Lost in Transmission:
A Comprehensive Critique of the BC Energy Plan

Prepared for:
Canadian Office and Professional Employees Union
Local 378
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The British Columbia Energy Plan

A Three Paper Critique

At the request of the Canadian Office and Professional Employees Union, Dr. Marvin Shaffer, with the research assistance of Jennifer Hove and Jason Yamashita, undertook an independent review of the British Columbia 2007 Energy Plan. The critique, which focuses on BC Hydro-related policies in the Plan, is presented in three policy papers:

- Self-Sufficiency and Insurance: Exaggerating the Need for New Sources of Electricity Supply
- BC Hydro Electricity Rates: The Impacts and Costs of Buying High and Selling Low
- The Supply Side in the Energy Plan: Targeting Low Value/High Cost Resources

The papers point out that the Energy Plan is fundamentally flawed.

The self-sufficiency policy in the Plan will require BC Hydro to acquire enough new sources of supply to be able to meet all of its requirements with domestic resources even in drought years. It fails to recognize how BC Hydro can cost-effectively import and store energy in those years when its hydro capability is reduced by low water conditions. BC Hydro's own analysis shows that backing up the risk of low water by importing and storing energy when needed will be lower in cost and have less environmental impact than what the Energy Plan will require. Under the Plan, BC Hydro will acquire more new sources of supply than necessary. Self- sufficiency even in drought years combined with 'insurance' is effectively a policy of unnecessarily and uneconomically acquiring new independent power producer (IPP) supply for export, with BC Hydro and its customers assuming all of the export price risk.

With respect to BC Hydro electricity rates, the Energy Plan extends in perpetuity the policy of setting rates on the basis of the low historic costs of BC Hydro's hydroelectric and other heritage assets, not the current market value or cost of new supply. While a policy of low electric rates may have superficial appeal, it promotes electricity-intensive industrial growth on the false premise that BC Hydro has surplus low cost electricity available for sale and it undermines conservation efforts. It is like a subsidy program that is promoting unsustainable economic development and benefiting the largest electricity users and households more than those who use the least amount of electricity. A far better strategy would be to be phase out the effective subsidy of electric rates, as the government's own task force on energy policy recommended. The increased revenues that the higher rates would generate to provide targeted relief for households (limiting the low rates to a basic electricity requirement) and to promote sustainable economic development in other ways (with strategic infrastructure investments, greater investment in training and education, and broad-based tax relief).

On the supply side, the Energy Plan limits BC Hydro's ability to develop its own resources, supports the retirement of the Burrard natural gas thermal plant despite its strategic location and function, and directs BC Hydro to recognize more firm energy value from run-of-river and wind resources. While classified as green, run-of-river and wind are green only in terms of their GHG emissions. They and the transmission lines they require can have significant cumulative environmental effects. Moreover, they are relatively high in cost and low in value to the BC Hydro system. Run-of-river projects provide much of their energy in the spring time when it is least needed and of least value to BC Hydro. And wind energy needs minute-to-minute and longer term back-up because of the intermittent nature of the supply. The back-up and related services that wind energy needs impose significant costs on BC Hydro. Also, wind provides very little if any dependable capacity when needed to meet peak requirements. It is true that these sources do not emit GHGs, but it is not at all clear that pursuing these high cost low value resources are a cost effective way of meeting our GHG targets.

Overall, the three paper critique points out that despite the green veneer, the province's Energy Plan is designed more than anything else to artificially increase the market for new IPP supply. A truly green strategy would start first with minimizing the need for new supply. It would then instruct BC Hydro to acquire or develop whatever new resources it unavoidably needs in the best possible manner taking all economic, environmental, and social factors into account. The Energy Plan simply does not do this.

Do we really need so much new power?

Exaggerating the Need for New Sources of Electricity Supply

The Policy of Self-Sufficiency and Insurance

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ISBN 978-0-9784058-0-9
Published by the Canadian Office and Professional Employees Union Local 378
June 2007

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1.0 Introduction

The province's 2007 Energy Plan is fundamentally flawed. It will needlessly increase the cost of electricity supply in the province and greatly diminish the value of our unique, publicly-owned hydro reservoir assets.

- The Plan calls for self-sufficiency in electric energy supply even in critical low water years. It ignores the ability of BC Hydro to back up the risk of low water conditions with cost-effective market purchases of power. One industry expert estimated the cost of this policy to be in the order of $160 million per year, equivalent to a rate increase of 5.5%.

- The Plan calls for so-called 'insurance'—the acquisition of 3000 Giga Watt hours (GWh) of electricity over and above its self-sufficiency target. There are no economic parameters or constraints for this policy. Nor is there any economic rationale. It will almost certainly add to the uneconomic acquisition of new sources of supply, and potentially double the cost impact that the self-sufficiency policy will in itself have.

- The combination of self-sufficiency in critical low water years plus insurance is effectively a policy of acquiring new Independent Power Producer (IPP) resources for export, with BC Hydro and its customers assuming all of the export price risk.

- The Plan calls for conservation and energy efficiency measures to meet half of forecast incremental requirements. At the same time, however, it extends in perpetuity, through the Heritage Contract, the policy of selling electricity at well below market prices. The Plan does not recognize the fundamental conflict between its rate and conservation policies. It does not offer a serious, coherent strategy to reduce inefficient or uneconomic requirements for electricity—electricity that customers would not want if they had to pay the economic and environmental costs of new supply.
- The Plan calls for the rapid development of IPP resources, like run-of-the-river hydro and wind, that are generally high in cost; rely on and diminish the value of BC Hydro's reservoir system; can have significant cumulative environmental impact; and do not offer any security of supply or price beyond specified contract periods. While there are specific circumstances where these resources may be beneficial, in excessive amounts they will have excessive cost. BC Hydro should be allowed to select the best resources available to it, taking into full account all of the economic, environmental and social consequences they have.

In short, the Plan is not well-considered and it is not in the general public interest. There is no constraint on demand by rates that reflect the cost of new supply, and no constraint on new IPP supply by what the market and BC Hydro's own projects would otherwise cost. The Energy Plan will result in the development and purchase of too much electricity supply at too high a price.

The purpose of this paper is to address the self-sufficiency and insurance policies in the Plan. It examines why imports and other market purchases are currently used to meet BC Hydro's requirements—why they have been a cost-effective supply strategy as opposed to evidence of a reliability concern. It considers what acquisition and supply strategies are needed going forward to ensure both reliability and cost-effectiveness in meeting growing electricity requirements. And it provides estimates of the cost of the self-sufficiency and insurance that the province is forcing BC Hydro to pursue.

2.0 BC Hydro's Current Supply and Requirements for Electricity

In 2006, BC Hydro's gross requirements (domestic sales plus losses) totaled almost 58,000 GWh. As shown in Table 1, 46,850 GWh of that was met by BC Hydro's hydroelectric generation and 6,700 GWh from Independent Power Production contracts. BC Hydro's thermal power production in 2006 was less than 400 GWh.

Table 1
BC Hydro Supply and Requirements - 2006[1] (GWh)

Requirements		Sources of Supply	Trade
Domestic sales	52400	BCH hydro	46850
Losses/own use	5300	Burrard thermal	40
		Other BCH thermal	340
		IPP contracts	6700
		Net imports	4400
		System Storage	(600)
Total	57700	Total	57700

Net imports[2] totaled 4,400 GWh in 2006. Some 3,800 GWh of that were needed to meet domestic requirements. The other 600 GWh that were imported served to increase BC Hydro's reservoir levels.

Under an internal transfer pricing agreement between BC Hydro and its trading subsidiary Powerex, net imports are now separately allocated to BC Hydro domestic and Powerex trading accounts.

In 2006, the amount of net imports allocated for BC Hydro domestic use was 5,900 GWh. Powerex's allocation was –1,500 GWh; in other words it was a net exporter in that year. These allocations don't change the physical power flows, or total system reliance on imports; rather they affect the internal corporate accounting of imports and charges for their current or future use.

[1] *Sources: BC Hydro 2006 Annual Report (for requirements and BC Hydro production), BC Hydro 2006 Integrated Electricity Plan (for IPP contract volumes), and BC Hydro F07/08 Revenue Requirements Application, BC Hydro Response to IPPBC IR 1.11.2 (for net imports and changes in system storage). The total requirements and supply do not exactly equal due to rounding as well as the different sources that were needed for the Table.*

[2] *Net imports include market purchases from Alberta, the U.S and in-province IPPs. They are the overall net imports to the BC Hydro system for both domestic and trade purposes.*

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As shown in Table 2, BC Hydro has been a net importer of electricity every year since 2001. In 2005 net imports totaled 7,400 GWh, of which 6,900 GWh were allocated for domestic use.

Table 2

***BC Hydro Net Imports* - 2001-2006 [3] (GWh)**

	System Net Imports	Domestic	Trade
2001	1700	n.a.[4]	n.a.
2002	5200	n.a.	n.a.
2003	1800	n.a.	n.a.
2004	5100	5300	(200)
2005	7400	6900	500
2006	4400	5900	(1500)

There has been a lot of concern expressed about BC Hydro's net imports of electricity. IPP lobbyists, the media and government officials have all decried what they describe as a deficit position. A Times Colonist editorial stated: "B.C. has been in an electrical deficit for five years… that's a shocking fact".[5] The CEO of BC Hydro recently wrote in an op-ed article defending the government's self-sufficiency policy: "Hydro has had to import electricity from neighbouring jurisdictions in each of the past five years **just to meet our needs**" (emphasis added).[6]

However, suggestions that BC Hydro's net imports of electricity over the past five years are evidence of a shortage of power or supply concern are simply incorrect. BC Hydro did not need to purchase 5,900 GWh to meet domestic requirements in 2006. It chose to import those volumes because it was economic to do so. As a technical spokesperson for BC Hydro pointed out in response to media, industry and political concerns about the so-called deficit: "there are good reasons for importing power… BC could lessen its reliance on outside sources by developing its own facilities, but that would mean higher electricity prices for consumers".[7]

A major reason why BC Hydro chose to import electricity in 2006 and previous years is because it could purchase electricity in wholesale markets at a lower cost than operating its Burrard thermal plant.[8]

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[3] *Source: BC Hydro F07/08 Revenue Requirements Application, BC Hydro Response to IPPBC IR 1.11.2.*

[4] *Domestic vs trade allocations were not defined prior to the 2003 Transfer Pricing Agreement.*

[5] *Times Colonist, March 31, 2006.*

[6] *Vancouver Sun, April 10, 2007.*

[7] *Reported by Scott Simpson, Vancouver Sun, October 19, 2004.*

[8] *Over the past three years, the cost of electricity from Burrard would have been $10 to $50/MWh more expensive than the cost of imports. Source: BC Hydro 2006 IEP and LTAP Application, BC Hydro Response to Cloudworks Energy IR 1.6.1.*

BC Hydro rates the annual energy capability of the Burrard plant at over 6,000 GWh.[9] In 2006, production at Burrard was less than 40 GWh. In the language of BC Hydro's energy traders, Burrard was almost never 'in the money'. It was not economic nor was it necessary to buy natural gas and run Burrard for domestic (or export) purposes.

BC Hydro has also chosen to import electricity in order to add to its hydro storage when its reservoirs were relatively low and not expected to be refilled with annual water run-offs. The imports have enabled BC Hydro to reduce its own generation, leaving more water behind the dams. In 2006, imports effectively added 600 GWh to BC Hydro's system storage; in 2005 they added 3,600 GWh.

In Table 3, BC Hydro's system net imports over the past six years are shown along with Burrard thermal production, its hydro generation and changes in reservoir storage. The table clearly shows the role imports have played in displacing production from Burrard and backing up the hydro system.

Table 3

Net Imports in Relation to BC Hydro Production and Reservoir Levels - 2001-2006 [10] (GWh)

	System Net Imports	Burrard Thermal Prod.	BCH Hydro Generation	Change in Reservoir Storage
2001	1700	4000	45500	(1900)
2002	5200	2700	40500	800
2003	1800	100	47600	0
2004	5100	100	44800	100
2005	7400	500	41800	3600
2006	4400	40	47200	600

Burrard production has been less than its firm capability every year over this period, most notably since 2003. Burrard is an old and relatively inefficient power plant, and not economic to run when gas prices are high relative to the market price of electricity, which they have been in recent years. Nevertheless Burrard has a unique value. It is strategically located where BC Hydro needs power, and helps ensure peak and annual electricity requirements can be met. It doesn't have to be operated, but can be when required. The Burrard plant has let BC Hydro take advantage of wholesale electricity markets without being dependent on them. Over the past six years it has been increasingly advantageous for BC Hydro to do so.

[9] *BC Hydro 2006 Integrated Electricity Plan.*

[10] *Source: BC Hydro F07/08 Revenue Requirements Application, BC Hydro Response to IPPBC IR 1.11.2.*

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With respect to BC Hydro's hydroelectric generation, production levels have been relatively low over the past six years. BC Hydro estimates that under average water conditions, its annual hydro production would be approximately 47,000 GWh. In four out of the last six years, hydro production was significantly less than that. In 2002 and 2005, hydro production was particularly low, and imports correspondingly high.

