PREMIER'S TECHNOLOGY COUNCIL

10TH REPORT

SEPTEMBER, 2007

We believe that with strong cooperation between the provincial government and private enterprise, British Columbia will be one of the world's top ten technology centres

Every effort has been made to consider all information obtained and to be as accurate and consistent as possible in our use and analysis of all research materials. However, errors or omissions may have occurred. Please notify the Premier's Technology Council of any significant inaccuracies by e-mail at:

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Foreword

The Premier's Technology Council (PTC) was created in August 2001 to provide advice to the Premier on technology-related issues. The mission of the Council is to help make British Columbia one of the world's top-ten technology centres.

The Honourable Gordon Campbell is Chair of the Council, a position shared with the Co-Chair, Greg Peet, formerly Chairman, President and CEO of ALI Technologies (acquired by McKesson Corp in 2002). The Council is fortunate to draw its membership from twenty-one other leaders of BC's technology industry and from senior levels of the academic sector.

This is the PTC's 10th report, the third of the government's mandate, and my second as President. We follow up in a more in-depth way on material we touched on in the 9th report, including technology and learning as well as innovation and commercialisation, and also the emerging clean technology industry.

I would like to express my personal appreciation to all the members of the Premier's Technology Council who volunteered their time and energy, and to the Premier and government officials for their continuing support.

Sincerely,

Cheryl Slusarchuk
President, Premier's Technology Council

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Executive Summary

In this 10th report, the Premier's Technology Council (PTC) presents recommendations in three areas that are critical to making BC a top-ten high-technology jurisdiction: learning and technology; clean technology; and innovation and commercialisation. Ten of the recommendations are critical and they are supported by a number of supplementary recommendations

The PTC recognises British Columbia's tremendous advantages in terms of its superior quality of life, high-standard universities, and dynamic array of innovative high-tech firms. Together, these attributes have already contributed to the province's reputation as an important incubator of marketable ideas and a leading destination for top-flight researchers and other high-tech professionals. At the same time, we acknowledge that, as a relatively small high-tech market (compared to, for example, the Silicon Valley) which does not have a major firm in the sector headquartered here, BC needs to leverage its existing strengths and confront challenges that have been raised by researchers, investors, and the high-tech companies.

Learning and Technology

One of the best places to begin is in the classroom. Today's generation of students is more technologically savvy than any of its predecessors, yet our K-12 institutions have not entirely kept pace. We commend the Government for taking significant legislative steps in 2006 to permit students to enroll in any distributed learning course in the province, and note that by next year it is expected there will be more than 50,000 participants in these programs. The legislation has enabled the creation of BC's virtual school, LearnNowBC, empowering students to take charge of their futures by tailoring their learning to meet their career aspirations and personal interests.

To move to the next level of integrating technology into K-12 learning, the PTC notes that there is need for a unifying vision that sets long-term measurable targets and establishes clear roles and responsibilities for within ministries and in the K-12 sector itself. A single Ministry of Learning could be a catalyst to draw together all stakeholders, develop the vision, and ensure its effective implementation. Similarly, in our consultations, stakeholders urged that LearnNowBC become the central repository for electronic learning programs and that the Province establish a "single window," a common website to access all BC's educational programs and services. Finally, the PTC proposes that the

Government of BC consider investments in both training of teachers to ensure they are able to integrate technology in the curriculum, and in infrastructure to expand the number of one-on-one computer projects for learners.

Clean Technology

Global consciousness about the impact of energy usage on the environment has perhaps never been higher. British Columbia, as one of the most environmentally aware jurisdictions in Canada, is in an enviable position to provide clean energy and technology products and services to an ever-expanding market. The PTC believes that the Government of BC can play a facilitative role to advance the industry as businesses in other sectors and consumers make the transition to clean technology and greener practices. Indeed, the Province's commitment to making the 2010 Winter Olympic and Paralympic Games the first sustainable events of their kind is a major symbolic and substantive step.

BC's Energy Plan sets a goal for BC to become self-sufficient by 2016 and attain a surplus of 3,000 GWh by 2026. The PTC endorses this commitment and recommends expanding that goal to include a power production reserve that can address seasonal and annual reductions in power production due to climate change, potential increases in power demand for electric vehicles or other economic development opportunities such as export. Accordingly, the PTC recommends that the Province aim to become an annual net exporter of clean energy by 2020. As a starting point to achieving this objective, we need to build on BC's environmental consciousness to recognise the true value of our natural resources and to support a greater commitment to clean energy, conservation and energy security. For instance, in considering rate structures, the pricing model for rate structures should incorporate the current externalities of power generation and make appropriate rate structure adjustments. This will provide the basis for important investments in large-scale clean power generation, the smart grid, demand-side management, and research and development for BC Hydro and BCTC in sustainable energy initiatives. It will be essential to initiate a public communications campaign to engender a "low-energy" culture and explain the benefits of new pricing structures and conservation measures.

Throughout its consultations, the PTC has also found that there is a helpful role for the Government of BC to play in specific sub-sectors of clean technology, including green buildings and transportation. For instance, we note that in the 2007 Speech from the Throne, the Government committed to a new green building code. Other jurisdictions, such as Washington State and California, have found that such codes and standards make a marked contribution to energy conservation and efficiency. We support making the green building code the baseline that must be met by all new houses and buildings.

In terms of transportation, as 40percent of BC's carbon emissions come from this source, environmentally-friendly vehicles will be a key component of reducing greenhouse gases. We are impressed with the potential of plug-in electric hybrid electric vehicles (PHEVs), which combine a conventional gasoline or diesel engine and an electric motor. Although the technology is operational, the consuming public requires a clear demonstration that PHEVs work. The Government of BC could advance this industry by committing to finance a major demonstration project and through an initial, significant purchase.

Innovation and Commercialisation

The world's leading high-technology jurisdictions are acutely aware that their competitive edge involves both the spark of discovery and the transfer of these ideas from the laboratory to the marketplace. To advance BC's performance in innovation and commercialisation, the PTC has concentrated on three priorities: expanding support for research; attracting and retaining talent; and widening and deepening capital markets for high-tech investment.

Research investment is the most important direct contributor to innovation and commercialisation. Currently, BC's investment in research accounts for only 1.5 percent of the province's GDP, compared to Ontario (2.4 percent); Quebec (2.7 percent); California (4.1 percent) and Massachusetts (5.3 percent). The PTC believes that BC should establish a long-term strategic target of raising R&D investment to 4.5 percent of GDP, with 65 percent of this coming from the private sector. To spearhead this initiative, we propose the creation of a new Ministry of Research and Talent. As universities are central to creating clusters, we also recommend that the Province must set the goal of making one of them a top-20 global institution and develop plans to attract new faculty and graduate students. Finally, to capitalise on creativity, university-industry liaison arrangements need to become more uniform to reduce the current complexity involved in sharing marketable ideas.

To spur BC's innovation and commercialisation future, we need to attract the best and the brightest talent. The province's lifestyle and tolerance towards newcomers are already magnets for the "creative class." Even so, high-tech firms often have difficulties in attracting highly quality personnel (HQP) as well as senior executives (such as vice-presidents of sales). Through its extensive consultations, the PTC has learned that housing costs, taxation levels, and immigration-approval processes are barriers to the inflow of talent. We propose that that the Government of BC investigate joint-equity housing models as used for faculty members in major high-tech jurisdictions; remove taxes for employees on stocks or stock options; and promote streamlined immigration processes so that firms may obtain immediate temporary work visas for much-needed foreign employees and so graduate students from abroad may gain permanent residency

without an existing job offer. Furthermore, as key part of the strategy to attract talent, BC should target our expatriates, many of whom are in their early thirties and would like to return to raise a family or are closer to retirement and wish to care for elderly parents who live here.

With regard to capital markets, the small comparative size of BC's venture capital market and its greater risk adversity means that there are more commercialisable ideas in our research labs than there is money to develop them. Some BC-based firms must even locate elsewhere to obtain necessary. The Province can provide leadership as an investor itself, as has happened in many other high-technology jurisdictions, helping to demonstrate confidence in proofs-of-concept to the wider market. We propose that an innovation fund be established through the Discovery Foundation.

In terms of taxation, the Canada-US Income Tax Convention does not recognise limited liability corporations – a major deal-breaker for US investors, notably institutional funds which use this vehicle to provide incomes directly to their shareholders, who are then taxed. The last federal budget proposed to address this issue, and the PTC urges aggressive follow-up. In terms of BC's own jurisdiction, we recommend that the annual investment cap be raised and the Equity Capital Program doubled to encourage "angel investors" to participate in BC's high tech sector. To ensure effective follow-up on the proposed innovation and commercialisation initiatives, the BC Innovation Council can play a central role, including in areas such as talent recruitment and mentoring to start-ups.

The PTC appreciates the contributions from the very wide array of stakeholders in shaping the content of this report and stands ready to assist the Government of British Columbia in putting the recommendations into action.

Summary of Recommendations

Ten Critical Recommendations

LEARNING AND TECHNOLOGY

Programs and Services
That the Ministry of Education work with the Boards of Education to create a realistic plan for expanding the one-to-one computer programs around the province and to determine the costs. (Recommendation 10.4)

School of the Future
That the Ministry of Education work with a school district to pilot a 'school of the future' that combines the elements of a modern learning environment. (Recommendation 10.8)

CLEAN TECHNOLOGY

The Target
That BC set a target to become an annual net exporter of clean energy by 2020. (Recommendation 10.10)

Recognizing the True Value of our Energy Resources
That government direct BCUC to consider the broader goals of government in its monitoring role, in particular the objectives of the Energy Plan. Examples of specific measures that need to be considered are:

- Investment in infrastructure, including smart grid technologies, to allow access to more supplies and enable system efficiencies;
- Stimulation of conservation initiatives through such measures as public awareness/education and pricing structures including time based pricing; and
- New tariff structures that encourage the development of a range of renewable energy supplies. (Recommendation 10.11)

Large Scale Clean Power Generation
That government direct BC Hydro to advance its investigation of Site C and provide large-scale clean energy generation to meet growing demand for energy and capacity and

to provide dependable power. (Recommendation 10.12)

COMMERCIALISATION

Research –Investment

That the government's long term strategic plan for Research and Innovation include interim goals to increase gross investment in R&D toward the world class benchmark of 4.5 percent of GDP, increase private investment in R&D to 65 percent of that total, and move toward these targets with aggressive but realistic time frames. (Recommendation 10.33)

Research –One University to Top 20

That government set a long-term goal for a British Columbia university to achieve a top 20 world university ranking. (Recommendation 10.35)

Talent – No Tax for Employees on Company Stock (or Stock Options)

That the provincial government develop and implement an employee equity participation incentive to attract technology companies, senior management, key employees and head offices to British Columbia. The incentive should eliminate the provincial tax on the exercise or disposition of stock from the employee's company. (Recommendation 10.41)

Talent – Immigration

That the provincial government streamline immigration to BC by:

- using the PNP program to grant immediate permanent residency for graduates of BC universities' Master's and PhD programs, with no requirement of existing job offer;
- amending the PNP program to allow the designation of approved employers in the technology sector with such designation allowing for automatic qualification for the program (The system should be subject to audit);
- working with the federal government to pilot a BCTFW program that allows designation of approved employers in technology areas so that their prospective employees can obtain immediate temporary work visas (The system should be subject to audit);
- negotiating with the federal government the provision of immediate work permits to the foreign spouses of returning Canadian citizens; and
- allowing children of temporary foreign workers to qualify as domestic rather than international students at our universities. (Recommendation 10.45)

Capital – Encouraging Angel Capital in BC

That the provincial government raise the annual investment cap and double the size of the Equity Capital Program to provide the opportunity for more angels to get involved with more money. (Recommendation 10.49)

Ancillary Recommendations

LEARNING AND TECHNOLOGY

Vision

That a government task force which includes the Virtual School Society, BC Campus, and the Ministries of Education and Advanced Education develop a long-term vision for technology and education by the end of March 2008. (Recommendation 10.1)

Programs and Services

That the Ministry develop Key Performance Indicators to measure the success of programs that encompass learning technology and use those KPI to ensure quality. (Recommendation 10.2)

That the Ministry of Education continue to use LearnNowBC as a central repository for electronic learning programming in order to ensure interoperability, quality and effective use of resources. (Recommendation 10.3)

Professional Development

That the Ministry of Education develop an independent certification program that rewards teachers for expanding their professional qualifications to include technology-supported learning. (Recommendation 10.5)

Infrastructure

That the Government use the implementation challenges facing BCeSIS as a proxy for determining infrastructure barriers, and move to address them. (Recommendation 10.6)

Single Window

That government develop a single window for learning for government-supported e-learning services. (Recommendation 10.7)

CLEAN TECHNOLOGY

The Target

That government continue to pursue its goal of self-sufficiency by 2016. (Recommendation 10.9)

Smart Grid – Including Advanced Metering

That government direct BCUC to consider government policies for conservation and renewable energy when reviewing the long term strategic plans of the utilities to invest in a 'smart grid' digital power infrastructure. (Recommendation 10.13

Public Awareness

That government and appropriate utilities embark on public awareness campaigns that explain the importance and value of conservation and renewable energy initiatives. (Recommendation 10.14)

Conservation – Demand Side Management (DSM)

That BC Hydro invest in an infrastructure that allows BC to become a leading jurisdiction in the application of DSM technologies and that BC Hydro implement rate and regulatory structures that take full advantage of these DSM technologies. (Recommendation 10.15)

Conservation – Green Buildings and Communities

10.16: That government continue to advance the Green Cities Project and the Green Building Code, through the mandating of green targets and promoting the use of green technologies. (Recommendation 10.16)

Conservation - Transportation

That as part of a demonstration project, 100 government vehicles be PHEVs, either through conversion of existing fleet or purchase of new vehicles. (Recommendation 10.17)

That the government continue to work with industry and the federal government to develop the guidelines and regulations to achieve British Columbia's biodiesel targets. (Recommendation 10.18)

That government support a 'Hydrogen Highway Rally' to California for 2009.

(Recommendation 10.19)

That BC investigate other incentives to promote the use of green vehicles. (Recommendation 10.20)

Greening BC Energy – Energy Purchasing Policies

That government support the development of appropriate feed-in tariffs that decline over time to assist the commercialisation of emerging, renewable energy sources and their associated technologies. (Recommendation 10.21

Greening BC Energy –Transmission

That BC Hydro and BCTC identify areas rich in renewable energy potential in the near term for transmission system investment. (Recommendation 10.22)

That the cost of building transmission lines including the transmission interconnect to new power sources be factored into the price of electricity. (Recommendation 10.23)

Greening BC Energy - Storage – Renewable Energy

That BC Hydro assess the current energy storage capacity and the needs for the future, determine the best options to meet those future needs (in particular the Site C dam), and initiate the development of those capacity options. (Recommendation 10.24)

Greening BC Energy – Regulatory Issues

That government adequately resource the approval mechanisms for developing renewable energy projects, including an expediter dedicated to clean energy. (Recommendation 10.25)

Building our Technology Base – BC's Biomass Resource Advantage

That government finalise and support the bio-energy strategy to enable BC to reach its renewable energy targets and its bio-energy leadership potential as soon as possible. (Recommendation 10.26)

Building our Technology Base –Demonstration Projects

That government continue to support demonstration projects that make BC a clean technology showcase. (Recommendation 10.27)

Building our Technology Base –Target BC as a National Centre of Excellence

BC should leverage federal programs to create research chairs and develop centres of excellence around existing strengths in clean technology. (Recommendation 10.28)

BC should have a coordinated approach to applications for federal funding for clean technology. (Recommendation 10.29)

Building our Technology Base –BC Hydro, BCTC and Powertech Labs

That BCTC and BC Hydro's abilities to contribute to the deployment of pre-commercial technologies be recognised and these organisations be provided with an effective R&D budget. (Recommendation 10.30)

That government support the transformation of Powertech Labs into a Centre of Excellence for Smart Grid Technology. (Recommendation 10.31)

COMMERCIALISATION

Research – Ministry Restructuring

That government restructure to create a Ministry of Research and Talent, and a Ministry of Learning. (Recommendation 10.32)

Research –Investment

That the provincial government extend the British Columbia SR&ED tax credit program beyond its current expiration date (September 1, 2014) and make it an ongoing program with periodic reviews. (Recommendation 10.34)

Research –Develop a Faculty Recruitment Plan

That the provincial government develop a faculty recruitment plan in concert with the BCIC. (Recommendation 10.36)

Research –Develop a Graduate Student Strategy

The government should develop a graduate student strategy to attract, teach and retain the best possible students. (Recommendation 10.37)

Research –UILOs

That government and the universities should restructure and simplify the UILO process. (Recommendation 10.38)

That government appoint a group of independent advisors led by BCIC to work with the UILOs to develop new policies and procedures. (Recommendation 10.39)

Talent – Talent and the New Ministry

The Ministry of Research and Talent should focus on strategies to attract and retain the top talent in the world. (Recommendation 10.40)

Talent – No Tax for Employees on Company Stock (or Stock Options)

That BCIC lead the innovation associations in other key provinces to advocate to the federal government for the elimination of federal tax payable on the exercise or disposition of stock from the employee's company. (Recommendation 10.42)

Talent – Housing

That government continue to develop programs that address housing issues. Government could begin investigating University housing models, implement them within our own University system and expand programs based upon their success. (Recommendation 10.43)

Talent – Deemed Disposition

That the provincial government work with the federal government to change the deadline for deemed disposition of assets from five years to seven years. (Recommendation 10.44)

Talent –Recruitment Plan for Talent

That the new Ministry develop a recruitment plan for expatriate Canadians which could potentially be executed through the BCIC. (Recommendation 10.46)

Capital – Barrier to Large Scale Foreign Investors

That BCIC lead the innovation associations in the other key provinces to press for implementation of the changes to the tax treaty. (Recommendation 10.47)

Capital – Proof-of-Concept Funding

That government work with the Discovery Foundation to form a set of proof-of-concept funds with a few select partners. (Recommendation 10.48)

BCIC – Improving Research Efficiency

That BCIC facilitate the UILO review. (Recommendation 10.50)

That BCIC implement province wide Entrepreneur-in-Residence program. (Recommendation 10.51)

That BCIC develop a virtual board to support and advise start-up companies in BC. (Recommendation 10.52)

BCIC – Facilitate Talent Development

That BCIC partner with the proposed new Ministry to develop a repatriation program. (Recommendation 10.53)

That BCIC encourage development of technology sales and product management training programs in universities. (Recommendation 10.54)

That BCIC encourage development of multidisciplinary programs in universities. (Recommendation 10.55)

That BCIC help develop and deliver training programs in world class recruiting and virtual company management. (Recommendation 10.56)

That BCIC assist in the expansion of existing mentor programs and in the development and delivery of further mentoring programs. (Recommendation 10.57)

Learning and Technology

Introduction

Skills shortage is a global phenomenon and a critical issue for British Columbia. One report estimated that between 2003 and 2010 there would be 350,000 more new jobs than there would be high school graduates to fill them.[1] We don't just need high school graduates...we need graduates with a certain skill level. The *2006 OECD Indicators Report* states that "[a country's] capacity to compete in the global knowledge economy will depend on whether they can meet the fast-growing demand for high-level skills. This, in turn, will hinge on significant improvements in the quality of schooling outcomes and a more equitable distribution in learning opportunities."[2] Improving educational outcomes and solving the skills shortage are integral to the broader goal of fostering BC's productivity and competitiveness at both national and international levels.

