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Cleantech Access to Venture Capital in British Columbia: Analysis and Recommendations

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EXECUTIVE SUMMARY

This paper identifies and discusses potential and/or existing barriers to venture capital (VC) access for the cleantech sector in British Columbia (BC). An overview of the government's role, the venture capital environment, investments in the province, and the cleantech industry is presented, along with recommendations. The report is based on two rounds of interviews with experts from the venture capital industry in BC, cleantech CEO's and executives, and key individuals within the provincial government, including BC Hydro employees.

Barriers

It is important to understand first that the capital-intensive nature of cleantech makes for highly illiquid investments, which are not ideal for venture capital. Furthermore, it generally takes longer in cleantech to exit, or generate a cash return for the investors, which is an important aspect of venture capital portfolio performance. Second, the experts who develop clean technologies often lack business experience and partner with other scientists, creating management teams that have substantial technical skills but lack business skills. In addition, the scope of clean technologies is very broad, and venture capitalists cannot become experts in the entire sector. Third, the public sector has significant influence on the cleantech industry, and BC Hydro's procurement process is lengthy, which makes the bidding price for energy obsolete by the time the Electric Purchase Agreement is awarded. Moreover, the Innovative Clean Energy Fund was judged to be too small to have a significant impact in the development of cleantech in BC. Fourth, British Columbia, as an energy market, is relatively small compared to other jurisdictions, forcing many local business developers to turn to the export market in order to thrive. Finally, interviews and research revealed that the costs of pollution are not fully internalized into the economy. For BC this means that there is significant potential to create more consumer and industry demand for clean technologies.

Additional Findings

Several additional themes emerged:

- the Clean Energy Act was generally identified as a step in the right direction, albeit one that lacks an adequate implementation strategy
- taxing dirty energy was preferred to instigating a fee-in tariff program
- pursuing an export strategy generated mixed reviews, as it was unclear how exporting energy would help the cleantech sector in BC
- the current BC carbon tax was considered too low to have a measurable impact on consumer behaviour, but when compared to a cap and trade system, it was the preferred instrument
- influencing the adoption of clean technologies and leading by example were strongly suggested for the BC government, particularly in the transportation sector
- all respondents were in favour of increasing the public's participation in the adoption of cleantech technologies

Recommendations

Appropriate public policies can help the industry overcome a number of these barriers although not all, as some are inherently tied to the nature of specific industries and are not responsive to public-policy changes. Recommendations include:

- I. increase the carbon tax
- II. create an Implementation Commission for the Clean Energy Act
- III. make the government an early adopter of clean technologies
- IV. increase the funding and transparency of existing programs
- V. do not adopt a feed-in tariff
- VI. create a Clean Transportation Act
- VII. encourage more exits by expanding BC's network of investors
- VIII. allocate more resources to community and school programs that promote a cleaner BC

1. OVERVIEW: WHITE PAPER

1.1 The Importance of Cleantech Investments in British Columbia

Over the past few years, British Columbia has taken significant steps toward becoming a global leader in sustainable environmental management. The provincial government has created initiatives such as the BC Air Action Plan and the BC Energy Plan to cut down on carbon pollutants. Furthermore, important pieces of legislation such as the Green House Reduction Targets Act (2007) and the Clean Energy Act (2010) have been passed into legislation. The first Act established the targets for the reduction of greenhouse gases (GHG) in the province; whereas the latter set out the province's energy objectives for the years to come.

The provincial government's efforts have been reinforced by a number of forward-thinking BC municipalities. Vancouver, which hosted the 2010 Winter Olympics, is a prime example of coordinated efforts to label itself as a "green city" and, consequently, attract cleantech investment dollars.

In addition to its environmental benefits, clean technologies are a strong source of economic development. According to the Cambridge Energy Research Associates, the global response to climate change could result in US \$7 trillion in total clean energy investments by 2030. Moreover, a study by the United Nations Environment Programme (UNEP) revealed that given the strong and rapidly rising interest in energy alternatives, future years may see worldwide employment soar—possibly as high as 2.1 million jobs in wind energy, 6.3 million in solar PVs, and around 12 million in biofuels-related agriculture and industry. This represents a possible total employment for renewables of over 20 million jobs by 2030. The same study also points out that advancements more generally in the "green economy" are closely tied with clean technology investments, which for the first time surpassed capital injections in fossil fuel technologies in 2008.

Public policy influences where venture capitalists invest, according to a survey of clean technology investors conducted by Global Insight and the National Venture Capital Association. Further, venture capital has proven to be the fastest, most efficient driver of job creation, according to the consulting firm The Cleantech Group. An analysis made by the Group in conjunction with environmental policy advocates Environmental Entrepreneurs, estimated that US \$100-million of venture capital investments will help create, over a period of two decades, 2,700 jobs, \$500-million in annual revenues, and many more indirect jobs. By contrast, it is fair to assume that the impact of stimulus spending may be considerably slower, given the time required for stimulus grant application, selection, and funding. Relative to US President Barack Obama's position that US \$825-billion in stimulus spending would create 3 to 4 million jobs by 2010—US \$235 thousand per job—venture capital can be regarded as a cheaper medium of job creation.

1.2 Problem Definition

Despite the favourable environment toward cleantech investments and the recent provincial and municipal initiatives in BC, some senior executives in the emerging cleantech industry indicated that they have had difficulty attracting venture capital for cleantech initiatives in the province, whether they involve the expansion of production capacity or the installation of new infrastructure. This white paper asks

whether access to venture capital is a problem consistent throughout the industry, and attempts to reveal barriers that inhibit access to venture capital. Based on this evaluation, this paper presents a suite of recommendations designed to foster a better environment for cleantech companies to grow in British Columbia.

2. OVERVIEW: THE GOVERNMENT'S ROLE

2.1 Introduction

Over the past decade, Canadian governments, both federal and provincial, have worked to improve their levels of involvement and the channels of support to cleantech and venture capital activities. Direct investments, in the form of grants and subsidies, fiscal measures such as tax credits, and public policies constitute some of the approaches used in BC government.

For comparative purposes, prominent federal programs and incentives are reviewed in the following pages, prior to a description of their BC counterparts and an analysis of public institutions that have the most influence in the energy sector.