It is important to recognize that BC Hydro's hydroelectric generation can vary over 10,000 GWh depending on water conditions[11]; more with changes in reservoir levels.[12] In an isolated electric system, fluctuating water conditions have to be backed up with domestic firm resources. However, BC Hydro is interconnected with Alberta and the western United States. It has the opportunity to buy electricity from the market in years when water conditions are low. And because of its large, multi-year hydro storage capability, it can buy from the market when electricity is readily available and relatively low in cost. Well over half of BC Hydro's imports for domestic purposes are purchased during light load hours, when surplus thermal capacity keeps prices relatively low. And a significant amount of its imports have been in the spring when surplus freshet hydro production in Pacific Northwest system typically causes market prices to fall.[13]

IPP industry lobbyists have argued that BC Hydro should not be importing electricity under any circumstances. They even suggest that BC Hydro should pursue a policy of oversupply.[14] However, what this ignores is that importing electricity has been a very cost-effective strategy for BC Hydro.

The alternative that the IPPs have demanded and that government will now force BC Hydro to pursue is to acquire more IPP resources instead of importing to back up the hydro system and displace Burrard. As shown in Table 4, a conservative estimate of the extra cost that this would have caused in 2006, based on BC Hydro import and IPP cost data, is some $60 million. This estimate is conservative because it ignores incremental transmission costs with the IPP supply (the average cost of imports is for electricity delivered to the Lower Mainland). And it reflects the cost of existing sources of IPP supply, not the cost of incremental sources of supply. The extra cost of replacing all imports with long term IPP contracts would have been $160 to $180 million[15] based on the prices in the contract awards from BC Hydro's F2006 Call.

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[11] *In the Heritage Contract hearing, BC Hydro estimated that its historical hydro production averaged 46,600 GWh and ranged within +/- 5000 GWh (BC Hydro Proposal for Heritage Contract, Stepped Rates and Access Principles, BC Hydro Response to CBTE IR 2.3.0). More recent estimates of the range around hydro production in average water years is from –4,000 GWh in low water years to +6,000 to 8,000 GWh in high water years.*

[12] *In 1995, BC Hydro's hydroelectric production was 39,900 GWh. In 1997 it was 53,300.*

[13] *Source: BC Hydro F07/08 Revenue Requirements Application, Response to IPPBC IR 1.24.3.*

[14] *Harvie Campbell of the IPPBC Association stated in a Board of Trade panel that oversupply is actually a good policy because it prevents this kind of flow of funds [for imports] out of British Columbia. Reported by Scott Simpson, Vancouver Sun March 24, 2004.*

[15] *Brian Wallace estimated the extra cost of adding 4,000 GWh of firm IPP purchases at $160 million (Presentation to the 4th Annual BC Power Summit). The $180 million estimate reflects the assumed replacement of all 2006 BC Hydro imports by new IPP purchases, based on an average IPP cost of $88/MWh for electricity delivered to the Lower Mainland.*

Table 4
***Import vs IPP Cost* - 2006**[16]

Quarter	Avg cost of imports ($/MWh)	Avg cost of existing IPPs ($/MWh)	Volume of Imports ($/GWh)	Import cost saving ($million)
1	53	66	2882	37.5
2	48	62	948	13.3
3	72	73	896	0.9
4	63	70	1274	8.9
Total			***6000***	***60.6***

3.0 Planning and Acquisition Criteria

The Energy Plan states that BC Hydro must acquire sufficient B.C. based resources to be able to meet its requirements with domestic resources at all times, even in critical water years—the lowest sequence of water run-offs experienced over the last 60 years. This policy directive, while cast in the context of ensuring reliability, is not in fact needed to ensure the security of our electricity supply.

Security of electricity supply requires that BC Hydro have sufficient dependable generating and transmission capacity to be able to meet peak loads. Market liquidity or transmission constraints could limit imports or other market purchases to meet peak demands in the specific hours they occur. But the focus of the province's Energy Plan is not on peak capacity. It is on annual energy capability—the ability to meet electricity requirements over the course of the year.

Security of electricity supply does not require that BC Hydro have sufficient domestic annual energy capability to meet the total amount of electricity required over the course of the year. It certainly doesn't require, as prescribed in the Energy Plan, that BC Hydro have sufficient domestic annual energy capability in all years regardless of water conditions. Unlike peak capacity, annual energy capability can be supplemented by the purchase and storage of seasonal and off-peak imports or other market sources of supply.

To ensure security of annual energy supply, BC Hydro need only have sufficient domestic supply that together with its annual import or other market purchase and storage capability, it can always meet its annual requirements.

BC Hydro previously recognized its ability to rely on 2,500 GWh of imports or other market purchases to meet annual requirements. This market allowance was part of its energy planning criteria until BC Hydro's latest Integrated Electricity Plan. The 2,500 GWh allowance for imports was conservative; it was first developed in 1995 before open access and the expansion of markets in the Pacific Northwest,

[16] *Sources: BC Hydro 2006 IEP and LTAP Application, BC Hydro Response to Cloudworks Energy IR 1.6.1 (for average import and existing IPP costs); BC Hydro F07/08 Revenue Requirements Application, Response to IPPBC IR 1.24.3 (for import volumes by quarter allocated for domestic use).*

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Exaggerating the Need for New Sources of Electricity Supply

California and Alberta greatly increased BC Hydro's ability to import electricity. Actual net imports and other market purchases over the past five years demonstrate that BC Hydro could, if it chose, rely on considerably more. In 2005, net imports totaled some 7,400 GWh. With the existing intertie capacity between B.C. and the U.S. and Alberta, BC Hydro could import over 10,000 GWh of electricity, even if the intertie capacity were only available and used 50% of the time.

That isn't to say BC Hydro should depend on imports of up to 10,000 GWh per year. It might not be cost-effective to buy that much electricity on the market. Rather, the point is that to assume no imports or other market purchases can be made, even in low water years, is unnecessary. Nor is it economic.

BC Hydro could, for example, plan on the basis of average water conditions[17], still ensure security of supply and do so in a more cost-effective manner than what the Energy Plan will require. Planning on the basis of average water conditions would mean that BC Hydro would only have to acquire new resources such that its firm purchase contracts together with its hydro capability in average water years and its reliable, firm thermal capability[18] would be sufficient to meet annual requirements. In low water years BC Hydro would have to import up to 4,000 GWh to meet its requirements, in addition to any imports or other market purchases it chose to make to displace its thermal capability.

BC Hydro would have to pay the market price for the imports or other market purchases required to back up low water conditions. However, under this planning criterion BC Hydro would avoid the need to enter into additional long term contracts for 4,000 GWh of supply and the economic cost and environmental impact they entail. Even run-of-the-river hydro and wind farms have environmental impact; 4,000 GWh of electricity would displace the need for 100 to 200 small (5-10 MW) hydro sites or some 500 (3 MW) windmills and their associated transmission requirements.

There is no question that BC Hydro is physically able to import (or make other market purchases) and store 4,000 GWh of electricity if required because of low water conditions. Indeed, the lower our water run-offs and reservoir levels, the more electricity can BC Hydro import and store. Relying on imports and other market purchases to back up fluctuating water conditions would in no way risk BC Hydro's physical ability to meet its requirements.[19]

The issue, as the BC Utilities Commission (BCUC) stated in its recent BC Hydro IEP/LTAP Decision, is not one of physical supply, but rather one of price. And the price issue is not simply that market prices may be high. Rather, the price issue is whether relying on market prices to back up low water conditions will be more or less economic than entering into long term, fixed price contracts. BC Hydro's own submissions in the recent IEP/LTAP hearing favoured market purchases: "the portfolios [that BC Hydro analyzed] with 3,000 and 6,000 GWh of market purchases are both cheaper and less sensitive to gas price forecasts than other scenarios".[20]

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[17] *This is in fact the definition of hydro supply that the provincial government required BC Hydro to use in the development of the Heritage Contract—the supply that is priced on the basis of historic average cost.*

[18] *Whether that would be 6100 GWh for Burrard or some fraction of that would depend on the maintenance program or other plans BC Hydro instituted for Burrard, an important issue in its own right.*

[19] *BC Hydro acknowledged in the recent IEP/LTAP hearing that there are well established spot markets and there will always be the opportunity to buy electricity. BCUC, In the Matter of BC Hydro Integrated Electricity Plan and Long Term Acquisition Plan, Decision, May 11, 2007, p. 120. In addition to the out-of-province market sources there are in-province as well. For example, BC Hydro could purchase energy at market prices from Teck Cominco. Teck Cominco has surplus energy capability; in 2006 its net exports totaled 830 GWh. It could also purchase energy from the province, which receives over 4,000 GWh per year from Bonneville Power as a result of its entitlement to downstream benefit (DSB) power under the Columbia River Treaty. More economic sources of energy than the DSBs will most likely be available because the DSBs are delivered to the province on-peak and consequently are higher in value than the off-peak energy BC Hydro can buy. In terms of security of supply, however, they are physically available if required.*

[20] *BCUC, In the Matter of BC Hydro Integrated Electricity Plan and Long Term Acquisition Plan, Decision, May 11, 2007, p. 124.*

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The province's self-sufficiency policy confuses three quite distinct aspects of supply: physical reliability; price certainty; and source of supply. Self-sufficiency is not needed to ensure physical reliability of supply. Self-sufficiency can provide greater price certainty if secured with long term fixed price contracts, but that in itself won't reduce price risk, it will just change the nature of the risk. The only certain thing self-sufficiency will do is ensure that B.C. resources are used to meet B.C. requirements regardless of the cost.

If there are benefits from self-sufficiency they will come from the price certainty and the requirement for domestic supply. But the province's policy does not address what the magnitude of these benefits is likely to be and how that compares to the costs. The fundamental problem with the province's self-sufficiency policy is that it is not backed up with any data or analysis that suggests that the benefits can be expected to exceed the costs. Nor is the policy qualified in any way—it does not say, for example, that price certainty and domestic supply should be pursued but only to the extent the benefits are expected to outweigh the costs.

There is, in fact, little reason to expect there will be net benefits from the price certainty that the province's self-sufficiency policy will provide.

- The proportion of BC Hydro's total supply subject to short term market price uncertainty is relatively low, and would remain so on average even if it were to rely on imports or market sources of supply to back up low water conditions.[21]

- Entering into fixed high price contracts raises the risk of paying too high a price, which is in fact what recent IPP contract awards suggest would happen. The fixed long term prices in the F2006 contract awards are well above all but the highest forecasts of future market prices.[22] And with the constraints imposed on BC Hydro by the province's Energy Plan, domestic IPP supply prices could increase. The more BC Hydro is required to rely on domestic IPPs, the more expensive they are likely to be.

- The province's self-sufficiency policy will only reduce BC Hydro's exposure to market prices in low water years. In all other years it will increase it. Buying enough electricity to meet BC Hydro requirements in critical water years will result in surpluses in all other years. The province's requirement for 3,000 GWh of 'insurance' will add to the surplus. The value of those surpluses and therefore net cost of the long term fixed price contracts to BC Hydro and its customers will depend on market prices.

- The price risk associated with up to 4,000 GWh of imports or other market purchases if required to offset low water conditions is already fully hedged by the Downstream Benefits (the DSBs) returned to the province under the Columbia River Treaty—electricity that is sold for the province by Powerex at U.S. market prices. Even if the DSBs are not directly used to meet BC Hydro requirements, from a provincial perspective they provide a perfect financial hedge. Any spike in import costs would be more than offset by the higher revenues the province would receive for the DSBs. The price risk associated with low water year purchases is also offset by Powerex profits, to the extent that higher market prices increase the value of the storage and arbitrage that Powerex can effect. From a provincial perspective, high electricity market prices would also be offset by the higher natural gas royalties that the province would receive, given the typically strong correlation between electricity and natural gas prices.[23]

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[21] *BCUC, In the Matter of BC Hydro Integrated Electricity Plan and Long Term Acquisition Plan, Decision, May 11, 2007, pp. 119-120.*

[22] *BC Hydro, Report on the F2006 Call for Tender Process Conducted by BC Hydro, August 31, 2006, p. 49.*

[23] *Given the province's entitlement to the DSBs and its large natural gas resources, from a provincial perspective B.C. is currently exposed to electricity and natural gas market prices being lower than expected. The province's self-sufficiency policy will increase that exposure.*

With respect to the benefits of local supply, there is the protectionist notion that we are better off paying our own workers and businesses for all of the goods and services we need. However, as economists have long argued, there are benefits to trade. We should produce those goods and services for which we have a comparative advantage, and backing up fluctuating water conditions with high cost domestic sources of supply may not be one of them.

Even if B.C. did have a comparative advantage in this, the benefits to BC Hydro and its customers will be quickly lost with mandated domestic supply, as required by the Energy Plan. There is no surer way to raise costs than to increase demand for domestic supply and at the same time eliminate all import competition. It is a policy that is designed to benefit the IPP industry, not customers.