To address this challenge, the province should engage electronic learning technologies, amongst other tools. They are a key enabler that can help to address the skills shortage by providing more students with greater opportunities to learn the skills needed for the future. Such technologies can enhance the students' education experience, offering them improved services, particularly in rural or remote areas, and they can be applied through all educational sectors, including K-12, advanced and continuing education.

In addition to providing better opportunities for students, learning technologies have other benefits. They can increase the productivity of the education sector, saving time, money and labour costs. In a 1999 New York Times article, John Chambers, the CEO of Cisco Systems said: "The next big killer application on the Internet is going to be education. Education over the Internet is going to be so big it is going to make E-mail usage look like a rounding error."[3] He then went on to prove his point: by switching to e-learning practices, Cisco saved $142 million in a single year.[4] Learning technologies can also greatly reduce the use of textbooks and can be applied to assist the government in meeting its commitment to a zero carbon footprint by reducing travel requirements.

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[1] Jothen, Kerry. Maximizing 2010-Related Employment & Skills Opportunities in British Columbia: Connecting Labour Market Supply & Demand. December 2003.
[2] Organization for Economic Cooperation and Development. "Education at a Glance" (2005a), page 15.
[3] Friedman, Thomas. "Foreign Affairs; Next, It's E-ducation." The New York Times. November 17, 1999.
[4] Kelly, Tom. The Business Case for E-Learning. Cisco Press. October 2004.

Role of Learning Technologies

To properly prepare students for post-secondary education and the workforce the K-12 system should not only teach reading, writing, numeracy and technology skills to students, it must also engage those students so that they embrace lifelong learning.

The PTC has often commented on the role of electronic technology in the education system. We believe it plays a role in three ways. It can assist in distance education ('e-learning'), it can be used as a delivery tool to enhance education in the classroom (blended learning), and it can improve the administrative operations of the education system.

The recent *Campus 2020* report also recognised the importance of technology in the education system and its role in providing access and pursuing excellence. The report asks how BC can "push technology in the service of learners…to make it more learner-driven and outcome-focused."[5]

Given the challenges posed by the impending skills shortage, we believe it is time to review the role of technology in BC's education system and make recommendations that will enhance progress in these areas. There have been advances in the post-secondary education sector, such as the ongoing support for BC Campus. Services for students are improving and online learning usage has grown exponentially since 2004. Consequently, apart from some measures around coordination, we have focussed efforts in this report on the K-12 education system.

Technology and BC's K-12 System

Technology literacy will be critical to maintaining lifelong learning in the future. It will be increasingly difficult to function in today's world and maintain the skills necessary to fully participate in society without being able to use the new technologies that are becoming ubiquitous.

Most students today are already "digital natives." They use technology in all aspects of their lives yet, for the most part, turn off the technology as they enter the doors of their local school. In order for the education system to stay relevant and to engage our students more fully, it

[5] Plant, Geoff. Campus 2020 Thinking Ahead: The Report. April 2007. p. 4-5

must make better use of technology in classrooms across this province.

That said, the digital divide is still a reality for a significant number of students. Many rural students, particularly from First Nations, lack broadband access and hence the opportunity to become as familiar with the technology as their peers. This limits their learning opportunities now and in the future. The PTC continues to work on ways to bridge this divide.

At its simplest, technology literacy is the ability to use technology. In this respect, most students exceed the ability of their parents and their teachers as youth rapidly adopts new technologies. But technology literacy also involves the ability to understand technology's strengths and weaknesses, and to understand the risks implied by their use, such as potential loss of privacy, reduced ability to control quality, rapid dissemination of incorrect or potentially dangerous information, and excessive reliance on systems that may break down in emergencies. This presents another critical reason for our education system to embrace technology as a key tool.

In addition, a technology-based public education system significantly affects the administrative and physical structures created in the early 1900's For example, in the K-12 online system, some students in the sixth year of schooling ("sixth grade") are taking courses normally undertaken by students in their tenth year of school ("tenth grade"). As early as tenth grade, students are able to successfully complete courses that are offered by colleges and universities. The administrative divide between the systems - once logical - has become a barrier to speedy and successful completion of educational programs. Therefore a new language of administration and new methods of managing students' educational progress and accomplishments are required.

Current Progress

There are five core elements required for the successful delivery of an educational environment that makes the best use of technology. Those are:

- a secure and reliable high-speed data network;
- the ability to identify and track students;
- supporting legislation, policy and funding algorithms;
- quality online content and exceptional online supports for learners; and
- educators trained to deliver in an online environment and exceptional online supports for educators.

BC has traditionally enjoyed a very strong network infrastructure. However, PLnet, once a

national exemplar of how government could connect learners to the Internet, has been in place for 10 years and requires upgrades to keep pace with increased use and emerging applications that consume more bandwidth - such as BCeSIS and online courses.

Good progress has been made on the issue of tracking students. BCeSIS, discussed in the ninth PTC report, enables the tracking of students across the system. Developed by the Ministry of Education, it has now been implemented in over half the public schools across the province.

Over the past 24 months, however, the most significant steps taken have been legislative. Legislation introduced in the spring of 2006 enabled senior secondary students to take any distributed learning (DL) course in the province, with the costs paid by the Ministry of Education. This change to the funding model was intended to better accommodate students taking online learning courses. It enabled creation of BC's virtual school at LearnNowBC, allowed the Ministry of Education to put the foundational infrastructure in place, and now offers students the opportunity to individualise their education program based on their interests, abilities and aspirations. In short, it has changed the landscape of our education system.

The success of the virtual school, LearnNowBC, has been tremendous. In the fall of 2006, over 17,000 students in K-12 enrolled in one or more courses outside their local neighbourhood school. By May 2007, this number had soared to over 32,000 students. Of those, 26,000 were students in grades 10-12. With 177,000 BC students now enrolled in these three grades, that figure represents almost 15% of the student population. The virtual school uses technology not only to support students who learn at a distance, but also to provide services that reach out to all BC students. For example, there were over 20,000 uses of online tutoring services offered for selected courses in grades 10 through 12 through one virtual location. Clearly there is pent-up demand for these services and by this time next year, we expect the total number of students enrolled in DL to exceed 50,000. No other province offers these types of comprehensive online services to its student population, making BC both unique and a leader in this arena.

LearnNowBC is designed to be flexible and remains a work in progress. Built in modules, it can be modified in response to feedback and new technologies. It currently provides online tutoring and academic advisory services, and over time, new modules and services will be added in order to continuously improve student achievement and satisfaction. This year, additional online educator support is being provided as well as expansion of online content, especially in the areas of languages. In response, Boards of Education - aided in part by the Virtual School Society and the Ministry of Education's policies regarding quality - are systematically improving the quality and content of online services. Furthermore, LearnNowBC was deliberately designed to mirror the user interface of BC Campus so that

over time, a single window of learning access can be accommodated for the learners of BC, one that bridges the administrative divisions of the education system in this province and better facilitates students' access to lifelong learning.

Another area where technology is being successfully integrated into education is through one-to-one computer programs. In this kind of initiative, wireless laptop technology is extended throughout the school and laptops supplied to each student and teacher. Studies have indicated that such programs increase learners' success and level the playing field in terms of economic backgrounds. Pilot projects have taken place in BC with positive feedback. In Fort St. John (SD 60), it has been reported that students were more successful in meeting grade-level expectations, had higher levels of achievement and showed improvement over the school year.[6] In Kelowna (SD 23), a preliminary report on that project concluded that a one-to-one computer program:

- improved student achievement;
- encouraged inclusivity; and
- made important use of software in achieving student outcomes.

The study further indicated that, "With further teacher support and technology-based student/teacher training, it's expected that students will continue to improve performance and meet the challenges of learning in a wireless environment."[7]

SD 23 has estimated that the cost of its one-to-one computer project, including hardware, software, wireless, technical support, teacher training and assorted peripherals, was only $60 per student per month. Many of these costs would vary depending upon the administrative structure of the program, geographic challenges, and the baseline wireless infrastructure that would need to be upgraded or built upon. It is also important to note that this is the outright cost of the program and does not include how it offsets costs in other areas. The program would, for example, enable a switch to e-textbooks. Again, SD 23 estimates that by switching to electronic text for just one math textbook, it will save approximately $150,000 over the life of the project. There are other offsets as well. By decommissioning existing computer labs, capital and operating costs are eliminated and lab space is freed up for classrooms, thereby reducing the need for portables. Although the PTC believes this program should be expanded, the Ministry needs to analyse the costs of rolling out such a program.

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[6] Jeroski, Sharon. Research Report: The Wireless Writing Program 2004-2005. Report prepared for Peace River North (SD 60). September 2005. http://www.prn.bc.ca/wwp2005.pdf

[7] Campbell, Robert and Veronica Gaylie. Together iLearn Laptop Pilot Project: Preliminary Report. Prepared for School District 23. p. 13-14

The Next Challenges

The next challenges are to coordinate resources across the education sector, understand the effects of the changing legislation, ensure our educators complete their initial training with a good understanding of working in an online environment, and inject more capital into the underlying infrastructure - such as expansion of the data network and provision of additional computers for our learners.

COHESION

BC lacks a province-wide unifying vision for leveraging learning technologies to provide better services to citizens. There is a need for a unified, cohesive network with stable funding and clear mandates. This vision should clarify linkages and transition from K-12 to advanced education.

MEASURING SUCCESS AND IDENTIFYING BEST PRACTICES

Data for students enrolled through distributed learning is collected several times a year. The Ministry should analyse this data to obtain a better understanding of how the legislation has changed the educational landscape and how to modify this environment to realise continuous improvement in student achievement. Students now make the choice about which program is best suited for their needs - the highest quality programs will grow and prosper, while the less successful ones will cease to exist. At the same time, measuring best practices can also include improving productivity within the school system and using technology to address the carbon footprint.

COURSE CONTENT

Course content has been a long-standing challenge for education, technology-driven or otherwise. It will be easier to deal with in future, however, because new technology now allows courses to be broken down into their constituent parts - learning outcomes and their respective modules. The effectiveness of each module can be gauged by student results and reactions. This approach -a repository of lessons and modules, accessible to students and teachers alike, - is under development by the Virtual School Society.

PROFESSIONAL DEVELOPMENT

New technology is here and is being integrated into the system as it becomes mainstream. Current teacher education does not train them to deal with the rapid emergence and potential of new technologies. Given the speed with which technology is evolving in schools and

industry, familiarity with its use should become a requirement for teacher certification.

INFRASTRUCTURE AND COSTS

Financial resources represent a key theme that underlies all of the challenges. Infrastructure issues that have been raised affect all programs and services. They include rolling out BCeSIS, providing computers to students and teachers, providing technology support in the school system, and creating an online mechanism that unifies processes across ministries and organisations.

DATA NETWORK

Of all the infrastructure issues, the most pressing one is the need for a reliable, secure, high-speed data infrastructure. At present, the pace of technology implementation is exceeding the network's ability to deliver service. This is especially true in BC's rural communities, where First Nations people represent a growing proportion of the population. Given the low graduation rate of First Nations students, government should continue its efforts to improve service and do a better job of using technology to provide them with improved educational access. This is a critical area that affects social, health, economic and educational issues. The PTC continues to work on this wider issue of addressing the digital divide and will make further recommendations in its 11th report in the spring of 2008.

SCHOOL OF THE FUTURE

The application of technology in the field of education has changed very little over the past few centuries. A schoolroom of today would be different - but still recognisable - to someone from a hundred or even two hundred years ago. In part, this is a testament to the strength of the education system, but technology has at last reached a stage where it is opening up significant avenues for improvement. BC must be ready to take advantage of the impending paradigm shift in education.

LearnNowBC, as a virtual school, has made BC a leader in using technology in education. Its success has shown that students are eager to take advantage of technology to improve their learning. However, it has also shown that the traditional school environment has in some ways become a barrier to a student's ability to use electronic technologies. The PTC believes that to take advantage of this ability, a system needs to be flexible enough to meet a wide variety of student interests and learning styles, and to provide the best available technology. We believe that a "school of the future" will be built using this combination of flexibility and technology. More importantly, we believe that such a school can be built and tested on a small scale today.

The primary design goal of the school of the future should be to provide a learning experience that goes well beyond traditional academic study to include the development of skills required for the future - including collaboration, multi-disciplinary problem-solving and project based planning and development. This complex objective requires students to work in a mix of physical and virtual environments. They have to be supported by a community of peers and need to develop strong capabilities in the use of information and technology.

The flexibility of such a system will be provided by breaking the courses up into multiple learning outcomes. The role of technology will be to:

- provide the students with multiple ways of achieving those outcomes;
- provide students with additional avenues of working with and supporting each other;
- provide the teachers with multiple opportunities to assist the students;
- manage and track a much more complicated learning system.

Potential Solutions

The PTC has identified four discrete areas for attention. They are the need for Vision, Programs and Services, Professional Development, and Infrastructure. Within each of these areas, the need for a unifying vision is the key driver.

VISION

The one clear message that has arisen from the research consultations is the need for a coordinated, unified vision. The vision should include the pragmatic and practical aspects surrounding learners' access to programs and services. The quality of all programs and services are influenced by the ability of stakeholders to collaborate and delineate clear roles and responsibilities, both within and across ministries and organisations.

A modern vision should encompass K-12, advanced education, continuing education and trades training. The vision would need to:

- incorporate long term targets;
- reduce duplication in the programs and services being offered;
- foster collaboration and communication between key bodies;
- clearly establish roles and responsibilities in legislation;
- incorporate accountability measures;

- be combined with the appropriate infrastructure (an online mechanism that unifies systems and processes).

Finally, given that technology is leading to increasing crossover between the services provided by the Ministry of Education and the Ministry of Advanced Education, such a vision should also consider combining the learning-related services of the two Ministries into a unified body.

10.1: That a government task force, which includes the Virtual School Society, BC Campus, and the Ministries of Education and Advanced Education, develop a long-term vision for technology and education by the end of March 2008.

PROGRAMS AND SERVICES

In BC, there are many projects and programs that use learning technologies. A majority of these, particularly DL, are now represented at LearnNowBC. The Ministry has begun to collect data to assess the quality of services offered by school districts through the annually renewable agreements that are required before the government will pay for services. In order to pursue ongoing evaluation and quality improvement of programs that encompass learning technology, the Ministry needs to identify key performance indicators (KPI) that should include improved students services and improved productivity.

10.2: That the Ministry develop Key Performance Indicators to measure the success of programs that encompass learning technology and use those KPI to ensure quality.

There are a host of electronic technology service providers in our education system. For example, there are about 40 different online testing systems. Because of rapid change and evolution, it is impossible (and probably unadvisable) to consolidate their services. The Ministry of Education is moving to ensure that services are "inter-operable." LearnNowBC is assisting the Ministry by ensuring that all students have access to all courses that are supported by government, and that are being operated by the public and independent school systems. This, in turn, demonstrates to the schools that they need to collaborate in the acquisition of capital and labour-intensive applications.

10.3: That the Ministry of Education continue to use LearnNowBC as a central repository for electronic learning programming in order to ensure interoperability, quality, and effective use of resources.

The one-to-one computer pilot programs around the province have demonstrated tremendous success at reasonable cost. These programs now need to be expanded. Not only have they generated better outcomes for students, but they also pave the way for other uses of

technology such as in e-textbooks.

10.4: That the Ministry of Education work with the Boards of Education to create a realistic plan for expanding the one-to-one computer programs around the province and to determine the costs.

PROFESSIONAL DEVELOPMENT

Services for initial teacher training and ongoing professional development are less than optimal. BC's teacher training programs must better adapt to the technology-supported learning environment in which K-12 and post- secondary institutions function.

10.5: That the Ministry of Education develop an independent certification program that rewards teachers for expanding their professional qualifications to include technology-supported learning.

INFRASTRUCTURE

Infrastructure continues to be an ongoing challenge in the delivery of electronic technology education services. As BCeSIS is a standard program being recommended for province-wide implementation by the Ministry, its success or failure can be used as a measure of available infrastructure. By determining where the biggest obstacles to BCeSIS exist, the government can determine the priority areas for addressing the data infrastructure.

10.6: That the Government use the implementation challenges facing BCeSIS as a proxy for determining infrastructure barriers, and move to address them.

SINGLE WINDOW

Many of these measures may take some time to develop. In the short term, however, one specific step that can be taken to improve the use of technology in education is the development of a common Website or single window for accessing all of British Columbia's educational programs and services, from K-12 through post-secondary. A single window that would promote easy access for citizens to all learning services that are available to them throughout the province. This is a simple step that would not negatively impact the broader plans that the PTC is recommending. In the longer term it would ease the integration of the learning portals already offered by the secondary and post-secondary systems and make them much more user-friendly.

10.7: That government develop a single window for learning for government-supported e-

learning services.

SCHOOL OF THE FUTURE

In order to begin implementing a modern learning system that will provide BC students with the best opportunities to learn, BC needs to consider developing a 'school of the future'. The key components needed in such a school are laid out in this paper - a curriculum made up of learning outcomes, a wireless-enabled school with a laptop for every student and teacher, and educators trained to support such a system.

10.8: That the Ministry of Education work with a school district to pilot a 'school of the future' that combines the elements of a modern learning environment.

Clean Technology

Introduction

CLEAN TECHNOLOGY IN BC

"Green Technology is the largest economic opportunity of the 21st Century"
- John Doerr, partner at Kleiner Perkins Caufield & Byers

This powerful statement by well-known venture capitalist John Doerr raises questions about the nature of 'clean tech', namely why there are such bold predictions for its growth, and more importantly from the perspective of the Premier's Technology Council (PTC), what it means for British Columbia.

Clean technology is defined as knowledge-based products or services that improve operational performance, productivity, or efficiency while reducing costs, inputs, energy consumption, waste, and pollution. For example, clean tech includes renewable energy supply technologies (such as wind, biomass and solar power), information technology, fuel cells, hybrid vehicles, biomass, bio-fuels, lighting and energy efficient household appliances.

Low environmental impacts, and increasingly, cost competitiveness, are key aspects of clean technology. This represents the best of both worlds for a society of concerned citizens who want to make a difference, but who often lack the time. In terms of protecting the environment, the application of clean technology is the easiest and most cost-effective way for the greatest number of people to participate. We could, for example, have houses that self-regulate water and power usage, cars that run on electricity or non-fossil based fuels, and a variety of power generation options for our own homes. In the long term, such options would save us money as well as saving the environment – a win-win situation.

This is why clean technology represents such a rich opportunity. With environmental concerns, global climate change in particular, as the key driver, governments and the public are beginning to demand products and practices that subscribe to an environmental ethic. Clean technology is the industry response to this demand, but more than that clean tech represents a hopeful future. It's a future that people feel good about investing in.

The Premier's Technology Council believes that this 'hopeful future' of clean technology is a tremendous economic opportunity for British Columbia. A unique combination of assets will allow us to take advantage of the global interest in clean technology- assets that go well beyond the impressive natural resource base.

BC, famous for its pristine wilderness, has long had the reputation of being environmentally progressive or 'green'. Its citizens place a high value on the natural environment and the quality of life it provides. This means that they are often prepared to sacrifice a little more. The province also has a highly educated and innovative work force, a burgeoning high-tech community, and a recognised community of experts in clean energy.

Furthermore, the population size of BC is very appealing for those who are bringing new technologies to market. The local market is not large in global terms but is ideal for those who wish to test a product before bringing it to a broader market. These factors - an educated populace with an interest in the environment, a skilled workforce with expertise in the matters at hand, abundant natural resource advantages and a medium sized population base – combine with political leadership dedicated to environmental issues to make BC fertile ground for clean tech development and investment.