2.2 Programs and Incentives

SDTC and IRAP

The Sustainable Development Technology Canada (SDTC) and the National Research Council's Industrial Research Assistance Program (IRAP) constitute two well-established granting agencies at the federal level. Both programs provide support to enterprises in the cleantech sector. To date, SDTC has completed 16 funding rounds and allocated a total of \$478-million to 195 projects. In 2009, the Federal Budget allocated \$200-million over two years to the IRAP "to enable it to temporarily expand its initiatives for small and medium-sized businesses". The national budget is allocated to five IRAP regions across Canada, the Pacific Region (BC and Yukon) being one of them. Contributions are capped at \$1-million per project. However, typical amounts in BC range from \$50,000 to \$200,000 per project.

SR&ED

The Scientific Research and Experimental Development (SR&ED) program supports the federal objective of encouraging Canadian businesses of all sizes and in all sectors to conduct research and development (R&D). SR&ED provides Canadian-controlled private corporation (CCPC) with investment tax credits of 35% up to the first \$3-million of qualified expenditures for SR&ED carried out in Canada, and 20% for expenditures over this amount. Following the federal government's footsteps, the BC government has also implemented complementary programs directed at incentivizing innovation in the province.

The Venture Capital Programs

The BC government, through the Ministry of Small Business, Technology and Economic Development, offers three programs to help small businesses gain access to capital. One, the Venture Capital Program encourages investors to make equity capital investments in four strategic areas, including cleantech, in exchange for a 30% refundable BC income tax credit.

In order to qualify, investments must be made in small businesses that employ no more than 100 people and pay at least 75% of the wages to BC employees. In addition, these businesses must be substantially engaged within BC in manufacturing, processing, researching, or developing technologies that increase energy efficiency and conservation, reduce GHG emissions or reduce the environmental impact of energy generation and use.

The Innovative Clean Energy (ICE) Fund

Introduced in 2007 as part of the BC Energy Plan, the ICE Fund supports the development of clean power and energy efficiency technologies in the electricity, alternative energy, transportation, and oil and gas sectors. Its two calls for applications have resulted in \$47-million flowing to 34 projects across the province. According to government figures, these projects represent a total value of over \$174-million and showcase a variety of clean energy technologies including solar, wind, tidal, geothermal, ocean wave and bioenergy.

The ICE Fund is collected through a 0.4% levy on the final sale of electricity, natural gas, fuel oil, propane, and any other product prescribed by regulation as an energy product, with the exception of transportation fuels. The levy is assessed on residential, commercial, and industrial customers. On average, a family will pay about \$3 a year for the levy on electricity, \$5 a year on natural gas, and \$8 a year on fuel oil. Industrial customers are protected by a \$100,000 cap per year.

The BC Renaissance Capital Fund Ltd. (BCRCF)

The BC Renaissance Capital Fund (BCRCF) is an initiative to attract successful venture capital managers and their capital to the province. Wholly owned by the BC Immigrant Investment Fund (BCIIF), the BCRCF pursues investments in four technology sectors, including cleantech. In essence, the BCRCF evaluates and selects venture capital fund managers through a request-for-proposal mechanism. It then enters limited partnership agreements to commit to invest with the fund managers who ultimately select companies for investment and solicit capital from the BCRCF and other partners.

Thus far, the BCRCF has committed \$90-million to seven venture capital fund managers based in the US and Canada. To date, \$15-million has already been placed, contributing to an aggregate of \$61-million invested in BC companies. BCRCF expects the balance of the committed funds to be invested over the next three to four years.

It is important to note that the provincial allocations received from BCIIF program are repayable to the federal government without interest on the fifth anniversary of their receipt. In order to participate in the Program, the Province has provided the federal government with a repayment guarantee of the funds.

The Clean Energy Act (CEA)

In June 2010, the Clean Energy Act (CEA) received royal assent in the BC legislature. The law represents a structural change in the electricity industry in British Columbia. Among its goals, the Act aims to create power self-sufficiency with low rates for domestic consumers, reduce greenhouse gas emissions and demonstrate environmental stewardship.

Embedded in the Act are provisions for efficiency and conservation, a smart power grid with smart meters, development of electricity export, merger of the British Columbia Transmission Corporation into British Columbia Hydro and Power Authority (BC Hydro), a reduction in the role of the British Columbia Utilities Commission (BCUC) as a regulator of hydro projects, and the creation of a First Nations Clean Energy Business Fund.

Despite its apparent comprehensive nature, the BC Clean Energy Act has sparked a lot of criticism among different sectors in the province. Part of the business community claims it discourages low-cost, low-carbon energy alternatives. Native leaders complain the government failed to consult with them and the official opposition contends that consumers will end up paying more for energy under this plan.

2.3 BC Hydro and Power Authority

BC Hydro and Power Authority is a dominant player in the power sector of the province. BC Hydro controls most of the generation and distribution of electricity in the province. It operates 30 hydroelectric facilities and three natural gas-fuelled thermal power plants, serving an area containing over 94% of BC's population. Major hydroelectric generating stations on the Columbia and Peace rivers produce about 80% of the province's electricity.

In terms of pricing, BC Hydro provides BC citizens with inexpensive electricity.

Table 2.1 compares average prices for residential customers across selected North American cities. Vancouver ranks third cheapest among the listed urban areas, behind Montreal and Winnipeg, which for the most part also rely on hydro power.

Table 2-1

Average Electricity Prices for Residential Customers in Major North American Cities

City	Price in ¢/kWh	City	Price in ¢/kWh
Montreal, QC	6.87	Calgary, AB	12.13
Winnipeg, MB	6.94	Nashville, TN	13.25
Vancouver, BC	7.13	Halifax, NS	12.88
Seattle, WA	8.34	Miami, FL	13.50
Edmonton, AB	10.22	Chicago, IL	15.05
Regina, SK	10.91	Detroit, MI	15.38
Portland, OR	11.01	Charlottetown, PEI	17.29
St John's, NF	11.02	Houston, TX	17.86
Ottawa, ON	11.27	San Francisco, CA	24.54
Toronto, ON	11.46	New York, NY	25.32
Moncton, NB	11.66	Boston, MA	25.99

Source: Hydro-Québec, rates in effect April 2009.

