of no-go zones? I like the idea of considering other values in these watersheds, like wild salmon, tourism and wilderness values. These are very significant values in British Columbia, but can we have power and can we preserve these values at the same time? What is the trigger for that kind of discussion? Second, should there be a moratorium on new development until we figure this out? Or do we talk and log, as the old saying goes, at the same time?

Ray Pillman responded:

I spent the last ten or more years on land use planning. The big problems that we ran into were short-term interests versus long-term interests. It was supposed to be long-term planning; that is, to plan at least 50 years ahead. However, there were always urgent short-term problems that people around the planning table brought out and they wanted those dealt with. Often, they weren't particularly interested in the long-term plans and there were only a few of us representing the conservation and tourism and recreation sectors who tried to keep their noses to the job of long-term plans. Government is part of that short-term thinking. They are elected for the short term and they want to be popular and have done something in that term so they can get re-elected. Relying on government to set this thing up is questionable.

The participant responded:

I am still looking for answers on triggers and whether you agree that a moratorium should be in place. What is the trigger to get government to act? Many of us here, as far as I can tell, agree on a lot of broad

stroke issues. If together as industry representatives, representatives of the First Nations, conservation groups, community groups and individuals, we were able to get together on a suggestion, or a set of proposals to take to the government and say, "Look, there's some percentage of people that are not going to come along, but there are 80 percent of us and we think that you should go this way" – if we could convince them that they would have a lot more peace on their hands by adopting a set of proposals that a wide swath of us agreed to, then that could be a relatively formidable way of encouraging them to act.

Having a moratorium seems to be a logical consequence of a broader planning process. At the very least, for where construction has not started, and where any licenses that are out there that end up being in a no-go zone or are not appropriate or sub-optimal compared to other places, the government would be perfectly justified in taking back those licenses. Some element of that could be a part of a broader process.

Ian Gill responded:

When I think about intractable social problems and the ability to sometimes have breakthroughs around them, I think of the example of the US Senator George Mitchell who went to Ireland and sat down with the IRA and others long enough to hear them out and then came up with a solution to what was, internationally, one of the most intractable, divisive issues you could imagine. I believe that there are ways to have a planning process and sets of criteria that are well supported by a broad spectrum of the public. I don't think those planning processes or sets of criteria are going to emerge from the narrow confines of a few like minded NGOs, however, nor are they going to emerge from the provincial cabinet or from an industry group. I frankly don't think they will emerge from a mixing together of those groups, because this would likely end up with the lowest common denominator. Again, I return to somebody having the moral authority and technical skills and ability, as well as a budget, to listen and come up with something that can be defended by most reasonable thinking people in this province. We can come up with some criteria but we do not have the authority to then impose them on the public. I am sure that the IPPBC has a set of criteria that it thinks would be acceptable. However, somebody, some-

where, needs to be given the authority to help us work through these issues and come to some sort of conclusion about what is or is not acceptable around these issues.

On the question of a moratorium, I do not believe that we will see 661 sites developed in this province; in fact, probably no more than 10 or 20 percent of them are even economically viable at any time. My main concern is my long-term interest in economic and social justice for First Nations communities who are, in many instances, just coming into part of what you would otherwise characterize as the economic mainstream of this province. I would not want to be the person who went to the Taku River Tlingit a couple of years ago, halfway through a development process on what I think is a good project, and tell them, "We've got some anxieties about all this green power stuff in BC. So you are going to have to suspend your project for a few years while we go and work it out." A moratorium in some cases maybe, but a blanket moratorium, I think not.

A representative from Gitanyow Fisheries commented: There is an EA process in place for projects under 50 megawatts. It has been repeatedly noted here that there isn't one. That is what I have been immersed in for the last two years. The differences between the processes for smaller and larger projects are the smaller ones do not seem to have a socioeconomic component, and the government is not on timelines for responding for projects under 50 megawatts. The process does include hydrological and geomorphological studies and studies of drift invertebrates and fish biomass, as well as archeological and navigable waters information. The Canadian



Environmental Assessment Act gets triggered on almost all the projects. We deal directly with MOE and DFO, but not the BC Assessment Office. The cost of the pre-project and post-project monitoring is paid for by industry and typically there are at least two years of studies before the project is commissioned and five years of studies after, but that is variable depending on the statistical power analysis and the particular study design. In addition to that, any habitat compensation is designed, built, maintained and monitored at the cost of the proponent. The legal obligations for all these aspects are covered in the water license.

How could this be improved? I agree with Ian Gill's idea of an independent inquiry. A similar example to this would be the June 2009 Independent Science Panel Review on the Skeena watershed and the commercial fishery. That happened in a short timeframe with some very positive results. Obviously, a planning process and a holistic, cumulative effects assessment would be a big improvement. We need to beef up the socioeconomic component for the small projects and certainly improve on the public involvement process.

The main thing is not to rush into any new projects until we have had time to properly monitor the projects that have already been built. We need to get those five years of data and find out what is happening to fish and invertebrates and stream morphology before we start new projects. Finally, we need to protect salmon in general in BC and focus on strict protection of the critical areas of spawning habitat; for example, the shores of Babine Lake where there is currently a copper and gold mine proposed. That is the most productive salmon lake in BC and there should be some no-go zones especially in areas of critical habitat, which have already been mapped out.

### **A coarse filter and regionally based planning**

Aaron Hill commented:

I want to address the idea of what has been dubbed, 'first past the post principles'. It is an interesting idea and a number of people have talked about various aspects of it. A 'coarse filter' might be a more appropriate way to describe it. It is a good idea in principle. One suggestion is to move forward with some of these smaller projects that are getting small

communities off diesel power, that should probably have been built 20 years ago; for example, a project that the Hartley Bay First Nation is building in their territory. These projects should probably be fast-tracked, as long as they are not impacting any core environmental values.

In general, however, it should not be up to us in this room to decide what those things should be. They are going to vary region by region and as Tanis Glower and I discussed earlier, valued ecosystem components and social values are also going to vary region to region. There are also going to be trade-offs involved that will be different from region to region. Therefore, regionally based planning is the only way to go, in my opinion, and maybe BC Hydro can take that on. Maybe also First Nations, but I do agree with Ian Gill that somebody has to have the mandate and the moral authority to get it done and that process has to be based on rigorous science and transparency and have a lot of stakeholder input from First Nations and non-First Nations communities alike. Tanis Glower and I suggested some tools for moving forward with processes like these.

Finally, with regard to a possible moratorium, that might be a strong word for some people and maybe it is not warranted. But the reality is that the thermal inertia of the oceans, regardless of any actions that we take, is going to continue to drive climate change for 30 years or more. I am not sure what the latest statistics are, but China is building coal-fired power plants at a rapid pace. Therefore, I don't think that it is going to make or break global climate change if we take a little bit of extra time in BC to make sure that we get this right.

### **All hands on deck are needed**

A participant commented:

Several people have mentioned that we need "all hands on deck" to solve a problem of this scale. No one mechanism, whether conservation efficiencies or new clean power generation, is going to be enough. We will have to go with all of them and we need to keep finding as many different possible solutions as we possibly can. Government policy can do a lot for things like seasonal light displays – they could be regulated so that they all have their own power generation or they could be solar powered. There could be regulations on your household electronics

where you can no longer make or sell products that drain electricity when they are not being used. There are a lot of things that can be done with appropriate policies. However, there needs to be more leadership from politicians and there needs to be a lot of leadership in the cooperation factor. We cannot have another election like the last one, where it was politicking rather than working toward solving problems related to the environment. We have to say, "All right, let's work together no matter what." And we need to demand that from our leadership.

As far as personal initiatives go, we can all make sacrifices – we already do. For example, many of us have switched to public transportation or working from home more often so that we are not driving our cars. Pricing energy is going to help with the initiative. We need to have somebody focusing us on the idea that we need to use less stuff. Chief Willie Charlie noted that we should take only what we need and share what we have. I want to go further than that, and say that we should take what we need and if there isn't any, we don't take it. Canada is a resource-based country and most of our economic system is based on going into the hinterlands that we do not see, taking the resources, and then using them. We do not actually give back to where they are being taken from.

### **Subsidized electricity**

Gwen Barlee commented:

In our dialogue there has been an emphasis on personal use of electricity and being more efficient, which the Wilderness Committee agrees with. But we also need to examine the heritage contract, which gives a subsidized rate of electricity to industrial users. That is a very large subsidy and industrial users make up about 40 percent of the electricity users in BC. Also, we need to tie in conditions about the production of low-carbon electricity, and ensure that it actually lowers greenhouse gas emissions in the long run. Highway 37 is an example; the BC and federal governments plan to go ahead with electrifying this highway in northwestern British Columbia, and that would bring on five large smelting mines and two coal mines, Groundhog and Klappan. Each smelting mine would be subsidized to the tune of \$35 million per year in electricity, leading to massive increases in greenhouse gas emissions, especially for the coal mines. Finally, from a recent poll conducted by the

Wilderness Committee with respect to what British Columbians think about the private versus public power debate we were very surprised to find that, of the 1,000 British Columbians polled, just ten percent supported private power production over public.

A participant commented:

One thing that people might want to consider is that there are many great ideas as to what can happen in different arenas, policy, and personal choices. But the question is: What collectively are we going to do with those ideas? Will they move forward with future dialogue sessions? I am sure people will take the ideas into the areas they work in now. But is there a role for this collective to go forward and what might that look like?

Michael Harstone:

We have talked a lot about power developments in the province and how the success factors might apply on a broader scale. We have also discussed some short fallings in terms of power development initiatives. How can we learn from this information and apply it in a broader scale in terms of green energy?

# PERSPECTIVES ON GREEN ENERGY

Panelists include:

*Ron Monk, Kerr Wood Leidal Associates Ltd.*

*Trent Berry, Compass Resource Management*

*Simon Robinson, Environmental Specialist, Vancouver International Airport*

*Nick Heap, Climate and Energy Policy Analyst, David Suzuki Foundation*

*Nigel Protter, Exergetics Development Co.*

## First Panelist

*Ron Monk, Kerr Wood Leidal Associates Ltd.*

### Introduction

I have worked on both the private and the public sides of power development – I worked at BC Hydro for 14 years before joining Kerr Wood Liedal, a consulting engineering firm, three years ago. Prior to that I worked for an independent power producer.

Our firm focuses on energy planning, small hydro, water resources and municipal engineering. We cover a wide range of projects; for example, we are involved in helping BC Hydro and BCTC with the planning for the Section 5 inquiry on the long-term transmission plans, and we are also involved in the district energy system installed at the Athletes Village in Whistler, utilizing the waste heat coming off the Whistler sewage treatment plant.

### Looking to the future electricity needs in BC

I think that there will be a large increase in electrical demand due to shifts that are moving transportation away from fossil fuels. BC Hydro has forecast that if all the cars in BC were converted to electricity, they would demand about 9,000 gigawatt hours a year of electricity to charge them. That would be just under a 20 percent increase in the electricity generation from BC Hydro. As much as the increase in electricity is a concern in terms of the impacts of the generation methods, getting transportation off fossil fuels is a very good thing to do.

The other thing that will result in an increase in demand for electricity is moving to heat pumps, whether they are ground source, air source, or wastewater systems, as in the case of the Whistler example. There are also some new technologies that will result in increased demand for electricity. Our

firm is involved in a number of municipal infrastructure projects, for example, and we find that when we install wastewater or drinking water treatment facilities, the electricity usage with the new facility that provides better treatment quality to more people, is greater than the systems that are being replaced.

### What will change?

We need to reduce our use of fossil fuels and this will happen because of high cost, scarcity, and greenhouse gas emissions, as well as local pollution and global security.

There are some forces that are going to cause change. We are going to see a lot of conservation but I worry that some of the conservation forecasts may be overly aggressive. I also worry about BC's ability to meet BC Hydro's forecasts because there are changes that need to happen, behavioural changes, and there are a lot of people that are not as thoughtful about the problems we face in the world as the people that are participating in these discussions. I worry about our ability to get their commitment to change and conserve electricity and use natural gas and other resources.

Smart Grid and Smart Appliances will help a lot. We can make our appliances much smarter so that they use electricity at off-peak times and use less electricity or less natural gas or other resources.