4.0 Impact and Cost of Energy Plan Self-Sufficiency and Insurance

In its February 2006 load forecast, BC Hydro is projecting its total domestic load (including losses) to grow from 57,100 GWh in 2006 to 59,400 GWh in 2007; 68,300 GWh by 2016; and 78,100 GWh by 2024. The amount of new supply needed to meet the forecast load, given the policies in the Energy Plan, are shown in Table 5. By 2016, almost 10,000 GWh of new domestic supply will be required. By 2025, over 18,000 GWh of new domestic supply will be required.

Table 5
***New Supply Requirements Under the Energy Plan* - (GWh)** [24]

	2007	2016	2025
Forecast Load (incl. losses)	59400	68300	78100
Forecast Load after DSM	59400	63850	68750
Insurance Requirement	------	------	3000
Available Supply (as per Energy Plan)	58100	54000	53400
New Supply Requirements	***1300***	***9850***	***18350***

[24] *Source: BC Hydro, Report on the F2006 Call for Tender Process Conducted by BC Hydro, August 31, 2006, p. 38. In accordance with the Energy Plan, the new supply requirements assume that 50% of load growth is met by DSM, hydro capability is limited to the energy available under critical water conditions, and 3000 GWh of insurance is required by 2025. The available supply includes the expected firm supply from the F2006 contract awards and assumes the Burrard thermal plant is retired by 2016.*

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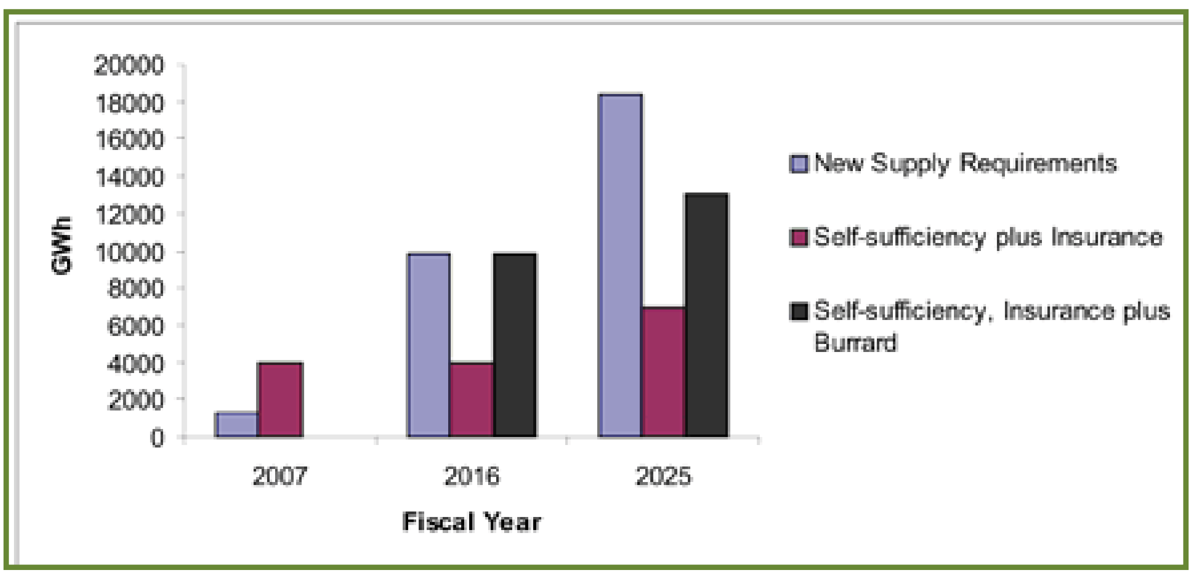
Exaggerating the Need for New Sources of Electricity Supply

These new supply requirements are significant. Given the attrition rate in recent IPP contract awards, there might have to be five Calls for 5,000 GWh of energy or more over the next 20 years[25]. It certainly suggests there is an urgent and major requirement for the acquisition of new sources of supply.

What is important to note, however, is that the scale and urgency of the new supply requirement is a creation of the province's Energy Plan. It is not dictated by the need for a secure electric energy supply.

The chart below shows the amount of the new supply requirements that is due to the self-sufficiency and insurance policies in the Energy Plan, and the amount due to those policies plus the assumed retirement of the Burrard thermal plant.[26] As shown in the chart, the amount of new supply required in 2016 under the Energy Plan is almost 10,000 GWh. However, 4,000 GWh or 40% of that requirement is due simply to the self-sufficiency policy in the Energy Plan—the policy that would prevent BC Hydro from backing up low water conditions with imports if required. And 10,000 GWh, which is equal to the entire new supply requirement in 2016, is due to the self-sufficiency policy combined with the assumed retirement of the Burrard Thermal Plant.

Amount of New Supply Requirements Due to Provisions in the Energy Plan



[25] *BC Hydro estimated that the attrition and outage factor that should be applied to its F2006 Call awards is 30% (BC Hydro, Report on the F2006 Call for Tender Process Conducted by BC Hydro, August 31, 2006, pp. 34-35). At that rate, Calls for over 25,000 GWh would be necessary to secure 18,000 GWh of firm supply.*

[26] *The province supports the retirement of Burrard in the Energy Plan, even though the Utilities Commission has concluded that the retirement of Burrard requires further consideration, noting that BC Hydro has not made an application or case that better sources are available. (BCUC, In the Matter of BC Hydro Integrated Electricity Plan and Long Term Acquisition Plan, Decision, May 11, 2007, p. 73).*

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In other words, if imports were allowed to back up critical water conditions and Burrard is not retired, no new supply would be required for 2016. That is not to say that no new supply should be acquired. New sources should be acquired if they are economic or otherwise advantageous in relation to their economic and environmental costs. The point is that, except for the dictates of the Energy Plan, there is no urgent need to acquire new sources of supply. The Energy Plan says to BC Hydro: 'buy more IPP supply whatever the impact and cost'. What it could and should say is: 'buy, but only to the extent it makes good economic and environmental sense'.

Even for 2025, the requirement is much less dramatic than the Energy Plan suggests. Almost 40% of the new supply requirement in that year (7,000 GWh of the 18,350 GWh requirement) is due to the self-sufficiency and insurance policies in the Energy Plan—policies for which there are no economic criteria or justification. And over 70% of the new supply requirement in 2025 is due to those policies combined with the assumed retirement of Burrard. Exactly what should be done with Burrard is not yet clear. However, there are environmentally responsible options for Burrard that may be preferable both economically and environmentally to the generation and transmission projects that would be required to replace it. If that proves to be the case, the new supply requirement in 2025 would be some 5,000 GWh, not much more than what the Site C project would provide if it could be developed in an environmentally and socially acceptable way. With or without Site C, that is a much different outlook than what the Energy Plan would require.

There is no doubt that the urgent, large scale demand for new sources of supply created by the Energy Plan is beneficial to the IPP industry. There will be greater opportunity and higher prices for their projects. However, the portfolio analyses that BC Hydro undertook for its 2006 Integrated Electricity Plan report suggest that BC Hydro expansion plans under the Energy Plan will not benefit customers or the environment. The expansion plans with self-sufficiency and insurance are higher in cost and have greater land, water and local air emission impacts than alternative scenarios.

Table 6 presents a summary of the financial and environmental consequences of five different expansion plans that BC Hydro analyzed for its most recent Integrated Electricity Plan. The alternative plans were specifically designed by BC Hydro to assess the impacts of maintaining versus retiring Burrard, and of self-sufficiency or self-sufficiency plus insurance versus relying on different amounts of imports in critical water years.

Table 6

Financial and Environmental Consequences of Alternative BC Hydro Plans [27]

	Maintain Burrard	Imports up to 6000 GWh	Imports up to 3000 GWh	Self - sufficiency	Self-sufficiency plus insurance
System costs ($m,PV@6%)	4261	4178	4271	4458	4824
Impacted Land (ha)	8387	8822	8950	9199	9260
Impacted Aquatic (ha)	4069	4167	4169	4240	4295
GHG Emissions (kilotonnes)	19778	13926	12935	11340	11167
Local Air Emissions (tonnes)					
-NOx	206	99	87	1065	5915
-SOx	2259	1454	1312	5866	21418
-CO	382	260	88	8060	39072
-VOC	64	43	15	4	3539
-PM10	0	0	0	4019	14431
-PM2.5	567	588	501	485	480

The table indicates the lowest system cost (BC Hydro incremental expenditures including all purchases net of any surplus export revenue) would be realized when imports are allowed. There would be savings of some $180 to $280 million as compared to the self-sufficiency case and $550 to $650 million compared to self-sufficiency plus insurance. Maintaining Burrard is also a low cost option—with savings of $200 million relative to the self-sufficiency case and $560 million relative to the self sufficiency plus insurance case.

With respect to impacts on land and aquatic areas, maintaining Burrard is the best case, followed by the import cases. The self-sufficiency and self-sufficiency plus insurance cases require the most amount of new development, and consequently impact the greatest amount of land and aquatic areas.
With respect to local air emissions, the import cases are best. The highest local air emission impacts for all contaminants but PM2.5 would occur under the self-sufficiency plus insurance cases. They are significantly higher than not only the import cases, but also the case with Burrard. The large amount of local air emissions, most notable in the self-sufficiency plus insurance case, is due to the amount of biomass development that was assumed in this case.

[27] *Source: BC Hydro, 2006 Integrated Electricity Plan, Table 6-4, p. 6-19.*

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The one advantage of the self-sufficiency and self-sufficiency plus insurance cases is for Green House Gas (GHG) emissions. The cumulative difference in GHG emissions over the planning period would be almost 2 to 3 million tonnes relative to the import cases and 8.6 million tonnes relative to the Burrard case. However, this benefit to some extent is already factored into the financial cost. The system cost analysis assumed a charge of $15/tonne for GHG emissions, rising to $25/tonne by 2015— a charge that is intended to reflect the cost of offset measures.

There are, of course, many assumptions underlying BC Hydro's analysis of these alternative plans. Spot market prices may be different from the forecast that BC Hydro used. The charge required to offset GHG emissions may be different from the charge in BC Hydro's analysis. The cost of the new resources required in the different cases will almost certainly be different. BC Hydro's analysis assumed unit energy costs of $49-$64/MWh for wind, and $50-$60/MWh for run of the river. The bids in the F2006 Call were much higher than that.

Nevertheless, the analysis that BC Hydro did is what is currently available and does not support the self-sufficiency, insurance or Burrard policies in the Energy Plan. To the contrary, BC Hydro's analysis suggests that whatever superficial appeal the Energy Plan self-sufficiency and insurance policies may have, they could be costly in financial and environmental terms. At a minimum, BC Hydro's analysis suggests exercising caution in the policy direction to BC Hydro—not urgency in the pursuit of what appear to be the highest cost, highest impact plans.

5.0 Conclusions

As stated at the outset, the province's 2007 Energy Plan is fundamentally flawed. The problems with the self-sufficiency and insurance policies in the Plan are addressed in this paper.

The self-sufficiency and insurance that the Energy Plan would force BC Hydro to pursue reflect a misunderstanding of the BC Hydro system, and the role that imports have played to displace Burrard and back up low water conditions—a role they could continue to cost-effectively play if not for the dictates of the Plan.

Self-sufficiency and insurance are not needed to ensure the physical security of our electric energy supply. They may provide price certainty in fixed price IPP contracts, but that will not eliminate price risk. They will raise the risk that BC Hydro will be paying too high a price for its electricity supply. Self-sufficiency and insurance will ensure that BC Hydro acquires all of its energy from B.C. sources, but like all protectionist measures, that will serve only to benefit the IPP industry, not BC Hydro customers.

With respect to the environment, the self-sufficiency and insurance policies will cause more land and aquatic impacts and more local air emissions than would otherwise occur. They may result in a reduction in GHG emissions, but GHG emissions can be offset, and there is no evidence to suggest that expansion plans with self-sufficiency and insurance would be preferred at any reasonable offset charge. Indeed, BC Hydro's analyses suggest otherwise. Put somewhat differently, BC Hydro's analysis suggests there are more cost effective ways to reduce GHGs than by developing new power projects BC Hydro does not in fact need.

The Energy Plan provides a solution to a problem that does not exist. It creates an urgency for new supply and it imposes artificial limitations on how that supply can be met. It will almost certainly prevent BC Hydro from meeting B.C.'s energy requirements in the most cost-effective, environmentally and socially responsible way.

Are we really serious about conservation?

The Impacts and Costs of Buying High and Selling Low

Prepared for:
Canadian Office and Professional Employees Union
Local 378
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ISBN 978-0-9784058-0-9
Published by the Canadian Office and Professional Employees Union Local 378
June 2007

Designed by Talking Dog Communications (UFCW 120B) talkingdogcomm@gmail.com

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1.0 Introduction

BC Hydro's hydroelectric generating stations and reservoirs are extraordinarily valuable assets. With their initial construction costs largely written off and relatively minor operating and maintenance costs, they can produce electricity at very low cost. The large, multi-year hydro storage capacity provides added value. It enables BC Hydro to shape the hydroelectric output to peak periods, when the electricity is most needed and valuable. Subject to the constraints of the self-sufficiency policy in the province's recent Energy Plan,[1] the hydro storage also enables BC Hydro to buy relatively low cost off-peak and seasonally surplus electricity, and store the purchased power for later use or resale.