Procurement Process

The wholesale electricity market in BC is open to competition. In the retail sector, only large industrial companies can choose an electricity service provider other than BC Hydro. To be able to meet the growing demand for electricity, BC Hydro announced the expansion of its heritage assets, the implementation of aggressive conservation and efficiency initiatives, and the addition of more supply through long-term electricity purchase agreements with Independent Power Projects (IPPs).

BC Hydro constitutes one of the province's most important economic and environmental advantages. It provides what is arguably the cleanest stable source of energy available at a low price. However, in cleantech terms, Hydro's focus on reliable low-cost power becomes a challenge for clean innovative technologies in British Columbia that must compete with the very low-cost alternative while drawing on Hydro's firming and shaping capacity to be able to engage in export agreements.

BC Hydro is a large and complex organization whose structure and policies often represent insurmountable hurdles for cleantech companies. Grid access, favourable procurement rules, and flexibility are some of the minimum requirements the energy sector must achieve to foster a high-quality cleantech industry. The province counts on the resources to make clean energy entrepreneurs flourish; BC Hydro's support will be crucial for them to achieve success.

2.4 Transportation

In a growing number of environmentally progressive jurisdictions, the transportation sector has become the target of strategies designed to reduce GHG emissions and promote innovation. California's Clean Car Law (the Pavley GHG Standards) not only claims to be a decisive initiative in terms of pollution reduction, but also an economic program that will provide Californians with over US \$12-billion in savings by 2020.

According to LiveSmart BC figures from 2008, transportation accounts for the largest share of provincial GHG emissions (37 per cent). Meanwhile, the electricity industry remains a small contributor (2 per cent) to the province's total emissions due a greater reliance on hydroelectric power generation. In general terms, the emissions breakdown in BC differs significantly from the rest of Canada. The transportation sector's share is much higher than for the country as a whole (37 versus 27 per cent) whereas, BC's electrical generation share is much lower (2 per cent versus 17).

Drafted in June 2008, the BC Air Action Plan represents an effort to reduce air pollution from all sources. Complementing the government's GHG reduction target act of 2007 and the BC Energy Plan, it set out 28 actions, some of which are directly targeted at the transportation sector. For instance, some of them refer to objectives such as expanding green transportation, getting old cars off the road, promoting an anti-idling campaign, and retrofitting heavy-duty trucks and transit buses.

3. OVERVIEW: VENTURE CAPITAL

3.1 An Explanation of Venture Capital

Venture capital is one of the main drivers behind technological innovation. It is the lifeblood for small companies seeking to transform R&D into real, marketable and commercial products. Without it, it would be very difficult for these early-stage companies to find suitable financing to sustain their growth. Venture capital has helped convert small-scale companies with big ideas into some of the most successful companies on the planet.

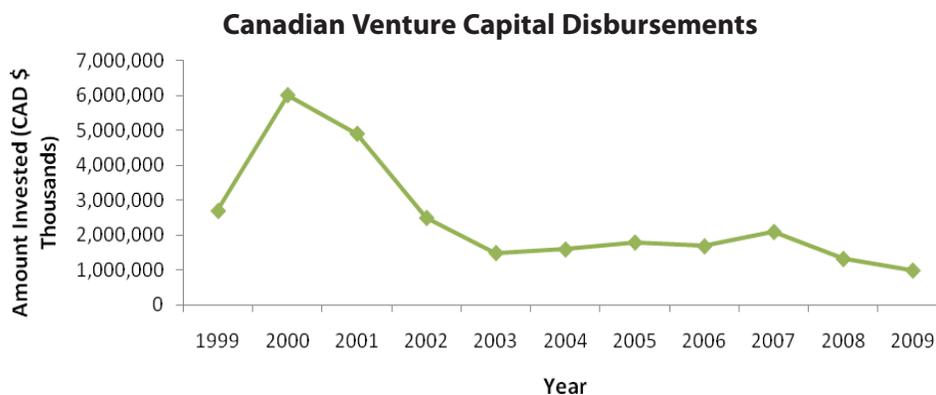
3.2 The Canadian Venture Capital Market

Canadian Venture Capital Statistics

The current structure of the venture capital market reflects the manner in which it evolved and today its composition is far different from that in the United States where 77.2% of all venture capital is sourced from independently managed funds. Canada sources only 19% of VC from domestic private independents, 34% from foreign funds, 22% from retail funds, and 10% directly from government investments. The dissimilarity of the private equity markets in these two countries is the consequence of America's greater emphasis on non-interventionist policies to develop financial markets.

Canadian venture capital investments grew rapidly in the 90s, exploded in 2000, and averaged \$2-billion per annum ever since (Figure 3-1). The high level of investment activity in 2000 was the result of large deals in the areas of communications, software, life sciences and electronics. More recently, the 2008 financial crisis led to decreased levels of disbursed venture capital, which has stifled the growth of Canada's innovation-based industries.

Figure 3-1



Source: Compiled from J.P. Cayen, *Venture Capital in Canada*, (June 2001), p.4, and from Thomson Reuters Datastream, accessed July 2010.

Current Investment Activity

The recent financial crisis has hurt the venture capital industry in three major ways. First, large institutional investors re-adjusted their portfolios to include lower proportions of higher risk capital. This risk aversion has made it far more difficult for

venture capitalists to raise their funds. Second, the market for initial public offerings (IPOs) collapsed and investee companies found it increasingly difficult to launch successful IPOs. Third, venture capital provided by larger corporations dried up as companies cut back on R&D expenditures during the recession. However, a slight benefit of the financial crisis accrues from the fact that those start-ups who have managed to survive the recession so far have been forced to become leaner and more efficiently run. These companies will be more competitive in the long run, which enhances the attractiveness of their exit opportunities.

Venture capital disbursements have remained weak through 2009 and 2010. While fourth quarter figures were at their highest level for the year, total invested capital for 2009 fell to levels characteristic of the mid-1990s. This regression continued in 2010 with investments down 15% in the first quarter from the end of 2009. Furthermore, first quarter venture capital disbursements in 2010 showed no improvement from 2009, decreasing by \$3-million to only \$276-million. At the sector level, however, cleantech showed significant improvement during the first three months of the year with disbursement up nearly 83% from the previous quarter. So while most of the venture capital industry continues to suffer, there is hope that cleantech is recovering from the devastating blow that the financial crisis delivered.