There is going to be a change in the export of green energy from BC and more trading in green energy. BC, compared to many parts of the world, has an abundance of green electricity resources. Therefore, if we want to help solve a North American or global problem, part of the solution will be to export green resources from BC. We could, for example, see a connection to Alaska especially because of their

abundant renewable resource, and use BC's transmission system to get those green resources to other markets. We could also see stronger connections with Alberta and other parts of the US.

We need to use hydro and smart loads for shaping. Dialogue is needed with all communities and agreements are needed with First Nations.

**Potential electricity resources in BC**

The map in Figure 1 shows the potential electricity resources in BC. The blue dots represent potential small hydro resources, 8,242 in total. In the study that Kerr Wood Liedal conducted for BC Hydro and BC Transmission, we actually screened out streams that have salmon in them and they are included in the Fisheries Information System database. These possible projects are not on reaches of streams that have salmon.

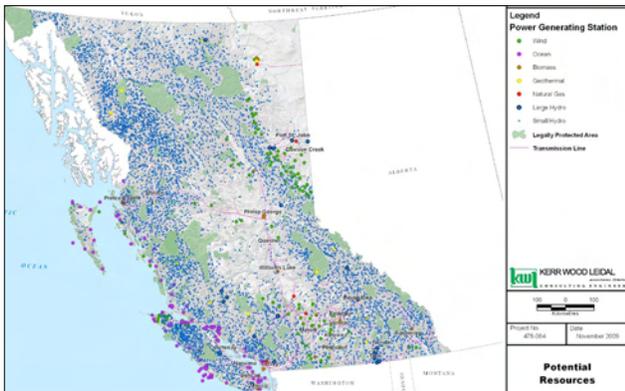


Figure 1. Map of potential small hydro resources in BC.

Similarly, the study could be conducted in different ways to screen out other areas of concern. Note that the parks are shown on the map and in most cases

we have not shown any resources in parks. Note that on the coast there is an abundance of ocean potential, both tidal and wave. There is also abundant biomass, geothermal and wind potential in BC as indicated by the green dots.

The question is: How much of this will be developed? Many of these sites are not currently cost effective in terms of development and many of them are too far from access roads and power lines to be developed in the short term. It means that we have to identify the best resources to develop from a community perspective, and from environmental and economic perspectives. We have been working with BC Hydro and BCTC to identify the areas that have the greatest potential generation (Figure 2). This information is available on BC Hydro's website. We have also looked at each of the sites indicated on the map in Figure 1 and identified the areas that have the highest potential for clean energy development. They are the 15 clusters indicated in Figure 3.

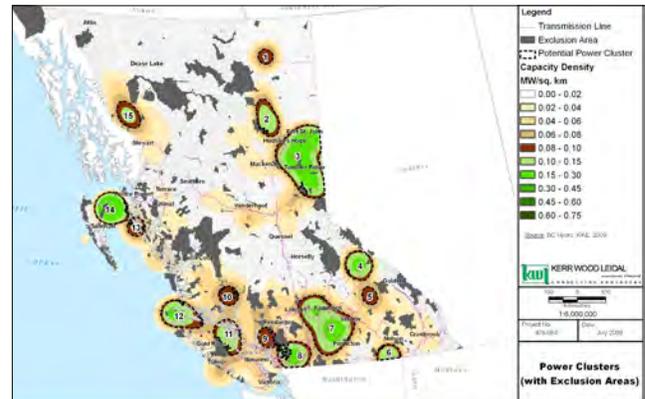


Figure 3. Clusters of highest potential for clean energy development.

		Transmission Region									
Resource Type		Central Interior	East Kootenay	Kelly	Lower Mainland	Nicola	North Coast	Peace River	South Interior	Vancouver Island	Totals
Geothermal	Capacity (MW)		40		390	40	370	48	40		928
	Annual Energy (GWh/a)		252		2,917	252	2,791	315	252		6,779
Small Hydro	Capacity (MW)	659	1,029	300	3,189	820	4,292	929	533	783	12,534
	Annual Energy (GWh/a)	2,603	3,628	1,081	13,858	2,864	17,483	4,130	1,730	2,258	49,635
Wind	Capacity (MW)	1,819	138	724	283	2,137	4,012	5,014	871	1,417	16,415
	Annual Energy (GWh/a)	5,002	252	1,511	729	4,305	10,771	13,680	1,799	3,465	41,514
Large Hydro & Pumped Storage	Capacity (MW)	360	985		2,095			5,893		400	9,733
	Annual Energy (GWh/a)	1,673	6,642		5,503			32,635		-	46,453
Ocean (Wave & Tidal)	Capacity (MW)				355		225			1,709	2,290
	Annual Energy (GWh/a)				1,244		764			5,874	7,882
Biomass	Capacity (MW)	372		73	1	39		60	3	46	594
	Annual Energy (GWh/a)	2,973		587	10	314		429	22	368	4,704
Natural Gas	Capacity (MW)			603	403						1,006
	Annual Energy (GWh/a)			3,876	2,443					3,831	10,150
Resource Smart	Capacity (MW)		30			1,000			500	49	1,609
	Annual Energy (GWh/a)		131		80		80		26	48	465
<b>Total Capacity (MW)</b>		<b>3,209</b>	<b>2,222</b>	<b>1,731</b>	<b>6,716</b>	<b>4,037</b>	<b>8,900</b>	<b>11,943</b>	<b>1,946</b>	<b>4,904</b>	<b>45,609</b>
<b>Total Annual Energy (GWh/a)</b>		<b>12,251</b>	<b>10,905</b>	<b>7,135</b>	<b>26,704</b>	<b>7,915</b>	<b>31,809</b>	<b>51,189</b>	<b>3,829</b>	<b>15,843</b>	<b>167,582</b>

Database-Summaries-TX\_and\_Cluster-v4.1-No-Exclusions-July21-2009.xls\Summary T1 21/07/2009 5:02 PM

Figure 2. BC Hydro Potential Generation Resource Options - Transmission Region Summary - Before Exclusions.

Note that the legally protected areas on this drawing are indicated in grey - these clusters preclude any development or power lines through parks.

This work is ongoing and eventually BC Hydro and BCTC will file in the Section 5 inquiry. This represents where we were on July 23, 2009 and it corresponds with what was presented at the stakeholder workshop that BC Hydro held on that date. Note that there are areas in the northeast of the province, Fort Nelson and the Peace River areas, that have abundant wind energy and other resources. The northwest of BC (in the Highway 37 area) has abundant hydroelectric and wind resources. There is abundant offshore wind energy off Prince Rupert, and the Okanagan is also a very rich wind resource.

Clearly, BC has abundant renewable energy potential. Some of the potential areas are not served by existing transmission, mainly in the northwest and northeast regions of the province. There are some potential clusters near transmission but in some cases it is not adequate transmission.

## Second Panelist

*Trent Berry, Compass Resource Management*



I have worked for almost every utility in the province on policy and project development, and it is from this wide lens of perspectives that I am making this presentation. I will address mainly the application, specifically of district energy, and use that as an example to discuss some relevant questions.

My first question for everyone is: Do you have knowledge or experience with district energy? Listed below are questions for your consideration and I encourage you to think about these in the subsequent dialogue (Figure 1).

### QUESTIONS

- Should our highest quality energy source (electricity) be used for our lowest quality energy service (heat)?
- Are there better uses of green electricity in the near term than heating (e.g., electrification of transportation)?
- Are some renewable resources better used for producing heat than for producing electricity?
- Is there a role for combined heat and power in a green energy system within BC and the western interconnection?
- Are there more efficient forms of electric heat?

Figure 1. Questions about energy for consideration.

### What is the best use of electricity?

In terms of a green energy strategy, I sense that a lot of the discussion so far has been focused on electricity. One question I often ask is: Should our highest quality energy source, electricity, be used for our lowest quality service, heat? Is that an effective use of resources? There is no easy answer. As Mark Jaccard pointed out, there are always tradeoffs. The question is: What are the appropriate applications and how do we use electricity? People that I work with, such as developers, often say, "Isn't our electricity supply green?" My response is that we need to know where that green electricity is coming from and the impacts on the province, in terms of new transmission, appropriation of land, air, water and so on.

The question is: Are there better ways to provide heating in some cases; for example, rather than using a wind farm located in northwestern British Columbia to heat a home in the Lower Mainland of BC? Sometimes there may be better ways of using green electricity but you should keep in mind the larger market exports. We are surrounded by brown, so if we use our green electricity to displace a lot of things where we have green alternatives or we can use it more efficiently then we have taken that resource away from serving a larger market that is reducing coal and natural gas use around British Columbia. Secondly, if you accept that we need to deal with carbon, then the question is: Which is a higher priority for electrification, transportation or space heating? There are very few alternatives in the transportation sector to make it decarbonized. However, there are a lot of alternatives to decarbonize space heating or at least reduce the amount of carbon in space heating. That is something else to keep in mind.

Also, if we have renewable resources can they be used better to produce heat or electricity? For ex-

ample, Hydro had a biomass call to use pine beetle kill wood. They were going into plants that were only producing electricity - it doesn't matter that it was biomass. A biomass electricity plant is still only 20 - 40 percent efficient unless the waste heat is recovered. To recover the waste heat there needs to be a load and also some place to put that waste heat. A good load would be buildings and small industries, among others. We would need to use and capture that waste heat; that might be a better use of that resource. Conversely, biomass may be better used for heating only, in some situations.

Is there a role in this province for combined heat and power? Combined heat and power is where we use a resource like biomass and produce electricity. You can only get so efficient with it and then there is a lot of waste heat. Combined heat and power means that the waste heat is captured and used to heat buildings.

Finally, if we are going to use electric heat are there more efficient forms of electric heat? Ron Monk mentioned heat pumps which is better than resistance electric heat. Air source heat pumps are better and geexchange and sewer heat pumps can be even better.

Heating is a large source of greenhouse gas emissions. Figure 2 shows the 2007 BC Greenhouse Gas Inventory. The bottom blue represents energy use. On the right, the 'energy subsector', or what we call stationary combustion, includes furnaces and everything that heats industry - 20 percent of that is residential. Therefore, one third of BC's greenhouse gas emissions comes from stationary combustion and 20 percent of that is from space heating. While that is lower than most other jurisdictions because we have a lot of electric heating in this province, it is still significant. Transportation is another third of that. The question is: Where should our priority be in that resource?

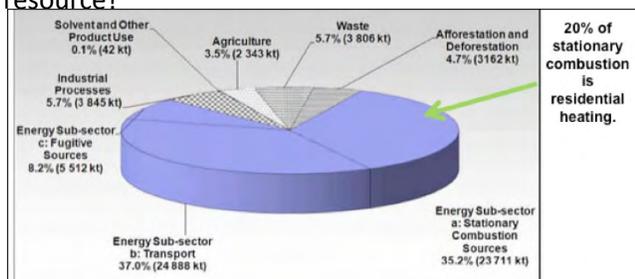


Figure 2. BC Greenhouse gas emissions - 2007. 67309 kilotonnes CO<sub>2</sub>e.

## District energy

What is district energy? Figure 3 describes some examples of district energy. It is one way of implementing renewable heating. What district energy does is to centralize heating and create a network for distributing hot water. What you have then is a central energy centre or centres such as the one from southeast False Creek. Here we have created a sewer heat recovery system to heat the Olympic Village buildings. In the case of the distribution system, the centre photograph shows the distribution pipes going into southeast False Creek. Then, at the building scale, there is an energy transfer station (right photograph). In this case, it is an existing building that had a retrofit – it used to have a boiler, which has now been replaced by the small blue box, which is a heat exchanger. If this was a new building all we would need is the heat exchanger with a meter. Then within the building there are hydronic heating systems or hot water heating systems (lower right photograph). These can be baseboards, wall systems, or radiant fan coils – there are many different ways of doing that.