Analogous to conventional oil and gas resources discovered and developed at low cost years ago, BC Hydro's hydroelectric assets generate what economists term resource rents. The value of the electricity they produce, as clearly indicated by current market prices and the cost of new supply, far exceeds the cost of production. A central issue for energy policy in British Columbia is how the resource rents from BC Hydro's hydroelectric assets should be utilized and sustained.

In the oil and gas sector, major efforts are made to capture the resource rents with royalties and other charges, in order to provide government financial resources that support investment in public infrastructure and services, or enable the reduction of income or other taxation. The strategy for electricity in the province's Energy Plan is quite different. Under the Heritage supply contract, which the Energy Plan will extend in perpetuity, BC Hydro must sell electricity to its customers at rates that reflect the low historic cost of its hydro assets—not their current market value. The Energy Plan essentially calls for the hydroelectric resource rents to be given away in the form of low electricity rates—rates that for large industrial users are less than half the market value or cost of new electricity supply.

While superficially attractive, much like below-market pricing of British Columbia's low cost natural gas resources would appear if the province decided to subsidize natural gas to protect consumers and attract industry, this strategy is flawed and over the long run unsustainable. Below-market pricing of electricity will attract new electric-intensive loads that will pay a fraction of the cost of the new sources of supply required to serve them. It will encourage shifts from natural gas to electric heating and other applications, even where natural gas is more efficient. It will work against BC Hydro and the province's conservation efforts, limiting the amount of conservation potential that is achieved and sustained. Over the longer term it will needlessly increase electricity requirements and average costs of supply, and thereby reduce the benefit British Columbians derive from BC Hydro's unique hydro reservoir and generating assets.[2]

This is the second of three papers critiquing the province's Energy Plan. The first paper addressed the impacts and costs of the exaggerated need for new sources of power due to the self-sufficiency and insurance provisions in the Plan. This paper addresses the impacts and costs of the low electricity rate policy in the Energy Plan—a policy that will inflate the demand for electricity and exacerbate the exaggerated need for new sources of power caused by the self-sufficiency and insurance policies in the Plan.

It is commonly argued that low electricity rates are beneficial in protecting consumers and promoting economic development. This paper identifies economically and environmentally more attractive strategies for protecting consumers and promoting economic development, recognizing that British

[1] *See Marvin Shaffer and Associates, "Self-Sufficiency and Insurance: Exaggerating the Need for New Sources of Electricity Supply", June 2007.*

[2] *The more new electricity requirements that BC Hydro has to meet, the more high cost sources of supply must it acquire. The additional high cost sources will raise BC Hydro's average costs, and thereby diminish or dilute the benefit each British Columbian derives from the low cost heritage assets.*

Columbia does not have low cost sources of electricity to meet new load growth. The existing low cost resources are already fully utilized. New demands for electricity will have to be met from new high cost sources (all the more so with the restrictive new supply policies in the Energy Plan).

Encouraging new load growth with low rates is basically a policy of buying high and selling low—an unsustainable policy that will dissipate the very large resource rents BC Hydro's hydroelectric assets could otherwise generate for the benefit of British Columbians.

2.0 BC Hydro Rates under the Energy Plan

A basic, widely accepted principle in economics is that prices must reflect the marginal costs of supply for consumers to be able to make efficient decisions about their demand for and use of different goods and service. It is the marginal cost, which in the case of electricity must reflect wholesale market prices or the cost of new supply, that signals to consumers the cost consequences of the decisions they make.

A decision to use more electricity means, in the short term, that more power must be purchased (or surplus sales foregone) and, over the long term, that additional supply must be developed. With prices reflecting market prices or the cost of new supply, electricity consumption decisions will be subject to an appropriate benefit-cost test—users will be forced to consider whether the value of their electricity use exceeds the cost consequences that use will entail.[3]

Under the Energy Plan, the province has rejected, in perpetuity, the principle of marginal cost pricing. While the Plan calls for BC Hydro and other utilities to 'explore new rate structures that encourage energy efficiency and conservation', the average level of BC Hydro's rates are to reflect the low historic costs of its hydroelectric production.

[3] *If the goal is to promote more efficient use of electricity on an hour-by-hour, daily or seasonal basis, prices should ideally reflect short run marginal costs (market prices). To promote efficient electricity use over the long term, prices should reflect long run marginal costs (the cost of new supply). In theory there should be a close link between short and long run marginal costs (with new supply developed when it is competitive with long run forecasts of market prices). They can vary, however, and whether one should price on the basis of short or long run marginal costs depends on the type and sophistication of users and the choices they can reasonably make. Regardless, either basis for marginal cost pricing will provide better price signals and promote more efficient energy use than historic average cost-based rates.*

Are we really serious about conservation?

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In Table 1, BC Hydro's average rates per kWh are shown for each major customer class and the system as a whole. These rates are far less than what BC Hydro is paying for new electricity supply. The average price BC Hydro has agreed to pay IPPs in the contracts it awarded following the F2006 Call for Energy is $88/MWh or 8.8 cents per kWh.[4] The average rate BC Hydro is charging its customers across the entire system (5.27 cents per kWh) is 60% of that new supply price. The average rate BC Hydro is charging its industrial customers (3.63 cents per kWh) is 42%—less than one-half—of the price BC Hydro is paying for new supply.[5]

Table 1[6]

BC Hydro Average Rates (cents/kWh)

Residential	**6.53**
Small General (<35kW)	**7.12**
Large General (>35kW)	**5.20**
Industrial	**3.63**
Total system average	**5.27**

There are clearly very major discrepancies between the costs that customers are signaled by the rates that BC Hydro charges and the cost consequences of the decisions they make. A potential new industrial customer, for example, will evaluate the economics of its project and the relative merits of any process alternatives that affect electric intensity, on the assumption that electricity costs 3.63 cents per kWh. It will do this despite the fact that BC Hydro will incur a cost over two times that amount to supply the incremental requirements. The price signal does not reflect and, consequently, the project and process decisions will not properly take into account the real economic (let alone environmental) cost that the incremental load will entail.

BC Hydro has tried to address the inefficiencies caused by its low historic cost-based rates in its rate design. In the industrial sector, for example, there is a two-tier rate structure. A low rate is charged for the first 90% of the customer base load. The remaining electricity consumption is charged a much higher marginal rate to provide a greater incentive to conserve. In the large general sector, BC Hydro is proposing to flatten what was previously a declining rate structure, again trying to provide a more appropriate price signal for decisions about marginal energy use.

[4] *BC Hydro, Report on the F2006 Call for Tender Process Conducted by BC Hydro, August 31, 2006, p.23-26. That is the price BC Hydro indicated it would use to reflect current marginal costs of electricity supply (BC Hydro 2007 Rate Design Application, BC Hydro Response to COPE IR 1.1.2).*

[5] *BC Hydro is paying more than necessary to meet its growing load because of the province's self-sufficiency and insurance policies. That is, however, the policy environment governing BC Hydro's marginal costs. In any event, even with a more economically efficient supply policy, BC Hydro's rates are well below marginal costs, particularly in the industrial and large general sectors, based on the forward prices in competitive U.S. electricity markets.*

[6] *Based on existing (February 2007) rates and the number of customers and electricity consumption patterns forecast for 2008. See BC Hydro, 2008 Rate Design Application, Appendix C, Schedule 10, p.14.*

These rate design initiatives do not, however, eliminate the inefficient price signals and energy use decisions that are made. Firstly, as shown in Table 2 below, the marginal rates BC Hydro is proposing in its latest rate design application are still below BC Hydro's marginal cost of supply. Secondly, marginal rates, even if adjusted to better reflect marginal costs, do not change the incentives for new incremental loads (which depend on the overall average rate[7]) nor do they sufficiently address the incentives for major changes in electricity use. The two-tier industrial rate, for example, does not provide an incentive to reduce electricity consumption by more than 10%. And perversely, it provides industrial customers an incentive to exaggerate their customer base load.[8]

Table 2 [9]

BC Hydro Rates for Marginal Energy Use (cents/kWh)

Residential	**6.21**
Small General (<35kW)	**6.55**
Large General (>35kW)	**3.39**
Industrial	**5.40**

In sum, BC Hydro's electricity rates are far below the costs it is incurring for new supply. The differences are most marked for industrial and large general sectors. In economic terms, the resource rents that are generated by BC Hydro's hydroelectric assets are being used to subsidize electricity prices. The rates do recover historic average costs, but historic costs are irrelevant to the market value or marginal cost of new electricity supply—the values or costs that need to be signaled to reflect the cost consequences of the electricity use decisions each customer makes.

[7] *The second tier industrial rate is scheduled to be adjusted in April, 2008 to better reflect the costs of new supply. However, that will not change the average rate. As the second tier rate goes up, the rate on the first tier will be adjusted down to leave the average rate unchanged.*

[8] *With an exaggerated customer base load, an industrial customer can more easily reduce its second tier, relatively high price electricity consumption. This enables the customer to reduce its average rate and total electricity bill.*

[9] ***BC Hydro Rate Design Application,** BCH Response to COPE 1.1.1.*

3.0 Impact on Electricity Requirements

Rates affect the demand for electricity. As stated in a July 2006 U.S. report on energy efficiency: "Retail electricity and natural gas utility rate structures and price levels influence customer consumption and they are an important tool for encouraging the adoption of energy efficient technologies and practices".[10]

There is a wide range in estimates of the magnitude of impact, but econometric studies of the demand for electricity do show that consumers respond both to the level and structure of prices. Estimates of the price elasticity of demand (the estimated percentage change in demand that results from each percentage change in price) indicate that the higher the price, the lower will be the demand, particularly over the longer term when there is greater scope for changes in energy-using processes and equipment.[11]

The low, historic cost-based rate policy in British Columbia is significantly inflating the total electricity requirements that BC Hydro must meet. In its forecasts of future requirements, BC Hydro uses long run price elasticity estimates of -.27 for the residential sector, -.35 for the commercial (general) sector, and -.28 for the industrial sector.[12] What that implies for the industrial sector, where rates are less than one-half the cost of new supply, is that industrial electricity requirements are inflated by over 20% because of the discrepancy between rates and marginal costs. [13]

BC Hydro's estimates of the price elasticity of demand are relatively low. Many studies estimate the long run price elasticity of demand for the industrial and other sectors to equal or exceed –1.0. [14] An elasticity of –1.0 would suggest that industrial requirements are more than double what they would be if rates reflected marginal costs. Electricity requirements are inflated in the residential and commercial sectors too, though to lesser extent because of the smaller discrepancy between rates and marginal costs.

A major factor underlying the inflated demand for electricity in the industrial sector is the effect the low rates have in attracting electric intensive loads—projects that would not proceed (or proceed in the same electric intensive way) if the developers had to pay the incremental cost of the electricity they require. The proposed Kemess North mine project in northern British Columbia is a good example. If it receives environmental approval, this gold/copper mine project will commence in 2008 or 2009 and operate for some 11 years. It will require approximately 1,000,000 MWh of electricity

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[10] *U.S. Department of Energy and Environmental Protection Agency, National Action Plan for Energy Efficiency, July 2006, p. 5-1 (http://www.epa.gov/cleanrgy/pdf/napee/napee_report.pdf).*

[11] *For a survey of price elasticity estimates see BC Hydro Rate Design Application, BCH Response to BCUC IR 1.004.03, Attachment 1. See also, California Energy Commission, Testimony on the Effects of Restructuring on Price Elasticities of Demand and Supply, Report prepared for the August 14, 1996 ER 96 Committee Hearing; Australia National Institute of Economic and Industrial Research, The own-price elasticity of demand for electricity in NEM regions, Report prepared for the National Electricity Management Corporation, 2006; Bernstein, M.A. and J. Griffen, Regional Differences in the Price Elasticity of Demand for Energy, Report prepared for the National Renewable Energy Laboratory, Santa Monica, California: RAND Corporation, 2005; Verbruggen and Couder, "Demand Curves for Electricity Efficiency in OECD Countries", 26th IAEE Annual Conference, Prague, June 4-7, 2003.*

[12] *BC Hydro Rate Design Application, BCH Response to BCOAPO 2.27.2.*

[13] *The exact impact would depend on the shape of the demand curve for electricity. An impact of over 20% assumes a constant elasticity relationship (Qd=A*p-.28)*

[14] *See, e.g., Verbruggen and Couder, "Demand Curves for Electricity Efficiency in OECD Countries", 26th IAEE Annual Conference, Prague, June 4-7, 2003.*

annually, by itself contributing to a 1.8% increase in BC Hydro's total requirements (relative to what BC Hydro's requirements would be without this mine project going forward).