3.3 British Columbia's Venture Capital Activity

British Columbia's technology sector is playing an increasingly important role in the province's economy. In 2007, it accounted for nearly 6% of BC's gross domestic product, generated over 80,000 high paying jobs, and produced combined revenues of over \$18.1-billion. Along with tourism, the technology industry is part of British Columbia's new economy. These two sectors are expected to drive economic growth in the future while helping to diversify the province's economy, making it less susceptible to cyclical fluctuations in commodity prices.

Until just recently, the level of venture capital investments in BC was strong compared to the rest of Canada, apparently signaling a surge in technology-intensive activities. However, the financial crisis hit BC harder than other provinces, and venture capital disbursements fell to \$35-million for the first quarter in 2010, some 13% of Canadian venture capital activity. Returns for venture capital funds have been also been dismal. According to BC Business Online on 7 July 2010, GrowthWorks, a major venture capital group based in Vancouver, was posting three-year returns in the negative seven-to-ten per cent, while other firms are currently failing to meet share-redemption requests.

On a more positive note, BC cleantech investments last year were up 35% to a respectable \$45-million. This figure constitutes 44% of the total Canadian venture capital invested in cleantech in 2009. Moreover, venture capitalists have managed to raise substantial capital for their cleantech funds in the early part of 2010. Chrysalix recently raised a US \$123-million Energy Tech Fund and Yaletown topped off a \$162-million fund that focuses on cleantech and information technology. While there is no guarantee that these funds will be invested in British Columbian companies, the future still looks bright for the province's prized collection of cleantech firms.

4. OVERVIEW: CLEANTECH

4.1 Definition of Cleantech

There are almost as many ways to define cleantech as there are clean technologies. It is a popular and growing sector, so everyone wants in. For the sake of clarity, we adopted the definition introduced by The Cleantech Group, an organization which encourages the development and market adoption of clean technologies in various ways:

“Cleantech is new technology and related business models that offer competitive returns for investors and customers while providing solutions to global challenges.”

Thus, we considered companies that offer products, services, or have operations in BC that could contribute to important reductions in carbon emissions as part of the cleantech industry. More specifically, we included companies operating in the following segments and their categories:

- Energy Generation (wind, solar, hydro/marine, biofuels, geothermal)
- Energy Storage (fuel cells, advanced batteries, hybrid systems)
- Energy Infrastructure (management, transmission)
- Energy Efficiency (lighting, buildings, glass)
- Transportation (vehicles, logistics, structures, fuels)
- Water & Wastewater (water treatment, water conservation, wastewater treatment)
- Air & Environment (cleanup/safety, emissions control, monitoring/compliance trading & offsets)
- Materials (nano, biochemical)
- Manufacturing/Industrial (advanced packaging, monitoring & control, smart production)
- Agriculture (natural pesticides, land management, aquaculture)
- Recycling & Waste (recycling, waste treatment)

4.2 Cleantech in British Columbia

A lot of positive statements have been made about the British Columbian cleantech cluster, but it is still developing. “British Columbia has the resources and potential to be a world cleantech leader, but has yet to capitalize on these advantages,” says Ernst & Young’s recently released report: “Making BC a clean energy powerhouse.”

Although cleantech remains in the development stage, BC in fact hosts the largest cluster of cleantech companies in Canada: more than 1,300 companies and 18,000 workers. BC has several natural advantages including the Pacific Gateway, a well-developed entrepreneurial spirit, and the cluster itself. It is strong in the wind, hydro, fuel cells, and energy management sectors. Its geographical position is advantageous, yielding access to abundant natural resources in the forms of bioenergy, geothermal energy and tidal, run-of-river, solar and wind power. BC also enjoys a scale

advantage: the Ernst & Young report states that “the province is small enough to make change happen relatively quickly. But it’s also large enough that any change has wide significance.” And finally, the relatively recent introduction of carbon tax and offset programs illustrates the province’s strong leadership in the renewable-energy development sector. Regardless of these significant advantages, measures can still be taken to ensure companies that invest in local technologies are committed to doing business in BC.

4.3 Development of Cleantech through Venture Capital

Venture capital investments are said to create a “snowball” effect on industries. As explained in the latest report from the Canadian Venture Capital Association, “Why Venture Capital is Essential to the Canadian Economy”, VC investments help with domestic creation of jobs and economic growth, and will also influence wealth creation. The report notes, “When a company is acquired or makes a successful IPO on NASDAQ, this creates a large amount of wealth for the Canadian founders who very often reinvest part of it in start-ups by becoming angel investors. They reinvest not only their money; they also invest their time and skills to help the next generation of entrepreneurs.” Therefore, future generations of cleantech companies will benefit from the success of those now active. Serial entrepreneurs, angel investors and management talent pools will emerge from the first few successful cleantech companies in BC.

5. IDENTIFICATION OF BARRIERS

5.1 The Nature of the Investment

From a venture capitalist standpoint, cleantech investments are not generally an ideal investment. This type of private equity was traditionally intended to fund technology-intensive projects that were initially illiquid, but had the potential for high growth and eventual exit. Since the inception of the information technology revolution, the venture capitalist model has undergone some alterations. Toward the end of the past century, venture capitalists enjoyed opportunities that were highly liquid and could generate phenomenal returns in the short term. The success of venture capital funds during the dot-com bubble raised the expectations of investors and narrowed the scope of possible venture capital projects.

Cleantech companies are essentially competing for the same investment dollar as the entire technology sector, but they do not compare well with competing investment opportunities, at least at this time. Cleantech has longer investment periods and is far more capital-intensive which makes it highly illiquid. What many of the venture capitalists remarked is that often cleantech companies approach them not fully understanding the requirements necessary for a venture capital fund to be successful. Investors currently expect higher returns in a shorter amount of time compared to investment expectations ten years ago. Given that the typical cleantech firm lacks revenue generation in the first few years and its technologies may take up to ten years to develop, it is difficult for many of these companies to position themselves as attractive investments. It follows that venture capitalists can be hesitant to invest in this sector. Moreover, commercial banks usually require tangible assets as collateral.