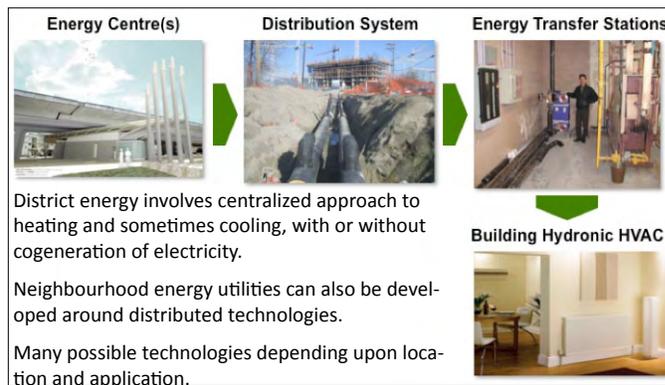


Figure 3. Examples of district energy.

District energy therefore is simply a system. It is an approach to delivering space heating, and sometimes cooling, in a development. District energy is as old as the Romans who built the first heating systems on district energy, bringing geothermal springs into their cities. In Europe there are some countries that have as much as 50 percent or greater of their total floor area connected to district energy (Figure 4).

Some North American politicians are becoming interested in district energy; for example in the photograph in Figure 4 former President George Bush is opening the new Biomass District Energy Plant, the

largest in the US, in St. Paul's in the early 2000s.



Figure 4. European examples of district energy systems.

What you may not know is how much activity is going on in this sphere locally (Figure 5). The most prominent project is the one being developed in southeast False Creek. There are also central heating plants downtown in Vancouver that serve 100 or more buildings. The largest point source of greenhouse gas emissions is in the City of Vancouver; most people don't know that because it is natural gas. This presents a significant opportunity to fuel switch or do efficiency on one resource, rather than going into a number of individual buildings and trying to accomplish that in one go. All these systems are based on, or are proposing, different energy sources.



Figure 5. Local Activity.

I always say that there is no bad technology or energy source, there are just bad applications. When we started out in southeast False Creek we didn't know what the best energy resource would be. We looked at a range of options and it turned out in this particular case that the best application was sewer heat. East Fraserlands in the southeast corner of Vancouver are looking at capturing waste heat from the Burnaby waste-to-energy incinerator, which is

already in place.

Why do we look at district energy? In some cases, it reduces first costs and life cycle costs for providing heat, and it improves the quality of service. We have supporting data from case studies, including the power outage in the middle of winter in Toronto, the earthquake in San Francisco, and the ice storms in the Atlantic Provinces and northeast states showing that the only systems that provided heat were district energy systems and they became the emergency shelters. All the buildings on electric heat were shut down. District energy therefore is high quality and high reliability.

### Improved environmental performance and reduced risk

There are two prominent ways to go with district energy: one is with renewable fuels, such as biomass. The chart in Figure 6 compares Business as Usual (BAU), where the typical construction is a mix of electricity and gas use for heat, with a District Energy System. Remember that even in an electrically heated building gas is mostly used for domestic hot water. It is also used for ventilation air, which can be a huge load in any building, even though the suites have electric heat. Consequently, gas still makes up the large portion of the energy used by electrically heated buildings. If we convert that to a district energy system based on biomass, all the electricity consumption is eliminated, and a good portion of the gas consumption goes down. We still use a small amount of gas for peaking and back up.

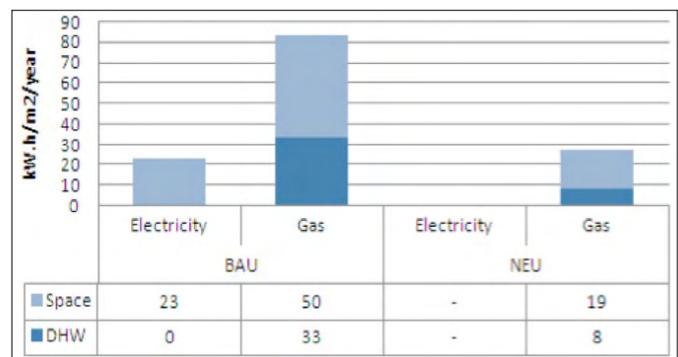


Figure 6. A comparison of gas and electricity consumption between business as usual and biomass district energy system.

The chart in Figure 7 represents another example of district energy, based on heat pumps, which can have anything on the other side of it. It could be a sewer, as in the southeast False Creek example. It could also be a geexchange system or an air source heat pump. A heat pump is the way of getting that heat up to a grade that is useful. We still use a small amount of electricity or gas, but the amount decreases. Heat pumps tend to be less effective in capturing summer loads - that is why we still use a small amount of electricity or natural gas.

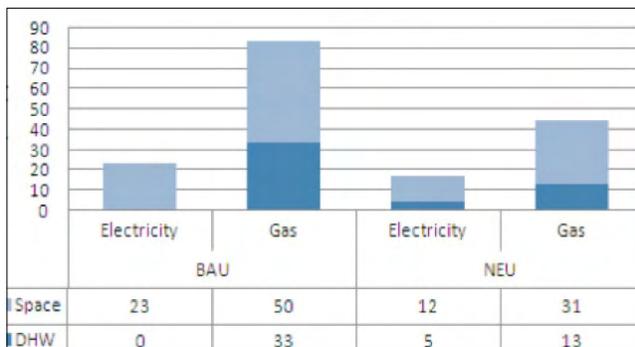


Figure 7. A comparison of gas and electricity consumption between business as usual and heat pump district energy system.

Recall the information in Figure 4 describing the countries in Europe that use district energy. In Sweden, about 50 percent of its floor area connects to district energy. The chart in Figure 8 shows how Sweden's systems have grown in the last 30 years, tripling the amount of floor area connected to district energy since the 1970s.

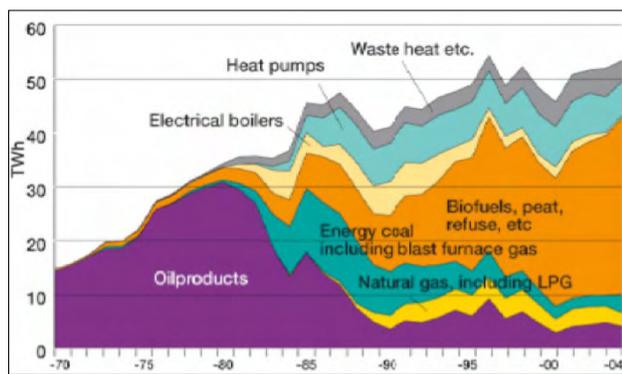


Figure 8. Swedish district energy growth and fuel sources (1970 - 2004).

On top of that, they have gone from a predominately oil-based system over time to a mix of systems. The largest source is biofuels. Ironically most of those biofuels currently are coming from wood pellets

produced in British Columbia. What is important to note here is not that they are getting most of their heat from BC, but rather the technological flexibility. Because they have district energy systems, instead of hundreds of thousands of individual buildings with their own individual heating systems, they have several hundred district energy systems with individual plants. I have worked a lot in technology change and have never seen this rate of change occur. Basically, in 30 years they have gone from almost 100 percent oil to a mix of resources, predominantly biomass. I would argue that that would never have happened if they hadn't had district energy.

Finally, as Figure 9 demonstrates, in the southeast False Creek system, we have captured about 6.3 million square feet of floor area, using sewer heat.

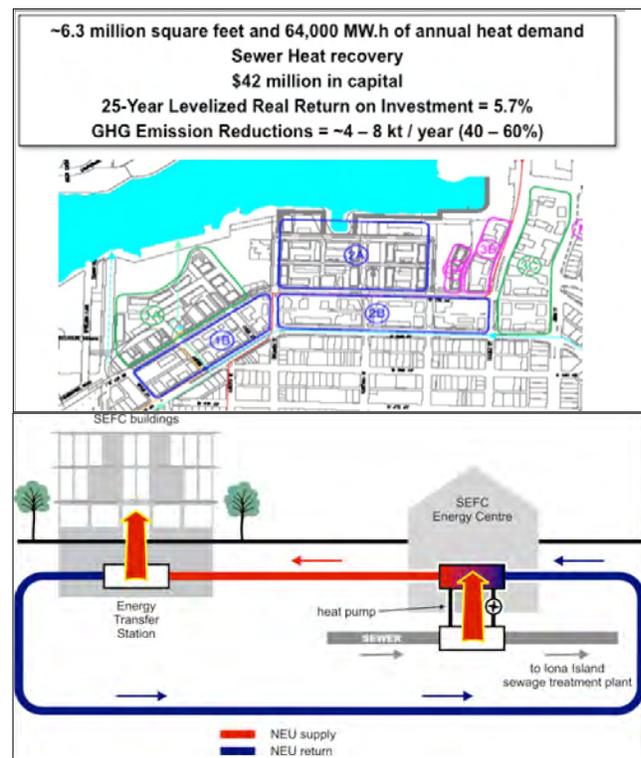


Figure 9. Southeast False Creek system.

This is a \$42 million system, and we are saving about 4,000 to 8,000 tonnes of carbon through the system, a 40 - 60 percent reduction, and we are doing this by capturing waste heat in the sewer and distributing that to the buildings.

### Third Panelist

Simon Robinson, Environmental Specialist, Vancouver International Airport

#### Introduction

My first reaction when I was asked to speak today was why would someone from the airport be invited to give a presentation. We are more of a power consumer than a power producer, and so I thought we might be the bad guys in the room. But when I thought about it and noted that I was asked to offer our perspective on green energy and my role as an environmental specialist at the airport, I believe that I have come up with the right topic.

The Airport Authority was created in 1992 to operate and build the airport and we have been building the airport since. You have all seen the expansions to the runways and terminal buildings. Last year, the YVR airport handled 17.9 million passengers, there were 278,000 runway movements, landings and takeoffs and as well about 21,000 tonnes of cargo moved through the airport.

#### Energy conservation at the airport

We use power in many different ways. My work in the environmental field at the airport is focused on energy efficiency and energy reduction. The greenest energy is the energy that we don't use at all, and that has been our primary focus. How do we do that? As we expand we build more efficient buildings and we are continually replacing the old pieces of equipment and infrastructure and putting in newer, more efficient equipment as well as doing lighting retrofits.

Why do we do energy efficiency? Being energy efficient just makes sense. We have found, for example, over the last few years that every dollar we save in energy efficiencies for the airport results in \$5 of revenue that we do not need to earn. It costs money to make money, so there is a big incentive there and we don't need to pay for the energy that we don't use. One of the things I do is closely monitor energy use at the airport. Figure 1 shows the actual and avoided electricity use from 2001 to 2007.

The bottom half of the bars show the amount of electricity consumed at the airport in the terminal buildings, about 85 gigawatt hours per year in 2007. The

amount consumed has been increasing as we have been building out the airport. The blue-purple bars demonstrate the avoided energy as the result of the efficiencies that we have implemented. Importantly, these savings are cumulative. If we replace a piece of equipment this year then it continues to be a saving in the future years. In total, about 25 percent of our energy use has been offset already or has been avoided.

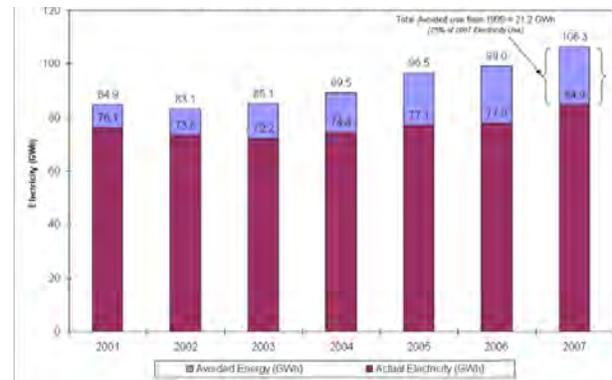


Figure 1. Actual and avoided electricity use at YVR, 2001-2007.

How have we done that? We have taken a variety of initiatives. One of the most successful programs has been our solar hot water system. Two of them have been installed, one on the domestic terminal and one on the international terminal.

This heats the hot water used in kitchens and washrooms and everywhere else at the airport. It has been a very successful program. The two different systems are shown in Figure 2, with the big solar panels and an evacuated heat tube system. We estimate that we save over \$60,000 a year by not having to heat the water. In the summer these systems provide all the energy we need to heat water and in the winter we use the solar system to preheat the water before it goes into a hot water system.



Figure 2. Solar hot water systems.