Kemess North will pay approximately 3.6 cents per kWh or $36/MWh for the BC Hydro electricity it consumes. However, BC Hydro will pay over $80/MWh for the incremental supply it will need as a result of this load.[15] If Kemess had to pay the marginal cost BC Hydro is facing, it would have to pay over $44/MWh or $44 million more each year for the electricity it will consume. Based on financial forecasts provided by the proponents of Kemess North at an Environmental Review Hearing, it is almost certainly the case that the project would not proceed on that basis.[16]

Some would argue that the mine should be encouraged—subsidized if necessary—because of the economic activity and employment it will generate. However, as discussed later in this paper, there are other ways to promote economic activity than to subsidize electricity consumption.

British Columbians have to pay the effective subsidy (the difference between what BC Hydro charges and the costs it will incur to meet the requirements) for Kemess and other projects like it. The more load that the subsidy attracts, the more high cost sources of supply BC Hydro has to acquire. That in turn raises the average costs of electricity supply British Columbians in general have to pay and thereby reduces the benefit that they derive from BC Hydro's existing, low cost hydro assets. Like most subsidies, it is a fundamentally unsustainable economic development strategy.[17]

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[15] *BC Hydro's reference purchase price from the F2006 Call is $88/MWh. That is for electricity delivered to the Lower Mainland. The cost of electricity delivered to Kemess North would be somewhat less because of lower transmission costs and losses.*

[16] *In October 2007, the joint BC and Canadian government environmental review panel recommended that the Kemess North project not proceed in its current form. Journal of Commerce, October 15, 2007. However should it, or projects like it proceed, they will entail subsidies of this magnitude.*

[17] *Rising costs of electricity will raise rates and gradually eliminate the unsustainable subsidy and the inflated electricity demand it causes. However, the higher costs also eliminate the opportunity to capture the resource rents that BC Hydro's hydro assets could have provided for the benefit of all British Columbians. There is a difference between higher rates implemented as a matter of policy (rates that better reflect the incremental cost of supply) and higher rates due solely to higher costs of supply.*

4.0 Limitations of Power Smart Programs

As part of its demand-side (DSM) planning, BC Hydro estimates conservation potential—the amount of electricity requirements that consumers could cost-effectively reduce with load-displacement or energy-saving measures. By cost-effective, BC Hydro means that the total costs to achieve the reductions in demand would be less than BC Hydro's marginal cost of supply. In the language of DSM planners, the cost of the 'negawatt hour' is less than the cost of an incremental 'megawatt hour'.

The last conservation potential review was completed in 2002. It indicated that over 20% of the electricity requirements that BC Hydro was then forecasting for 2015/16 could be cost-effectively reduced.[18] That was based on a marginal cost of electricity supply of 6 cents per kWh. The percentage of BC Hydro's requirements that could be cost-effectively reduced given the higher marginal costs of supply that prevail today would presumably be significantly greater.

A large amount (some 45%) of the conservation potential that BC Hydro identified in its 2002 Review was in the industrial sector. BC Hydro estimated that almost one-third of the forecast industrial requirements could be cost-effectively reduced by load-displacement or energy-savings measures.[19]

It is extraordinary that so much conservation potential exists. It means that over 20% of BC Hydro's total requirements and one-third of its industrial requirements are economically inefficient—the value of the electricity to the user is less than what it costs BC Hydro to supply it. There are a number of reasons for this conservation potential (economically inefficient electricity consumption). Consumers may not be aware of the energy saving opportunities. Those responsible for implementing the measures (for example developers of new buildings or tenants in rental units) may not be able to capture the long term benefits of the energy-reducing investments they may make. There may be financing issues and constraints preventing some energy saving investments from being made.

However, the most obvious reason for the very large amount of cost-effective conservation potential, particularly in the industrial sector, is the low price of electricity. Industry's profitability depends on minimizing costs and there is little reason for large users of electricity to forego the cost savings that efficient load displacement or energy saving measures could provide. The problem is that the price they pay does not reflect the marginal cost of supply.[20]

Firms will invest in load displacement or energy savings measures as long as the cost per kWh displaced or saved is less than the rate they would otherwise have to pay for the electricity they purchase from BC Hydro. However, they have no incentive to go beyond that to invest in measures that cost more than the rate they pay but still

[18] *BC Hydro, Conservation Potential Review 2002, May 2003, Table 1, p.8.*

[19] *BC Hydro, Conservation Potential Review 2002, May 2003, Table 11, p.32.*

[20] *The two tier industrial rate structure that has been introduced since the 2002 Conservation Potential Report was done will address some of this problem, but still will not signal industrial customers the marginal cost savings of major energy saving or load displacement initiatives—initiatives that would reduce their requirements by more than the second tier 10% of base load.*

less than the marginal cost of the electricity they consume—the cost BC Hydro incurs on their behalf. This is what economists term a 'market failure'. The market failure here is massive, in terms of both the extent of the price distortion (the failure of rates to reflect the marginal cost consequences for BC Hydro) and its impact on demand.

BC Hydro has responded to the large amount of conservation potential (inefficient electricity consumption) in the industrial and other sectors by offering Power Smart subsidies in order to increase the financial incentive for customers to reduce their requirements. These subsidies are intended to offset the disincentives caused by its rates as well as any other barriers to the adoption of cost-effective conservation measures. However, Power Smart-type DSM subsidy programs are limited in their effect. They do not address the attraction of new electric intensive loads, like the mining example discussed in the previous section. Moreover, they are subject to 'rebound' and 'free-rider' effects that limit the amount of energy savings that are actually achieved.

Rebound effects refer to the impact that more efficient appliances and equipment can have on the amount of appliance or equipment use. Increased appliance or equipment efficiency reduces the costs of operation (e.g. lighting cost per hour). The lower operating costs encourage a greater amount of use. There is no Power Smart program to turn off the lights, and the more efficient the lighting, together with the low price of electricity, the less incentive there is.

Free-rider effects refer to the widely recognized tendency of subsidy programs to be taken advantage of by people and business that were about to invest in more efficient appliances or equipment in any event. Some of the savings would have been realized without the subsidies, and some are simply advanced in time, but not incremental to what would have occurred even without the subsidies.[21]

A 2004 econometric analysis of a large sample of U.S. utilities found that the energy savings from DSM subsidy programs, based on actual patterns of electricity consumption, were approximately one-fifth and the costs per unit of energy saved consequently five times what the utilities had estimated based on engineering estimates of DSM participation rates and impact.[22] Some analysts have raised technical questions about this 2004 analysis, and have argued that in at least one reformulation of the econometric analysis, the utility estimates are within a 95% confidence interval[23] of the true savings and unit costs. However, even in this reformulated analysis the utility estimates are at the very low end of the likely range. The data suggest it is very probable that the savings are significantly less and unit costs significantly higher than what the utilities estimate. The actual rebound and free rider effects are much greater than what most utilities recognize.

BC Hydro's Power Smart programs undoubtedly have some impact, but they would be much more effective if they complemented, not tried to substitute for efficient pricing. As Verbruggen and Couder concluded on the basis of their analysis of electricity demand and energy efficiency in OECD countries: "The results from the data confirm basic economic wisdom and observed experience in the energy field that prices do matter and that continuous efficiency improvement requires backing by economic interest of the end users".[24]

[21] *See F. Wirl, "Lessons from Utility Conservation Programs", Energy Journal, 2000, Vol.21, pp.87-108.*

[22] *D. Loughren and J. Kulick, "Demand-Side Management and Energy Efficiency in the United States", Energy Journal, 2004, Volume 25, No.1, pp.19-43.*

[23] *A confidence interval provides a range which has a specified probability (e.g. 95%) of containing the true value.*

[24] *Verbruggen and Couder, "Demand Curves for Electricity Efficiency in OECD Countries", 26th IAEE Annual Conference, Prague, June 4-7, 2003.*

5.0 Distributional Issues

The low, historic cost-based rate policy in the Energy Plan is, in effect, a very large and significant government program. If the government were to treat BC Hydro's hydroelectric assets like the province's natural gas resources, and let consumer prices reflect the market value or current marginal cost of electricity consumption, it could have captured $1.8 to $2 billion each year, or more, in additional water rentals or other resource rent collection measures.[25] It could then have used that additional revenue to finance needed public investments, reduce income or other taxes and/or provide targeted financial support to assist lower income households with the high cost of energy.

The hydroelectric resource rents that the province is foregoing each year (equivalent to roughly 5% of the province's total budget revenues) are instead being used to subsidize electricity rates. As discussed above, this subsidy program is inefficiently inflating the demand for electricity. It also raises equity concerns. A disproportionate amount of the total subsidy is allocated to industry and large general users as compared to residential or small general customers. Within the residential sector, a disproportionate amount of the subsidy is allocated to higher income households.

The cost of serving industrial and large general customers is less than for residential or small general. There are economies of scale in serving the larger customers. Also, for industrial (transmission level) customers there are no distribution costs. However, the differences in rates between industrial and large general on the one hand, and residential and small commercial on the other, go beyond the differences in the marginal costs of supplying each group of customers. Table 3 below shows the estimated ratio of rates to marginal costs of supply for each major customer class, taking all categories of cost into account (the electric generation, transmission, distribution, and customer service). The estimated ratios are for 2005, but similar patterns would prevail today.

The ratio of rates to marginal cost (the proportion of marginal cost that is recovered in the rate that is paid) is lower for industrial customers than for all other customer classes. They and to a lesser extent large general customers get the largest subsidy per unit of electricity consumption relative to the cost consequences of their electricity demand. For the year the study was conducted, small general customers received no effective subsidy at all.

Table 3 [26]

Ratio of Rates to Marginal Cost of Supply

Residential	**.87**
Small General (<35kW)	**1.04**
Large General (>35kW)	**.80**
Industrial	**.66**

[25] *The historic average cost of BC Hydro's hydroelectric output is less than 3 cents per kWh or $30/ MWh and falling each year as the original investments are paid off. The value of that output, which averages 46.6 million MWh per year) is over $80/MWh based on the price BC Hydro is paying for new supply. Valued at $80/MWh, the hydroelectric output would generate rents of over $2 billion per year. Even at a much more competitive market value of $70/MWh, the potential rents would be over $1.8 billion per year.*

[26] *Energy and Environmental Economics, Ltd., Long Run Incremental Cost Update – 2005/06, prepared for BC Hydro, December 1, 2004, p.35.*

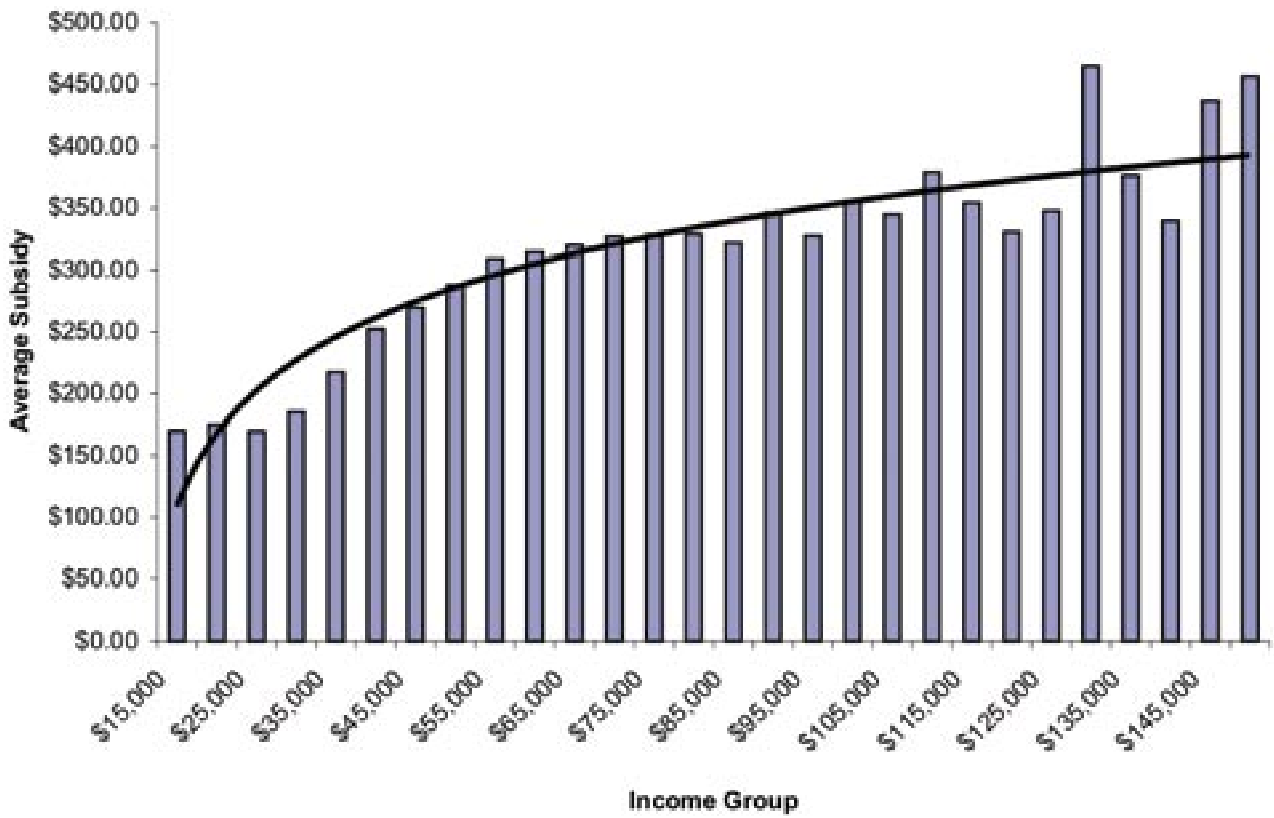
Residential customers do benefit from the low rate policy. Though not to the same extent as industrial or large general customers, residential rates are less than the marginal costs of supply. However, the greatest amount of benefit goes to the largest electricity consumers. And those consumers are generally the highest income households.