5.2 Technology and Business is a Difficult Mix at an Early Development Stage

Market Definition and Technology Commercialization

A large, clearly defined addressable market opportunity is also a primary criterion of selection when investing in business ventures. In some cases, cleantech entrepreneurs or developers have a hard time identifying the market because the technology is often at a very early stage of development. Some technologies are also very specific and, although innovative, the connection between their function and the problem or opportunity they would address in the marketplace is difficult to make.

Commercialization capability is one of the most commonly identified perceived risks of investing in a clean technology project. Commercialization requires that the technology work in a consistent way. For example, it should generate a reliable output, and be easy to set up or install by the customer. Most technologies in need of financing are at a developing stage and it is often difficult for developers to see the commercialization stage that early in the process. Venture capitalists would perceive a technology far from being ready for the commercialization phase as a risky investment.

Furthermore, changing public behaviour is a legitimate major barrier, as it is very difficult to obtain cognitive recognition of a new way to do things. The social change issues include the infrastructure in which cleantech evolves, an acceptance of change by the public, and acceptance of the need to include cleantech in people's everyday lives and choices. Dealing with such behavioural challenges requires massive coordinated efforts between government and industry.

Cleantech Expertise

The availability of cleantech expertise amongst investors and cleantech management teams can present a barrier for accessing venture capital. When selecting higher return rate investments, venture capital firms first look at a company's management team. While experience is definitely an asset, balance can be just as important.

Often, management teams in cleantech start-ups lack experience and/or balance, or both. They have the technical background and understanding of the technology, but lack business skills. This problem is different in British Columbia compared to Ontario or Quebec where the well-established and much larger manufacturing sector provides a corporate ladder that allows business leaders to gain experience quickly.

Although every venture capital firm interviewed for this study employed a cleantech "specialist", industry veterans indicated that cleantech expertise is not as developed in BC as in other sectors (e.g. information technology). This is due in part to the early development stage of the BC cleantech industry. This perception is anecdotal however, and not based on hard data. It was apparent from the interviews that success can be achieved when technology experts—the cleantech entrepreneurs—merge skills with business investment experts—the venture capitalists. A willingness to educate each other and share knowledge bears fruit.

5.3 The Public Sector as a Barrier

BC Hydro's Procurement Process

The majority of those interviewed believe that BC Hydro's energy procurement process takes too long and, in many cases, makes the bidding price for energy obsolete by the time the Electric Purchase Agreement is awarded. The lengthy application period also contributes to a sense of regulatory uncertainty within the sector. This notion is reinforced by the fact that projects, once accepted by the utility, must be submitted to BCUC who may turn them down in the name of ratepayers' interests. Furthermore, in some instances the process was considered to be expensive due to requirements that may apply before entering an agreement.

According to BC Hydro, the Standing Offer Program was designed to address these barriers. Instead of a competitive call, the offer is an open-ended process available to any project meeting the eligibility requirements. As a result, IPPs can devote their resources to develop a project, knowing that in the end there will be a buyer for the electricity. BC Hydro is confident that the removal of BCUC's regulatory role will contribute to a smoother power acquisition process.

Applications for Grants and Programs

Our interviews revealed a relatively high degree of satisfaction with governmental initiatives at both the federal and provincial level. Federal programs such as IRAP, SDTC, and SR&ED were described as well-established, reliable, and with straightforward application processes. Some interviewees confirmed that they have boosted the industry, not only by means of injecting capital, but also by fostering a positive investment environment through stability. However, two expressed concern about a possible hiatus in SDTC funding, with one respondent referring to it as a bureaucratic process, requiring an unreasonable amount of data.

The local cleantech support initiative, the ICE Fund, is considered a step in the right direction that intends to address the financing gap that exists in the development and demonstration stages. However, most respondents consider the fund to be too small to yield the desired effects. Moreover, they also believe the application rules to be cumbersome and that the process as a whole involves too many obligations and requirements.

In general terms, the BC Renaissance Fund was regarded as a good idea. Nevertheless, there is little understanding about how it can foster investments in BC, especially because the fund is not involved in the investment decision-making process. One interviewee expressed concern about the repayment of funds to the Federal Government.

5.4 Size of Home Market as a Barrier

BC boasts an enviable amount of natural resources. The province's vast hydro assets provide the population with low energy prices that fuel the economy. However, interviewees repeatedly acknowledged that those abundant resources do little to entice consumers and industry to adopt clean technologies whose costs are still relatively high. Furthermore, some of the most important sectors of the economy are dominated by a few procuring players such as BC Hydro. This situation entails a great deal of difficulty for clean technologies to be tested or bought by local companies.

Moreover, in the context of US and European states, this province has a relatively small population that contributes to the notion that BC is a difficult market to access. Most cleantech entrepreneurs expressed the need to consider an international market to take advantage of economies of scale, while noting that the costs associated with pursuing foreign markets can be high. It was made clear that establishing strong domestic demand would help bridge the financial gap for export.

5.5 The Environment is NOT Fully Internalized in the Economy

An inherently difficult aspect of cleantech firms is that many of their products solve problems that have yet to become of economic importance. Essentially, clean technology aims to reduce the amount of GHG emissions into the atmosphere. Unfortunately, for a demand to be created for these technologies, the price of pollution must be fully internalized into the economy. As it stands, consumers and industry alike are not fully paying for emissions that compromise the environment.

In order to invigorate uptake of cleantech in British Columbia, industry requires stronger governmental action that incorporates the social cost of carbon emissions into the economy. Without it, industry will be forced to find jurisdictions with stronger environmental policies that make export attractive. To persuade the government to adopt such policies, cleantech companies should consider establishing a strong, centralized, lobby group.

5.6 BC Hydro's Mandate

Clean Energy Act

Half of the interviewees who expressed their views on the Clean Energy Act see it as a step in the right direction; the other half considered it a flawed piece of legislation. An absence of a clear strategy, tangible actions, and procedures to engage stakeholders were pointed out by those critical of the Act. It was felt that these deficiencies could threaten its future success. Some believed that the Quebec and Ontario energy plans constitute similar but better examples, since they offer better defined objectives and implementation plans. The BC Government might have drawn on those examples to assign roles and responsibilities for the development, implementation and standardization of the measures proposed in the CEA.