Another attraction of BC for those developing clean technologies is the 2010 Olympic Winter Games, as it will be the world's first sustainable Olympics. Putting a global spotlight on sustainability and clean technology makes the event an ideal showcase for those who want to introduce or demonstrate a new technology to the world.

BC has all the necessary assets to establish itself as a world leader in the development of many clean tech disciplines. We can build companies, attract others from abroad to develop and deploy their technologies here, and demonstrate the cleanest, most efficient energy system possible. Not only can BC take a position on the world stage as a leading centre of advanced energy technologies, but this sector can grow to become an important contributor to BC's economy.

RENEWABLE POWER

In this the tenth report, the PTC focuses primarily on the clean technology sectors associated with renewable energy supply and advanced power technology. With the worldwide concern about climate change driving government policy this is the largest and most critical opportunity at the moment. There are many other tremendous opportunities in the clean technology sector. The PTC will address certain of these in its 11th report scheduled for the Spring of 2008. Clean energy and power supply are areas the PTC has addressed in the past through the reports released by its Alternative Energy and Power Technology Task Force.

Many of the issues raised by that task force were addressed in the Energy Plan released by the provincial government in the spring of 2007.

Approximately a quarter of the energy delivered in BC in 2000 was supplied in the form of electricity; the remaining three-quarters came from natural gas, petroleum products, and recycled waste – primarily biomass. This report concentrates largely on the electricity sector for two reasons: first, electricity issues are central to the BC Energy Plan; and second, carbon emission constraints may drive electricity into new market areas, such as transportation, assisted by the development of new technologies.

Electricity is not a primary energy source but rather an energy carrier, or energy currency. It can be created by many different means and is regarded as 'clean' when it is generated from renewable primary sources, of which BC has many.

The PTC's focus on renewable energy is the result of two major considerations: the growing demand for clean energy supply and lower GHG emissions; and the significant economic opportunities for BC associated with clean energy. The global pressure for renewable energy sources to alleviate climate change - specifically the aggressive measures taken in California - are creating a huge market for renewable energy and the associated technologies. Many companies and governments have recognised the opportunities and are already pursuing them. If we in BC act decisively, we are well positioned to capture a disproportionately large share of the market.

BC's position is further enhanced by the BC Energy Plan which lays out some aggressive targets, both for conservation and for the use of clean energy. The government is to be commended for these initiatives as the Energy Plan now provides a springboard for the commercialisation of BC clean technology.

In this report, the PTC makes recommendations on how the targets laid out in the Energy Plan become the levers that grow our renewable energy and power technology industries, and how the conservation targets can be achieved with maximum efficiency through the use of technology.

THE TARGET

Before considering the options, the PTC believes that government and industry in BC needs one clear target to inspire and inform all other activities in this sector. Targets already in the Energy Plan include becoming self-sufficient in electricity by 2016, and having a surplus of 3,000 GWh generated in BC by 2026. The PTC endorses this commitment and believes the goal should be expanded to ensure the surplus provides a power production reserve that can address seasonal and annual reductions in power production due to climate change, potential

increases in power demand for electric vehicles or other economic development opportunities.

The specific economic development opportunity we believe BC should set its sights on is to become a net exporter of clean electrical energy. This target would build on those goals already specified in the Energy Plan, drive the necessary changes to regulation, transmission, electricity purchasing policies, and stimulate the development of a smart grid. Such an ambitious target will generate business opportunities that will encourage the private sector to commit development resources, ensuring that other commercialisation and conservation goals are met.

This is not an easily attainable target, particularly given the inherent uncertainty of forecasts, and would require determined action by government and its entities. It also places a greater emphasis on the electricity sector of the energy portfolio, where, in the near term, the greatest market opportunities exist. However, the PTC chose this goal carefully. Given the nature of BC's energy infrastructure, electricity will ultimately affect other aspects of the energy sector, including transportation.

Because of the renewable portfolio standards adopted by the western United States, there is already a market for BC's clean energy. It could also address BC's needs in other areas because British Columbia may need carbon credits from trading clean energy to meet its Greenhouse Gas targets. An energy surplus would provide the province with a buffer should estimates of demand prove too low - for example if there is an unexpected surge in the number of electric cars on the road, or if other industries decided to move to BC to access green energy, or if there is a failure to meet conservation targets.

The target of becoming a net exporter of clean electrical energy will require that substantial new renewable energy capacity be developed, stimulating the development of BC's renewable energy industry, both in terms of project and technology development. It will bring new players to BC who will enhance our own knowledge and experience and encourage innovative thinking as we learn how to optimise our resources and solve some of the supply issues that currently represent a challenge, such as storage of non-firm power.

At the same time, such a firm target could act as an incentive to address other challenges facing the renewable energy industry. It would demand a build-out of advanced infrastructure, in particular transmission lines and a 'smart' grid to allow for distributed generation and technology-driven conservation. Tariff structures would be required to encourage conservation while allowing for the development of a whole variety of renewable power sources and technological solutions, from energy generation and processing hardware, to consumer software applications.

Accurate usage forecasting is a major challenge, however, that makes it difficult to estimate a realistic timeframe for becoming a net exporter of clean energy. The PTC believes that the date of 2026 set for having 3,000 GWh of surplus energy is conservative. We encourage the government and the utilities to revise current forecasts and set a realistic target

10.9: That government continue to pursue its goal of self-sufficiency by 2016.

10.10: That BC set a target to become an annual net exporter of clean energy by 2020.

Overarching Issues

To achieve the goal of becoming a net exporter of clean energy by 2016 - indeed, to achieve many of the targets laid out in the Energy Plan - there are a number of areas where government can take action. Government needs to encourage and initiate conservation, to remove certain barriers to the development of clean renewable energy, and to capitalise on specific opportunities that are arising. Before those topics are dealt with, however, there are issues that need to be addressed to enable the most effective action across all three of these categories.

RECOGNISING THE TRUE VALUE OF OUR ENERGY RESOURCES

Energy in North America has been readily available and supplied at low cost. As a result, energy use here has been very high, and until recently, the broader global impact of such high use was neither known nor considered. Over the past twenty years, it has become readily apparent that such high use is not sustainable. We now realise the need to be smarter in how we supply and manage energy.

The final price of energy must ultimately reflect its true value. British Columbia has been blessed with inexpensive energy for many years. Unfortunately, the rates that we pay as consumers are based on the cost of the energy rather than the value. This has left little room to manage our energy resources or invest in alternatives. British Columbia needs to switch from a model based on the cost of producing the power consumed today, to one that incorporates the value of the resource in the future.

In terms of the major utility, any new initiative costs money, and how to accommodate these costs is a critical question. The costs involved with developing clean energy supplies and encouraging careful energy management can be divided into three key areas. First, the utility will need to make large investments in infrastructure to build a grid system that can support both conservation and distributed generation. Second, it will need to pay a higher tariff that enables the development of certain renewable energy supplies that call for technologies that

cannot yet compete with BC's existing low cost power supply alternatives. Third, the utility must be allowed to amend rate structures to activate energy conservation. This does not require massive rate increases but incremental adjustments to encourage behavioural change. These short term costs, which are necessary to protect our environment and provide for a secure energy future, are balanced out by savings in the long run. This is an energy future where economics and social well-being are given equal weight.

Currently, the BC Utilities Commission (BCUC), whose mandate is to protect the ratepayer from undue costs, must approve rate structures. The Energy Plan contemplates a review of BCUC to determine how it can take into account social and environmental costs and benefits. The PTC believes that (a) the goals of the Energy Plan cannot be achieved without instructing BCUC to include relevant externalities as it balances the interests of the ratepayer with other important factors and (b) that the goals of the Energy Plan cannot be met without BCUC being instructed to include other government goals in its decision-making process.

The recent Special Direction 10 to the BCUC is a good first step and an excellent indication of BC's commitment to addressing long-term energy issues. The PTC believes the BCUC needs more of these specific directions in order to address BC's long term energy goals.

10.11: That government direct BCUC to consider the broader goals of government in its monitoring role, in particular the objectives of the Energy Plan. Examples of specific measures that need to be considered are:

- **Investment in infrastructure**, including smart grid technologies, to allow access to more supplies and enable system efficiencies;
- **Stimulation of conservation initiatives** through such measures as public awareness/education and pricing structures including time based pricing; and
- **New tariff structures** that encourage the development of a range of renewable energy supplies.

LARGE SCALE CLEAN POWER GENERATION

As BC's population and economy grows, so too will its consumption of electrical power. According to BC Hydro's projections, energy demand in this province is expected to grow between 25 and 45 percent over the next 20 years, and we are now increasingly relying on imported power to meet British Columbia's needs. As the energy plan's targets demonstrate, we need to recognize the importance of energy security, and not rely on fluctuating markets to buy our power.

Even with conservation, purchases of clean, renewable power from independent power

producers and substantial reinvestment in BC Hydro's existing generating assets, more is still needed. Further, the Energy Plan requires that all new generation come from clean resources.

Fortunately, BC has a wide variety of clean, renewable supply options, namely hydro, wind and large-scale biomass power, which can be accessed using largely commercially- ready technology, while others – such as solar, tidal geothermal and wave energy – are in various pre-commercial stages. These options differ, however, in their ability to provide both energy and capacity, and on whether their electricity output can be relied upon 365 days per year and on the coldest day in winter. With carbon-sequestered coal not currently commercially available in BC, and new natural gas plants not meeting the Energy Plan requirements to ensure clean power for all new electricity generation, that leaves large hydro as the best option for energy and capacity that is clean, renewable, and dependably available whenever it's needed.

Site C is a hydro dam that has been proposed many times over the years. The Energy Plan directs BC Hydro to conduct initial consultations on this project. The ready availability of relative low-cost hydropower has already been a foundation of the province's energy security. Adding more dependable hydro power to our existing resources can further support the development and viability of intermittent, but clean, green and renewable resources such as wind and run-of-river.

Large hydro, however, has a significant lead time to develop. Construction of a large hydro dam can take up to seven years, and many years before that to plan, undergo comprehensive regulatory processes and conduct formal consultations. While additional large hydro may not meet immediate energy needs, its development should be continued to help address energy demand into the future.

10.12: That government direct BC Hydro to advance its investigation of Site C and provide large-scale clean energy generation to meet growing demand for energy and capacity and to provide dependable power.

SMART GRID (INCLUDING ADVANCED METERING)

In its Energy Plan, the government laid out goals for both conservation and the development of clean electricity. One of the preconditions for these elements is investment in, and development of, a 'smart grid'- the electricity infrastructure of the future, where advanced information and communications technology is embedded within the electricity system. Conservation targets envision a future where customers have access to real time information about how much power they are using and how much it costs. Until they have such information, they are not only poorly motivated to change their demand patterns, but are less able to do so. A smart grid can flow data as well as power so the utility so that consumers are

fully aware of their power consumption at any given time. Advanced systems will also provide them with the tools to alter their demand patterns. Properly designed systems allow new technologies that optimise or automate the electricity consumption to be grafted onto the system as they are developed.

Building BC's energy supply portfolio means that renewable energy will be fed into the system from a variety of sources. Some may be large-scale supply projects such as geothermal, wind farm or bio-energy plants. Others may be midsized, such as a run-of-river project or a cogeneration facility producing power for an urban village or a large institution that could feed excess power into the grid. Still more projects might be small-scale, such as photovoltaic panels on a building. Such "distributed generation" calls for careful micromanagement of data and electricity flows, and possibly net metering on facilities that will sometimes draw from the grid and sometimes feed into it. Currently, the system is not sophisticated enough to manage these required elements of the Energy Plan.

To accomplish these two critical objectives of the Energy Plan, BC needs a complex, integrated energy and data system. Advanced Metering (AM) is an interconnected system of advanced technologies including communication networks, smart meters and controls that integrate management software and databases. This intelligent infrastructure will enhance the generation, movement and usage of electricity through sharing of real-time knowledge and automated, remote control.

Any such investment must be made with a long-term view. One Californian example demonstrates that a positive, short-term business case does not guarantee long-term success in advanced metering investments. CPUC, the California regulator, required utilities to create a business case for advanced metering. In 2004, two major utilities, Pacific Gas & Electric (PG&E) and Southern California Edison (SCE), took two very different approaches. Due to its older infrastructure, PG&E was able to make a business case for investing only in existing technology and was still able to realise significant short-term cost savings. SCE, however, already had a more modern infrastructure and thus was not able to make a positive short-term business case. The company was forced to take a more strategic approach, assessing future needs and collaborating with the original equipment manufacturers (OEMs) to speed the development of more advanced technology and applications. The net result is that PG&E may have to reinvest yet again to update their technology, while SCE has gained significant savings in the demand side because of their strategic approach.

Developing a smart grid will require similar major capital investments by our utilities. The challenge is that this capital investment must be made on the basis of potential, as well as actual savings. The utility will need full support from government in order to create public trust and to meet the requirements of BCUC.

10.13: That government direct BCUC to consider government policies for conservation and renewable energy when reviewing the long-term strategic plans of the utilities to invest in a 'smart grid' digital power infrastructure.

PUBLIC AWARENESS/ EDUCATION

Public understanding and support are critical in order for the government initiatives about renewable energy and conservation to be successful. The investment in clean technology or measures to promote conservation will only be successful if they reinforce what the public already believes. This is borne out in studies by the European Solar Industry Federation which indicate that the first step in introducing any new technology is to build public awareness.

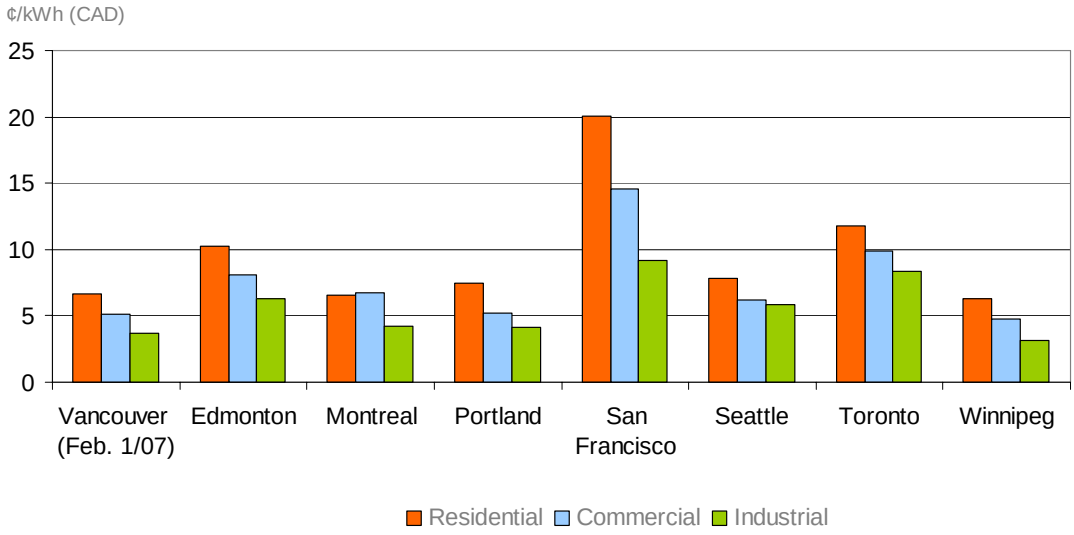
There will never be consensus on this kind of issue. An active minority will always be in favour of environmental regulation. A much smaller minority is opposed to environmental restrictions, and either believes that environmental concerns are exaggerated or can be addressed solely through free market measures. The vast majority of people lie between these two extremes - they are concerned about the environment but are unaware of what they can personally do, or what measures are appropriate for government to take.

It is this latter group that must be convinced about the economic and social benefits of going green. It is up to the government to sell the economic and social benefits of conservation and renewable energy by providing a few simple signposts. Once BC citizens are more aware, they will be able to understand the need to participate in the "green movement". Particularly, they need to understand how simple measures, like putting on a sweater instead of turning up the heat when the temperature drops can be incredibly effective to achieve conservation and will that save rather than cost money.

In general, practicality and compromise affect most government decisions. Some quarters of the public may question the government's commitment to environmental issues. Given that public trust is critical, it may be advisable for government to partner with academia, scientific bodies, and credible, fact-based environmental organisations in undertaking an awareness initiative. Furthermore, public awareness programs must take into account the specific geographical and commercial issues of the various regions in the province, and be tailored to address these differences.

Finally, but most importantly, the public needs to appreciate the relatively low energy prices we enjoy in BC compared with almost anywhere else in the world. It should be made clear that although prices will increase, they will remain lower than those paid in many other jurisdictions, both across North America and around the world.

Figure 1. Electricity prices of major North American cities



Source: BC Hydro

10.14: That government and appropriate utilities embark on public awareness campaigns that explain the importance and value of conservation and renewable energy initiatives.

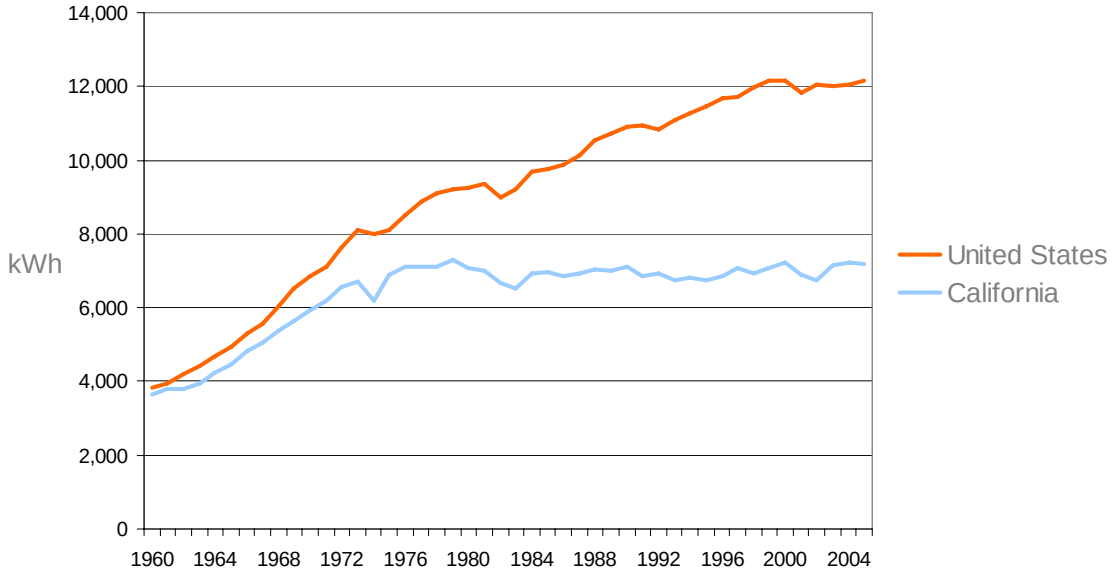
Conservation Issues

The Energy Plan mandates that BC Hydro meet 50 percent of its future incremental demand through conservation. This translates into roughly 10,000 GWh per year in 2020. Like many of the goals laid out in the plan, this represents both a challenge and an opportunity for British Columbia. The challenge is simply meeting that target, and will require a great deal of capital investment in order to put the technologies in place that will encourage and allow for conservation on that scale. The opportunity lies in the very nature of that aggressive target. It will put BC at the forefront of developing, identifying and deploying technologies to improve the efficiency of how we generate, move and use energy. How we implement these new, environmentally progressive measures will ultimately determine how we run businesses, design buildings, and transport ourselves.