In a study analyzing average household electricity consumption in relation to census area data on household income, former University of Victoria Professor P. Pineau found a very clear positive correlation. He estimated that the average annual subsidy for the highest income households in British Columbia was over two times the average subsidy of low income households (see Figure 1).[27]

Based on the results for British Columbia and similar circumstances in other jurisdictions, Pineau concluded that by all measures, the subsidy embedded in the low historic cost rate policy in British Columbia is not well targeted or well considered. It not only undermines conservation efforts, it runs counter to the general notion that subsidies should be directed more to lower, not higher income families.

Figure 1 [28]

Average Annual Subsidy per Residential Account by Income Group



[27] *P. Pineau, "Electricity Subsidies in Low Cost Jurisdictions: The Case of British Columbia", School of Public Administration, University of Victoria, Draft April 25, 2006.*

[28] *Based on BC Hydro consumption data and Statistics Canada household income data by census district for the year 2000.*

6.0 Alternative Strategy

Low historic average cost-based electricity rates do attract mining and other electric intensive industry that would not otherwise locate in British Columbia. And they do protect consumers from the high cost of new sources of electricity supply. However, the economic development that this fosters is based on the false premise that British Columbia has low cost electricity available for sale. And the households that are most protected from the high cost of new supply are those that consume the most and are generally highest in income.

There are much better ways to promote economic development and protect consumers than to subsidize electricity rates in this way.

First, instead of extending the Heritage contract in perpetuity, as the Energy Plan would do, the Heritage contract and the low, historic cost-based pricing it entails should be phased out. That is what the current government's own Task Force recommended when it undertook a major review of electricity policy in the province. As the Task Force stated in its 2002 report: "Ultimately, electricity must move to a price that reflects the costs of new resources…to do otherwise results in the continued inefficient use of energy". [29]

Second, the government must revise its water rental policy to ensure the very large amount of resource rents that hydroelectric power can generate is captured by the government for the benefit of British Columbians. Water rentals on BC Hydro's hydroelectric generation could be increased by $40 to $50/MWh and generate $1.8 to $2 billion in revenue.

Water rentals on private producers like Alcan and Teck Cominco should also be increased to capture the full resource rents that are generated when they use their water rights for power sales. The policy of nominal water rentals could be retained for that portion of the hydroelectricity that is used, as originally intended, for industrial purposes. However, there is no reason why the public should not capture the full value of water that is used for power sales. It is the water that is the valuable scarce resource and the water is publicly-owned.

Third, a large portion of the incremental water rentals from BC Hydro (and private producers) should be dedicated to infrastructure investments and tax reduction measures that are aimed a promoting sustainable economic development—development that isn't predicated on the false premise of cheap power. Special efforts could be made for the regions and communities most adversely affected by the increase in electricity rates (the ones that are currently most dependent on electric intensive industry).

Finally, a portion of the incremental resource revenues could be used to subsidize, in a targeted way, a basic level of household electricity requirements. This could be accomplished through lifeline or inverted rate structures, as exist in California and other U.S. states, that offer a relatively low rate for an initial basic amount of electricity usage, but then increase to reflect marginal costs for usage beyond the basic amount.

A serious conservation policy requires that customers are signaled the economic and environmental costs of the electricity consumption decisions they make. At the same time, a socially responsible pricing policy requires that average and low income families have the ability to meet their basic energy needs. A targeted subsidy could accomplish that in a much more efficient and equitable way than what the Energy Plan policy would do.

[29] *BC Energy Task Force Report, Strategic Considerations for a New British Columbia Energy Policy, March 15, 2002.*

7.0 Conclusions

If BC Hydro's hydroelectric assets were treated in the same manner as British Columbia's natural gas assets, customers would pay the market value or marginal cost of the energy they use and the province would capture the resource rents that the assets provide with water rentals reflecting the difference between market value or marginal cost and historic average costs. The province could then utilize the electricity resource rents, just as it does with natural gas royalties, to support public expenditures or the reduction of income or other taxes as explicitly set out in budgetary documents debated in the legislature.

In the Energy Plan, the province has chosen not to do this. It has effectively chosen a program of subsidizing electricity rates relative to the levels they would be if, as with natural gas and other forms of energy, the rates were to reflect current market values and the current cost consequences of consumption.

The Energy Plan policy will inflate electricity requirements and average costs of supply, thereby diminishing the benefit that British Columbians derive from BC Hydro's unique hydroelectric assets. It serves the interests of electric intensive industry more than other sectors, and wealthier (greater electricity-using) households more than others. It is another part of an Energy Plan that is aimed more at promoting the development of unnecessary electric generation and transmission facilities than the efficient use of, and full and equitable benefit from the province's publicly-owned hydro resources.

Is the Energy Plan really green?

The Supply Side: Targeting Low Value / High Cost Resources

Draft 10/29/07

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ISBN 978-0-9784058-0-9
Published by the Canadian Office and Professional Employees Union Local 378
June 2007

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1.0 Introduction

As discussed in two previous papers[1], the British Columbia government's Energy Plan will result in the development of more electricity generation and transmission facilities than necessary. The policy of setting rates below the market value or marginal cost of new supply, which the Energy Plan extends in perpetuity, significantly inflates the demand for electricity. The self-sufficiency provision in the Plan, which prevents BC Hydro from backing up the risk of drought conditions with cost-effective market purchases, unnecessarily exaggerates the amount of new supply BC Hydro has to acquire to meet the inflated demand. And the insurance provision in the Plan will force BC Hydro to acquire even more supply, ensuring a significant surplus even in drought years.

After some debate, the British Columbia government recognized a broad consensus that BC Hydro's unique and very valuable reservoir and hydroelectric generating facilities should remain publicly owned. In 2003, the government passed the BC Hydro Public Power Legacy and Heritage Contract Act to ensure these assets were not sold. However, the Energy Plan makes it clear that you do not have to sell BC Hydro's assets to give them away. The potential resource rents – the net return or benefit that British Columbians could derive from the reservoir and hydro generation facilities – are being dissipated by the Energy Plan policies that inflate demand and exaggerate the need for additional supply, both of which increase the average cost and environmental impact of electricity supply more than necessary or economically efficient.

The resource rents that BC Hydro's assets could generate are being dissipated in another important way. In addition to requiring more new supply than necessary or economically efficient, the Plan will force BC Hydro to acquire low value, high cost resources to meet the inflated requirements. The 2007 and previous Energy Plan limit BC Hydro's ability to develop its own resources regardless of their benefits and costs relative to the independent power from IPPs BC Hydro is being forced to acquire. The 2007 Plan supports the retirement of the natural gas-fired Burrard Thermal plant despite the strategic location and role of that facility within the overall system. And the 2007 Plan pressures BC Hydro to acquire more intermittent energy by requiring BC Hydro "to further recognize the value of intermittent resources such as run-of-river and wind … and examine ways to increase the amount of firm energy calculated from [those] resources".[2]

This third and final paper in a three-part critique of the province's Energy Plan addresses the issue of the types of resources the Plan is requiring BC Hydro to acquire. It specifically addresses the pressure to acquire run-of-river and wind energy which, despite their superficial appeal, are low in value and high in cost, and can also have significant environmental impact. These resources may be classified as green, but they are green only in terms of their GHG and other air emissions. They and the transmission lines they require can have significant cumulative land use and resource effects.

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[1] *See Marvin Shaffer & Associates, "Self-Sufficiency and Insurance: Exaggerating the Need for New Sources of Electricity Supply", June 2007, and "BC Hydro Electricity Rates: The Impacts and Costs of Buying High and Selling Low", August 2007.*

[2] *Government of British Columbia, The BC Energy Plan , 2007, p.15*

2.0 BC Hydro System Requirements

In isolated areas unconnected to BC Hydro's integrated system which are served by diesel-fired generation, the value of new run-of-river, wind or other sources of electricity supply is clear. Each additional kWh of electricity supply reduces the need for, cost and environmental impact of diesel generation. The avoided diesel cost plus the value of the avoided greenhouse gas (GHG) and other emissions measures the value of the new electricity supply.

Within the integrated electricity system, however, the situation is much different. The effect that new supply has on the system and the value it has to BC Hydro depends on its location, seasonality, reliability and other factors. These characteristics govern what costs BC Hydro will avoid or incremental requirements or market opportunities it can meet with the new supply.

In a recent workshop on system requirements,[3] BC Hydro officials outlined the types or characteristics of electricity supply that the BC Hydro integrated system needs – what will provide greatest value. They highlighted the following key factors:

- Seasonality – BC Hydro reservoirs typically fill in the spring freshet period due to melting snow packs. Spring is also a time period when the demand for and the market price of electricity are relatively low. Energy delivered during that period is therefore generally low in value. If reservoirs are full with the potential to spill, the purchased electricity may simply have to be exported at low market prices. And, even if BC Hydro's reservoirs are not full, the purchased electricity may limit BC Hydro's ability to purchase and store for later use or resale the low cost market power that is often available at that time.

- Reliability – New sources of electricity can provide firm or non-firm energy. Firm energy is certain to be available within a specified time period. Non-firm energy is electricity that may or may not be available depending on water or wind conditions, transmission availability or other factors. The value of non-firm energy is lower and less certain than firm power. It is lower in value because it cannot be relied upon to meet domestic requirements or contractual commitments. Its value is less certain because its market value can vary greatly, depending on annual fluctuations in BC Hydro's own capability, as discussed below, as well as fluctuations in general market conditions.

- Annual variability – The annual output from BC Hydro's hydroelectric facilities can vary over 10,000 GWh (almost 20% of BC Hydro's total supply) depending on water conditions. The value of energy, particularly energy delivered in the spring that BC Hydro may not be able to store in its reservoirs, can therefore vary greatly from year to year. In high water years, energy will generally be less valuable than in average or low water years. The issue with respect to new sources of supply is whether their annual output also varies and, if so, whether the annual variation is correlated with the variation in water conditions governing BC Hydro's own capability. New sources of supply whose output is correlated positively with BC Hydro's capability will be relatively low in value compared to sources that are uncorrelated and even more so sources that are negatively correlated with BC Hydro's own capability.[4]

[3] *BC Hydro System Needs, June 6, 2007.*

[4] *A positive correlation would mean the output from the new source tends to be high when BC Hydro's capability is high; low when BC Hydro's capability is low. No correlation would mean there is no systematic relationship between the annual variability of the new source and BC Hydro's capability. A negative correlation would mean output the output from the new source tends to be low when BC Hydro's capability is high; high when BC Hydro's capability is low.*

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- Dispatchability – One of the reasons BC Hydro's hydroelectric facilities are so valuable is that subject to minimum flow and other operating constraints, the hydroelectric output can be controlled or dispatched to suit system requirements or market opportunities. Sources of supply that are dispatchable have much greater value than those whose output cannot be controlled. They enable the system to be operated more efficiently and they provide what economists term an option value – an ability to respond to or take advantage of unforeseen opportunities and events. At the other extreme, sources of supply that not only are not dispatchable but unpredictably intermittent in their supply are lowest in value. They offer no option value and need to be backed up on a minute-to-minute and longer-term basis because of the uncertainty in availability and exact timing of their supply.

- Capacity – BC Hydro not only needs electrical energy (the ability to generate sufficient megawatt hours of electricity over the course of a year to meet its annual requirements), it needs dependable capacity (the ability to generate sufficient megawatts of power within any given hour to be able to meet peak loads). Resources that provide dependable capacity when and where required (e.g. in the winter evening hours in the Lower Mainland when loads are at their highest or other times when the system is capacity-constrained) have greater value than those sources that do not.

As R. Reimann concluded in his presentation at the BC Hydro system requirements workshop, the energy product that BC Hydro requires – that offers greatest value – is firm, non-freshet energy. The capacity that BC Hydro needs must be dependable and reliably deliverable to the Lower Mainland and other load centers in the peak hour time periods when required.[5]

The Energy Plan directs BC Hydro to "further recognize the value of" intermittent sources of energy like run-of-river and wind. It clearly expects BC Hydro to acquire a large amount of these resources to meet future requirements. The question is: what value will these sources provide to BC Hydro? How do their characteristics compare to the products BC Hydro requires?