We also have a groundwater cooling system (Figure 3). You have probably seen our terminal building, which resembles a greenhouse with glass walls and roof. It tends to hold a lot of heat in the summer and even on a sunny day in the winter it generates heat, so we need to cool that building down quickly. The groundwater is always at a cool temperature and we use that to chill the water system before it is used to cool the space. We estimate that our chilled water system represents a 25 percent savings.



Figure 3. Groundwater cooling system.

Figure 4 shows a small system that is a pilot demonstration of a wind power lighting system developed by a local producer. It also has a small solar panel for charging a battery.



Figure 4. Wind and solar lighting.

From a business point of view this system is not yet successful, but on a demonstration one-off case study basis, it has provided a great opportunity to showcase the potential of both wind and solar power. Locating it right beside the new Canada Line gives this demonstration project a very high profile.

There are several other energy efficiency measures that we have taken. One of the main ones and part of my role at the airport is to have an energy reduction team, a group of airport employees from across departments and different organizations, that meets once a month. The team is looking for ideas about where we can cut energy use - often it leads to increased awareness and we now have an awareness program for employees; for example, turning off lights and equipment when not needed. We have an energy manager and do energy audits. We also do lighting retrofits.

Another initiative is the development of our own sustainable design guidelines for new buildings at the airport. All of our new building projects are run through these guidelines to make sure that they are incorporating energy efficiency measures and all those other environmental features that we want to make sure get carried on.

For us the greenest energy is the energy that we don't use. I think this is something that all organizations and individuals should be doing. We need to take advantage of the incentives for energy conservation that are offered by various agencies including BC Hydro and Natural Resources Canada. These are available to us as individuals for our homes as well where we can replace windows and increase the insulation, for example. That has to be the greenest power that you can come across.



#### Fourth Panelist

Nick Heap, Climate and Energy Policy Analyst,  
David Suzuki Foundation

#### Introduction

Despite the polarized rhetoric that we have witnessed over the past year or 18 months I believe that there is a remarkably broad consensus on the areas of concern regarding the way that renewable energy is being developed in BC. I have spoken with other NGOs, and people in the development community, and have deliberately tried to capture the emerging consensus amongst NGOs and at least some IPPs.

Let me be clear. The David Suzuki Foundation wants to see renewable energy in BC. We want to see lots of renewable energy and we want to see a fundamental shift to a low carbon energy supply in BC, Canada, and worldwide. Renewable energy is an indispensable component of any strategy to achieve deep reductions.

Meeting the targets for reductions in GHG emissions In a recent report that we published with the Pembina Institute, we said that by 2020 it is possible to achieve deep emissions reductions to levels that are 25 percent below 1990 levels, even with economic growth and with Alberta still getting richer faster than the rest of us. In that scenario, wind power is massively built out and provides 18 percent of Canada's electricity supply. At the same time there is a significant fuel switch to electricity, which increases total demand by over 25 percent. Renewable energy is a part of the solution and real action on climate change.

In BC we are not only connected to the planet in terms of needing to deal with the climate crisis but we are also physically connected to the Western Interconnect grid with the United States. BC has a lot of renewable resources including commercially viable large and small hydro, wind and biomass and conventional geothermal, as well as the future potential of dry rock geothermal, wave and tidal energy. And, of course, there is the potential to supply power into the grid if we choose to go in that direction.

#### Is renewable energy development in BC sustainable?

But the question is: Is renewable energy develop-

ment in BC sustainable? The answer is that it is not because the current framework for renewable energy fundamentally undermines the potential for sustained large-scale development of renewable energy. The current system reinforces two extremely unsustainable concepts. The first is that renewable energy development is in conflict with protection of the environment. The second is that renewable energy under development in BC is in conflict with the economic interests of British Columbians. Another way to pose this question is to ask: Are we developing in a way that meets the needs of renewable energy developers, be they public or private, without compromising the ability of future renewable energy developers, be they public or private, to meet their own needs?

So how do we deal with this? There are two general approaches to get around this. The first one is to ensure benefits to British Columbians and ensure that British Columbians understand that they are benefiting from this development.

#### Ensure low-impact renewable energy

Simon Robinson talked about the importance of efficiency and conservation. We need to maximize efficiency and conservation not least because it is cheap, or because it is the lowest impact form of energy generation we can have. If we maximize the potential for efficiency in BC that does not mean that we need to generate more, given the need to essentially de-carbonize our energy system. Figure 1 presents a ballpark estimate based on BC Hydro's estimates of future energy requirements.

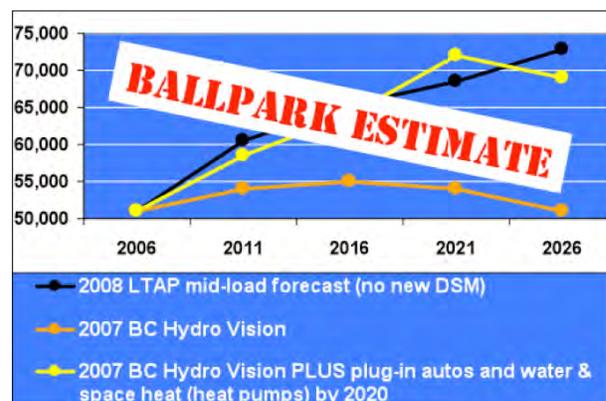


Figure 1. Estimates of future energy requirements.

BC Hydro's vision in 2007 was to reduce total energy demand by 2026 back down to 2006 levels. That vision is somewhat beyond what people think is economically feasible or politically possible at the moment. But if we do that and start electrifying private automobiles and converting natural gas heat to heat pumps, then what we will get is a total demand scenario that looks very much like the business as usual demand growth scenario, before energy efficiency was factored in and before there was any kind of shift to electrification of vehicles or electrification of space heating. Therefore, we can take all the steps to increase efficiency and we will still have a significantly increased demand for electricity, if we are doing the things that we need to do to achieve deep reductions.

Another important point is that we need to plan for low impact power development. There is a long history in BC of high impact power development. This isn't something that started with IPPs. In the 1960s and 1970s there were big power developments in this province, lead by BC Hydro. These developments flooded entire valleys, drowned villages and sank orchards. There are entire submerged forests that are now being logged with submarines. This is high impact power development and it has been going on for a long time.

### Renewable energy zones

Figure 2 shows a very promising concept that recently came out of the US Southwest, 'Renewable Energy Zones', in response to the enacting of renewable portfolio standards in some of the southwest US states.

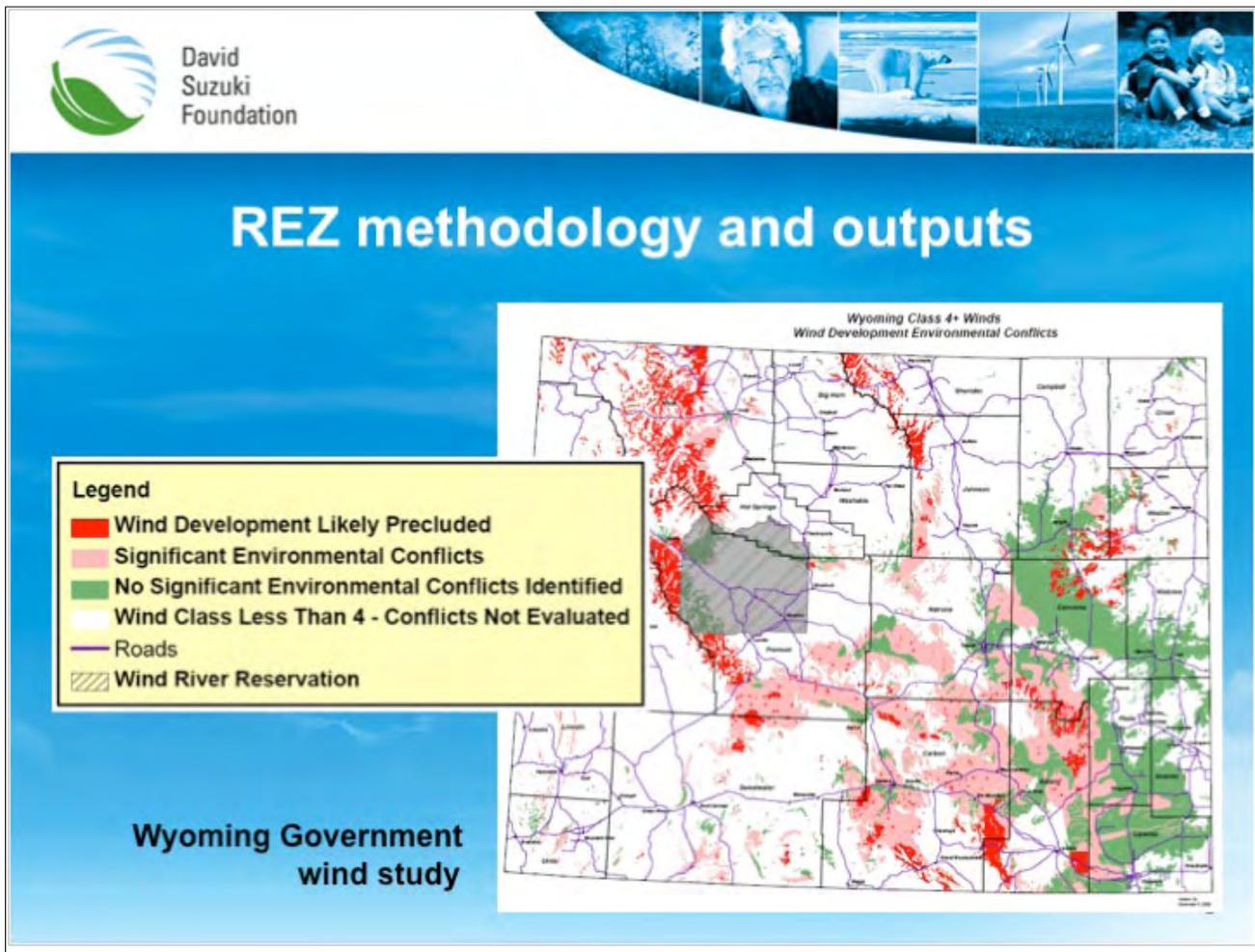


Figure 2. REZ methodology and outputs.

There are practical reasons for doing this - in order to serve this load you have to go to where the generation is. When there is renewable generation you have to build where the wind is, or where the water is falling, or where there is a lot of biomass to burn. The renewable energy generation is not as flexible as the old fossil fuel systems. Because it takes longer to permit and build a transmission line than it does to build a renewable energy generation station you have to know where the transmission line is going before the plants even get built. The basic rationale is to identify all lands with high renewable energy potential, and at the same time identify all environmentally sensitive lands in the area. You are then selecting for areas with high renewable energy potential and relatively low environmental sensitivity.

We recognize that there are no lands with zero environmental sensitivity but what we are finding is the optimum places of high energy potential and low environmental sensitivity. These are also areas of sufficient energy potential to bring a lot of power to bear.

The framework that was used in the Western Renewable Energy Zones process, which BC took part in, was 1,500 megawatts of developable renewable energy. Starting with those zones, we can do a cost benefit analysis, and then stage them in terms of development. This enables us to have an efficient provision of transmission infrastructure. We would be encouraging large-scale development of renewable resources in the areas that we know will result in less impact on the environment and the local biosphere.

The problem is that we are still waiting for this process in British Columbia. The plan, as it appeared to be, was that BC would participate in the 'Western Renewable Energy Zones Process', which was to do this kind of analysis across the Western Interconnection that includes everything in California and points west and BC and Alberta. The outputs from that process, which would have identified renewable energy zones and high energy/low impact areas, would have been fed into the BCUC Utilities transmission inquiry process, and that information would have been used as a very important input into the discussions about investing in transmission in BC. However, it did not work out that way. The resource assessment was

botched. The environmental lands assessment in BC was very good but it was not completed. There were some things that they intended to do that they did not complete and it was never applied. The BCUC transmission inquiry process was instructed to look at lands not limited to parks and protected areas as being unsuitable for generation, but that recommendation has not as yet been picked up by the Utilities Commission. The result is that the government has actually got a good environmental land screen, or it will have when it is completed, yet to date it has not been applied. It would have great potential to avoid a lot of impacts and a lot of grief over badly sited projects in British Columbia.