Experience has shown that it is the combination of Demand Side Management (DSM) and advanced codes and standards that most effectively reduce energy demand. California has captured the environmental momentum in North America and is an excellent example of what can be accomplished. Its electricity usage has stayed constant over the last 30 years while the entire usage in the USA has continued to increase (Figure 2.). California's success is

largely due to demanding codes and standards and utility DSM programs. The estimated 40,000 GWh cumulative savings (2003) are almost equally created by utility / DSM programs, and codes and standards related to buildings and equipment.

Figure 2. Electricity Use per Capita in California and USA



Source: BC Hydro

DEMAND SIDE MANAGEMENT (DSM)

Managing our energy demand is more than just a matter of inducing behavioural changes. In fact, the most effective means of reducing energy use is to deploy technologies that allow us to continue much as before, while using energy more efficiently.

However, there are certain DSM tools that can be used to modify the behaviour of electricity consumers such as:

- **Rates and rate structures**: This is one of the most basic ways to control consumer behaviour and can include real time pricing to help balance peak loads and stepped rates for over consumption. With the exception of the "stepped rate" for large industrial customers that was introduced in 2006, BC Hydro's rates do not currently send the proper price signals.

- **Codes and standards**: Codes and standards can achieve substantial electricity savings and allow BC Hydro to direct its efforts at emerging, energy efficient technologies

rather than the basics. The top priority in this area is the establishment of stringent energy efficiency requirements in the BC Building Code.

- **Power Smart programs**: BC Hydro's Power Smart programs complement rates, codes and standards and set the stage for increasing the market share of energy efficient products to the point where regulation can take over.

- **Public attitude and behaviour shift**: Creating a 'low-energy' culture in BC requires a lengthy, coordinated and very well-planned series of communications, activities and policies. This effort will carry over from electricity use to transportation and heating energy use.

- **Energy-efficient technologies**: BC Hydro has increased its focus on introducing new, energy-efficient technologies to the BC market and supporting their market penetration. While BC Hydro has demonstrated success in this area in the past (see examples below), much more is needed in the future to achieve the Energy Plan's conservation target.

- **Community engagement programs:** Municipal government and community leaders implementing and driving sustainable practices and conservation at the local level will be key to encouraging a conservation culture in BC. Local governments can change regulation within their authority, educate the public, ensure their facilities are operated efficiently and even deliver Power Smart programs in their communities.

Saving energy is almost always cheaper than supplying it, particularly as we all recognise the true costs associated with capturing and delivering it. There is a powerful business case for DSM not only in BC, but worldwide, especially where energy costs are high. Based on its existing initiatives, BC Hydro calculates that procuring new electricity supply costs twice as much as saving energy through DSM, and consumers benefit by avoiding energy costs.

There are also ancillary benefits because DSM creates a more stable, cost-effective, and responsive system. In the short term, DSM reduces costs across the board because it will help the system adjust to variable supply costs and decrease price spikes for the user. This will become a more important issue in BC as we purchase more clean power from Independent Power Producers and rely less on coal-fired generation from Alberta. In the longer term, DSM will help alleviate peak demand, reduce the need for new capital investment, and increase our ability to become an exporter of clean energy.

The savings potential represented by DSM, together with increasing electricity prices, creates a worldwide demand for DSM technologies. The true price of electricity fluctuates in response to supply and demand, but few consumers have access to the actual, real-time price of the

electricity they are using. Numerous demonstration projects and commercial applications have shown that when consumers understand the true costs, they are motivated to use less and pay less for what they use. Research reveals that consumers - residential and commercial - want to manage their energy spending and use, as long as it is relatively convenient.[1] [2] [3] [4] [5] [6]

That, of course, is the role of technology. IT advances, especially IP-based, inexpensive sensors, are creating new opportunities for advanced metering and demand-management. The emerging mass market in residential wireless sensor management provides a low-cost pathway to electricity management. Systems are being developed that feature residential smart meters which monitor the cost of power being consumed and automatically control major energy-using appliances, such as air conditioners and washing machines. Investment is imperative to support all of these interdependent technologies: a smart meter relies on a smart grid.

Population and economic growth in BC, as well as changes in weather patterns, could increase electricity demand by 25 to 45 percent in 20 years, according to BC Hydro. The historical load patterns used in previous long-term planning processes are now uncertain due to changes in technology, consumer behaviour and weather, and so are less reliable as a basis for future grid design. BC needs DSM both to manage that growth and to provide the kind of responsive and flexible system needed for the future.

BC already has a successful track record with aspects of DSM. BC Hydro is recognised as a pioneer for launching its Power Smart programs in 1989, encouraging energy conservation and adoption of energy-saving technologies through a suite of programs in all three customer sectors: residential, commercial and industrial. Each sector has one program targeted to energy efficiency retrofits and a second program for energy efficiency in new structures. In addition, there are some more specific initiatives in the residential sector, such as lighting (ended April 2007), window rebates, refrigerator buy-back, compact fluorescent light and seasonal lighting programs.

Success in Power Smart programs - Energy Star® Windows rebate

Just five years ago, a simple and easy-to-understand differentiation between standard and energy efficient windows did not exist in BC. BC Hydro played an instrumental role in establishing an Energy Star® standard for windows in each of BC's climate regions. It worked with the provincial government to develop standards and incentives. The company also supported BC window manufacturers' attainment of Energy Star® certification for their products, and promoted Energy Star windows with advertising and financial incentives.

Today, Energy Star® windows are a known product category with a 25-50 percent market share and are Provincial Sales Tax PST exempt. The Power Smart Windows Rebate Program offers a $1.00/sq foot rebate for the installation of Energy Star® windows in new, renovated or upgraded single-family homes, duplexes, townhouses or apartments. These windows will become the regulated minimum in January 2009.
Source: BC Hydro

Success in Power Smart programs – Seasonal LED program

Five years ago LED Christmas / holiday lights had a very small market share in the US and they were not even available in Canada. BC Hydro introduced the product to BC, worked with manufacturers to address technical faults and secure safety certification, and facilitated the establishment of relationships between manufacturers and retailers. It also promoted the product with advertising, displays and rebate coupons.

Today, 25 percent of the global supply of LED Christmas lighting is sold in BC. The product commands a majority market share here and its price has come down from roughly $50 to $10 per string. The lights create an estimated saving of 55 GWh per year (enough to supply 5,500 homes) in BC. Thus, the Power Smart Seasonal LED program is highly cost-effective relative to new electricity supply available during the peak times in the winter.

Source: BC Hydro

Although there has been some initial success, the ongoing challenge facing the implementation of DSM in British Columbia revolves around the substantial initial costs. As the primary utility, BC Hydro needs to invest in Smart Metering Infrastructure, campaigns to increase public awareness, and the development of energy-efficient technologies. In all cases, BC Hydro must apply to the BC Utilities Commission to factor such costs into the rates. This requires a much longer-term strategic plan than BCUC currently takes into account.

10.15: That BC Hydro invest in an infrastructure that allows BC to become a leading jurisdiction in the application of DSM technologies and that BC Hydro implement rate and regulatory structures that take full advantage of these DSM technologies.

GREEN BUILDINGS AND COMMUNITIES

One of the key ways to promote conservation of energy and greenhouse gas emission reductions is through encouraging 'green' buildings and communities. Canada's Energy Outlook 2004 estimated that BC's commercial and residential buildings used over 260 petajoules of energy per year - over 23 percent of total consumption in BC - while domestic transportation used 271 petajoules, or 24 percent. Hence, as well as encouraging the application of technology, design innovation and new concepts of structural and community planning in BC, this represents a tremendous opportunity to reduce our energy consumption.

Green building and community design have greater benefits than just energy conservation. Complete communities that are compact, pedestrian-friendly and mixed-use, help meet the diversity of needs facing seniors, working-age citizens and young families, and can make housing more affordable over the long term. Improved air quality, reduced greenhouse gas emissions, and lower costs for clean water and proper sewage treatment make these neighbourhoods more liveable. Buildings that feature natural light and better indoor air quality mean better working conditions for staff, higher productivity, and reduced sick time. In hospitals and other care facilities, they reduce the length of patient stays. And in schools and places of learning, they contribute to higher student test scores. Interestingly, these substantial benefits are rarely, if ever, accounted for in economic assessments, but align precisely with the Premier's Great Goals for the Golden Decade.

BC companies and communities are already recognised leaders in innovative sustainability practices - in particular, green building design architects, engineers and other professionals along with 'smart community" planners and non-profit organisations. Using this expertise at home will serve to expand this cluster and allow us to sell our expertise abroad.

The Province is aware of this need and is taking steps to encourage green buildings and communities. At the Union of BC Municipalities convention in the fall of 2006, the Premier announced the Green Cities Project to help B.C. communities become vibrant, sustainable, liveable and reflective of the commitment British Columbians share to preserving BC's spectacular natural environment.

In the 2007 Speech from the Throne, government followed up on its Green Cities Project with a commitment to a new green building code. Such codes and standards are absolutely critical to achieving BC's long-term conservation and climate change goals. This has proven true in other jurisdictions where energy codes and standards have made an enormous contribution to energy conservation and efficiency. In California and the Pacific Northwest, for example, energy codes and equipment standards have existed for 25 years and have contributed close to half of the total energy savings achieved to date. BC's Green Building Code should take Washington's code (updated on a three year cycle), or California's Title 24 standards, as a

starting point.

The energy codes should be flexible enough to include several different compliance paths which can be categorised as:

- **prescriptive** – for simple applications, and for the majority of builders who prefer clearly defined requirements;
- **trade-off** – allows more flexibility to introduce different designs, components, systems and technologies;
- **performance** – allows any design (that meets other building code requirements), provided that an energy intensity budget for the building is met. Compliance is usually demonstrated through modeling and post-commission monitoring.

All three options should exist, but the third option is particularly critical as performance-based compliance paths provide the most opportunity to incorporate advanced technologies such as distributed (co)generation, solar thermal and geo-exchange into building design.

In order to further encourage innovation, the Green Building Code (GBC) should establish a baseline that must be met by all new houses and buildings. It can then encourage builders to go beyond the minimum and build to other standards. LEED Silver, Gold or Platinum is one system, while for houses, EnerGuide or "Built Green" is probably a more appropriate rating system. Proposals for encouraging such high-performance options include fast-track permitting, permit cost incentives, and utility and government incentive programs.

In this way, the Green Building Code can encourage the use of existing, broadly recognised standards. The added benefit is that accredited professionals, rather than government inspectors, can certify compliance with green requirements, easing the administrative burden on local governments. The City of Vancouver, for example, already requires compliance with ASHRAE 90.1 for Part 3 (large) buildings. This is a widely recognised standard that is updated frequently to include the latest developments in technology and building practice. Certification of buildings to ASHRAE 90.1 can be done by accredited professionals through letters of assurance.

The government could consider a renewable energy requirement like the "Merton Rule", named after the London borough where it was first introduced. The "Merton Law" requires that all major developments above a threshold of 1,000 m2 incorporate at least 10 percent of their energy needs from renewable energy equipment. As a complement to the Green Building Code, local governments in BC could be encouraged to go beyond the GBC to introduce additional bylaws on energy use and technology in buildings, or at minimum, the installation of "renewable energy ready" wiring and plumbing for future addition. However, new legislation would be required similar to the water conservation plumbing regulation

under the Local Government Act. Local governments in BC do not have the authority under current legislation to enact "Merton Rule"-type building bylaws, and are currently limited to enacting building bylaws for reasons of health, safety or protection of persons or property only.

10.16: That government continue to advance the Green Cities Project and the Green Building Code, through the mandating of green targets and promoting the use of green technologies.

TRANSPORTATION

The obstacle to the introduction of clean technology transportation solutions in BC is market size. The market here is simply not big enough to drive the development of new standards set by global manufacturers. As a result, BC has to focus on more experimental areas, and develop its new industries accordingly. The PTC Clean Technology Task Force plans to explore these opportunities more fully in the 11th report scheduled for the spring of 2008. In the short term however, there are some time sensitive opportunities the government needs to consider.

A. PLUG-IN HYBRID ELECTRIC VEHICLE DEMONSTRATION PROJECT

As 40 percent of BC's carbon emissions come from transportation, the province must determine how to encourage transportation technologies that will reduce those emissions. Currently, BC has incentive programs that promote the purchase of hybrid electric vehicles. The PTC believes that BC has great strengths in technologies that accelerate the commercial development of Plug-in Hybrid Electric Vehicles (PHEVs).

PHEVs combine a conventional gasoline or diesel engine with an electric motor. Future designs may use fuel cells in place of internal combustion engines. They operate on both conventional fuel and grid-supplied electricity, and can run solely on electricity for tens of kilometres depending on the design of the vehicle and the operating conditions. Because the vast majority of vehicle trips are for short commutes (i.e. to and from work, shopping, school), PHEVs can substantially decrease the gasoline usage when compared to a traditional gasoline or gasoline-hybrid electric vehicle.

Existing hybrid designs can be converted to PHEVs, and several BC companies can provide highly advanced components, such as battery packs, control systems and advanced on-board charging devices. Although these technologies are operational, there is currently no commercial market, and the public needs a clear demonstration that they are functional. Furthermore, manufacturers need an initial firm order that is significant enough in size to trigger wholesale production. The most effective and efficient of these conversion kits are

made primarily with components being developed here in British Columbia. This represents a tremendous commercial opportunity which local companies recognise, and which can be greatly assisted by judicious government action.

It is notable that PHEVs can play a very useful role in power grid management. When connected to the grid, they provide the utility with the opportunity to store power 'downstream'. When deployed in significant numbers, they can represent an important asset that allows the utility to optimise distribution operations. The so-called vehicle-to-grid interconnect raises the need for numerous utility control and data management technologies, all of which represent market opportunities for local companies.

Currently, certain international clean tech investors are taking a keen interest in BC's PHEV-related technologies The BC government could play a major role in catalyzing a major investment by committing to finance and host a major PHEV demonstration through an initial, significant purchase. This would achieve a number of goals: it would spur the development of a clean technology solution to one of our largest transportation challenges; it would encourage the growth of clean automotive technology component development; and it would assist BC Hydro in optimising its distribution network and meeting its own targets with regard to a carbon footprint.

This would also position BC to take advantage of this opportunity as it expands. In their book, *The Clean Tech Revolution*, Pernick and Wilder note that PHEVs "are on the verge of a transition…to the production lines of global automakers," and that "opens up compelling growth opportunities for entrepreneurs to work with the big companies on battery technologies and other key components."[7] The BC government has taken note of this opportunity and is investigating options to exploit it.

10.17: That as part of a demonstration project, 100 government vehicles be PHEVs, either through conversion of existing fleet or purchase of new vehicles.

B. BIODIESEL STANDARDS

In the Energy Plan, BC has mandated a 5% renewable diesel standard for diesel fuels. This represents a challenge for the petroleum and renewable fuels industries in two ways: obtaining the required volumes of biodiesel to meet the 5% renewable fuel standard and secondly, developing the appropriate infrastructure to meet a 5% renewable fuel standard in advance of the 2% federal renewable fuel standard which is meant to be in place by 2012.

The PTC lauds this ambitious target but cautions the provincial government that in order to meet this target by 2010, industry will need a minimum of two years lead time to bring its

infrastructure into compliance. Furthermore, in order to reduce the regulatory burden the PTC advises that the provincial government should work with the federal government in designing the regime that governs the targets. Although the percentage of the standard and the timing for implementation may be different, the governments should work to ensure all other aspects of the regulatory regime are as compatible as possible. This should include development of appropriate quality standards for biodiesel.

10.18: That the government continue to work with industry and the federal government to develop the guidelines and regulations to achieve British Columbia's biodiesel targets.

C. DEMONSTRATION OF BC EXPERTISE IN HYDROGEN FUEL CELL TECHNOLOGY

The provincial government has long been a supporter of the hydrogen fuel cell industry, particularly through its Hydrogen Highway initiative. One of the methods by which the hydrogen fuel cell industry drew public attention was through its 'hydrogen rally' to Whistler held in 2006 and 2007. This allowed participants to demonstrate the latest experimental vehicles to the public and, more importantly, to industrial customers and investors.

One way to demonstrate the feasibility of a west coast hydrogen highway is to support a hydrogen rally to California. The rally would travel from Victoria to Sacramento, and would involve the Hydrogen Technology Centre at Powertech Labs, the California Hydrogen Fuel Cells Partnership, and many others. Staging the rally in the fall of 2009 would be a tangible demonstration of the agreement between BC and California to develop the hydrogen highway to connect the two jurisdictions by 2010. It could also capitalise on the publicity generated by the sustainable 2010 Winter Olympic Games. The rally could spur the fuel cell industry and provide great opportunities to work with California, Washington and Oregon on common practices and standards. Ideally, it would be used by local companies and government to partner with potential purchasers or distributors from the most important future markets in Asia. The government's role lies in providing moral rather than financial support.

10.19: That government support a 'Hydrogen Highway Rally' to California for 2009.

D. INCENTIVES FOR GREEN VEHICLE USAGE

The BC government already encourages the use of green vehicles through incentives. Through the sales tax rebate on hybrid vehicles, government will refund up to $2000 and this offer has been extended through 2011. This is a good step, but there are measures in other jurisdictions that BC should consider emulating.

Both Arizona and California, for example, have allowed clean cars to access High Occupancy Vehicle Lanes. In Arizona they are issuing new plates and special permits, and in California, cars are equipped with Clean Air Vehicle Stickers. On a smaller scale LAX airport provides free parking to electric vehicles.

Ontario is also implementing a license plate-based program. In August 2007, the province announced that hybrids and other low emission vehicles will be entitled to an Eco-license plate and indicated that there will be tangible benefits from the designation.

London, England, has gone one step further and implemented a congestion charge to enter central London. Anyone driving or parking a vehicle on a public road in the zone between seven am and six pm, Monday to Friday, must pay the daily congestion charge of £8 pounds. Clean vehicles, however, are exempt from such a charge.

10.20: That BC investigate other incentives to promote the use of green vehicles.

Using Technology in the Greening of BC's Energy System

British Columbia's geography, topography and climate are the basis of our renewable energy riches. These provide options for ocean, wind and geothermal energy, as well as various hydropower and biomass-fuelled options. Even though BC is a northern province, solar energy can contribute materially to our heating and power needs as well.

As already discussed, capturing renewable energy and delivering it to market will initially cost more than continuing with conventional technologies. And new environmental restrictions and standards require new regulatory regimes. Given the realities of GHG and global warming, a transition must occur.

In addition to developing new energy sources, there is a need for increased storage capacity and expanded transmission infrastructure. The province must apply a broad range of measures to meet the new demands of renewable energy production.

ENERGY PURCHASING POLICIES

To drive the development of alternative, renewable, cost-effective energy technology and meet the goals of the Energy Plan, BC Hydro must make some changes in the way it purchases electricity, in particular green power.

As already mentioned, most renewable energy technologies are still relatively immature. Some, such as small hydro and wind power, have reached a stage where they are economically viable in BC's regime, yet there are many others that cannot yet compete. The purchase price for electricity generated in British Columbia is simply too low to bring on stream certain renewable power options that may be quite viable in many other locations where energy prices are higher. This serves as a barrier to the deployment of these technologies in British Columbia.

We need to address this issue if we are to develop the expertise in these renewable generation technologies here in BC. There is a global market that is seeking ever greater sources of renewable energy, and if the window of opportunity is shut, BC will pay dearly later if it has to buy expertise and products from elsewhere to meet its power needs.