Those who analyzed the CEA objectives in detail detected two seemingly conflicting goals: promoting exports vs. developing clean energy. As it stands, the province can only export its surplus if it imports cheap dirty energy during low-demand periods. In addition, one interviewee questioned the need for self-sufficiency when North America evolves to becoming a more integrated market. All respondents were skeptical about the government's capability to replace BCUC in the role of monitoring energy policies. Finally, the commitment to clean energy was not clearly seen.

Public Sector: Implementation of Feed-In Tariffs

The implementation of a feed-in tariff (FIT) program to spur the generation of electricity from renewable sources was opposed by the majority of research participants. Main concerns revolved around the fact that FITs do not optimize the costs for taxpayers who are billed for the subsidies handed to renewables. Many believed that efforts should be directed at taxing dirty energy instead. Moreover, some referred that feed-in tariffs are susceptible to political interference, citing the

difficulties that hampered the success of the program in Spain. Additionally, they say in a FIT environment there is no motivation to conserve energy or improve efficiency on the consumer side.

Supporters of FITs expressed they are a good mechanism to get the market started. They believed a reasonable rate of return around 10% and a program length of 20 years are minimum requirements of implementation. Germany's solar program was cited as proving the effectiveness of coupling sliding prices with long term stability and attractive investment opportunities to encourage early adoption.

Energy Export Strategy

Pursuing an export strategy, as proposed in the Clean Energy Act, generated mixed reviews from interviewees. BC and jurisdictions such as California have different seasonal demand peaks that allow their systems to complement one another. BC's energy use peaks in the winter when temperatures are coldest; California's peaks in the summer when temperatures are highest. Therefore, many respondents deemed exporting inexpensive hydro power to the Californian market as a lucrative opportunity. However, there was concern about BC's ability to compete in the long run with American incentives to local clean energy producers. It was felt that BC could pursue an export strategy where power is bundled with cleantech infrastructure and services to meet the growing clean energy appetite south of the border.

There is a significant impediment to such an initiative, however. Intermittent and location dependent clean energy sources often require firming and shaping from BC Hydro in order to secure contracts in the US. Some BC entrepreneurs have encountered difficulties in meeting this requirement. Without a major overhaul to the procurement process for these technologies and adequate support from the province's utility, it remains unclear how exporting energy would help the cleantech sector in BC.

5.7 Feedback on Carbon Taxes and the Cap and Trade System

Respondents agreed that the BC Carbon Tax is a step in the right direction. However, some mentioned that the tax is too low to have a significant impact on buying behaviour. For example, a Californian study, "The optimal gas tax for California", suggests that due to the inelasticity of demand associated with gasoline the optimal gas tax for combating global warming should be between \$0.33 and \$0.40 per litre. Under the BC Carbon Tax, gasoline is currently taxed at \$0.0482 cents per litre, almost one tenth of the optimal level suggested for California. However, BC's carbon tax incorporates more than just gasoline usage and a tenfold overall increase would hurt many valuable industries in the province. Based on these considerations, there ought to be an extension of the BC carbon tax that includes greater annual increases while respecting the needs of the province's industries.

In terms of the cap and trade system, concerns were raised about the risk of political interference since lobbyists may persuade the government to offer exemptions to certain industries. Furthermore, the program adds significantly to accounting costs and it has been difficult to determine whether it has done more good than harm in jurisdictions where such a scheme now exists.

A clear preference was given to the tax as the best means to incorporate the external costs of carbon emissions into the economy since such a tax sends a strong signal to industry that the government is taking action on climate change. Price signals are a great way to motivate markets in a capitalist economy. Additionally, they are more resistant to bureaucratic interference.

5.8 Clean Transportation and Community Programs

Clean Transportation

On the question of what additional measures should be taken to encourage clean transportation in BC - given that 37 percent of provincial GHG emissions arise from the transport sector - it was recommended that government take a lead role. Developing measures to influence the adoption of clean transportation technologies through the government's crown corporations was strongly suggested. In addition, government agencies could be the first to procure these types of technologies, and be first-movers in the consumer market.

The second theme centred on fuel consumption. Most believe that price signals are the best way to motivate the market. The carbon tax for example will (eventually) discourage excessive consumption. Subsidies of hybrid cars and taxation of sport utility vehicles could also motivate consumers to make more environmentally responsible choices. Finally, making public transit more accessible as cities develop could also help BC's transportation to be cleaner.

Community and School Programs

The majority of respondents were in favour of community and school programs that encourage "greener" behaviour. Community pride is often strong, especially among small and medium sized communities. Creating awareness within different population groups could also help the development of clean technologies, and community programs would help reach different audiences. Examples, such as first nations communities developing their own energy sources with the help of BC Hydro, were mentioned as positive programs already in place.

6. RECOMMENDATIONS

The following recommendations are intended to help eliminate or reduce the barriers that inhibit access to VC by the cleantech sector in BC. We note that some of the difficulties in accessing venture capital are not specific to cleantech but are in fact common to all industries. Moreover, thanks to a number of government programs and the increasingly popularity of cleantech investments, there is also good news: it could be argued that access to venture capital has been easier for cleantech firms during the global recession than for some of their counterparts in other industries. But access barriers still exist in the cleantech industry, and the following recommendations are intended to address those while particularly encouraging more market certainty and increased attractiveness of cleantech to venture capitalists.

I. INCREASE THE CARBON TAX

BC should expand the carbon tax and set more aggressive increases to more directly influence buying behaviour. The current tax is well designed but too low. We recommend that the government design a new schedule over five years, starting in 2013, with an annual increase of \$10-\$15 per tonne of carbon dioxide (CO₂).

The optimal “gas tax” that is calculated from a Californian study suggests that it should be between \$0.33-0.40 per litre. This number only takes into account the effects of climate change and excludes other parameters that were used in the model (for example congestion costs) that are likely dissimilar to the BC situation. If these parameters were to be included, the optimal “gas tax” would be much higher. In this light, BC’s current carbon tax, which will reach a maximum of at \$0.0724 per litre of gasoline by 2012, is extremely low.