[5] *R. Reimann, "System Needs: An Energy Planning Perspective", June 6, 2007.*

3.0 Run-of-River

BC Hydro is already acquiring a large amount of run-of-river IPP energy. Almost all of the non-firm and 40% of the total energy that BC Hydro acquired in the F2006 Call for Energy were from run-of-river IPPs.[6] Under the Energy Plan it will almost certainly acquire considerably more.

Some commentators see run-of-river hydro projects as the answer to British Columbia's energy needs. The Canadian Taxpayer Foundation, for example, recently argued that small run-of-river hydro projects are less expensive than large hydro projects like Site C, and that the run-of-river IPP projects BC Hydro has already purchased are keeping BC Hydro electricity rates low.[7]

Run-of-river projects are not less expensive than Site C. BC Hydro is paying levelized prices of $60 to $100/MWh (in 2006$) for the firm run-of-river energy it is buying from the F2006 Call.[8] That is higher than the estimated cost of energy from Site C even with hundreds of millions of dollars set aside for the mitigation and compensation of adverse impacts.[9] And run-of-river projects are not 'keeping BC Hydro rates low'. It is the low cost hydroelectric facilities BC Hydro built in the past (combined with the historic cost-based, low rate policy in the Energy Plan) that are keeping BC Hydro rates low, not the high cost run-of-river IPPs BC Hydro is currently acquiring.

However, it is not just their relatively high cost; proponents of run-of-river IPPs like the Canadian Taxpayer Foundation completely ignore the relatively low value of the energy and capacity run-of-river projects provide to the integrated BC Hydro system.

- Most run-of-river energy is delivered in the spring freshet period when it is least required and the system is least able to absorb it.
- A large amount of run-of-river energy is non-firm.
- Data are limited, but the year-to-year fluctuations in run-of-river output are likely to be more positively than negatively correlated with BC Hydro's own capability (both being dependent on precipitation), offering more energy when it is least needed by BC Hydro.
- Run-of-river projects, by design, offer very limited storage and dispatchability, and provide little dependable capacity in the winter peak months.

The seasonal pattern of run-of-river output varies by region in the province. The proportion of total supply delivered in the spring will be greatest in colder and higher elevation regions where water flows are most affected by snow melt. However, all run-of-river projects provide a disproportionate amount of their total annual supply—especially their total annual firm supply—in the spring period.

Figure 1 (next page) shows the estimated monthly pattern of output that could be expected for the Clemina project in the Rocky Mountain region. Over 42% of the total annual firm supply is provided in the three month April-June period; over 64% of the total annual firm supply is provided in the four month April-July period.

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[6] *BC Hydro, Report of the F2006 Call for Tender Process Conducted by BC Hydro, August 2006, pp. 58-59. If the coal projects that were awarded contracts in that tender process do not proceed the share of run-of-river would exceed 50%.*

[7] *Canadian Taxpayers Foundation, "Dam it: Taxpayer-Funded Mega-Project Most Costly Alternative", August 20, 2007.*

[8] *BC Hydro, Report of the F2006 Call for Tender Process Conducted by BC Hydro, August 2006, p. 47 and 51.*

[9] *BC Hydro provided a range of $43-$62/MWh for the cost of energy from Site C, with the high end assuming a 40% escalation in the estimated capital costs (BC Hydro, 2006 Integrated Electricity Plan, p.5-4).*

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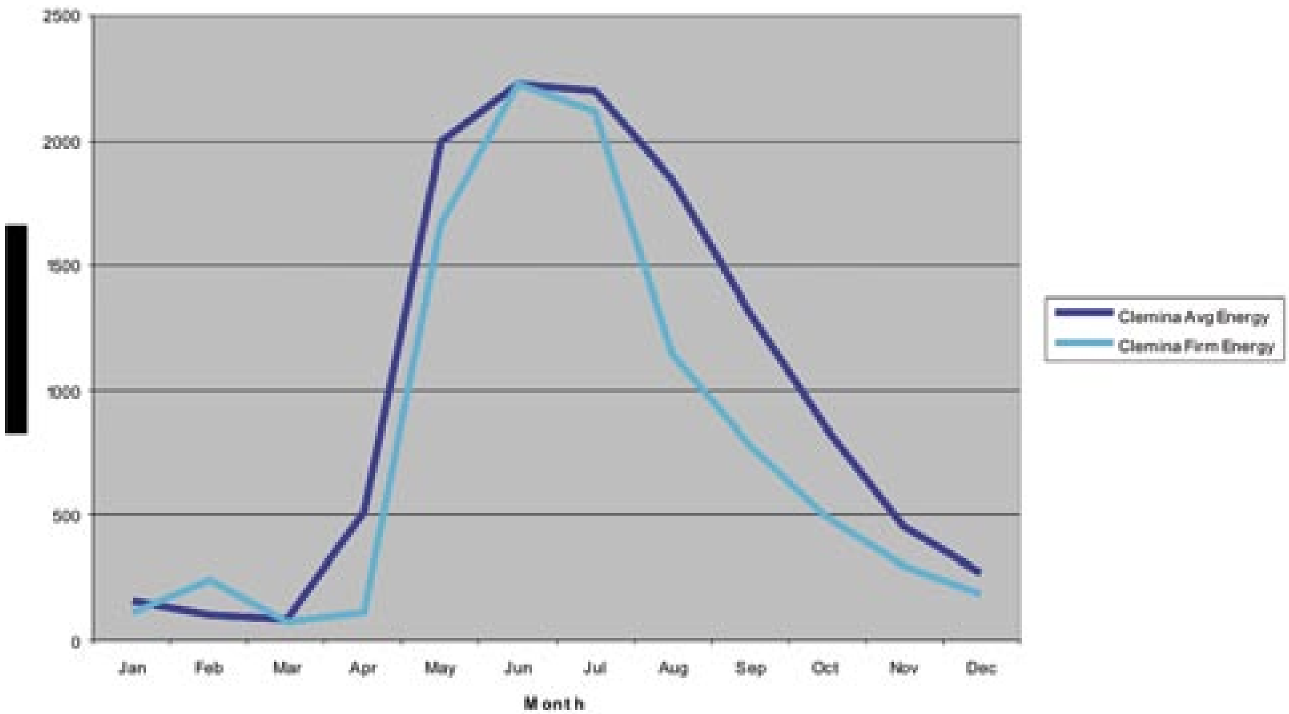
Figure 1

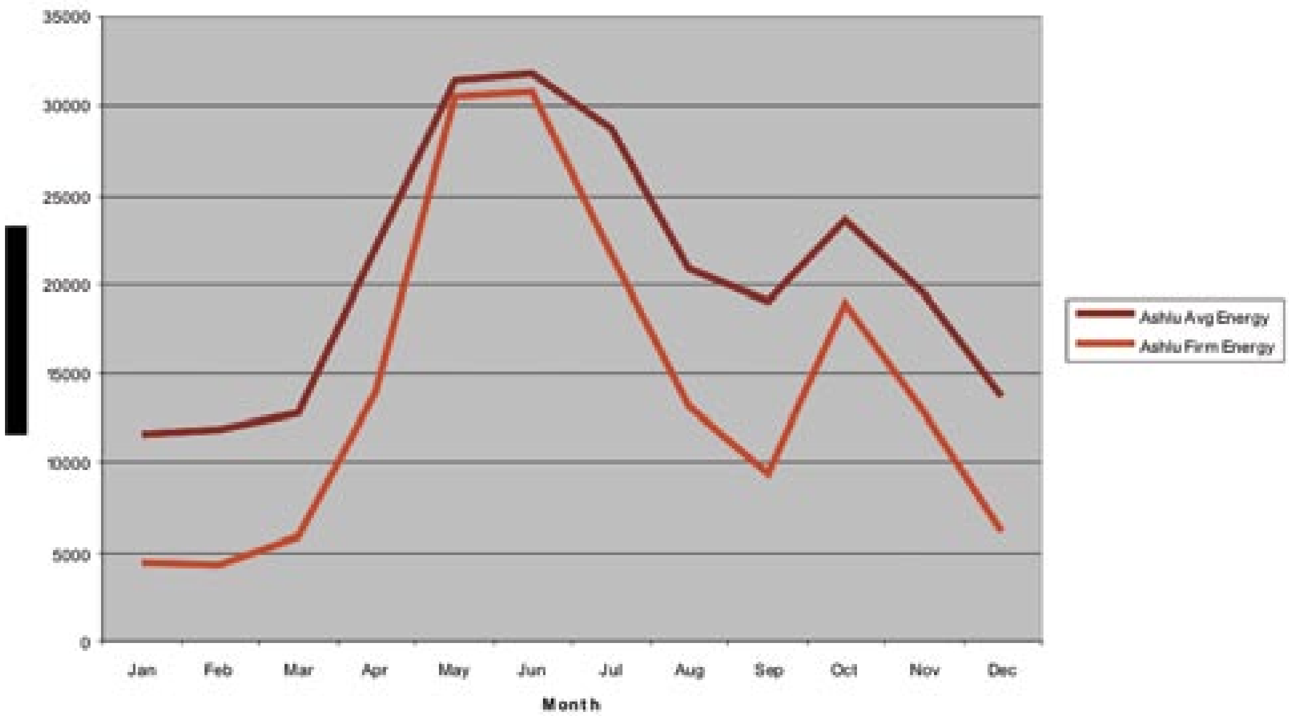
Clemina Monthly Energy Profile [10]



In the south coastal region, the seasonal pattern is less pronounced. However, there is proportionately more non-firm energy. Figure 2 (next page) shows the estimated monthly pattern of output that could be expected for the Ashlu project. Over 43% of the total annual firm supply is delivered in the April-June period; over 56% is delivered in the April through July period.

[10] *Based on energy profiles in Sigma Engineering Ltd., Green Energy Study for British Columbia, Small Hydro, prepared for BC Hydro, October 2002.*

Figure 2
Ashlu Monthly Energy Profile [11]



The lower value of the springtime and non-firm energy delivered by run-of-river IPPs is reflected in price adjustment factors in BC Hydro's energy purchase contracts. However, the price adjustment factors do not change the fact that in buying more run-of-river energy, BC Hydro is committing to long term purchases of energy that will increasingly constrain BC Hydro's ability to utilize its own hydro storage capacity to best advantage. The more of this energy BC Hydro is committed to buy, the less will it be able to acquire low cost seasonal energy for later use or resale. It is another way that the potential resource rents or value of BC Hydro's heritage assets are being diminished.[12]

Whether Site C is a good project to develop will have to be assessed on its own merits. Regardless, it is incorrect to point to run-of-river as a preferred resource. There may be specific projects that are beneficial, particularly in isolated areas served by diesel, but they are not low cost and they are not high value. Moreover, they are not environmentally benign.

The environmental impacts of run-of-river projects will vary depending on the specific site and design. However, there is the potential for a wide range of adverse impacts, including:

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[11] *Based on energy profiles in Sigma Engineering Ltd., Green Energy Study for British Columbia, Small Hydro, prepared for BC Hydro, October 2002.*

[12] *The more run-of-river energy that BC Hydro buys, the less adequate will the price adjustment factors be. In the F2006 Call, BC Hydro applied price adjustment factors that varied depending on the proportion of a project's total output delivered in the spring period. However, the issue is not the proportion of spring deliveries from any one plant—it is the total amount of spring deliveries from all projects that matters. The more run-of-river projects BC Hydro acquires, the greater will be the total spring deliveries and the greater must the spring discount be. However, the IPP contracts do not provide for changes in the price adjustment factors due to increased total spring supply, even if warranted by the value of the power that is delivered.*

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- Impacts during construction—disruption to wildlife and communities; accidental spills;
- Impacts on aquatic ecosystems and fish—impedance of fish movements (especially resident fish that may not benefit from the mitigation measures that the Department of Fisheries and Oceans will demand for salmon and other anadramous fish); impingement and entrainment of fish; changes in water flows throughout the diversion reach; changes in water levels in headponds and the diversion reach; changes in water quality and temperature;
- Impacts on adjacent riparian areas and wildlife;
- Terrestrial impacts – alienation of land for infrastructure, roads and transmission lines; pressure on wildlife from increased human access;
- Recreational and aesthetic impacts – change in recreational experience (e.g. for kayaking and other wilderness activity); intrusion in pristine areas, often in scenic canyons and areas of cultural significance.[13]

The impacts of individual projects may be small, but cumulatively they can be significant, particularly given the large number of projects that may be developed and the lack of integrated planning. Project proposals are driven more by where different proponents are able to secure water licences than careful consideration of coordinated development patterns that would minimize water flow impacts, resource use conflicts, and transmission, road and other infrastructure requirements.

4.0 Wind

Wind is the other resource that the Energy Plan specifically promotes. However, it too is a relatively high cost, low value resource. The plant gate bid prices BC Hydro received from wind projects in the F2006 Call ranged from $71 to $91/MWh.[14] To this must be added transmission costs, which can be very significant for wind projects because of their low capacity factor[15] , and the costs that BC Hydro has to incur to integrate an intermittent resource like wind into its system.