BC Hydro has made a good first step by establishing a standing offer for small power generation, but the deal still rules out many renewable energy options. More aggressive options need to be considered such as a feed-in tariff system that varies by the source of renewable energy and the maturity of the technology. These kinds of tariffs are being successfully deployed in Europe and elsewhere.

It is important to take a long-term view of supply, and while certain power supply technologies will not be commercial for some time – such as ocean energy from waves or tides – they will eventually be needed, and BC is in a good position to develop an industry around these technologies. Appropriate feed-in tariffs can be a powerful stimulus to the industry. Of all the different measures used to encourage development, tariffs have been the most successful at developing renewables markets and domestic industries, and achieving the associated social, economic, environmental, and security benefits. They can also be flexible enough to account for changes in technology and the market place. However, it is important that they be properly implemented. If tariffs are not adjusted over time, consumers may pay unnecessarily high prices for renewable power.[8]

Legislation that governs the energy system mandates that higher rates be paid for power supplied by deploying emerging technologies. This guaranteed rate allows for the development of the project. As the technology becomes more viable, the incentive rates are lowered until over time that particular technology becomes commercially competitive. The German model has been particularly successful. Their Renewable Energy Sources Act introduced in 2004 mandated such a system for a number of sources including biogas. Germany now employs 8,000 in the on-farm biogas industry. Manure-fired power plants generate nearly 5 TWh per year of electricity, or about one percent of consumption.[9] Yet it is estimated that energy from biogas makes up less than 0.1 cents per kilowatt hour of the electricity price for end users.[10] In 2005, the cost per KWh for a German household was approximately $0.25.[11]

The most appealing aspect of this model is that it can be tailored to encourage a variety of energy sources and develop our clean energy tech industry base. BC has many options for the generation of renewable energy and such a model would allow us to test and develop those that are appropriate to our system.

10.21: That government support the development of appropriate feed-in tariffs that decline over time to assist the commercialisation of emerging, renewable energy sources and their associated technologies.

TRANSMISSION

A large challenge facing developers of renewable energy is the cost of getting the power to market. Many locations where power can be produced are distant from the transmission system, and the very ruggedness of BC means a high cost of building out the transmission lines to develop the potential renewable power generation projects. As well, each renewable power source has its own unique set of energy characteristics and the manufacturers have a variety of standards, requiring each renewable energy interconnect to be assessed and developed in a manner that best protects the integrity of the overall grid. The cost of building out the interconnect, grid and feeder lines to these new power projects is currently borne by the Independent Power Producers (IPP). This frequently jeopardises the economics of the projects, which are often small scale and are developed by small companies in a new industry who do not have the resources to bear this added capital cost.

In the long run, both the province and the consumer benefit from the development of a transmission system that provides the infrastructure onto which renewable power supply projects can be linked. The infrastructure is an asset that assists all citizens in BC. The costs associated with building such public infrastructure should not be borne by the renewable power developer, but should instead be factored into the cost of the electricity ultimately paid for by the consumer.

The build-out of the transmission system must be implemented strategically by the utility, and BC Hydro and the British Columbia Transmission Corporation (BCTC) must prioritise areas where investment in transmission infrastructure will have the largest impact in terms of access to renewable energy resources.

10.22: That BC Hydro and BCTC identify areas rich in renewable energy potential in the near term for transmission system investment.

10.23: That the cost of building transmission lines including the transmission interconnect to new power sources be factored into the price of electricity.

STORAGE – RENEWABLE ENERGY

Some renewable energy sources can generate 'firm' power, such as geothermal or biomass plants, but most are variable, or 'intermittent', and not always predictable. Wind does not blow constantly, solar energy varies by the minute, and run-of-river plants generate much more in the spring freshet than in the later summer when stream flow drops off dramatically. It is prudent to generate electricity when it is available as this maximises the use of the invested capital and is very important to economics. The inability to sell power means low load factor, lost revenues, lower returns, and also higher costs to the consumer.

Yet, the demand side of the electricity equation rarely aligns with the instantaneous supply. Electricity is difficult to store, but in BC we are blessed with a system of dams and lakes that can act as an enormous battery. The available capacity of this battery varies throughout the year according to water levels - when the lakes are full in the early summer there is little capacity, yet this is when the run-of-river plants have their greatest output. Too often we cannot absorb the energy that is available, so the plants run at less than their potential.

To meet the needs of the future, however, BC needs more capacity to store renewable, yet intermittent, sources of energy. Certain small-scale storage technologies are being developed that will help balance the load, but we need much more capacity in total. BC needs to assess current and future capacity needs and determine how best to meet those needs. It is storage capacity that will allow BC to meet its own needs through renewable sources, as well as enable it to sell renewable power to other jurisdictions.

10.24: That BC Hydro assess the current energy storage capacity and the needs for the future, determine the best options to meet those future needs (in particular the Site C dam), and initiate the development of those capacity options.

REGULATORY ISSUES

Regulation and permitting that have developed under a different energy paradigm can be inappropriate to renewable energy projects. This is because the vast majority of our renewable energy sources are tied to the natural resources of the province. As a result, they are subject to environmental assessments at varying levels of governments, to water licensing, land access, land tenure, development permits and to other land based regulation. The Independent Power Producers Association of BC estimates that it takes as many as 50 permits, licenses, reviews and approvals from 14 regulatory bodies for a single run-of-river project.

These issues are equally relevant to the more urban forms of renewable energy generation which can be subject to regulations around transport of wastes, outright bans on bio-energy,

tax assessment issues, and development permits.

The provincial government has worked hard to lower the regulatory barriers in many industries. As well as reducing the regulatory burden, the government has also provided more assistance to those who must deal with it. The mining industry, for example, has access to Front Counter BC, an organisation that provides one-window access and helps walk applicants through the regulatory process. As government intends to develop more renewable energy, there is a need to deploy more resources to alleviate process delays through a coordinating body within Front Counter BC.

10.25: That government adequately resource the approval mechanisms for developing renewable energy projects, including an expediter dedicated to clean energy.

MEETING THE DEMAND

The PTC believes there are key issues to be addressed in stimulating the introduction of clean technologies. The first is building awareness of and demand for those technologies. The second is shaping regulations and incentives to encourage their use. Thirdly, if the province is successful in building a desire for clean technology alternatives, then it must take steps to ensure not only that the technologies are available, but also that they are properly supported. Trained engineers, scientists, installation experts, and highly skilled technology maintenance operators are necessary to ensure the successful uptake of clean technology options.

Government can materially assist by creating the right environment in which the clean tech industry in BC can prosper. As well as deploying regulatory and fiscal measures, it can encourage centres of excellence, support demonstration projects, and spur development through procurement. Many of these same issues that address product development will also help to develop the necessary workforce skills in BC. The very act of building a cutting-edge clean technology industry will draw people to the province.

There is also the need, however, to take more direct action to train, retrain, and attract more skilled technology workers. This is addressed in the section of the report on Innovation and Commercialisation.

Building Our Technology Base

BC'S BIOMASS RESOURCE ADVANTAGE

BC has already recognised biomass as one of its most ready and richest opportunities for renewable energy, and is close to releasing a bio-energy strategy. We are blessed with a

growing supply of forest biomass, and though the Mountain Pine Beetle (MPB) has dramatically changed the dynamics of the forest industry, along with its challenges it has provided a window of opportunity to utilise the killed wood as fuel source.

We have already developed a great deal of expertise in that area. Our forest industry relies heavily on woodwaste as a heat source for kiln drying. Black liquor is a by-product of wood pulping and is used as a fuel in the process. BC's wood pellet industry is burgeoning, and we are now selling products to Asia and to Europe, where it has captured one sixth of the market.. Strengths such as these make a good foundation for growing the bio-energy sector.

Beyond its broad macroeconomic and social goals of improving our economy and protecting our health and environment, the bio-energy strategy should have several objectives. First, it should assist in meeting BC's renewable electricity targets. Second, it can also aid the existing agriculture and forest industries by utilising their excess biomass, and at the same time foster diversification and long-term sustainability. Finally, the strategy should provide effective mechanisms to generate economic use of MPB-damaged wood and provide sufficient revenue to regenerate the forest.

To help industry achieve these objectives, the bio-energy strategy must first quantify and delineate the resource. While the biomass available in BC's forests is immense, there are still questions about quantity and location, and the regulations that govern its ownership are complex. There are a number of near-term bio-energy projects but, as with many IPP projects, there are a multitude of regulatory, fiscal and policy barriers to their implementation. In addition in the IPP projects generating power for the grid, there should be an investigation of off-grid opportunities for remote, non-integrated communities where diesel generators often provide the power in the range of $200-250/MWhr. Priority should be given to areas affected by the pine beetle and that would involve the closure of beehive burners used for mill residue and roadside debris. Often these remote communities have a significant First Nations demographic and as such any projects will need to provide for First Nation's ownership and participation. All these issues should be addressed by the bio-energy strategy and the operational strategies under such bio-energy strategy.

Forest biomass is not the only source of bio-energy, as landfills and other biomass streams also represent exploitable energy reserves. BC technology companies are active in upgrading low-BTU landfill gases both to power and to pipeline-quality gas.

BC possesses globally-recognised forest biomass expertise. However, as other jurisdictions around the world foster their own industries, they are targeting BC's experts. To counter this brain drain, government must foster a collaborative effort to establish BC as a Centre of Excellence on bio-energy. Meanwhile, we should build relationships with other jurisdictions as well as endeavour to attract their expertise here.

Finally, the bio-energy strategy must include a plan to make British Columbians aware of bio-energy and its advantages. Currently, myths and misunderstandings prevail about the nature of bio-energy and have led to poor public opinion and needless regulation at the local level.

10.26: That government finalise and support the bio-energy strategy to enable BC to reach its renewable energy targets and its bio-energy leadership potential as soon as possible.

DEMONSTRATION PROJECTS

Government has an important role in assisting the development of our renewable energy, conservation, and power technologies through supporting demonstration projects that both showcase technologies, and prove them in real-world applications. Demonstration projects may involve private and government partners, as well as BC Hydro and other utility companies in collaborative work. It is particularly important for the clean technology sector to take advantage of demonstration projects because, unlike some technology such as software, clean technology often needs a physical manifestation of the product to help investors or potential purchasers realise the opportunity.

However, we cannot go it alone. High profile, 'full-solution' technology demonstrations that involve global partners present a powerful message that BC is active in the clean tech area and is open for business. If BC establishes the ideal energy policy regime, sound environmental goals, a supportive climate for economic development, and welcomes partners from around the world, then we can become recognised not only as a global centre of excellence, but also as the logical proving ground for "the 21st century energy system."

The PTC's earlier report, *A Vision & Implementation Plan: Growing a Sustainable Energy Cluster in British Columbia,* identified the need for a Sustainable Project Network to serve as a one-stop-shop for projects that advance the energy system and grow the Sustainable Energy sector.

This report highlighted the importance of developing technologies in five areas where BC already has strengths. These were chosen not only because there is a need for them in British Columbia, and hence a local market, but also because they represent substantial global markets: These areas are:

- Remote power supply;
- Sustainable urban practices;
- Smart urban transport;
- Smart grid;
- Large-scale clean and green generation.

Various initiatives are already underway in each of these areas. Some are conceptual, others are in the planning stages, and some are proceeding.

Remote Power: The BC Sustainable Energy Association is pursuing a province-wide '100,000 solar roofs' strategy that will advance BC's expertise and technologies in both solar hot water and photovoltaic systems, while BC Hydro is assessing a Hydrogen Assisted Renewable Power project to be located at Bella Coola. There are also proposals for a series of biomass-fuelled, combined heat and power stations to be located across northern BC. BC has a great market opportunity for remote power systems, replacing much diesel generation currently located in BC Hydro's non-integrated areas.

Sustainable urban practices: Dockside Green, now under development in Victoria, is a leading example of an advanced, low energy, small footprint, brownfield development that uses local BC technologies in the lighting and bio-energy fields. Several BC companies are developing 'demand side management' technologies designed to reduce or control energy use, either by operating quietly behind the scenes, or by providing energy users with signals that allow them to take control.

Smart urban transport: BC is trying to demonstrate leadership in this area. BC's Hydrogen Highway, together with the fuel cell bus fleet, will be an important demonstration of the real world viability of hydrogen-fuelled transport. Another already- existing project is the Integrated Waste Hydrogen Utilisation Project in North Vancouver which addresses vehicles, infrastructure and fuel supply, utilising local company expertise and technologies. A third project could be a large-scale demonstration of plug-in hybrid vehicles which would involve several BC companies with leading battery and control systems technologies.

Smart grid: Vancouver's False Creek Flats represents some 200 ha of urban brownfield development. A building planned by UBC as a Centre for Interactive Research on Sustainability, is envisioned as the hub of an entire sustainable precinct. This urban development can be supported by a smart grid that enables energy inflows from local generation sources and outflows to be balanced and optimised, and can incorporate plug-in hybrid vehicles.

Large scale, clean, green generation: BC has considerable expertise in hydropower but can also economically develop large-scale, thermal biomass-fuelled generation plants - the technological risk is low and some commercial plants are operating in Europe. We have already hosted a significant demonstration of tidal power generation at Race Rocks near Victoria. This is a pre-commercial technology, but one that has enormous potential for power generation both in BC and globally.

It is quite possible that certain proposed demonstration projects will tie various elements

together. A smart microgrid in False Creek Flats may, for example, tie together smart grid and advanced demand-side management technologies (sustainable urban practices), plug-in hybrids (smart urban transport), and microgeneration from solar or biomass (remote power).

These various demonstration projects often require government involvement for funding, research, removing regulatory barriers or other forms of support. The Innovative Clean Energy (ICE) fund is one example of a source of potential support.

10.27: That government continue to support demonstration projects that make BC a clean technology showcase.

TARGET BC AS A NATIONAL CENTER OF EXCELLENCE FOR CLEAN TECHNOLOGY AND CLIMATE CHANGE

BC has a well-deserved reputation for expertise at the academic and developmental level of clean technology, energy systems, climate change and related environmental sciences. This is in part because we have the resources that encourage such development, and in part because the lifestyle in BC attracts the kind of individuals who are interested in clean technologies. However, as the worldwide demand for the development of clean technologies grows, BC runs the risk of losing that expertise to other jurisdictions. BC must retain this expertise or our ability to lead in this area will be limited.

People with clean tech expertise are attracted to 'hubs' where there is investment in research and colleagues who share similar expertise and who can foster collaboration. In order to encourage and retain this expertise, BC must develop centres of excellence in different areas of sustainability which would, at the same time, attract new talent to the region. Such centres of excellence would also serve as engines of innovation, as showcase sites, and would allow us to take full advantage of our natural and human resources, thus retaining a leadership position in clean technology development.

Whether full-scale centres, or merely fully funded research chairs, contributions from government should build upon our existing strengths. A short, but by no means exhaustive list of areas of strength for BC includes Hydrogen/Fuel Cells, Power Electronics and Advanced Automotive Systems because of our expertise in these sectors, and the areas Bio-energy, Ocean Energy and Geothermal because of our resource base.

Currently there is a tremendous opportunity offered by the False Creek Flats brownfield development to establish a National Centre of Excellence for urban sustainability at that location. This could be funded in part by the federal government through the Natural Sciences and Engineering Research Council (NSERC) program, which is currently calling for expressions of interest. There are a number of applications that are being prepared, and as BC

provides matching funds for these applications, it should ensure that these submissions are collaborative when possible, and do not counteract each other or reduce the chance of obtaining federal funding in BC.

10.28: BC should leverage federal programs to create research chairs and develop centres of excellence around existing strengths in clean technology.

10.29: BC should have a coordinated approach to applications for federal funding for clean technology.

BC HYDRO, BCTC AND POWERTECH LABS

BCTC together with BC Hydro, and its subsidiary, Powertech Labs play an important role in technology demonstration and development. BCTC and BC Hydro contain a wealth of planning and operating experience and Powertech Labs, widely known for its expertise in power system analysis and testing, is a powerful tool in BC's arsenal of transmission and smart grid expertise.

In 2004, BC Hydro had much of its R&D budget denied by the BCUC, thus inhibiting its ability to pursue a number of sustainable energy initiatives. BC Hydro's participation is essential in micro-grid development, plug-in hybrid integration and other energy efficiency technologies, and these must be considered as part of its operations.

Establishing Powertech Labs as a Centre for Smart Grid Innovation, supported by appropriate funding, would enable it to expand its role into the integration of new energy technologies with the grid. For example, it could address the integration of intermittent renewable energy supplies, determine the effectiveness of different DSM technologies, and contribute to the modelling and development of urban micro-grids, to name but a few areas. Such a centre would accommodate many aspects of an intelligent or smart grid, including generation of clean and green energy, energy efficiency technologies and energy management.

We believe the role of Powertech Labs should be expanded so it can fulfil its potential as a centre to commercialise our technologies. It could act as a centre for developers, manufacturers, customers and the public to physically test and certify technology. This Centre would be linked to key demonstration projects around the province, and would play an important role in offering the benefit of a testing site on a fully integrated system to worldwide partners, thereby including BC Hydro and BCTC in the technology and innovation developments driven by their counterparts in jurisdictions with greater market pull.

Furthermore, Powertech Labs works collaboratively with BCTC and BC Hydro, hence its

access to the grid. The added benefit is that such a project would further the goals of the province, the Energy Plan, and the future objectives of BC Hydro and BCTC. Direction to BCTC, BC Hydro and BCUC would ease the funding of such a demonstration facility.

10.30: That BCTC and BC Hydro's abilities to contribute to the deployment of pre-commercial technologies be recognised and these organisations be provided with an effective R&D budget.

10.31: That government support the transformation of Powertech Labs into a Centre of Excellence for Smart Grid Technology.

Process: A summary of the roundtable process and stakeholder interviews

The PTC Clean Technology taskforce held five roundtables in May and June 2007 that focused on the issue of how to assist the commercialisation of BC's clean technology and renewable energy sectors. The five roundtables focused on Independent Power Producers, Bio-Energy, Clean Energy, Transportation and Buildings.

Each roundtable was attended by an average of twenty senior executives who participated in an open dialogue on a series of targeted questions. Issues addressed included barriers to commercialising products and services, new opportunities for companies to develop, and actions to overcome these barriers and enable companies to capitalise on opportunities. The taskforce then conducted targeted interviews with key stakeholders from government, business, academia and other organisations to gain further understanding of the issues and develop the recommendations.

Innovation and Commercialisation

Executive Summary

Knowledge based industries represent over 5 percent of GDP in BC and are growing quickly. While BC has some very successful companies in a number of key technology clusters, none of them are large and few of our biggest companies are headquartered in BC. If the technology industry in BC is to reach its full potential some critical issues will need to be addressed.

The knowledge economy is driven by three critical elements - research, talent and capital. Investment in research is, apart from talent, the most important driver of the knowledge economy. BC currently invests, through public and private means, about 1.45 percent of GDP in research. Top technology jurisdictions such as California and Massachusetts invest closer to 4.5 percent of GDP. BC needs to move towards the goal of investing 4.5 percent of GDP in research and 65 percent or more of that investment should come from private industry compared to the 40 percent which private industry currently invests. In order to ensure that this investment is efficient the government should develop a plan to focus the spending and it should revise the policies and procedures of the Universities Industry Liaison Offices. A significant strategic initiative should be made to invest in one of BC's universities with the goal of moving it into the top twenty in the world. World renowned universities are foundation elements for thriving technology centers and serve as powerful talent and research magnets. Finally, this increased research investment should be delivered according to a long term strategic plan for the technology economy of BC. A restructuring of the current Ministry of Advanced Education to place the education mandate in the Ministry of Education would the leave the newly named Ministry of Research and Talent dedicated to the task of developing this critical component of BC's economy.