However, since the carbon tax affects more than just gasoline, raising the carbon tax rapidly to the level of California’s optimal gasoline tax would have a serious impact on BC industries. Taking this into account, we adjusted the “optimal gas tax” to a lower target level of 20 cents per litre, which requires annual increases between 2013 and 2017 of \$10 per tonne of CO₂ emitted. The tax would thus reach \$80 per tonne of carbon dioxide emitted by the end of this proposed schedule. Furthermore, we suggest that a \$10 annual increase would be politically viable and moderate enough for businesses to plan accordingly. Should the government decide to take a more aggressive approach, we recommend anywhere up to a \$15 per tonne annual increase. Beyond that, and on the proposed timescale, industries would find it difficult to adjust. This increase would essentially double the target of the current plan and would send a strong signal that the government is fully committed to combatting climate change and to fostering a stronger domestic market for cleantech.

II. CREATE AN IMPLEMENTATION COMMISSION FOR THE CLEAN ENERGY ACT

We recommend that an independent interdisciplinary commission be created that would include key stakeholders (First Nations, taxpayers, government ministries, and crown corporations) tasked to develop an unbiased implementation plan that would achieve the Clean Energy Act’s ambitious objectives. The commission could be modeled on the California Air Resources Board, which created a clear roadmap for the implementation of that state’s landmark Global Warming Solutions Act (AB 32).

The commission would design equitable regulations to encourage early adoption of clean technologies where appropriate while respecting the interests of taxpayers. From the regulatory point of view, it would oversee the energy procurement process. In addition, it would take into consideration overall societal benefits of some of the Act's proposed measures (i.e. feed-in tariffs) and act accordingly. Overall, the independent entity we propose would considerably minimize the administrative burden by concentrating the decision-making process in a single institution.

III. THE GOVERNMENT AS AN EARLY ADOPTER OF CLEAN TECHNOLOGIES

As part of the BC Air Action Plan, Action #12, BC targets green products in its procurement process: “For example, by requiring the use of biodiesel in government vehicles, the government supports ongoing efforts to make biodiesel more commercially available.” The same action should be implemented for the adoption of new clean technologies in the province, and an emphasis should be placed on the purchasing of clean technologies that are in a demonstration stage. Given the purchasing power of the BC government, it should lead by example, and include in its general procurement process across ministries an obligation for its employees to research and consider clean technologies before a traditional product is purchased. By doing so, the government will help create a larger market for clean technologies within the province.

IV. INCREASE THE FUNDING AND TRANSPARENCY OF THE EXISTING PROGRAMS

Expanding the \$25-million ICE fund will contribute to reduce the financing gap that exists in the cleantech development and demonstration stages. That gap has proven to be a significant barrier to market entry for many BC cleantech entrepreneurs. The funding increase could be phased in over a period of five years, with the first few stages directly financed by a moderate increase of the existing levy. Later stages would require additional funding that could come in the way of public-private partnerships, which would exempt taxpayers from bearing the brunt of the increased expenses.

Increased transparency should come in the form of opening up the selection criteria during each call. Projects should be primarily analyzed on the basis of market potential. Processes similar to those used in the venture capital world must be used. Additionally, the fund should create a business advisory service to support entrepreneurs. The objective of this service would be twofold: contribute to reducing the risk associated with the technology and prepare entrepreneurs for downstream financing.

V. DO NOT ADOPT A FEED-IN TARIFF PROGRAM

While feed-in tariffs are often cited as being one of the reasons for the successful growth of Germany's cleantech sector, we do not believe that this policy is suitable for this province. There are several key differences between Germany and BC. First, energy prices in the Canadian province are considerably lower which would render the gap between FIT-protected and conventional sources large and difficult to justify. Second, the province counts on indigenous natural resources to source 100% of its energy needs. This situation substantially differs from Germany's where the country's security was at stake when FIT's were adopted. Finally, the province currently procures most of its electricity from clean sources.

An effective feed-in tariff program would necessitate high levels of subsidies and would prove to be too costly. Moreover, for a clean technology to be universally adopted, it must be able to compete with the traditional means of energy creation. Too often, firms become dependent on subsidies and become uncompetitive in the long term since they lack the proper incentives to innovate.

The Clean Energy Act states that an investigation will be put forth to determine whether or not feed-in tariffs are an appropriate policy for BC. We recommend that the government implement an innovation funding program rather than adopt a feed-in tariff scheme. The establishment of innovation funds would foster substantial innovation and growth within the cleantech sector without further burdening the provincial treasury. Similarly, BC must espouse the commitment to overturn local barriers through a set of actions that encourage the take-up of renewable energy technologies.

VI. CREATE A CLEAN TRANSPORTATION ACT

The transportation sector should be made a priority in British Columbia, and a legally binding act should be developed. The current BC Air Action Plan, which started in 2009, represents a great start but only has a lifespan of three years, does not set very aggressive targets, and is just lightly publicized.

We recommend the creation of a longer term Clean Transportation Act, which would help reduce GHG emissions from a sector that, as previously discussed, accounts for 37% of GHG emissions in the province, the most by any economic activity in BC. It is, therefore, imperative that the government take the appropriate measures to correct this situation.

The introduction of an emission-controlling regulation in California has paid dividends to both cleantech and citizens alike. The California Clean Car law currently provides consumers with cleaner, more fuel-efficient cars that reduce dependence on foreign oil and generate savings that will reach US \$12-billion by 2020. Moreover, the significant reduction in GHG emissions from the passenger vehicle fleet is spurring development of new transportation-related clean technologies including electric vehicles and battery technologies.

VII. ENCOURAGE MORE EXITS BY EXPANDING BC'S NETWORK OF INVESTORS

The lack of exit opportunities has made BC's investments less attractive to venture capitalists. While it is fairly understood that public policy plays little role in fostering better exit markets, the government can help by expanding the network of investors by undertaking and supporting a greater number of trade missions that focus on attracting the attention of large corporations who could be potential buyers of cleantech companies. Trade missions such as Premier Campbell's visit to Korea in 2008 have helped bolster the province as a cleantech leader while encouraging investment deals. The government should continue to advance its relationship with California since this state has a heavy concentration of venture capital and cleantech activity. Furthermore, the province should continue pursuing international marketing efforts that highlight BC as a center for cleantech activity. The expansion of networks will facilitate more acquisition activities and develop a stronger exit market for the province.