In conclusion, I believe that we need regulations that actually protect what needs protecting and a process that includes cumulative impacts assessment. We also need to ensure benefits to British Columbians. The message I want to leave is for you to encourage the government to use the work that they have already put into developing an environmental land screen in the Western Renewable Energy Zones process and make sure that it gets applied to the BCUC transmission inquiry process where there is actually a call to look at lands that are inappropriate for generation, not limited to parks and protected areas. If we brought in this one measure, it would have a significant effect on reducing the conflicts that we have about generation going into inappropriate locations.



## Fifth Panelist

Nigel Protter, Exergetics Development Co



I will focus on technology innovation and large-scale electricity systems and describe some of the results of my research and work. One of the reasons we are here is to address the collision of technology as adopted and the perception and reality of its impacts. I will try to explain some of the many factors that determine how and why society adopts, or in many cases inherits, large-scale electricity systems and then I will suggest where we might be going in the future.

### Background on how we got to where we are

#### **Technical issues**

There are actually two drivers: climate change and energy security. Governments have to consider strategic energy supplies. The global political landscape is ever uncertain, never more so than today, and emerging economies such as China, Brazil, and India will soak up a lot of hydrocarbons which will possibly lead to reductions in the world supply. When we look at where we are going it is all about the resource stack. It is a basket of electricity supply possibilities that are usually ranked, and historically have been ranked, on what is called the 'least cost merit order'. That is based on things like technology and fuel selection. Fuel can include water or wind or hydro-carbon resources. It increasingly includes sustainable development factors and it certainly includes system requirements, that is, the electricity system requirements such as firming and shaping requirements, black-start capacity requirements, spinning reserve requirements, peaking power, reactive power and load displacements, among others. These are technical issues that are very critical.

### Energy trading

We have heard a lot about energy trading. It is actually an essential efficiency piece in large-scale electricity systems, particularly regarding the Western Interconnect that Nicholas Heap described above. Without energy trading or electricity trading, each province or state would have to build more electricity capacity to meet its peak loads.

With trading we meet peak loads with trades or with peaking plants, which usually involves burning natural gas. Energy trading also allows us, regionally and transboundary, to benefit from a portfolio effect of intermittent generators. These are renewable generators and this portfolio effect is a type of smoothing of all the inputs, temporally and geographically. It is very important and it allows us to firm renewable resources without using gas-fired generation.

### The grid requirements

The grid requirements are also a critical factor in determining what we have inherited and where we are going, including: the existing infrastructure, new infrastructure, cost and buildability, permitting, social license, and a number of other factors, and in the future, the Smart Grid, and connecting the interconnects. North America has five major interconnects - the Western grid is one of them. They are not connected in a very efficient way and it is very difficult to trade electricity across them. However, if it was possible it would be good to take advantage of continent-wide diurnal temporal efficiencies.

### Policy considerations

Policy considerations are another huge advantage to pricing and so we look at lowest economic costs today. BCUC based its recent decision on that and it did not seem to consider sustainable development in its decision, as far as I can tell. We need to look at going forward with levelized fully internalized costs; namely, incorporating the external cost of climate change into the pricing of our energy and electricity. We also have to consider types of generation, monolithic generation, meaning fewer larger plants, or distributed generation with many smaller plants, and the pros and cons of each style. In addition, we have to consider consumer willingness to pay and a social license versus public interest, which are not always the same things, and the environmental risks

and tradeoffs. We seem to lack an objective measure of sustainability in electricity production and consumption.

We need to determine as well, and we haven't yet, what policy mechanisms are politically acceptable. There are renewable portfolios strategies, internalizing negative externalities, using carbon taxes versus cap-and-trade and also the existence and necessity of perverse policies and cross subsidies. IPP developers, and even utilities and publicly-owned developers, have their own set of issues; for example, the rate that they are going to be paid, or the rate base, and how that is determined; the permitting risks they take; the financial resources they have; and their selection based on things like reputation and experience.

### **New technology selection**

What about new technology selection? Should the market decide or should governments decide? My research has shown that markets are historically much better at predicting new technology adoption than governments. Can the technology be scaled? In other words, can it solve the big problems, or is it just an incremental small ladder? Not that incremental small ladders are not good, but you need to pick technologies to suit certain needs. What are the commercial timelines of new technologies? When are we really going to see them? There is a lot of optimism out there for new technologies. It is often misguided and too optimistic. Is it a science project or an engineering challenge? What about fusion, wave and tidal energy? Where do they fit in and are they real? Then there is the issue of capacity versus energy; that is, industrial capacity to manufacture, install and maintain.

My recent focus has been on wave energy. I founded a company called SyncWave. We don't have any of the large jack-ups and offshore oilfield equipment required to install offshore wind or wave energy here in BC, or tidal energy. It has all got to be brought in which is very expensive, and that is a limiting factor. In addition, the required labour technology and the training for all the people that would be involved could be limiting.

Another issue is the new technology adoption rate and the capital asset turnover rate. If you build a

big building and you have a heating system and it is only ten year's old you are not going to replace it with a new system because your financial plan didn't account for that and you could go bankrupt. What is the ability to finance new technology? Are the financiers willing to take the risk on financing that newfangled piece of equipment, is it buildable, and what are the maintenance and lifestyle expectations?

### **Conclusion**

I am going to conclude with my own personal estimates of technology trajectories to commercialization for BC and add what I think is a reality check.

Demand side management can be handled in several ways with price signals. Price signals on the consumer side is the only proven way to sway consumers' choices. People do not make personal choices in the long run to reduce their cost; they are looking for comfort. So we need to look at incremental efficiency improvements in technological infrastructure to make our DSM goals real.

Let's look at the potential of specific technologies. Tidal energy is probably two to five years out and we can expect very long permitting cycles of the same length as large stand backed Hydro because it is a very complicated and uncertain ecosystem with lots of conflicting values, including First Nations, tourism and intact ecosystems. It is the littoral zone of the ocean, the nearshore area and the 'nursery' of the oceans, and therefore huge tidal generators cannot be installed in numerous locations. Every tidal project has to be custom engineered for its location. It is not a scalable technology. I am fully in support of tidal energy it but it is not simple.

There is also unsubsidized solar photovoltaic energy. Solar PV energy is successful in California and Germany, but only because it has been heavily subsidized. It is a very polluting technology to manufacture. Limited resources and materials are required to build it. There are new thin film technologies coming out but the real cost is very high and we cannot really use it BC. On the other hand, solar thermal technology has a lot of potential. It is here now. It is very scalable and it can work in all types of climates. We saw one example in the presentation on the initiatives at the Vancouver Airport. It may not proceed at a large scale in BC, but you will be seeing it in the hot desert

areas of the world. It is fabulous technology.

There is also hot geothermal energy technology. It is a great technology but very risky. For example, at the Meager Creek geothermal site near Pemberton, over \$50 million has been spent by four different entities including BC Hydro in trying to prove out the resource, but they can't prove the recharge rate of the water. They are worried that if they suck the hot water out of that system it will destroy the hot springs, which is a natural beauty issue; that is, a trade-off of one small hot spring for a 200-megawatt plant. The idea is to drill a deep hole and pull out the steam, but if the natural flow of water can't recharge at any time then the plant would have to shut down. One issue then is that it may not work economically.

Biomass is happening now and many seem to be embracing this type of energy. However, I don't believe that you can predict fuel supply for biomass more than five years out, whereas plants typically have to be built for 20 to 40 year life spans. Another concern is that you need to locate the load for biomass where the fuel supply is, unless you are going to turn it into electricity and then the question is: Do we want to convert our biomass plants into electricity?

Wave power is probably two to five years out as well. It is a very large resource. I am very optimistic about wave power because I believe it will have extremely low environmental impacts per gigawatt hour and short permitting cycles. But it is a very tough thing to prove. It costs many millions to test each device and we don't have the infrastructure in BC to do that.

Wind energy is also here now. It has not been built out in BC because it is difficult to build and we don't have the transmission necessary to connect with where the wind is. It is also inherently more expensive than small hydro, which is why IPPs and BC Hydro have opted for small hydro. When I compare wind to hydro, I would say that small hydro is reliably unreliable but wind is unreliably unreliable.

So for the moment we are back to the devil we know, which is small hydro. It is not that anyone is supportive of damaging streams and water courses and ecosystems with small hydro, but when you look at the pragmatic realities of large-scale energy and the fact that we require, want and need our comforts

that are supplied by electricity, we have got to do it somehow.

# WHAT NEEDS TO BE INCLUDED IN A FUTURE VISION FOR GREENER ENERGY DEVELOPMENT FOR THE PROVINCE?

Panelists include:

*Tom Pedersen, Director, Pacific Institute for Climate Solutions*

*Janice Larson, Director, Renewable Energy Development, Province of BC*

## First Panelist

*Tom Pedersen, Director, Pacific Institute for Climate Solutions*

I'm going to touch on several keywords: urgency, pricing, mitigation, and political economy.

In 1936, Winston Churchill gave a very famous speech in which he remarked on the threat posed by Hitler. The theme of the speech was “the fierce urgency of now”, which is a phrase that has been used in the last six or seven months with reference to global change. It was most notably used by a group of Nobel Laureates in London in May 2009, when they issued a memorandum entitled “The Fierce Urgency of Now”, in reference to the crisis that faces humanity in terms of dealing with the global change challenge. We had a very passionate reminder yesterday from Tzeporah Berman who made a plea to get all hands on deck. Another way to phrase that is to say that we need to launch a full frontal assault. I particularly appreciate Nigel Protter's comments because he captured some of the options that sit before us as a society here in BC and he listed the pros and cons of each. However, we do need to think in terms of a full frontal assault.

Let me turn to some of the tools and possibilities. First, there is pricing. Mark Jaccard pointed out that we have a policy in British Columbia through our carbon tax that will foster a shift away from fossil fuel emissions toward electricity. Therefore, unavoidably, because of that carbon tax, we are going to see increased electricity demand.

We need to tackle that in two ways. Obviously we need to tackle it from the supply side and we have discussed this at length. We have not talked as much about the conservation side and the need for aggressive reduction targets in our electricity consumption. I think there is great scope for that here. We have also heard some discussion of, for example, changes to our building code, energy use by appliances, and so on. All of those things need to be tackled, and recognizing “the fierce urgency of now” we need to be aggressive in how we tackle them.

In terms of the carbon pricing issue, carbon taxation has another dimension to it that we dare not ignore, and that is the social equity issue. We cannot keep pushing up the price of energy for our society and at the same time ignore those who are least able to pay the additional costs. So there is a political dimension that also needs to be tackled as part of the overall package.

Turning to mitigation, this province is extraordinarily well placed to adopt clean technologies. We have heard that several times and Nigel Protter just captured that for us. The question that I pose, however, is: How do we accelerate the uptake? I have heard some people here say that we should slow down, but slowing down is in conflict with “the fierce urgency of now”. I believe that we need to speed up. We need to find ways to move faster in terms of our public consultation and public acceptance. I don't pretend to have the answers to that but I think that speed is of the essence.

One of the constraints that we face, and this has been brought up in some of the diagrams that have been presented, is the capacity of our electrical grid to accept alternative energy technologies. It is clear that our grids are constrained at least in BC and also in Alberta and Saskatchewan. The ability of these jurisdictions to accept broad-scale clean tech initiatives is constrained by their grids. Grid integration is an absolute must. Nick Heap presented a map showing the transmissions lines across western North America and you may have noticed that there was a line going into Alberta, near Cranbrook. That is our single intertie with the Alberta energy grid at the present time - 780 megawatts is its maximum carrying capacity and that is a very small amount of what is needed. There is another tie on the other side of Alberta into Saskatchewan and it is about 250 megawatts.

There is a great scope there however. Tying our grids together would allow us collectively, as a broader scale set of jurisdictions, to accept clean technologies on a more rapid basis than we can at the present time. In June 2010, the Pacific Institute for Climate Solutions will be hosting our second annual forum on 'Benefits, Hurdles and Pitfalls to Integration of the Western Canadian Electrical Grid'.