- Create a Ministry of Research and Talent dedicated to research and talent
- Increase research investment to 4.5 percent of GDP from private and public sources
- Ensure efficiency of research investment through strategic planning and streamlining of commercialisation practices
- Improve one of the BC universities to top twenty in the world

Talent - in particular scientists, researchers and top technology business executives – is the most important resource in the knowledge economy. We need to reorient ourselves around the talent challenge. Our economic success in the future will depend on our ability to retain

and attract these Highly Qualified Personnel (HQP). The government should put programs in place to retain our graduates, to recruit HQP including expatriates and to streamline the current immigration processes. Most importantly, BC needs to create a strong incentive for talented knowledge workers to live and work in BC and for corporations to grow their businesses here. The elimination of tax on company stock would provide such an incentive.

- Proposed Ministry of Research and Talent to focus on talent retention and recruitment of researchers, grad students, and expatriates.
- Eliminate tax on company stock to create incentives to attract and retain talent and to keep businesses growing in BC.
- Streamline the immigration processes for permanent residency and temporary foreign workers.

Capital is the third critical element of the knowledge economy. Our capital markets are growing, but remain immature relative to the top technology centers in the world. We have a strong angel community and a growing venture capital community but the total volume of capital available in BC does not support the development of companies in capital intensive sectors such as life sciences and clean technology, which often require hundreds of millions of dollars before their products reach the market. In order to fully fund these opportunities it is critical that the BC government work with the federal government to revise the US tax treaty to allow Limited Liability Corporation investors from the US to fund ideas in Canada more easily. Equally important is funding to move more ideas out of the lab and into the proof of concept stage where they can then be supported by angels and VCs. This development of prototypes and proof of concepts is supported by multiple levels of government in the US but no such support exists in Canada.

- Amend the tax treaty to allow US LLCs to invest in Canada.
- Develop a series of proof of concept funds to move more ideas out of the labs. The Discovery Foundation could provide the capital.

Finally, there needs to be an agent for change in BC which can take on the long term work of growing the knowledge economy. The government ministry will do its part by creating the right environment for the tech economy to flourish. The various industry associations will also play a critical role in advocating for their sectors but there also exists the need for an interested but unbiased third party to provide ongoing direction and development. The BC Innovation Council is the agency best positioned to serve this need and we recommend that the BCIC take on some of the important tasks necessary for the growth of the industry. Ninety-five percent of the technology businesses in the province have less than ten employees. These businesses would benefit greatly from the advice and mentorship that could be provided by a network of virtual board members coordinated by the BCIC. The Council should take a proactive role in providing talent development and encouraging our

educational institutions to develop programming for technology sales, technology product management, world class recruiting practices and virtual company management.

Introduction

"As for the future, your task is not to foresee it, but to enable it."
- Antoine de Saint-Exupéry, *The Wisdom of the Sands* (1948)

In today's world, particularly in countries like Canada with its modern economy and open trade practices, product and process innovation is the primary source of GDP growth. This does not mean only in the knowledge-based industries. The need to apply innovation and technology cuts across all sectors, including key sectors in BC such as mining, forestry, construction and retail. It is hard to imagine an industry that will not be transformed by technology. If our mainstream industries are not innovative, they will struggle to remain competitive in the global marketplace.

In mining, for example, Goldcorp[12], a Canadian mining concern, had a 55,000 acre site at Red Lake. Over the course of several years the firm invested over $10 million exploring the claim to little effect. Rob McEwen, the CEO, decided Goldcorp needed to change the rules of the exploration game if it was going to be successful in finding gold on the property. Their solution was to tap into the innovation of thousands of talented researchers in labs around the world. They posted the geological data from Red Lake on the internet and offered a prize of $500,000 for whoever could find extractable gold. Over 1400 qualified participants offered analysis from fields like advanced physics, intelligent systems and applied mathematics. Goldcorp found the gold and Red Lake is now considered the richest gold mine in the world.[13] [14] [15]

In retail, Netflix[16] has revolutionised the way people rent movies - by bringing the movies directly to them. After launching its subscription service in 1999, Netflix reached one million subscribers faster than industry giant AOL and now has over 6.7 million subscribers. Realising that accurate recommendations for movies are critical for customer satisfaction and commercial success; Netflix has offered a one million dollar prize to the system that improves the accuracy of their recommendations by 10 percent[17].

In the construction industry, BuildDirect, a BC company, has revolutionised the distribution of building materials. By approaching the manufacturers directly, they have cut the costs that accrue through the manufacturer's marketing and shipping efforts. Through volume buys, innovative logistics software, and on-line purchasing, BuildDirect has become the single-most cost efficient distribution channel. BuildDirect's model allows them to deliver product directly from the manufacturer to the homebuilder for less than half the traditional cost by

eliminating the standard tiers of distribution. Founded in 1999, BuildDirect now does business in over 60 countries. [18]

Although innovation and technology will play a role in allowing our traditional industries to grow and remain competitive, it is in the high tech industry where the greatest economic opportunities lie. British Columbia's high technology sector has undergone significant growth in the last decade. It has consistently grown at a faster rate than the overall economy and is likely to emerge as an even more important segment of the provincial economy in the years to come.[19]

In 2005, high technology industries generated about 5.1 percent of British Columbia's GDP, which is roughly similar to industries such as public administration and construction. The room for growth is clear, however, when we look south of the border. High technology industries generated just over 9 percent of GDP in the United States and in technology heavy states like California it accounted for just over 12 percent of the state's GDP[20]. Much of the rest of GDP growth in all countries will come from real breakthrough's in science. According to an OECD study, there is a long-term trend towards a knowledge-based economy where science, technology and innovation are the key factors contributing to economic growth[21].

Governments have traditionally invested in the type of infrastructure that supports the economy of the day. In the middle ages this meant building castles and hiring armies to pillage neighbours and extort taxes from the peasants. In Canada during the late 1880s and early 1900s, infrastructure involved canals and railways. Canadian governments borrowed millions for canal purposes in the 1840s alone. Early in the twentieth century, highways were the major investment, garnering the bulk of government infrastructure spending. In the 1960s it was airports, with federal spending totalling about $500 million during the decade. [22] [23]

Today, a commensurate investment needs to be made in the knowledge with the recognition that people and knowledge are the natural resources driving our future. Broadband and education facilities are part of the knowledge economy's 'hard' infrastructure. The BC government's commitment to broadband development is ongoing, and in the 2007 provincial budget, over 20 percent of the $5.2 billion in capital investment was for schools and post-secondary education[24]. It is in the area of research investment where BC lags behind.

People are critical to the knowledge economy. Talent is the natural resource of the future and talented people are in demand the world over. Some investments by government, like the Canada Research Chair Program for example, have already had a great effect. We have a firm foundation in BC with a strong creative class and the kind of tolerant environment that attracts them. Talent is mobile, however, and we need to make it attractive for talented people to stay here.

Take Stewart Butterfield, for example, a classics scholar from the University of Victoria, who completed his master's degree at Cambridge. Stewart returned to Vancouver after completing his degree in England, and in collaboration with a lead developer in New York, he and his wife, Caterina Fake, launched a photo-sharing site in February of 2004. Called Flickr[25], by 2006, the site had over 100 million photos and was sold to Yahoo for an estimated $25 to $30 million[26]. Stewart and his wife are the type of talented individuals we need to grow our knowledge economy. Unfortunately, Stewart and Caterina were persuaded by Yahoo to move to California.

A more hopeful example is New Horizon Interactive, which in March of 2005 set out to create an online world for kids where they could safely play games, have fun and interact. As parents and Internet specialists, New Horizon's owners wanted to develop a place they'd be comfortable letting their own kids visit. Based out of Kelowna, they launched Club Penguin[27] in 2005. The CEO, Lane Merrifield, was originally from Lethbridge and moved to Kelowna via California. Through the talents of the principle individuals, and while building the business entirely in Kelowna, Club Penguin quickly garnered an audience of more than four million active viewers. Club Penguin was sold to Disney in August of 2007 for $350 million[28]. The principals and the company will continue to be based in Kelowna.

British Columbia is not the only jurisdiction that has benefitted from recruiting talented, creative entrepreneurs from other parts of the world. The Silicon Valley is probably the best example of a talent magnet for star international talent. Google was founded by an American (Larry Page) and a Russian (Sergey Brin) who met at Stanford University.[29]. Ebay was founded by a Frenchman (Pierre Omidyar)[30]. Yahoo was founded by a Taiwanese native (Jerry Yang) with a Canadian as founding CEO (Jeffrey Mallett)[31]. Linux was founded by a Finn (Linus Torvalds)[32], Sun Microsystems by an Indian (Vinod Khosla)[33], and Hotmail by an Indian (Sabeer Bhatia)[34]. In fact, Business Week reported that for engineering and technology companies, "…half of those founded in Silicon Valley from 1995 to 2005, had a foreign-born chief executive or lead technologist as a founder." [35] Talent is clearly the key, and it goes where the action is. We need to keep our own talent and attract it from elsewhere.

One of the key factors in attracting talent to every top technology region is the presence of a world class city. Great cities are clearly, as Bill Gates claims, IQ magnets. Vancouver is already recognised as a world class city and this is having a positive effect. For example, Microsoft chose Vancouver[36] as one of its ten global research centers because of its current tech base, diversity, and immigration policies that are more open than in the US. As well, the city has large Asian, Indian and Eastern populations, which is critical for technology companies in the US, where the share of awarded degrees in science and engineering are declining, but remain high in Asia and Europe[37].

So where does BC stand in terms of growing its technology industry? We have a good

economic foundation built on our resource industries. This is being added to by some technology clusters that demonstrate real potential including digital media, life sciences, wireless, IT and clean technology. More importantly, we have some of the key elements needed for the knowledge economy including strong universities, positive immigration policies, and a tolerant and diverse population.

In spite of these tremendous assets, however, our knowledge economy infrastructure remains immature. There are a number of areas in which British Columbia needs to improve if the province is to take full advantage of its assets. We need to understand why our tech community remains quite small, without any companies of size, and why most of our biggest companies are not headquartered in BC.

That is the focus of this paper. The PTC will make recommendations on how BC can improve on its underdeveloped capital markets, boost investment on research, deepen the talent pool of scientists and business leaders and become more efficient at commercialising research. We need to develop a strategy and invest in the knowledge economy if we want to be a top tech region in the world. The knowledge based economy is all about people and research. We need to orient ourselves around these two important resources. This is not only necessary for us to succeed as a top tech region in the world, but is necessary for all of our industries to succeed in global marketplace.

Research

Our interviews, roundtables and the subsequent related research have made it abundantly clear that investment in research and development is the most important direct driver of innovation and commercialisation. Furthermore, it is predicted that the majority of GDP growth in almost all sectors of the economy will come from innovation in products, processes and services. Investment in research not only helps to develop the technology industry but in fact it helps to develop all industries in BC.

RESEARCH INVESTMENT

The Economist Intelligence Unit identified the most important direct drivers in innovation as:[38]

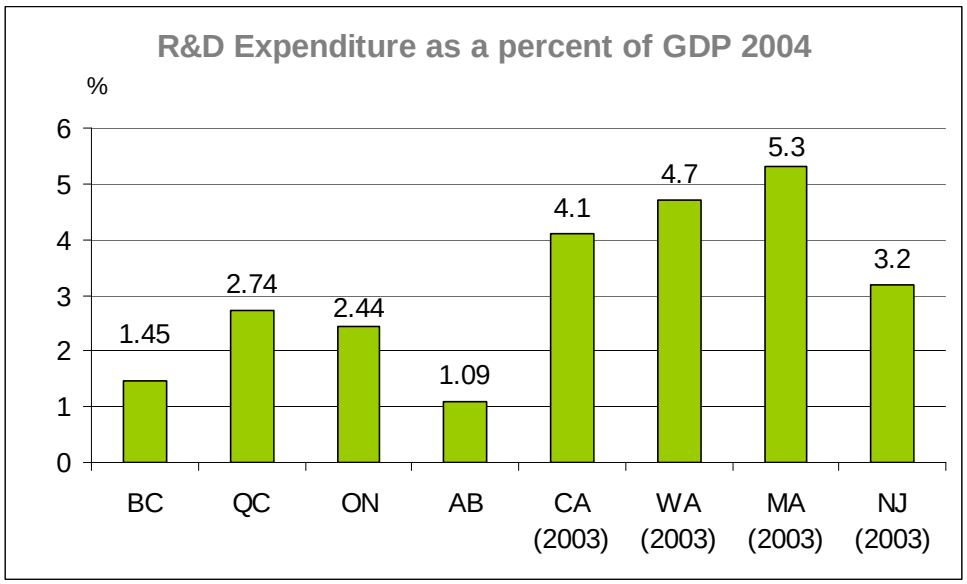
- R&D as a percentage of GDP
- Quality of the local research infrastructure
- Education of the workforce
- Technical skills of the workforce
- Quality of IT and communications infrastructure

- Broadband penetration

Apart from talent, the single most important direct driver of innovation and commercialisation is R&D investment as a percentage of GDP. The importance of research is also illustrated in work done by US Bureau of Economic Analysis which found that if R&D were treated as an investment instead of an expenditure, then the R&D investment and the income flows arising from accumulated R&D capital would account for about 4.5 percent of real GDP growth in 1959-2002. The percentage would be even higher for the latter part of that period at 6.5 percent for 1995-2002. Businesses' investment in commercial and all other types of buildings would account for just over 2 percent of the growth in 1959-2002.[39]

Many OECD countries have developed a national science and innovation strategy with targets for R&D investment as percentages of GDP. Of the 15 countries that have targets, most are over 2.5 percent, and the highest is over 4 percent[40]. BC has made great strides in the past ten years in increasing government support for research, including aggressively pursuing federal CFI funding, and developing the BC Knowledge Development Fund. However, in this critical area, BC with its 1.45 percent (2004) still trails the major technology centers of the world by a considerable margin.

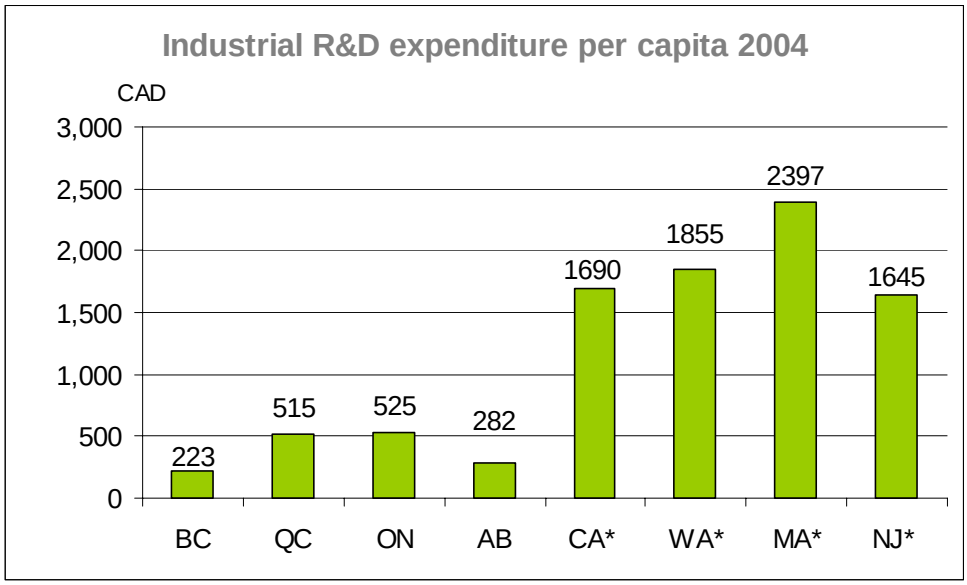
Figure 3. R&D expenditure as percentage of GDP in selected jurisdictions in 2004



Source: BC Progress Board (2007)

Furthermore, industry investment in research and development in BC also lags significantly behind the top regions in the world.

Figure 4. Industrial R&D expenditure per capita in 2004



** Exchange rate 1.3015 (2004 average)*
Source: Statistics Canada, National Science Foundation and Bank of Canada

World class economic performance requires investment in research and development of 4 to 5 percent of GDP. Government alone cannot generate that kind of R&D investment. Industry must play a role. The absence of any large tech companies or other large company headquarters located in BC is a significant disadvantage the province needs to overcome. A solid foundation of support for industry-based investment exists in the federal and provincial Scientific Research and Experimental Development (SR&ED) tax credit program, but a long-term strategic plan which includes the engagement of public, private and foreign parties will likely be necessary to achieve on-going investment in the range of 4 to 5 percent of GDP.

RESEARCH INSTITUTIONS

BC is blessed with several world class research institutions and three universities which rank in the top 400 in the world[41]. These institutions are critical foundation elements in the research infrastructure of our province. It is no coincidence that we have a cluster of high performing life science companies in BC. The Michael Smith Foundation, Genome BC, and the University of BC all play critically important roles in the ongoing development of our life

sciences industry. World class research institutions not only provide a body of work, but they also serve as IQ magnets for top talent, and provide vital infrastructure for that talent to perform.

First among these institutions are BC's research universities. Universities play a crucial role in any jurisdiction with a strong innovation climate. Not only are they the progenitors of most primary research but they are the training grounds for the HQP that an innovation economy needs. A strong university needs good faculty, focused and efficient research capabilities with strong mechanisms for transferring technology to industry, and a cadre of graduate students that support the primary research and act as the primary carriers of Intellectual Property (IP). Investment in post-secondary education (amount and quality) increases a jurisdiction's growth and its ability to adapt and use new technologies and innovation practices. There is a link between workers with university education and innovative companies, as well as a link between investment in masters and doctoral students and product and process innovations[42].

Table 1. Global universities ranking: top 10 and selected Canadian universities

Shanghai Ranking			Institution	Country	Province Canada	Newsweek Ranking
World	Regional	National				
1	1	1	Harvard University	USA		1
2	1	1	University of Cambridge	UK		6
3	2	2	Stanford University	USA		2
4	3	3	University of California at Berkeley	USA		5
5	4	4	Massachusetts Institute Technology	USA		7
6	5	5	California Institute of Technology	USA		4
7	6	6	Columbia University	USA		10
8	7	7	Princeton University	USA		15
9	8	8	University of Chicago	USA		20
10	2	2	University of Oxford	UK		8
11	9	9	Yale University	USA		3
12	10	10	Cornell University	USA		19
24	19	1	University of Toronto	Canada	ON	18
37	**30**	**2**	**University of British Columbia**	**Canada**	**BC**	**31**
67	45	3	McGill University	Canada	QB	42
101-152	58-77	5	University of Alberta	Canada	AB	55
153-202	78-100	6-8	University of Calgary	Canada	AB	not ranked
203-300	**101-140**	**9-17**	**University of Victoria**	**Canada**	**BC**	**not ranked**
301-400	**141-165**	**18-19**	**Simon Fraser University**	**Canada**	**BC**	**not ranked**

Source: Shanghai Jiao Tong University "Academic Ranking of World Universities: Top 100" (2007), Newsweek: "The Complete List: The Top 100 Global Universities" (2006)

In order to establish ourselves as a top tier technology center in the world, we need to have at least one top tier research university in BC. The key technology hubs of Boston, California, and Washington all have at least one and sometimes two top-ranked universities. The Shanghai Jiao Tong University has completed an academic ranking of the top 100 Research Universities in the world [43]. Newsweek[44]also prepares world university rankings. As the table above demonstrates, both place the University of British Columbia, BC's highest ranking university, in the 30s. The University of Toronto is the only Canadian university with a better ranking.