Wind resources have been compared to a negative load, except they tend to be more variable and uncertain because of changing wind conditions. As a result, they require more flexibility and back-up from the rest of the system to be able to maintain voltage stability and meet the total load on a minute-to-minute and hour-to hour basis. Studies of the costs of this requirement for increased system flexibility and back-up—wind integration costs—have concluded that they are significant. At its System Requirements workshop, BC Hydro reported estimates of wind integration costs in other jurisdictions ranging from $3/MWh to over $11/MWh.[16] Wind integration costs will vary depending on the system size and characteristics, and the diversity and predictability of wind conditions, but in all cases they tend to be higher the more wind resources are acquired.

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[13] *For a detailed discussion of impacts see, T. Douglas, " 'Green' Hydro Power – Understanding Impacts Approvals and Sustainability of Run-of-River Independent Power Projects in British Columbia", Watershed Watch Salmon Society, August 2007.*

[14] *BC Hydro, Report of the F2006 Call for Tender Process Conducted by BC Hydro, August 2006, p.47.*

[15] *Capacity factor refers to the ratio of the actual annual output in relation to the output that would be achieved if the plant were able to operate at full capacity. Capacity factors for wind projects are typically less than 40%. This tends to increase transmission costs per MWh because while transmission capacity has to be available to meet the full potential output of the wind resource, that capacity is only utilized a small proportion of the time.River Independent Power Projects in British Columbia", Watershed Watch Salmon Society, August 2007.*

[16] *S. Friedmand, BC Hydro Wind Integration Presentation, June 6, 2007.*

Proponents of wind resources argue that integration costs in British Columbia are low because BC Hydro's hydroelectric system can be used to back up fluctuations in wind output. When wind output is low because of calm wind conditions, hydro generators can be ramped up to meet system requirements; when the wind picks up and wind output increases, the hydro generators can be ramped down.

It is correct that BC Hydro's hydro resources have the flexibility to back up large amounts of wind resources, but that does not mean wind integration costs are low. Firstly, there are environmental and other limits to the operating flexibility of the hydro system. Sudden, major changes in wind output cannot always be accommodated. More importantly, there are very significant opportunity costs in using BC Hydro's reservoirs and hydroelectric generators to back up wind. It can result in the generation of hydro power at low value instead of higher value time periods, and it will restrict BC Hydro's ability to engage in profitable trading activity. In an analysis undertaken by Bonneville Power and the Northwest Power and Conservation Council, sub-optimal dispatch (e.g. having to use hydro energy at night to back up wind instead of using hydro in a more valuable daytime period) and reduced short term marketing capability were cited as two main components of wind integration costs.[17] These are significant in the BC Hydro system, and will be higher the higher are market prices and the more wind power that BC Hydro acquires.

In addition to being high cost, taking not only the IPP bid prices but also transmission and integration costs into account, wind resources are low in value. Wind output is intermittent and unpredictable, the opposite of a dispatchable resource that BC Hydro could utilize at highest value time periods. In this respect, wind power is even less valuable than spot market purchases. Wind power has to be absorbed whenever it is produced. Spot market purchases can be timed to when the electricity is needed or otherwise advantageous to buy.

Also, wind power offers virtually no dependable capacity. The Bonneville / Pacific Northwest Power and Conservation Council wind integration study noted that when loads are at their highest due to very high and low temperatures, wind output is often minimal, because of the high pressure conditions (and calm winds) that are often associated with the extreme temperature events. "For example, during the extreme heating event of July 24, 2006 the regional wind fleet as a whole generated at 5 to 10% of nameplate capacity. On November 27, 2006, during a peak hour load in a regional cold snap, the combined wind projects of BPA and NorthWestern Energy generated at 3% of their nameplate capacity". [18]

BC Hydro has not yet estimated the cost of the services it would have to provide to the wind projects the Energy Plan is encouraging it to acquire. However, those costs need to be fully investigated and appropriate charges for wind IPPs put in place. It is irresponsible to acquire wind projects without knowing what the total costs will be and charging the appropriate fees for the services that have to be provided.

Underlying the promotion of wind projects in the Energy Plan and elsewhere are two factors. Once built, operating costs are relatively low and not subject to fuel price risk. And, wind power does not generate any GHG or other emissions. There are environmental and social issues associated with wind power, especially the large wind farms that raise esthetic, noise, land use and bird-related concerns, but like run-of-river there are no direct or significant life cycle emission impacts.

The technical question, however, is whether these advantages outweigh the costs. Is the widespread

[17] *Northwest Power and Conservation Council and Bonneville Power, Northwest Wind Integration Action Plan, March 2007.*

[18] *Northwest Power and Conservation Council and Bonneville Power, Northwest Wind Integration Action Plan, March 2007, pp17-19.*

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development of wind projects a cost-effective way to avoid fuel price risk and avoid or reduce the emission of GHGs. BC Hydro's estimates of natural gas-fired thermal generation costs and emissions suggest it likely would not.

In a recent report, BC Hydro estimated that electricity from a new combined cycle natural gas plant in the central interior of British Columbia would cost an estimated $76/MWh delivered to the Lower Mainland, based on a United States Department of Energy reference case natural gas forecast.[19] The offset of all GHGs at the mid range offset charge in BC Hydro's 2006 Integrated Electricity Plan would add $10/MWh.[20] The total cost, with full offset of GHGs would therefore be some $86/MWh.

There is of course uncertainty both in the price of natural gas and the cost of offsetting GHGs, but they would have to be much higher than the US Department of Energy's reference case forecast or BC Hydro's mid-range GHG costs before wind power would be cost-effective. The total cost of wind energy delivered to the Lower Mainland, including the cost of the transmission, integration, firming and shaping services required to provide a product comparable to the output of a combined cycle plant, would be well over $100/MWh, possibly over $120/MWh for the higher cost sources of wind supply. Even if GHG offset costs were over $50/tonne, the combined cycle gas plant with full offset of GHGs would be, in most gas price scenarios, less expensive.

In other words, it is possible that BC Hydro could build a new combined cycle gas thermal plant (or even more economically repower the existing Burrard plant), invest in public transport, agriculture-related methane reduction and other measures to fully offset its GHG and other emissions, and still be significantly less expensive than wind. The Energy Plan should have required BC Hydro to carefully investigate that possibility. Instead the Plan encourages BC Hydro to ignore it.

[19] *BC Hydro, BC Hydro and Alcan 2007 Electricity Purchase Agreement Report, Draft, September 5, 2007, p.6-12.*

[20] *The mid range GHG offset cost was $25/tonne up to 2020, increasing 5% per year thereafter. BC Hydro, 2006 Integrated Electricity Plan, p.3-47.*

5.0 Conclusions

Despite the green veneer, the province's 2007 Energy Plan is designed more than anything else to augment and distort the market for IPP electricity supply. There are better ways to meet our electricity requirements in a cost effective and environmentally and socially responsible manner.

A truly green strategy would start with the objective of minimizing the requirements for new power project developments—something the Energy Plan, with its self-sufficiency, insurance and low rate policies, does not do.

It would then direct BC Hydro to develop or acquire the best sources of new supply, in the best possible manner, taking all economic, environmental and social factors into account. Again, the Energy Plan's artificial constraints on BC Hydro's own developments and biases to projects on the basis of one attribute – their direct GHG emissions – do not achieve that.

In terms of BC Hydro's own development versus IPP supply, there needs to be far more analysis and consideration of the implications these alternatives raise. There can be circumstances when IPP developments are advantageous, but for the most part, given the terms of the contracts BC Hydro is currently offering, there is little benefit and significant cost. The IPP projects have not been demonstrably low cost; they have not been reliable in terms of their ability to achieve target in-service dates or even reach commercial operation; they assume no future electricity market price risk; and they offer no long-term price security once the initial contracts expire. They do not offer BC Hydro the same opportunity to plan, develop and operate projects in an efficient, integrated fashion nor do they facilitate comprehensive environmental assessments of cumulative effects.

In short, there is no reason to restrict BC Hydro in the development of its own supply. IPPs should be an option, not a requirement in the development or acquisition of new resources.

With respect to the types of projects that are developed, there similarly needs to be far more comprehensive, transparent analysis of the costs, relative value and impacts that the different alternatives entail. And the range of alternatives should be broad – they should include the repowering of the Burrard gas thermal plant with the full offset of GHG and other emissions, and consideration of Site C or other medium and large hydro with mitigation, compensation and First Nation participation, as required, to achieve community and broad public support. Energy policy should dictate the standards (e.g. full offset of GHGs), and the evaluation and assessment process—it should not try to dictate or influence what the results of that process will be.

Glossary

Definitions are taken from the Glossary (Appendix L) to BC Hydro's 2006 Integrated Energy Plan where possible.

Annual energy: The amount of electricity produced or used over a period of one year, normally measured in megawatt-hours (MWh) or gigawatt-hours (GWh).

BCH: BC Hydro.

BCUC: BC Utilities Commission, the provincial regulatory agency for energy utilities.

Burrard Thermal Generating Station: A natural gas-fired generating station located in Port Moody, at the western edge of the Fraser Valley, that consists of six 150 MW units, the first of which were installed in the early 1960s.

Capacity: The instantaneous electricity demand at any given time, normally measured in megawatts (MW).

CO: Carbon monoxide, a colourless, odourless and tasteless gas which results from incomplete oxidation of carbon in combustion.

DSB: Downstream benefits, the Canadian portion of the Columbia River Treaty downstream energy and capacity benefits resulting from increased electricity generation on the Columbia River in the U.S. due to the construction of Duncan, Keenleyside and Mica storage dams in Canada. Under this treaty, Canada is entitled to the return of one-half of the downstream benefits commencing April 1, 1998, and ending September 15, 2024, to be delivered over existing interties with the U.S.

Energy Plan: A statement of Provincial Government policy related to provincial energy matters issued by the Minister of Energy and Mines in November 2002. The Energy Plan was updated and expanded in 2007.

GHG: Greenhouse gases.

GWh: Gigawatt-hour, equal to one billion watt hours or one thousand megawatt hours (an amount of electric energy that will serve about 100 residential customers for one year).

Ha: Hectare.

Heritage Contract: A ten-year, 49 000 gigawatt hour per year contract between BC Hydro's Generation and Distribution Lines of Business to ensure BC Hydro customers benefit from the existing low-cost hydroelectric and thermal resources in the BC Hydro system.

IEP: BC Hydro's Integrated Electricity Plan.

Insurance policy: Energy Plan policy action requiring BC Hydro to acquire 3000 GWh of electricity, over and above its self-sufficiency requirement, by 2016.

IPP: Independent Power Producer, a privately owned electricity generating facility that produces electricity for sale to utilities or other customers.

IPPBC: The Independent Power Producers of British Columbia, an organization representing the IPP industry and lobbying on its behalf.

IR: Information request made by interested parties in the BCUC decision-making process.

Local Air Emissions: Tracked separately, total tonnes of nitrous oxides (NOx), sulphur oxides (SOx), carbon monoxide (CO), volatile organic compounds (VOC), particulate matter 10 microns or less, and particulate matter 2.5 microns or less.

LTAP: Long-term Acquisition Plan, BC Hydro's plan of resource development actions over the next 10 years that, when added to the existing base of resources, will meet its customers' electricity needs through the LTAP period.

Glossary

MW: Megawatt, equal to one million watts. A unit commonly used to measure both the capacity of generating stations and the rate at which energy can be delivered.

MWh: Megawatt-hour, equal to one million watt hours.

NOx: Oxides of nitrogen, including NO and NO2, expressed as NO2 equivalent.

Particulate matter: A complex mixture of extremely small particles and liquid droplets. It is made up of a number of components, including acids, organic chemicals, metals, and soil or dust particles.

Peak capacity: The maximum amount of electrical power that generating stations can produce in any instant.

PM2.5: Particulate matter 2.5 microns or less.

PM10: Particulate matter 10 microns or less.

PV: Present value, today's discounted value of future receipts or expenditures.

Revenue Requirements Application: Hearing before the BCUC expected to determine the revenues BC Hydro will need for its operations, to ensure a safe and reliable supply of electricity to its customers.

Run-of-river hydro: A hydroelectric facility that operates with no significant storage facilities.

Self-sufficiency policy: Energy Plan policy action to achieve electricity self-sufficiency by 2016. Under this policy, BC Hydro must acquire sufficient B.C. based resources to be able to meet its requirements with domestic resources at all times, even in critical water years.

Site C: A proposed 900 MW hydroelectric generating station downstream from the existing Williston Reservoir and two existing generating facilities in the Peace River region.

SOx: Oxides of sulphur, including SO2.

Thermal generation: Generation of electricity by converting heat energy into electric energy through the controlled combustion of fossil fuels or biomass.

VOC: Volatile organic compound, emitted as gases from certain solids or liquids.

Watt: The basic unit of measurement of electric power, indicating the rate at which electric energy is generated or consumed. 1 watt = 1 joule per second.