Finally, I want to comment on the politics of all of this. I was pleased to hear Nick Heap point out that we need to think in terms of benefits to British Columbians. There are environmental benefits and ecological benefits but there are also economic benefits. We have 16 gigawatts of wind power available in BC according to the chart that Doug Little presented. I look at that as 8,000 turbines and I ask the question: Are those turbines going to be built in British Columbia? The answer is - not right now. The turbines for the Naikun development will come from Europe. The Bear Mountain development that is already in place near Dawson Creek has Enercon turbines built in Germany.

Ontario proclaimed its Green Energy and Green Economy Act on May 14, 2009 and in that Act they require every turbine installed in Ontario to have 25 percent content that is Ontario sourced. Their yardstick is based on financing, so that 25 percent of the cost of the turbine has to be sourced in Ontario. That is instantly generating new industry in Ontario. Quebec has a similar, but tougher, regulation for its

wind turbine industry, which is growing by leaps and bounds and new factories are springing up in that province. Clearly, there are direct economic benefits for those societies through the passage of a relatively simple regulation. We don't have such a regulation in British Columbia and we should have. In terms of our vision for the future let's think seriously about how we can best encourage a BC industry that focuses on alternative energy development, installation and manufacturing.

In conclusion, let me make a plea for better politics. We heard from Michelle Nickerson, and I agree, that all political parties need to start singing from the same prayer book. In the last election campaign I was distressed to hear the opposition launch a campaign to axe the tax. Now, fortunately, they have recanted on that position. First, I think we need to encourage our politicians to recognize the absolute gravity of the challenges we face. This really is a case where we need to apply a full frontal assault. Secondly, they need to co-operate closely on how we can improve this situation for all of humanity starting here in British Columbia.



## Second Panelist:

*Janice Larson, Director, Renewable Energy Development, Province of BC*

What does a future vision for green energy development need to include? That's what we've been thinking about for some time and it is certainly what we have all been thinking hard about during this meeting.

I suggest that the following themes, which have already in large measure been discussed, need to be considered in a green energy vision for BC. The vision needs to include a strong counterpart in reducing energy demand, and it needs to be part of what we are thinking about in green energy supply development. BC has indicated this is a focus area in our energy plan and in many of the programs underway at the moment such as our energy efficient building strategy, the Live Smart BC program, and work we are doing to address the building code to reduce energy demand in the built environment. Can we do more? Yes. Can we all do more? Yes. Continuous improvement in reducing energy demand is something we should all be working on. As one participant said, "We all need to reduce our energy demand in every aspect of our society, in every aspect of our industry, in every aspect of our commercial ventures".

Secondly, we need to recognize that the picture is not limited to electricity supply and demand. It also includes energy supply and demand for heating and cooling. Trent Berry addressed that in his description of district energy systems. And as Nigel Protter mentioned, we need to be aware of how very valuable solar thermal energy is and we saw an application of this in Simon Robinson's description of the Vancouver Airport initiatives. Solar thermal energy reduces electricity demand and it is a renewable heat supply and is displacing heat that we would otherwise have to get from fossil fuels. The same thing is true for geothermal. It is in the ground beneath us and is accessible for all to use in our homes, businesses, and industries, so we need to be thinking about that in terms of how we are heating and cooling our built environment. Biomass also has great potential. We produce a lot of wood pellets in the province and they are being exported for thermal power production in Europe. Let's think about ways in which we can use more of that resource here, again to offset

fossil fuel use and free up some of that electricity supply. The more energy we save, the more electricity we save, the less we have to produce, and the less new supply we have to build.

However, we are going to have to build new supply, there is no getting around that. So recognition of the quality and the diversity and distribution of all of the clean energy resources we have in BC is critical to what is going into our green energy vision.

What are the challenges? As we have discussed, there are environmental tradeoffs as well as economic and social tradeoffs. There are also environmental, social and economic impacts. We as human beings impact the environment in everything we do - we have to accept this and try to minimize the impacts and balance them as best we can. We also have to plan for cumulative impacts and plan to get the lowest impact projects developed first. The need for more planning has been mentioned many times and this is clearly important. It is also necessary to appreciate the role of green energy in the context of the broader green economy that we would all like to see.

What does that mean domestically for British Columbians in terms of new energy, new jobs, new green jobs, stable economic development in regions that suffer from single resource economy, and volatility in markets? Can these new jobs provide economic stability in some communities? We have heard about how it has provided some exciting opportunities for First Nations to participate in meaningful ways in a new industrial opportunity in their communities. Their children don't have to leave to go to the big city - they can stay and work in the community.

We also have to think about what this means for us in terms of international market opportunities, and not just in terms of clean energy export. We have been exporting clean energy for quite some time in the form of electricity and wood pellets. There is a clean energy export opportunity here that could grow and expand. There are also opportunities for clean technology export. It is important to develop these opportunities in the context of a broader green economy for the province.

We also need to appreciate the full range of potential

participants in this green energy opportunity. We have talked a lot about IPPs, and about BC Hydro, but we have not talked about individual households who could put geexchange and photovoltaic systems in the ground or on their roofs. The laundromat on the corner could put a solar water heater on its roof. A dairy farmer could utilize the animal manure and other agricultural wastes for anaerobic digestion systems. The community co-op could produce its own biodiesel. A greenhouse could use wood pellets as its energy system. A Vancouver Island First Nation could utilize small hydro or an interior pulp mill could generate more biomass electricity. Or we could consider more innovative co-operative partnership models such as the Bear Mountain wind project in the northeast of the province where First Nations and a community co-operative are involved as well as the private sector and the partnership is benefiting many different players while producing green energy.

It is also important to recognize that in addition to being used for heating and cooling, green energy can be used for transportation. It is not just a prospect for transportation in terms of electrification but also in terms of renewable fuel development. We have heard that BC's existing electricity profile is relatively green already, by many definitions. Could it be greener? Yes. But BC's biggest challenge is its transportation sector, and that is also true around the globe in terms of reducing carbon emissions. Our transportation sector for the most part is 95 percent reliant on fossil fuels. It is going to take huge transformational thinking to get our global and even local, regional and provincial transportation systems off fossil fuels. Whether it is going to be completely off fossil fuels is unlikely. The question is: Can we come up with ways to minimize, reduce or at least replace some of the transportation fossil fuels with clean electricity, or even replace our existing fuel supply with lower carbon fossil fuels such as natural gas? These will all benefit the broader global warming issue that we have been discussing. Green energy is going to have to become increasingly prevalent in our society to deal with some of the big challenges we face.

I will close with one theme that I have heard referred to many times, and it may well be the most important theme; that is, that ongoing public engagement and better understanding of the opportunities and

the challenges in developing new energy supplies is key. Perhaps, using some of those tools, such as shown to us in Nick Hedley's presentation, in the new technologically speedy world might be the way to get broader engagement and understanding of what the world looks like where these projects are being developed. It might also help get some of that deeper thinking at the broader community and public level that we need for all of us to work together to take on this challenge and to embrace this opportunity.



### A parting challenge

A member of the steering committee commented:

We don't want to lose the ideas and the energy from this room and we need to figure out a way to keep this going.

A number of people have commented that there is an appetite to continue this kind of dialogue. We could build out the steering committee to be a bit more inclusive of the various interests and work towards a future dialogue session that could perhaps come up with shared principles or recommendations to then be distributed.

# APPENDIX ONE

## WORKSHOP AGENDA

### Overview

Given the mounting concerns surrounding global climate change impacts, green energy is a topical issue. It has also been a controversial issue in British Columbia, with dialogue around the development of run-of-river hydropower particularly polarized.

The goal of the Building a Vision for Green Energy in British Columbia Dialogue is to examine options for renewable energy with a main focus on hydro electric power. To achieve this, presentations, panels and dialogue will explore the issues through diverse perspectives including industry, science, institutions, First Nations, and civil society. To help focus the dialogue, presenters will address overarching questions.

### Dialogue Questions

- What are the opportunities for and challenges of developing independent power production in BC (social, economic, environmental)?
- Are we on the right path?
- What is needed for better decision-making?
- Would a strategic plan help? If so, what would it look like?

### Dialogue Facilitator

Michael Harstone, Compass Resource Management

### Participation

This public dialogue will provide an opportunity to explore options in building a vision for renewable energy in BC. It will be valuable to those concerned with resource management,

policy, the ecological footprint and the social, economic and environmental trade-offs associated with the various energy options. The fee is \$200 including taxes and pre-registration

### Outcome

A report with a synthesis of perspectives and presentations will be made available electronically after the Dialogue.

### Context for dialogue

All proceedings will be recorded to support the post-workshop report. Photographs or digital vodcasts may also be included.

### Guidelines for Dialogue

These guidelines are designed to create opportunities to maximize participation, foster a safe place for dialogue, enable vigorous differences to surface without disrespecting anyone, promote an open and full exchange of information/ideas and generate an environment of shared learning.

- Presenters/responders respect time by keeping to their allotted timeframe.
- Participants respect time through concise comments and questions.
- Participants identify themselves when speaking.
- Participants listen and speak with respect.
- Participants try to find a good way to say difficult things.
- Let there be humour, where we explore tough issues, with a spirit of learning, creating a healthy and constructive learning environment.
- If there are any questions or concerns please bring them to facilitator.

# Agenda • Tuesday–Wednesday, November 3–4, 2009

## DAY 1: TUESDAY, NOVEMBER 3

### 8:00 am **Registration and Light Refreshments**

8:30–9:00 am

#### **Welcome and Introduction**

Welcome — John Pierce, Dean, Faculty of Environment, SFU

Introduction — Michael Harstone, Compass Resource Management

9:00–9:30 am

#### **The Difficult Trade-offs of Green Energy**

Presentation followed by discussion—Mark Jaccard, Professor, School of Resource and Environmental Management, SFU

9:30–10:00 am

#### **Future Power Needs in BC and the Potential for Green Energy**

Presentation followed by discussion—Cam Matheson, Director of Energy Planning, BC Hydro.

- Do we need more energy? What are the challenges for BC Hydro?

10:15–11:30 am

#### **Industry Perspectives on Hydro Power**

A panel will address the dialogue questions and then discuss their observations. The dialogue will then be opened to the larger group.

- Harvie Campbell, Chair, Independent Power Producers Association and Executive Vice President, Strategy and Development, Pristine Power Inc.
- Doug Little, Vice President, Customer and Strategy Development, BC Transmission Corporation
- Cam Matheson, Director of Energy Planning, BC Hydro

11:30 am–12:15 pm

#### **Aquatic Ecosystem Impacts of River Diversion for Hydro Power**

Presentation followed by discussion — Jack Stanford, Jessie M. Bierman Professor of Ecology and Director, Flathead Lake Biological Station, University of Montana

12:15–1:00 pm

#### **Lunch, ICBC Concourse**

Hosted by Pristine Power Inc.

1:00–1:30 pm

#### **Wildlife Impacts**

Presentation followed by discussion—Scott Harrison, Senior Environmental Specialist, BC Hydro

1:30–2:00 pm

#### **Framework for Cumulative Impacts**

Presentation followed by discussion

- Tanis Gower, Fernhill Consulting
- Aaron Hill, Biologist, Watershed Watch Salmon Society

2:00–3:00 pm

#### **Respondent Panel — Science Perspectives on Hydro Power**

A panel of scientists will respond to presentations, followed by discussion

- John Reynolds, Tom Buell Leadership Chair in Salmon Conservation, Biological Sciences, SFU
- Tom Pedersen, Director, Pacific Institute for Climate Solutions
- Dave Marmorek, President, Essa Technologies

3:00–3:15 pm

#### **Break**

3:15–5:00 pm

#### **Civil Society (The Public) Perspective on Hydro Power**

A panel will address the dialogue questions and then discuss their observations. The dialogue will then be opened to the larger group.