RESEARCH EFFICIENCY – COMMERCIALISATION

Investing in research is critical...investing efficiently should be our goal. It is assumed that research spending in industry is efficient. If it isn't, the market will soon decide and the company will struggle. Research investment in the public sector is more difficult to manage given the absence of market forces. Research investment is efficient when it produces new products, processes or services. How do we measure this and how are we doing?

The Economist Intelligence Unit did a study of innovation efficiency in April 2007 and analysed how much a nation invested in innovation - innovation inputs included R&D, research infrastructure, workforce education and technical skills, IT and communications infrastructure, and broadband penetration. It then compared these inputs with a nation's innovation outputs, or performance.[45] Canada proved to be inefficient in capitalising on its research investments with an input ranking of 9 and a performance ranking of 13. [46]

Table 2. Innovation index 2002-2006

Country	Patents per m	Innovation performance index	Rank	Direct inputs index	Rank	Innovation environment index	Rank
Japan	1213.103	10.00	1	9.50	11	6.88	23
Switzerland	501.797	9.71	2	9.88	4	8.50	5
USA	350.495	9.48	3	9.88	4	8.53	3
Sweden	334.625	9.45	4	9.94	2	8.24	10
Finland	321.717	9.43	5	10.00	1	8.48	6
Germany	300.296	9.38	6	9.56	7	7.95	14
Denmark	259.764	9.29	7	9.94	2	8.61	1
Taiwan	253.973	9.28	8	9.06	14	7.68	16
Netherlands	198.294	9.12	9	9.63	6	8.37	8
Israel	192.058	9.10	10	9.56	7	6.85	24
Canada	127.846	8.84	13	9.50	9	8.20	12

Source: Economist Intelligence Unit (2007), "Innovation: Transforming the way business creates includes a global ranking of countries, White paper", p. 28

Small countries like Switzerland, Sweden and Finland outperformed on the innovation index. They have clusters of world-class companies in research-intensive sectors and very high standards of education, particularly in science and mathematics. Israel is another country that, because of its well-educated immigrants, outperforms many larger countries.[47]

There are a number of requirements for efficient research investment including focus. The government has made a good start by committing to the key sectors outlined in the Research and Innovation Strategy. It makes good sense to select sectors – clusters if you will – where we already have some competency and critical mass. Providing additional support to these clusters, such as funding the CDRD in the life sciences cluster, funding of the Centre for Digital Media in the digital media cluster, and establishing the Innovative Clean Energy Fund in the clean tech sector, are great examples of focused investments. The government should be developing a long-term strategic plan to manage their investments and incentives for research in our province.

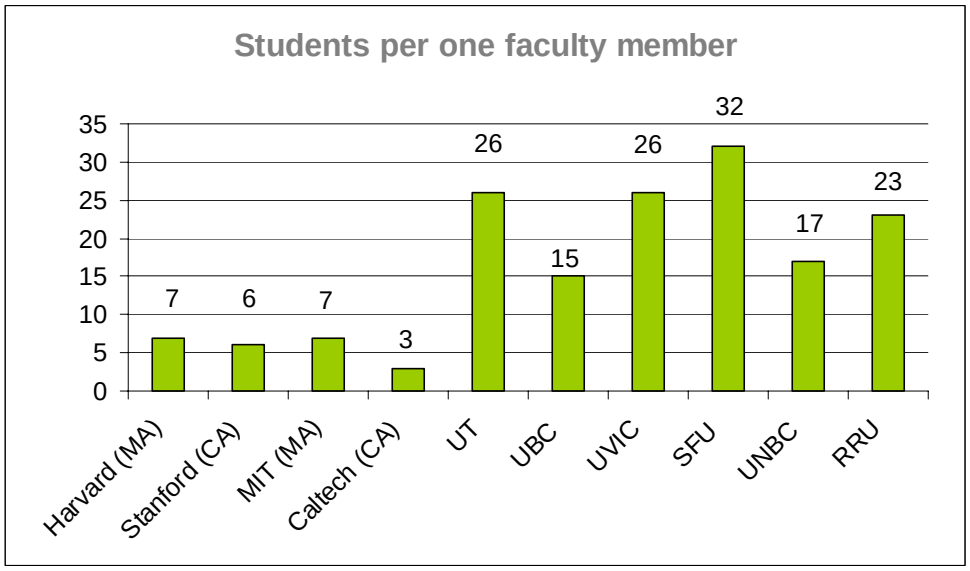
Geoff Plant, in his *Campus 2020* report to the provincial government in 2007, recognised the importance of focusing the public research investment in key areas and key institutions. He not only recommended a clear delineation between teaching-intensive universities and research-intensive universities, but also recommended that government should[48] :

> 45. Implement a "Georgia Strait" research cluster initiative by ensuring that at least 95 percent of all provincial research funding is awarded to UBC, SFU and UVic.

The best way to move ideas from the lab to industry is by investing in the people who make the discoveries. The researchers, the professors and the graduate students who are intimately familiar with the material are the best carriers of the new IP. In BC, we need to attract the very best faculty and graduate students, and we need to keep them working in BC. Further, we need to make it easy for them to move between academia and industry. It is axiomatic that the quality of a university revolves around its faculty. Without good faculty with the time and resources to do the job properly, our universities will not retain their current quality, let alone improve their international ranking. Furthermore, the quality research and innovation we are striving for will not occur.

The province recently made a laudable commitment to increase the number of graduate students in BC by 2,500[49]. One concern however, is that the universities might not have sufficient resources to absorb the increase in graduate level seats. The full-time student to full-time professor ratio has increased in BC from 12.7 to 16.1 since 1987[50]. The top universities such as Harvard and Stanford have graduate student ratios as small as 4:1 in certain disciplines such as science, engineering and humanities[51] [52] [53].

Figure 5. Student (undergraduate) to faculty ratio in selected universities



Source: www.petersons.com, the page was last updated on August, 2007

A further challenge or potential opportunity is the unprecedented level of staff turnover that our universities will experience over the coming decade. By 2018 almost 50 percent of the current 3,532 faculty members of BC's universities (2003/04) will have reached the probable retirement age of 65[54].The competition for new faculty will be intense – US universities pay on average 20 percent more than BC universities and, as we have seen, they have much more research spending at their disposal[55].

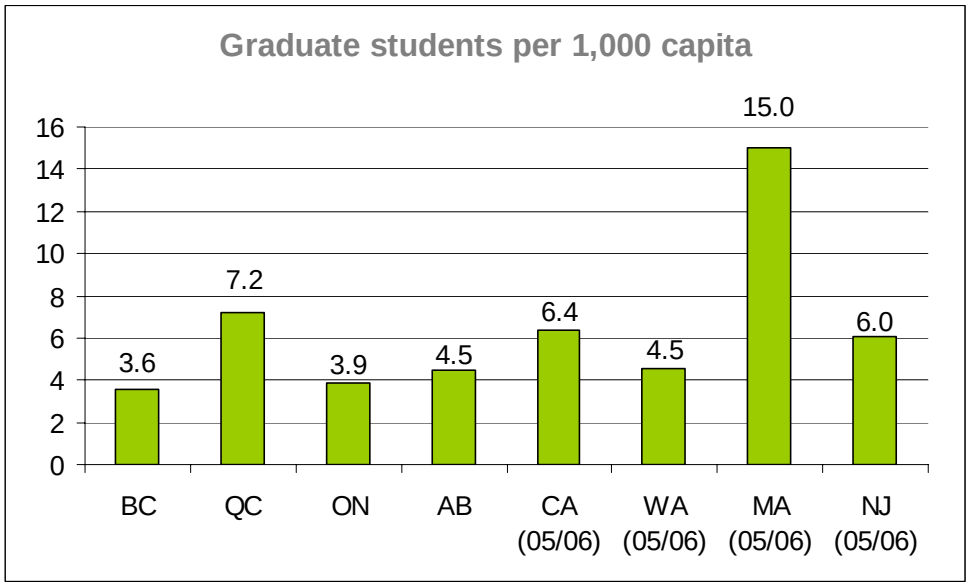
The federal Canada Research Chair program and the provincial LEEF program are excellent examples of targeted, leveraged government investment to attract world class researchers who in turn attract world class graduate students. The future of the CRC program is unknown and the Provincial LEEF program in its current form only funds twenty researchers[56].

Faculty researchers are generators of new research and often they are founders of new businesses based on their findings. Perhaps more often though the intellectual property makes it's way into the market through smart graduate students who are intimately familiar with the research and realise the potential for commercialisation. It goes without saying that we want great graduate students to attend our universities and to stay in BC after graduation. Currently BC has fewer graduate students than our comparator jurisdictions and our support for grad students is not competitive.

To add another challenge the competition for graduate students worldwide is intensifying. Countries such as Germany and Finland offer tuition free degrees in an attempt to attract students. Finland also offers study grants and housing allowances.

The provincial government has added 2,500 graduate student spaces and is providing $10 million dollars of scholarship funding over the next four years to support graduate students in our province[57]. Again these are important steps to move us in the right direction. However, even after adding the 2,500 spaces we will still fall well below the per capita enrolment in the other top provinces or top jurisdictions in the US[58].

Figure 6. Graduate student enrolment per capita ratio in 2004



Source: Statistics Canada, The National Center for Education Statistics (NCES), U.S. Department of Education.

Again looking to Plant's Campus 2020 report we note recognition of the critical importance of graduate students. Two of his key recommendations were[59]:

> 41. Building on the recent commitment to create 2,500 new graduate student spaces by 2010, develop a plan to implement the BC Access and Excellence Strategy target of the highest per capita enrolment of graduate students in Canada by 2015.
>
> 43. Establish an expanded program of graduate student financial aid to ensure no qualified applicant for graduate studies is denied access on the basis of financial circumstances.

The process of facilitating the transfer of IP from the research institutions needs to be efficient. Currently this process is managed through the University Industry Liaison Offices (UILO) at the universities. The Ministry of Advanced Education and the BCIC recently conducted a study of the efficiency of the BC tech transfer environment. The resulting Global Connect report echoed the recommendation of the BC Competition Council which suggested that the

UILO policies be simplified[60]. Most governments in Canada and the US have expressed a desire to maximise their investments in research. Some universities such as the University of Ottawa are actively experimenting with new models to streamline the process. The new TAP program at the University of Ottawa provides royalty free access to new research to small Ottawa based companies. The researchers receive research funding in exchange[61].

Facilitating student's interaction with industry through co-ops and internships has also proven to be exceptionally valuable. It helps with the transfer of IP to industry and students who have spent time in the local sector, build contacts, gain experience and are more likely to remain in British Columbia. BC has at least two successful models in place at the moment, WestLink's TCIP and MITACS. The BC government is to be congratulated for its June 2007 announcement 10 million in new spending for graduate student internship programs[62].

CLUSTERS

A key goal of any jurisdiction developing an innovation economy is to build a cluster, small wonder given the results of a recent survey by the Economist Intelligence Unit. It defined a cluster as a group of firms that have a powerful academic institution at the centre and perhaps a national laboratory in the neighbourhood. The survey found that 56 percent of those who were connected to a high tech cluster like the Silicon Valley felt they performed better than their peers compared to 36 percent outside a cluster.[63]

One way to encourage cluster development is to build centres of excellence. They allow a critical mass of research and businesses and thus ideas to develop. Centres of excellence that capitalise on BC's existing strengths can be a draw for researchers and high-end companies. This is of particular interest in rural regions where centres of excellence that make use of BC's resource industries can be used to generate research and technology in regions outside the lower mainland.

BC has as well made significant investments in such centres in recent years. Both the Centre for Drug Research and Development and the Centre for Digital Media will reap benefits down the road as centres of learning and innovation. Agencies around the province are moving to expand upon this development by capitalising on the federal government's Centres of Excellence in Commercialisation and Research (CECR) program. The CECR program has allocated a total of $165 million for the 2008 Competition[64]. This translates to about $15 million per center over five years. BC should continue to work on developing centres of excellence.

Recommendations Research

MINISTRY RESTRUCTURING

The PTC believes that to properly focus resources on the attraction and development of talent, and to focus our research funding more strategically, that British Columbia should create a ministry of research and talent. The Ministry would include research and innovation policy and resources from the Ministry of Advanced Education. The learning and instructional mandate of the Ministry of Advanced Education could be merged with the Ministry of Education to create a Ministry of Learning. In creating the larger Ministry of Learning, however, the government must take note of past experience and ensure that the advanced education aspects of such a Ministry are not overwhelmed by the size and mandate of the current Ministry of Education.

Also, as *Campus 2020*[65] noted, it is critical that this new body be able to focus resources. If the new Ministry attempts to be all things to all people it will spread our research investment too thinly and become ineffective. The new Ministry of Research and Talent would have a dual mandate to:

- develop and execute on long term strategy for Research and Innovation with focused and efficient research investment; and
- develop and execute on a long term strategy to attract and retain the top talent in the world.

10.32: That government restructure to create a Ministry of Research and Talent, and a Ministry of Learning.

RESEARCH INVESTMENT

It has become abundantly clear that R&D investment as a percentage of GDP is one of the most important drivers of an innovation economy. The strongest innovation economies all have R&D expenditures that range between 4 percent and 6 percent of GDP. In 2004 BC's research investment was up from the more traditional 1 percent to a stronger 1.45 percent but this is still not enough. We clearly need to spend more if we want a true innovation economy, and if we want to be a world class innovation economy we have to undertake R&D investment levels that account for more than 4 percent of GDP.

This kind of increase cannot be accomplished by government alone. In fact a much larger portion of the increase must come from the private sector. In 2004 private investment in R&D only represented 41 percent of the total. This is much lower than the Canadian average of 60

percent. To achieve greater levels will require not just government funds but careful planning and programming to encourage greater private investment in R&D.

The new Ministry should ensure that its long term strategic plan includes addressing the disparity between private and public investment. Potential solutions include programs that encourage more matching dollars from industry, extension and expansion of the existing SR&ED program, and providing tax relief for funding University research.

10.33: That the government's long term strategic plan for Research and Innovation include interim goals to increase gross investment in R&D toward the world class benchmark of 4.5 percent of GDP, increase private investment in R&D to 65 percent of that total, and move toward these targets with aggressive but realistic time frames.

As already noted in the PTC's 5th Report, R&D tax credits are an important source of capital for R&D in early stages of technology businesses[66]. In Canada, 73 percent of the respondents to a SR&ED survey confirmed more R&D as a result of the program, and 58 percent indicated that their profitability increased[67]. Fourteen hundred companies claim success with BC's SR&ED program as well. Although the SR&ED system is strong, it expires on September 1, 2014[68]. Other jurisdictions like Quebec do not have a sunset date for their program[69].

10.34: That the provincial government extend the British Columbia SR&ED tax credit program beyond its current expiration date (September 1, 2014) and make it an ongoing program with periodic reviews.

ONE UNIVERSITY TO TOP 20

The province should set a long term goal for one of its universities to achieve a top 20 world university ranking. An institution with international credentials would attract and retain the most talented people in the world, create high- quality graduate students and all of the benefits that accrue from having them contribute to our economy, and help meet the provincial goal of making British Columbia one of the world's top technology centres.

10.35: That government set a long-term goal for a British Columbia university to achieve a top 20 world university ranking.

DEVELOP A FACULTY RECRUITMENT PLAN

One of the biggest challenges facing British Columbia's post secondary institutions is attracting and retaining faculty. This is exacerbated by the large number of aging professors. By 2018, almost 50 percent of BC's current 3,532 faculty members (2003/04) will have reached the probable retirement age of 65[70]. Currently we have a professor to graduate student ration

of 16:1 up from 12:1 in 1987, as compared to ratios as low as 7:1 or 6:1 at Harvard and Stanford universities.

While this is a challenge, it also represents a tremendous opportunity. One of the first tasks of the new ministry should be to develop a strategy that assists the universities in recruiting the best faculty in the world. BC can start by capitalising and building on the good work of the Canada Research Chair program and the Leading Edge Endowment Fund.

Such an effort would support the goal of creating a top twenty university, attract better graduate students to study with the high-profile faculty, and help form the development clusters that will drive an innovation economy.

10.36: That the provincial government develop a faculty recruitment plan in concert with the BCIC.

DEVELOP A GRADUATE STUDENT STRATEGY

Graduate students are the most important product of the university system. We need to develop exceptional students and we need to retain them in BC. There are a number of tools available to the provincial government that might be incorporated into a provincial strategy. They include:

- offering all foreign graduate students permanent residency through the Provincial Nominee Program, without the requirement of a job offer;
- repayable graduate student support or loan that could be forgivable at 20 percent per year should the graduate student stay in British Columbia; and
- extending provincial support for graduate internship programs.

Work BC is currently planning a marketing strategy aimed at international graduate students. This is commendable, but we believe the marketing should be supplemented with some targeted recruitment strategies for key areas.

10.37: The government should develop a graduate student strategy to attract, teach and retain the best possible students.

UILOs

One of the concerns expressed by stakeholders regarding UILOs is that the process is too complicated. This is, in part, due to the mandate of UILOs to protect IP and the interests of the University. This challenge was also identified by Global Connect who noted that University-based researchers, investors and industry representatives believe the process is too complicated. Another issue identified by stakeholders is that UILO processes are further

complicated by different university regulatory procedures.

BC's universities need to make it easier for industry to conduct business with them. They should standardise the process with a limited number of standard agreements to choose from. The UILOs would also need to recognise that life sciences research and investment is significantly different from other forms of research, and the policies need to be developed accordingly.

Finally, the new system would have to measure how much technology is being transferred out of the University and how much money is being accrued through licensing. This would allow the process to be iterative. Universities could experiment with new processes and models to determine which is the most effective.

To manage such a cross-university process, there needs to be an independent body to manage, advise and measure. Industry should be included to ensure the process does the most efficient job of transferring technology to our economy. The goal is to create a more business-like and business-friendly model.

10.38: That the government and the universities should restructure and simplify the UILO process.

10.39: That government appoint a group of independent advisors led by BCIC to work with the UILOs to develop new policies and procedures.

Talent

"We no longer think of immigration as a gatekeeping function but as a talent attraction function necessary for economic growth."[71]

- *Peter Hodgson, New Zealand's Minister for Research Science and Technology.*

TALENT IS CRITICAL

Through its interviews, roundtable consultations and research, one definitive finding of the PTC is that the technology industry's most important resource is its people. In time, the ideas that people and companies develop become commodities, but top talent is a renewable resource that continues to perform. In today's modern economy, companies put a premium on talent (brainpower) as a competitive advantage. Accenture estimates that intangible assets now account for 70 percent of a company's value in the S&P 500 compared to 20 percent in 1980[72].

The key question becomes...what kind of people, or talent, do we want to attract to and retain in British Columbia? The PTC believes our focus should be on two areas. The first is researchers and their students, also called Highly Qualified Personnel (HQP), who are the creators and carriers of Intellectual Property (IP). Investment in post-secondary education (amount and quality) increases a jurisdiction's growth and its ability to adapt and use new technologies and innovation practices. There is a link between workers with university education and innovative companies, as well as between investment in masters and doctoral students and product and process innovations[73].