VIII. ALLOCATE MORE RESOURCES TO COMMUNITY AND SCHOOL PROGRAMS PROMOTING A CLEANER BC

The province and BC Hydro have programs in place that help communities to become greener. We recommend that these be reinforced and expanded, steps that will benefit the cleantech sector.

In particular, schools across British Columbia, in addition to communities, should be encouraged to support the clean technology movement. The state of Massachusetts, which has an important cluster of clean technologies, provides a template. The state's successful Green Communities Grant Program awards grants to projects that meet specified criteria such as exclusive purchase of fuel-efficient vehicles, and meeting benchmarks significant energy use reductions. The province should also follow the example of other jurisdictions by creating programs that allow individuals to generate their own clean energy and connect to the grid, and clearly publicize them.

CONCLUSION

Clean technologies have the potential to be a major economic force in the near future while contributing to a healthier environment, and a less-resource intensive economy.

In BC, venture capital continues to be one of the main drivers of technological innovation by providing financing that would otherwise not be available to technology companies. Venture capital activity is responsible for numerous positive spillovers: it closes the loop between the wealth and talent generated by successful investments and the next generation of start-ups; it creates a pool of serial entrepreneurs; and it provides a source of experienced managers.

Public policy in BC will continue to be crucial in creating high-quality cleantech innovations, companies, and entrepreneurs while attracting venture capital to the province. Enhancing existing and creating new legislation such as a Clean Transportation Act will yield a myriad of benefits while holding industries and citizens accountable for negative externalities associated with carbon emissions. Expansion of programs like the ICE Fund, and early adoption of clean technologies by Provincial Ministries and Crown Corporations will offer further societal benefits that are less obvious now but will be significant in the future.

GLOSSARY OF TERMS

Angel Investor Individual who provides capital to one or more start-up companies usually in exchange for convertible debt or ownership equity.

BC Air Action Plan <http://www.bcairsmart.ca/>

BC Carbon Tax http://www.livesmartbc.ca/government/carbon_tax.html

BC Energy Plan <http://www.energyplan.gov.bc.ca/>

BC Immigrant Investment Fund Ltd (BCIIF)

<http://www.bcrf.ca/BCIIF/Pages/Default.aspx>

BC Renaissance Capital Fund Ltd (BCRCF) <http://www.bcrf.ca/BCRCF/Pages/default.aspx>

Behind the Meter Generation Renewable on-site generation of electricity located behind a retail customer's meter.

Bioenergy Call for Power BC Hydro's initiative to procure bioenergy from projects that utilize wood fibre and biomass fuel sources.

California's Clean Car Law (Pavley GHG Standards) Passed in 2002, it directed the California Air Resources Board (ARB) to adopt regulations to reduce global warming emissions from passenger vehicles.

Cap and Trade Method for regulating and ultimately reducing the amount of pollution emitted into the atmosphere by providing economic incentives.

Clean Energy Act <http://www.gov.bc.ca/cleanenergyact/>

Clean Power Call Power acquisition process that aligns with policy actions outlined in the 2007 BC Energy Plan.

Conservation Potential Review Study launched by BC Hydro in 2006, designed to estimate the potential for electricity conservation in British Columbia.

Cost of Pollution (Economic) A cost (pollution), not transmitted through prices, incurred by a party who did not agree to the action causing the cost.

Electric Purchase Agreement (EPA) Legal contract between an electricity generator and a power purchaser under which the power purchaser buys energy, and sometimes also capacity and/or ancillary services, from the electricity generator.

Exit Opportunity/Strategy Method by which a venture capitalist or business owner intends to get out of an investment that he or she has made in the past.

Feed-in Tariffs (FITs) Policy mechanism designed to encourage the adoption of renewable energy sources and to help accelerate the move toward parity.

Firming Supplementing the output of an intermittent resource with a firm source of power to ensure total energy provided is sufficient to reliably meet customer demand.

First Nations Clean Energy Business Fund Special account, stipulated under the Clean Energy Act, to share the revenues generated by the export of electricity the first nations.

Global Warming Solutions Act California's environmental piece of legislation, which requires that by 2020 the state's greenhouse gas emissions be reduced to 1990 levels.

Green Building Creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle.

Green House Reduction Target Act <http://www.env.gov.bc.ca/epd/codes/ggrta/>

Illiquid Investment Any investment that may be difficult to sell quickly at a price close to its market value.

Immigrant Investor Program <http://www.canadavisa.com/canada-immigration-investors.html>

Independent Power Producers (IPPs) An entity, which is not a public utility, but which owns facilities to generate electric power for sale to utilities and end users.

Industrial Research Assistance Program (IRAP) <http://www.nrc-cnrc.gc.ca/eng/ibp/irap.html>

Innovative Clean Energy (ICE) Fund <http://www.tted.gov.bc.ca/ICEFund/About/Pages/default.aspx>

Net Metering Electricity policy for consumers who own small renewable energy facilities or V2G electric vehicles.

Public Private Partnerships (PPPs) Agreement between government and the private sector regarding the provision of public services or infrastructure.

Scientific Research and Experimental Development (SR&ED) <http://www.cra-arc.gc.ca/txcrdt/sred-rsde/menu-eng.html>

Section 116 <http://www.cra-arc.gc.ca/E/pub/tp/ic72-17r5/ic72-17r5-lp-e.pdf>

Shaping Molding with a firm source of power the variability of output from intermittent supply resources, so that it meets the timing and volume needs of customer demand on the electricity system.

Smart Grid (or Smart Power Grid) Delivery of electricity from suppliers to consumers using two-way digital technology to control appliances at consumers' homes to save energy, reduce cost and increase reliability and transparency.

Standing Offer Program Process to purchase energy from small projects with a nameplate capacity greater than 0.05 megawatts, and smaller than 10 megawatts.

United Nations Environmental Programme (UNEP) <http://www.unep.org/>

Venture Capital Programs <http://www.tted.gov.bc.ca/TRI/ICP/VCP/Pages/default.aspx>

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