- Gwen Barlee, Policy Director, Western Canada, Wilderness Committee
- Tzaporah Berman, Executive Director, PowerUp Canada
- Guy Dauncey, President, BC Sustainable Energy Association
- Jeremy McCall, Executive Director, The Outdoor Recreation Council of BC
- Elaine Golds, Vice President, Burke Mountain Naturalists

# Agenda • Tuesday–Wednesday, November 3–4, 2009

## DAY 2: WEDNESDAY, NOVEMBER 4

8:00 am **Light Refreshments**

8:30–8:45 am

**Overview of Day 1** — Michael Harstone

8:45–9:00

**Visualizing green energy potential and environmental performance in BC: A snapshot of tools to engage citizens and students**

Nick Hedley, Assistant Professor, Geography, SFU

9:00–10:30 am

**Government Perspectives on Hydro Power**

A panel representing Federal, First Nations, Provincial, Regional or Municipal perspectives will address the dialogue questions and then discuss their observations. The dialogue will then be opened to the larger group.

- James Mack, Head, Climate Action Secretariat, Government of BC
- Adam Silverstein, Manager, Environmental Assessment, Fisheries and Oceans Canada
- Randall Lewis, Environmental Coordinator, Fisheries Project/Environment, Lands and Resources, Squamish Nation
- Glen Davidson, Director and Comptroller of Water Rights, Management and Standards Branch, BC Ministry of Environment
- Steven Olmstead, Director, Planning and Development, Squamish Lillooet Regional District
- Shelley Murphy, Executive Director, Electricity, Electricity and Alternative Energy Division, BC Ministry of Energy, Mines and Petroleum Resources

10:30 am–12:15 pm

**Feature Case Studies**

Case study presentations will address environmental stewardship, public participation, First Nations involvement and/or partnerships and any other important processes involved in their development.

- Taku/Atlin—Peter Kirby, President and CEO, Xeitl Limited Partnership and Taku Wild Products
- Kokish River, Kwagis Power—Ray Pillman, Senior Advisor, The Outdoor Recreation Council of BC
- Sechelt Creek: Beyond Compliance—David Carter, Regional Power, & S.Quinn, Sechelt Indian Band

- Initiatives Under Consideration in the Chehalis Traditional Territory—Chief Willie Charlie, Chehalis First Nation
- NaiKun Offshore Wind Energy Project—Matt Burns, Vice President Operations, Naikun

12:15 pm–1:00 pm / **Lunch**

1:00–1:45 pm

**Climate Change and Potential Hydrological Consequences**

Presentation followed by discussion — Dan Moore, Professor, Department of Geography and Department of Forest Resources Management, UBC

1:45–3:00 pm

**Greener Vision for Hydro Projects: Open Discussion**

Summarize components of a strategic policy/plan for run of river IPP development. What would this look like in terms of next steps

- Ian Gill, President, Ecotrust Canada
- Josh Paterson, Legal Counsel, West Coast Environmental Law
- Ray Pillman, Senior Advisor, The Outdoor Recreation Council of BC

3:15–4:30 pm

**Perspectives on Green Energy**

A panel with broad experience in alternative forms of renewable energy (wind, solar wave, geothermal and tidal) will address the dialogue questions and discuss their observations. They will discuss the trade-offs and assess the different energy options. The dialogue will then be opened to the larger group. What would be the right power in the right place?

- Ron Monk, Kerr Wood Leidal Associates Ltd.
- Trent Berry, Compass Resource Management
- Simon Robinson, Environmental Specialist, Vancouver International Airport
- Nick Heap, Climate and Energy Policy Analyst, David Suzuki Foundation
- Nigel Protter, Exergetics Development Co.

4:30–5:00 pm / **Final Session**

What needs to be included in a future vision for greener energy development for the province?

- Janice Larson, Director, Renewable Energy Development, Province of BC
- Tom Pedersen, Director, Pacific Institute for Climate Solutions

## Speaker Biographies

**Gwen Barlee** is the Policy Director with the Wilderness Committee. Her campaigns in recent years have focused on environmental degradation and the erosion of the public good through privatization. Gwen's current campaigns with the Wilderness Committee include endangered species, parks and public lands, and the proliferation of private power projects in British Columbia.

**Tzeporah Berman**, MES, has been one of Canada's leading environmental voices for over a decade and is now the Executive Director and one of the co-founders of the new national climate initiative, PowerUp Canada. Tzeporah is also a co-founder of ForestEthics, a non-profit environmental organization with offices in Canada, the US and Chile that is well known for its successful campaigns to protect the Great Bear Rainforest, the boreal forest and to transform the buying practices of major corporations. Prior to joining ForestEthics, Tzeporah worked for seven years with Greenpeace International and Greenpeace Canada.

**Trent Berry** is a professional economist with diverse experience in the energy sector, including the private, public and non-profit spheres. He has worked on the design and evaluation of green power procurement programs, scenario models, net metering programs, renewable portfolio standards, and carbon pricing and offset policies. Trent has conducted evaluations of numerous green energy projects and technologies, including a review of the green energy industry for the governments of BC, Washington, and Oregon. In recent years, he has assisted in the development of green district energy schemes throughout the Pacific Northwest, including the Neighbourhood Energy Utility serving Vancouver's Olympic Village and surrounding Southeast False Creek neighbourhood. Trent holds a BSc in Environmental Studies from the University of Saskatchewan and a Masters in Resource Management from Simon Fraser University.

**Matt Burns** is the Vice President of Operations with the NaiKun Wind Energy Group Inc., a BC-based renewable energy company. The company is developing a 396 MW offshore wind energy project that will generate enough energy to provide

electricity to 130,000 B.C. homes, help the province reach its goal of becoming electricity self-sufficient by 2016, and play a significant role in combating climate change. As Vice President Operations, Matt Burns' primary responsibilities at NaiKun Wind are in the areas of First Nations, community relations, as well as overseeing the work related to the company's application for an environmental assessment certificate. Mr. Burns manages the entity that will operate and maintain the wind project after construction. This entity is a subsidiary that is a 50/50 partnership between the Haida Nation and NaiKun Wind. Matt holds a BA in Political Science from Simon Fraser University and an MBA from the University of British Columbia.

**Harvie Campbell** is a founder, the Executive Vice President and a Director of Pristine Power Inc. Having spent over 30 years in the energy business, he has extensive experience in project development and mergers and acquisitions. Harvie joined Westcoast Energy in 1984 as a financial analyst and economist, assuming successively more senior roles in planning, development and financial analysis before joining Westcoast Power in 1992. In 2001, he was appointed Vice President, Business Development. Harvie has played lead roles in the development of a number of power and international infrastructure projects including the Taylor NGL project, the Fort Nelson Transmission Project, the McMahon, Lake Superior Power, Whitby, Puncakjaya, Island Cogeneration, Frederickson, East Windsor, Savona and 150 Mile House Power Projects. He is Chairman and past president of the Independent Power Producers Association of BC and holds a Bachelor of Arts (Honours) from the University of Alberta and a Master of Arts in Economics from Simon Fraser University.

**David Carter** lobbied government to put in place a policy for the establishment of a private power industry in the 1970s and developed his first hydroelectric project in Ontario in 1975. He partnered with the Ojibways of the Pic River First Nation in 1988 to develop the 13.5 mw Wawatay Generating Station which became the first successful privately financed hydroelectric project in Canada,

paving the way for other First Nation communities to become involved in waterpower. David directed the team that received the Blue Planet Prize from the International Hydro Power Association awarded at the United Nations Climate Change Conference in Montreal in 2005 for the Sechelt Generating Station and he is the first recipient of the Ron Dodokin Lifetime Achievement Award, voted on by the membership of the Ontario Waterpower Association. David is a founding partner and Executive Vice President of Regional Power which has over 325 MWs of late stage waterpower developments in its portfolio.

**Chief Willie Charlie** is the Chief of the Chehalis Band. (Bio was not available at time of printing.)

**Guy Dauncey** is a speaker, author, and organizer who works to develop a positive vision of a sustainable future, and to translate that vision into action. He is author of the newly published book *The Climate Challenge: 101 Solutions to Global Warming*; the award-winning book *Cancer: 101 Solutions to a Preventable Epidemic*, and seven other titles. He is President of the BC Sustainable Energy Association, and publisher of *EcoNews*, a monthly newsletter that promotes the vision of a sustainable Vancouver Island. His home page is [www.earthfuture.com](http://www.earthfuture.com).

**Glen Davidson** is the Director of Management and Standards, for the Water Stewardship Division of the BC Ministry of Environment. He is also appointed as the Comptroller of Water Rights for the Province of British Columbia. Glen is registered as a Professional Engineer and holds a Bachelor of Applied Science in Civil Engineering from the University of British Columbia. Glen has over 25 years experience in many aspects of water resource management including, flood hazard, dam safety, water use planning and water allocation.

**Ian Gill** is president of Ecotrust Canada (Vancouver, BC) and a director of Ecotrust (Portland, Ore.), related non-profit organizations that promote the emergence of a conservation economy in the coastal temperate rainforests of North America. He is also a director of Ecotrust Australia, Vancity Credit Union, the First Nations Regeneration Fund, the Boat Basin Foundation and the Na na kila Institute, and is a

member of the Forestry Advisory Council at the University of BC. He is the author of the best-selling books *Hiking on the Edge: Canada's West Coast Trail*, *Haida Gwaii: Journeys Through the Queen Charlotte Islands* and most recently, *All That We Say is Ours: Guujaaw and the Reawakening of the Haida Nation*.

**Elaine Golds** is Vice President, Burke Mountain Naturalists, where she has been Conservation Chair for over 15 years. Elaine played a key role in the protection of Pinecone Burke Provincial Park, Colony Farm Regional Park and has served on various committees and panels including a provincial Advisory Committee to develop an Integrated Wildlife Management Strategy, the Lower Mainland Protected Areas Advisory Committee, BC Hydro's Consultative Committee for the Coquitlam River Water Use Plan and subsequent Monitoring Plan and Port Moody's Burrard Thermal Liaison Committee. Elaine has also taken an active role in addressing the potential environmental impacts of a proposed gravel mine and, most recently, a proposed private power project, in the Upper Pitt Valley. She holds a PhD in Biochemistry.

**Tanis Gower** is an ecologist with a focus on healthy watersheds and sustainability of water and fisheries resources. On behalf of Watershed Watch she distilled run-of-river power issues in BC into a widely read 'Citizen's Guide', and has done ongoing work regarding the sustainability of current policies and projects. Her experience includes several years with the BC Ministry of Environment, working on watershed and terrestrial ecosystem restoration.

**Michael Harstone**, MSc (planning), PEng, is a Partner of Compass Resource Management Ltd. He is a resource planner and decision analyst who has facilitated many community based environmental processes related to green energy and water use. This work has included involvement in community energy plans, a 20 year integrated electricity plan for the province, the development of the first Water Management Plan (under Part 4 of the *Water Act*), watershed planning, environmental impact assessments, and numerous fish and wildlife planning processes. Michael has used innovative decision support techniques to assist First Nations communities, environmental organizations, local

citizens, industry groups, and government agencies to manage environmental risks and grapple with scientific uncertainty.

**Nicholas Heap**, Climate and Energy Policy Analyst, David Suzuki Foundation, has worked for the David Suzuki Foundation for four years, and has been actively engaged in the Western Renewable Energy Zones initiative and the BCUC Transmission Inquiry. Nick has met with government, power producers and other non-profits to advance policy approaches that would enable the large-scale development of low-impact renewable energy in BC. He has an MA in Community Planning from UBC.

**Nick Hedley** is an Assistant Professor in the Department of Geography at Simon Fraser University, where he is the founding director of the Spatial Interface Research Lab. He has been researching geographic visualization and various 3D interface technologies for more than a decade and has designed visualization interfaces in a variety of environmental contexts, including: risk mitigation; environmental remediation; collaborative spatial decision-making; geological data exploration; human exposure to environmental hazards, dynamic oceanographic processes; hydrogeology; avalanche hazards; search and rescue; and interactive tsunami simulations. Nick has been a visualization consultant for numerous organizations in government and industry, including BBC, BHP Billiton, the Science Museum (UK), Boston Museum of Science and Lucasfilm, and has partnered on research programs with groups including the BC Provincial Emergency Program, the Canadian Water Network, and Geomatics for Informed Decisions. He received an MA in Geography from the University of Colorado and a PhD in Geography from the University of Washington.

**Aaron Hill** is an ecologist with roots in northwest BC, and works primarily on issues affecting salmon habitat and fisheries. Prior to working for Watershed Watch he completed a Masters degree in Biology at the University of Montana where he also worked on BC's north coast as a researcher on the Salmonid Rivers Observatory Network research program. Aaron's work currently focuses on Pacific salmon

conservation and ecological sustainability of energy development in BC.

**Mark Jaccard** has been a Professor in the School of Resource and Environmental Management at Simon Fraser University, Vancouver, since 1986—interrupted from 1992–1997 while he served as Chair and CEO of the British Columbia Utilities Commission. His PhD is from the Energy Economics and Policy Institute at the University of Grenoble. Internationally, Mark is known for his work on the Intergovernmental Panel on Climate Change (Nobel Peace Prize in 2007), the China Council for International Cooperation on Environment and Development, and the Global Energy Assessment (convening lead author for sustainable energy policy). In 2008, he was named British Columbia Academic of the Year and in 2009 a Fellow of the Royal Society of Canada.

**Scott Harrison** is Senior Environmental Specialist at BC Hydro. His work extends to BC Hydro's role as co-Chair of the Ecosystems Focus Area at the World Business Council for Sustainable Development. Scott is also a lead author for a section of the *Report from Business in The Economics of Ecosystems and Biodiversity* (TEEB)—a project sponsored by a number of international organizations including the European Union and the United Nations. Along with his explorations as a member of the National Geographic Expeditions Council, Scott has explored solutions for sustainability as a volunteer for governments, non-government organizations, and the United Nations. He holds a PhD in ecology from the University of British Columbia and was a post-doctoral fellow in the Department of Zoology at Oxford University.

#### **Janice Larson**

Janice Larson is the Director of the Renewable Energy Development Branch in the BC Ministry of Energy, Mines and Petroleum Resources in Victoria, where she and her colleagues work on policies and initiatives to advance the development of bioenergy, biofuels and renewable energy resources and technologies for domestic and international markets. Janice holds a Bachelor of Arts degree from the University of Lethbridge, degrees in Education and Law from the University of British Columbia, and is a

non-practicing member of the British Columbia Bar Association.

**Randall Lewis** is the Environmental Coordinator and Fisheries Project Manager in the department of Environment, Lands and Resource for the Squamish Nation. (Bio was not available at time of printing.)

**Doug Little** is the Vice President of Customer and Strategy Development for the British Columbia Transmission Corporation (BCTC) in Vancouver. BCTC operates, plans, maintains and expands the high voltage transmission system in most of British Columbia. Doug joined BCTC in 2005 and is responsible for business development, market operations and public affairs as well as strategy and policy. Prior to joining BCTC, Doug was at Powerex for more than 12 years, during the advent of open access and the growth of the power markets.

**James Mack** is currently the Acting Head of the BC Climate Action Secretariat in the Ministry of Environment. The Secretariat leads change to achieve the Province of BC's greenhouse gas emission reduction targets and is comprised of a strong team of committed and knowledgeable people with expertise in key areas of climate action including: carbon neutral operations, transportation and energy policy, research, and strategic partnerships. Prior to joining the Secretariat, James worked in Ottawa for the Government of Canada on a variety of environmental, social and economic development issues including work at the Canadian Environmental Assessment Agency, the Privy Council Office, and Indian Northern Affairs Canada.

**David Marmorek** is President of ESSA Technologies Ltd., based in Vancouver. He enjoys combining his technical knowledge (modelling, experimental design, adaptive management, decision analysis) with people skills (facilitation, team leadership) to tackle environmental problems at various spatial scales. He received his MSc in Zoology from UBC, and is an Adjunct Professor in the School of Resource and Environmental Management at SFU.

**Cam Matheson** is currently the Director of Energy Planning for BC Hydro, overseeing the development

and creation of the company's long-term power planning processes, demand forecasts, market price forecasts and regulatory filings. He has held previous roles as manager of BC Hydro's generation operations, strategic issues and power facilities. Cam holds degrees in law and international relations and worked for many years around the world in disaster and conflict relief operations with the International Red Cross.

**Jeremy McCall** is the Executive Director, of the Outdoor Recreation Council. He served as President of Nature Vancouver from 1998 to 2001 and as President of BC Nature from 2002 to 2006. During that time he visited 36 of BC Nature's 48 member clubs, including those in Dawson Creek, Mackenzie, Smithers and Terrace. He has been associated with the Outdoor Recreation Council in various capacities since 2005. After his initial career in the Royal Navy's submarine service in Britain and Canada, Jeremy obtained a Bachelor of Commerce degree at UBC.

**Ron Monk**, MEng, PEng, leads KWL's Energy Sector. His expertise includes feasibility, design and construction of small hydro projects. Prior to returning to KWL in 2007, Ron's key accomplishments at BC Hydro included leading the 2004 Integrated Electricity Plan, co-initiating the hydrogen program and co-developing BC Hydro's sustainability vision. He is currently leading the generation resource cluster assessment for BC Hydro and BCTC as part of the Long Term Transmission Planning Inquiry.

**Dan Moore** grew up in the lower mainland and completed his BSc (Hons.) in Climatology at the University of British Columbia in 1979. He then spent a year measuring river flow in the Yukon for Water Survey of Canada before travelling to New Zealand to conduct doctoral research on snow hydrology. After returning to Canada in 1985, Dan has held faculty positions at McGill University, Simon Fraser University and the University of British Columbia. His current research focuses on the hydrologic consequences of environmental changes, including climate change, forest disturbance and glacier retreat.

**Shelley Murphy** is the Executive Director for Electricity in the Electricity and Alternative Energy Division of the BC Ministry of Energy, Mines and Petroleum Resources. She has worked for the Provincial Government since 1991 as a policy analyst, senior advisor and various director positions in the Ministry of Energy, Mines and Petroleum Resources, Ministry of Economic Development and Ministry of Environment. Shelley has a Bachelor of Arts degree from the University of Winnipeg and a Master of Arts degree in Economics from Queen's University in Ontario.

**Steven Olmstead**, Director of Planning for Squamish-Lillooet Regional District, has 30 years of regional and small community planning experience in BC. Steven was responsible for development of the policy framework for IPP development in the SLRD and has participated in numerous project assessment teams and environmental assessments dealing with water power projects. He was a Union of BC Municipalities local government representative on an interagency task force that examined process and coordination issues among various government interests in IPP development and continues to advocate for a planned approach to regional IPP development.

**Josh Paterson** is the Aboriginal and Natural Resources lawyer at West Coast Environmental Law in Vancouver, where he works with First Nations and other communities on issues related to energy, oil and gas, and forests. He has a longstanding interest in Indigenous and environmental legal issues, and has also been actively involved in urban sustainability and livability issues for a number of years. Josh was called to the Bar in 2005, and graduated with law and master's degrees from the University of Toronto. Josh was named 2007 Lawyer of the Year by Pro Bono Law British Columbia for his advocacy at the Federal Court of Appeal.

**Tom Pedersen** was appointed Director of the Pacific Institute for Climate Solutions beginning September 1, 2009. His previous positions included Dean of Science and Director of the School of Earth and Ocean Sciences at the University of Victoria, and Associate Dean, Research, for the Faculty of Graduate Studies at the University of British Columbia. Tom

is an internationally recognized authority on ocean chemistry and has longstanding interests in climate change issues and the application of government policy to climate-change mitigation and adaptation. Tom holds a degree in geology from UBC and a PhD in marine geochemistry from the University of Edinburgh. He is also a fellow of the Royal Society of Canada and a fellow of the American Geophysical Union.

**John Pierce** has for the past 33 years served many diverse roles within Simon Fraser University as a researcher, teacher, administrator and community advisor. He has taught and published widely on topics relating to sustainable community development; food security, resource and environmental management/modelling; and public policy. As an administrator he served as Chair of the Department of Geography, Director of the Centre for Community Economic Development, Dean of the Faculty of Arts and Social Sciences; and most recently he serves as the inaugural Dean to the newly created Faculty of Environment at SFU. John received his PhD from the London School Of Economics.

**Ray Pillman** is a Civil Engineering graduate of UBC. His professional career was largely in hydroelectric project planning, design and construction. As an employee of the Acres Consulting Group he was engaged on projects for the BC Power Commission, Ontario Hydro, and private power producers and was the engineer responsible for major projects for Hydro Quebec and Manitoba Hydro. As a director of the Acres Consulting Group, and president of Acres International, Ray had overall responsibility for large and modest-sized power projects and planning in Guatemala, Brazil, Argentina, Thailand, Laos, Iraq, Taiwan, Kenya and East Pakistan. Since retiring, he was for 6 years, Chair of the Outdoor Recreation Council of BC and has since served as Senior Advisor to the Council. Ray has represented the outdoor recreation sector on the province's land use planning initiatives for the past 10 years.

**Nigel Protter** is a founder and former CEO of SyncWave Energy Inc. and SyncWave Systems Inc., companies founded, respectively, to develop and commercialize SyncWave Power Resonator wave

energy converter technologies and services. Along with scientists from the University of Victoria, he is an inventor of the SyncWave frequency-based motion platform and its integral reactionless tuning method, a new generation wave energy converter system. Nigel is currently managing director of Exergetics Development Co., which provides advice, analysis, and services to merchant green power project development companies in the realms of project feasibility, technology strategy, permitting and stakeholder acceptance, government relations, business development and sustainable development. Formerly a director of the IPPBC, founding director of the Ocean Renewable Energy Group, energy sector representative for the Sea to Sky LRMP, a founding member of BC Wind Energy Working Group, he was also the project lead and manager for the BC Hydro/BCTC Wind Interconnection System Expansion (BC WISE) project. Nigel holds an MBA from Simon Fraser University in Management of Technology, where he focused on technology shifts, deregulation, distributed generation, and sustainable development and their impacts on the performance of IPPs and the structure of the electricity industry.

**John Reynolds** is a professor at Simon Fraser University, where he holds the Tom Buell BC Leadership Chair in Salmon Conservation and Management. His research focuses on understanding connections between salmon and their ecosystems, emphasizing implications for conservation and sustainability. This includes long-term studies of links between salmon-derived nutrients and biodiversity in 50 watersheds in the Great Bear Rainforest. He has held a wide range of scientific advisory positions, including the BC Pacific Salmon Forum and the Skeena Independent Science Review Panel.

**Simon Robinson** is an Environmental Specialist with the Vancouver Airport Authority. He has 20 years of experience in environmental management and sustainable building design. Simon is responsible for managing the environmental aspects of the Airport's expansion program, which has included new terminal buildings, taxiways, roads, bridges and the Airport's portion of the Canada Line. Simon developed the Airport Authority's Sustainable Design Guidelines and is a member of the Airport's Energy Reduction

Committee. A registered professional biologist, Simon also manages environmental programs to ensure airport operation is not impacting the Fraser River estuary.

**Adam Silverstein** is the Regional Manager for Panel Environmental Assessments at Fisheries and Oceans Canada. Adam has a degree in Biology and 10 years of experience in addressing environmental issues for the Government of Canada. Prior to his current role, he was responsible for managing all of DFO environmental assessments for major development projects in the Pacific region. Adam has also undertaken environmental compliance, monitoring, audit, and emergency response with the Department of National Defense, Public Works and Government Services Canada, Canada Border Services Agency, and the Commissioner of Environment and Sustainable Development.

**Jack Stanford** is the Jessie M. Bierman Professor of Ecology and Director of the Flathead Lake Biological Station at the University of Montana, where he has worked since 1971. He is well-known for his research on natural and cultural interactions of large catchment ecosystems and his long-term studies of the Flathead River-Lake ecosystem in Montana and British Columbia in addition to his research on the ecology of rivers regulated by dams. In 1999, Dr. Stanford began extensive work on a suite of observatory salmon rivers in Kamchatka (Russia), Argentina, Alaska, and British Columbia; the research focuses on cross-site comparisons of the effects of marine nutrient subsidies on floodplain ecology. He is a board member of the Wild Salmon Center, Portland, OR, and has served on many national and international science review panels and editorial boards concerning the ecology and conservation of rivers and salmonid fishes. In June 2004, Professor Stanford received the Award of Excellence of the North American Benthological Society.