The second focus should be on top technology business talent like entrepreneurs, CEOs, and vice-presidents of sales and product management. The majority of our consultations indicated that these are the positions that local companies struggle most to fill and that the success of most technology companies rides disproportionately on the experience of these individuals. This is also the case on a worldwide basis. Demand for senior (experienced) talent is on the rise. In the United States, it is estimated that America's 500 leading companies will lose half of their senior managers in the next five years[74]. In China, two in three companies are having difficulties filling senior positions[75]. Also, as noted earlier, Business Week found that a full 50 percent of companies in Silicon Valley are founded by an immigrant[76].

Like other jurisdictions, British Columbia must train and attract talent in order to continue its growth as an innovative technology centre. A report done by the Conference Board of Canada suggests that there are three primary sources for HQP[77]:

- The existing labour force, who can upgrade their skills and knowledge;
- New graduates entering the labour force;
- Highly-qualified immigrants who bring skills and expertise.

Even though Canada's labour force has a high global ranking in educational attainment[78], the nation will find it a challenge to maintain and increase the number of Highly Qualified Personnel in the future[79]. This is due to demographic trends such as a declining birth rate and an aging population that will reduce the number of workers relative to the overall population[80]. It is suggested that by 2011 the outflow of retirees will surpass the inflow of young workers, and by 2016 almost 30 percent of the workforce will be on the verge of retirement[81].

This makes immigration a key tool for BC. The competition, however, is fierce. Top talent is mobile and is heavily recruited by the best universities, research institutions, and companies in the world. Foreign born engineers, for example, make up nearly one quarter (24 percent) of the US National Academy of Science. Foreign born scientists account for more than half (56 percent) of the 'classic' papers in the physical sciences.[82] German universities now offer free

international degree programs, taught in English, to attract students from Britain, America and around the world.[83]

Governments, as well, are offering extra incentives to attract top talent by relaxing immigration policies. France, for example, has introduced a "scientist visa". Australia has implemented a streamlined system of temporary long-stay business visas, and the United Kingdom created the Highly Skilled Migrant Programme[84]. Immigration policies are increasingly viewed as a recruitment tool.

BRITISH COLUMBIA'S ADVANTAGES

British Columbia really is one of the best places in the world to live. We have a strong education system, universal health care, relatively low rates of serious crime and poverty, and very low levels of unemployment. We are regularly ranked as one of the best places in the world to live[85].

In addition to our natural assets we have what it takes to attract HQP. HQP who significantly contribute to knowledge-intensive production and innovation are attracted by certain regional characteristics. A Global Creative-Class Index is used to measure the existence of this creative class within a region. It is suggested that this creativity is linked with the amount of innovation and economic growth taking place in the region. Canada was recently ranked 8th in the Global Creative-Class Index[86]. Vancouver and Toronto were ranked as top cities in Canada, and Vancouver was ranked seventh in the world.

The creative class is attracted by quality of life and regional diversity, and are also found in regions with a high incidence of 'bohemian' professions (such as artists, writers, producers, designers, painters etc). Vancouver and Victoria are ranked first and third in Canada respectively on this measure[87]. We have a rich culture, not only in terms of the arts but also in terms of the diversity we can offer and that is already acting as a magnet for BC. Microsoft chose to locate one of their ten global research centers in BC largely because of our diverse and tolerant population, the existence of a large pool of talented researchers, and our progressive immigration policies. British Columbia needs to build on these natural advantages to continue its growth as a technology centre.

CURRENT CHALLENGES IN ATTRACTING TALENT

Before we can build on our natural advantages in attracting talent to British Columbia, we must understand what barriers already exist. Throughout its interviews and research, the PTC identified two key areas of concern. The first area involves making the decision to move and the second involves the immigration process itself.

A. DECISION BARRIERS

Disposable income

The average real personal disposable income (PDI) increased 2.5 percent in BC in 2005. The growth was the strongest since 2000 and it was due to a multiyear economic upswing in BC. The continuing tax reductions in BC also play a huge role in the increase in PDI. Government is to be commended for the measures it has taken.

BC still lags behind the Canadian average however.[88] The gap is even more pronounced when compared to the United States. One major local technology company estimated that senior level management migrating from the United States faced a reduction of 13-14 percent on disposable income. In spite of the measures taken by the BC government, taxation still remains a contributor to this gap. Our personal tax rates are becoming competitive compared to the major technology jurisdictions in the US, particularly at the low and mid-income levels, however, the large number of possible income tax deductions, the addition of other non-income taxes, and the high cost of housing without mortgage interest deduction, leads to a much lower level of disposable income in BC.

BC has to address this. The difference in disposable income whether perceived or real not only prevents people from moving here but also plays a role in companies' decisions to relocate. If companies cannot attract the people they want then they must investigate other options. BC needs to consider measures that demonstrate a clear advantage to relocating here.

Housing

The cost of housing in British Columbia has a significant impact on disposable income, and the ability to attract talent. British Columbia is a desirable place to live, and the property values, when compared competing jurisdictions, reflect this[89]. The price of housing is further complicated by certain tax structures, which compare unfavourably with those in the United States. Even when compared with other Canadian cities housing here is very expensive – increasing 24 percent in 2006 alone[90]. Both the federal and provincial governments have taken steps to address the housing situation. The Provincial Budget 2007 contained measures that focus on low income and homelessness issues but there are some measures which can be related to talent as well.

The housing challenge is felt the most acutely by researchers, professors, scientists and mid-level business managers. These people, critical to the growth of our technology industry, are usually locked out of the market in Vancouver and increasingly challenged in cities like Victoria and Kelowna. To determine ways to make it easier for these kinds of people to

purchase a home, the provincial government will need to investigate creative solutions used elsewhere.

Once again, examples can be found in the United States, particularly in institutions where property values are very high. Stanford, for example, has a Mortgage Assistance Program (MAP)[91] [92] with a shared equity structure. The University will lend money to the faculty member, at a very low rate, and the loan is not due until the property is sold or the borrower ceases to be eligible. The University benefits from a possible appreciation of the property – taking a proportion of the appreciation based on what fraction of the value is represented by the loan.

The size of the technology community

Another challenge in attracting people to BC is the relatively small size of the technology community. A bigger hub attracts more people. Silicon Valley, for example, is large enough to provide plenty of opportunities, should someone decide to leave a position. In BC, there are only 37 large technology companies that have more than 200 employees, and 34 with more than 100 but less than 200 employees[93]. We need more and larger companies.

Efforts to attract larger companies have not proven effective, often because other jurisdictions are prepared to offer much larger subsidies. This is not a course of action that the PTC recommends. Instead, strategies need to focus on growing companies in BC rather than attracting them from elsewhere. Favourable conditions will do more to attract larger operations than any specific, targeted measure.

B. IMMIGRATION

As noted at the beginning, many jurisdictions are now looking at immigration as an economic development tool and hoping for the removal of regulatory barriers. Thus it is particularly troublesome that one of the issues raised most often, both in our roundtable consultations and in our interview process, was the regulatory barrier to immigration. Jurisdictions found the process for bringing in a Temporary Foreign Worker (TFW) particularly troublesome and the process to achieve Permanent Resident status often opaque and unreasonably lengthy.

Work BC

The Work BC initiative was launched in April 2007[94] [95]. It`s objective is to provide an innovative new labour market strategy to ensure the Province's success in meeting key economic priorities. Included in the initiative is an action plan that lays out how government, working with business and industry, will address skills shortages for the next five years and respond to longer-term labour market challenges. The initiative has expanded the Provincial

Nominee Program to speed up the immigration process and continues to seek Off-Campus Work Permits for international post secondary students. The aim is to increase provincial involvement in temporary foreign worker approvals, and in a number of other immigration processes.

The Premier's Technology Council commends the government for recognising the serious nature of this issue and for taking steps to address it. The PTC believes, however, that in addition to addressing these regulatory barriers, government can undertake some specific measures that will provide more concrete, 'marketable' benefits to talent.

Temporary Foreign Workers

In order for a prospective employee to get a work permit as a TFW in Canada, an employer needs to acquire a Labour Market Opinion (LMO) from the Human Resources and Skills Development Canada (HRSDC). Acquiring the LMO - a letter from Human Resources and Social Development Canada (HRSDC) to the employer stating that if a foreign worker fills a particular position, it will not negatively impact the labour market in Canada - is a serious challenge. The vast majority of applicants for a temporary work permit require a LMO.

While the goal of HRSDC is to provide a LMO within 10 to 15 days, interviews with prospective employers indicated the process currently takes 16-18 weeks or more to complete[96]. The work permit acquired through a LMO is also 'closed' - specific to one employer and not transferable to another. There are some exemptions, and occasionally 'blanket' LMOs are given to certain occupations but these are often too restrictive. [97]

Other countries that require LMOs often follow different processes. In the United States, [98] [99] [100] for example, the system is based on automatic approval and auditing. Applications are automatically approved once the employers have sworn that the processes have been followed and the information is correct. The government then does spot audits to ensure companies are following appropriate regulations. Under New Zealand`s [101] [102] [103] Temporary Foreign Worker program, certain licensed companies can automatically qualify TFWs provided they meet certain criteria.

The Premier's Technology Council believes the Provincial Government should investigate these as potential opportunities. A combination of the two aforementioned ideas, for example, would grant licensed companies an automatic LMO which would then be subject to a spot audit. Federally, some of these process changes could be implemented without legislative oversight. Work BC should encourage the federal government to consider this during its negotiations on TFW issues. BC might even consider negotiating its own TFW program based on the US model described above.

Permanent Residency

There are two HQP-relevant options for acquiring permanent residency in Canada. The system supporting the federal option, the Skilled Worker Class, is so oversubscribed that it takes years for an immigrant to attain residency status. Currently half of the applications are finalised in an average of 51 months. This varies depending where the application was processed. Half of the applications from European countries, for example, are finalised in 33 months as opposed to 62 months and 64 months for visa offices in Africa and the Middle East, and the Asia Pacific region respectively[104]. This leaves the Provincial Nominee Program (PNP) as the only real recruitment option. There are three classes of PNP that are related to the technology sector: skilled workers, international graduates, and a business category[105]. Fortunately, the PNP has been very effective for companies and immigrants who choose to use it. Interviews and consultations indicate that the PNP staff is extremely helpful and the program itself is flexible and timely. Some of the companies interviewed thought so highly of the program that they indicated they would consider paying more for the service should it be expanded.

The PTC is pleased to note that Work BC is already seeking ways to expand the PNP and believes there is plenty of opportunity for expansion. Currently the provincial government requires a job offer for an immigrant to qualify for the PNP under the strategic occupations category. This is a provincial requirement. Under the present PNP agreement with the federal government, only PNP- nominated immigrants are required to demonstrate some economic benefit.

One of the ways to encourage HQP in Canada is to retain those foreign students who are already here. These students are a great repository of Canadian trained talent and are clearly identified as desirable IP carriers. There are three options for them to either work while studying or shortly after their studies[106], namely the Off-Campus Work Permit Program, the Post-Graduation Work Permit Program and permanent residency through the federal program or the Provincial Nominee Program. The PNP currently requires that graduate students have a job offer. The PTC believes that if all graduate students were automatically eligible for the PNP program without a job offer it would serve as an excellent recruitment tool and facilitate the retention of a high percentage of these graduate students.

STRATEGIES TO ATTRACT TALENT

Measures in other jurisdictions

The governments of Ontario and Quebec have both provided incentives to attract technology workers. Quebec introduced a five-year personal income tax holiday for HQP in the following specialities: foreign researchers specialising in pure or applied science, management

or financing of innovation activities, foreign commercialisation, and transfer of leading technology[107]. The Ontario Research Employee Stock Option (ORESO) Credit provides a personal income tax reduction for the disposition of stock options granted to employees by research and development companies, and for capital gains arising from the sale of shares acquired through exercising eligible stock options[108].

Quebec has also worked creatively and proactively with companies for large-scale hiring and job creation initiatives. For example, large subsidies were provided to attract Ubisoft, a major video game developer. The PTC notes this kind of company-specific subsidy, not as a recommendation but as an example of the kind of competition we`re facing in BC.

Expatriates

One human resource strategy is to focus on the Canadian Diaspora as a source of potential talent. Many of the top students from our universities leave Canada when they graduate. Microsoft hires more graduates from the University of Waterloo than any other university in the world[109]. BC should encourage expatriate HQP and sales, marketing & product professionals to return to BC. They will have been trained at some of the best companies in the world, and are more likely than foreign nationals to stay in Canada if they return. About 2.7 million Canadians (over 8 percent of Canada's population) are currently working abroad[110].

Other jurisdictions around the world have also noted émigrés as a source of HQP. In an effort to attract the 20 million Indians living abroad, and to make it easier for émigrés (with a total annual income of 35 percent of India's GDP) to invest in their home country, India has introduced a special visa for "people of Indian origin". China has introduced incentives such as bigger apartments, access to the best schools, chauffer-driven cars, and elaborate titles. [111]

There are at least two potential expatriate target groups. The first is Canadians in their mid-30's who are starting a family or putting children through school, and who want their offspring to be raised in Canada. The second is Canadians who are closer to retirement age and looking for opportunities to return home, or who may want to be closer to elderly parents.

Recommendations Talent

TALENT AND THE NEW MINISTRY

One of the key recommendations in this report is for the government to create a Ministry for the promotion of innovation and research. Because talent is the most critical aspect of both

innovation and research, this new Ministry should also assume responsibility for developing and attracting the kind of people who will drive an innovation economy.

The Ministry should build on the efforts of Work BC by partnering with other key agencies such as BCIC and recruitment firms to develop a series of recruitment tools through the use of taxation, immigration, and housing options and should assist with opportunities for spouses and children of immigrants and be authorised to work closely with the private sector. This new Ministry must also be prepared to develop targeted communications and look beyond the traditional immigration exercise to the global recruitment initiative.

10.40: The Ministry of Research and Talent should focus on strategies to attract and retain the top talent in the world.

NO TAX FOR EMPLOYEES ON COMPANY STOCK (OR STOCK OPTIONS)

The provincial government has a history of using income tax reduction as an economic spur. The PTC believes that, on a purely income tax basis, it will be difficult to compete with key jurisdictions in the United States especially states like Washington which have no state tax. The provincial government instead needs to provide a more targeted initiative that will provide one clear 'win', such as the elimination of income tax on employee-owned company stock, in order to create the incentive for HQP to immigrate to British Columbia and for entrepreneurs to build their businesses here.

This tax incentive will serve as a method for attracting more companies here, growing more companies here, and keeping more companies here as it allows companies to be more frugal by using stock as incentive. Although this tactic could be used in all sectors, it is particularly critical for most technology companies where the number one line item expense is salaries.

Most importantly however is that such a tax reduction will serve as a strong recruitment tool for important technology talent. In light of this, the Premier's Technology Council would like to restate the recommendation 5.3 from its fifth report.

10.41: That the provincial government develop and implement an employee equity participation incentive to attract technology companies, senior management, key employees and head offices to British Columbia. The incentive should eliminate the provincial tax payable on the exercise or disposition of stock from the employee's company.

10.42: That BCIC lead the innovation associations in other key provinces to advocate to the federal government for the elimination of federal tax payable on the exercise or disposition of stock from the employee's company.

HOUSING

Housing has already been noted as a challenge and this is particularly key for researchers, academics, middle management, and key developers. BC and Canada have both recognised housing as a critical aspect of immigration and continue to develop measures that address it. However, aside from broad measures like allowing mortgage interest tax deductions, there are few existing models for addressing housing issues at this level.

One potential source of solutions is to be found in the university system. A number of universities in the United States have introduced successful programs, including some where they serve as an equity partner and jointly purchase a home with new faculty. This helps them to overcome the high cost of housing which is a significant obstacle in certain communities. The Premier's Technology Council believes similar programs can be initiated in BC.

10.43: That government continue to develop programs that address housing issues. Government could begin investigating University housing models, implement them within our own University system and expand programs based upon their success.

DEEMED DISPOSITION

Another challenge the PTC has identified is the regulatory regime surrounding the deemed disposition of assets. Even though there are legal ways to avoid paying this tax, it still represents a significant regulatory barrier. Given that in some industries, a company needs a Temporary Foreign Worker for two consecutive three-year temporary work visa periods, a five-year deadline for the assets to be deemed as disposed of is problematic. Extending the term from five to seven years would alleviate this problem.

10.44: That the provincial government work with the federal government to change the deadline for deemed disposition of assets from five years to seven years.

IMMIGRATION

The PTC has noted the effectiveness of the provincial government's PNP program. The program's success is a testament to the government's ability to manage immigration issues effectively. The PTC also commends the Work BC initiative. As it goes forward, we believe the provincial government should consider the following recommendations as ways of improving opportunities both for the talent who wish to move to British Columbia, and for the companies trying to recruit them. It is important to note, however, that should these measures increase the volume of work and pressure on those who administer the PNP program, the province should ensure take steps to ensure it is adequately resourced.

10.45: That the provincial government streamline immigration to BC by:

- **using the PNP program to grant immediate permanent residency for graduates of BC universities' Master's and PhD programs, with no requirement of existing job offer;**
- **amending the PNP program to allow the designation of approved employers in the technology sector with such designation allowing for automatic qualification for the program (The system should be subject to audit);**
- **working with the federal government to pilot a BCTFW program that allows designation of approved employers in technology areas so that their prospective employees can obtain immediate temporary work visas (The system should be subject to audit);**
- **negotiating with the federal government the provision of immediate work permits to the foreign spouses of returning Canadian citizens; and**
- **allowing children of temporary foreign workers to qualify as domestic rather than international students at our universities.**

RECRUITMENT PLAN FOR TALENT

Early in this discussion on talent, the PTC identified two critical types of talent we need to target to improve the innovation economy in British Columbia. The first group was researchers and their graduate students, and the second was senior executives and entrepreneurs. In the research section of this paper, the PTC identified the need for strategies to attract both graduate students and senior faculty.

The PTC believes the richest potential source of talent in the senior business category is the Canadian Diaspora. Many expatriates consider returning to Canada either when they have children of their own, or when their own parents begin to age. When targeting Canadians in respected universities abroad, subsidised trips for recruiting and social events in BC could be arranged. Senior talent could be attracted by inviting them to BC, perhaps to speak at events. Once here, they would learn about the province and network with people. Industry associations could play an active role in such an initiative.

10.46: That the new Ministry develop a recruitment plan for expatriate Canadians which could potentially be executed through the BCIC.

Capital

Throughout the PTC's interview and consultation process, technology entrepreneurs and companies in BC continued to recognise limited access to capital as one of the key inhibitors to starting and growing technology businesses here in BC. Although our technology industry is reasonably strong, it is also quite young. There are not many old technology companies and not many big ones. Only 43 (December 2006) large technology companies in BC have revenue over $25 million[112]. This is however, 11 more than in 2002[113]. According to BCTech, only 37 technology companies have more than 200 employees[114]. This small-scale business environment is due in part to an immature funding environment that limits innovation and technology development. We need to consider where government can best help the industry grow.

THE CURRENT STATE OF THE TECH INDUSTRY CAPITAL MARKET IN BC

Throughout our consultation process, interviewees regularly referred to 'Silicon Valley' as an example of a mature capital market resulting in a vibrant technology industry. In comparison, BC does not have as much money readily available at any stage of the life cycle. Furthermore, comparisons with the Silicon Valley revealed that companies in BC get less help from funders in mentorship, access to partners, recruitment and strategic advice. Finally, it is apparent that when BC companies do find funding, they find it in smaller amounts. This is because of the conservative nature of our investors. As one roundtable attendee stated, "The Valley makes bigger bets, and swings for more home runs." The BC community is more risk averse.

To understand how to address this disparity in investment, the PTC has examined the current investment cycle in the BC technology industry and tried to determine who the key funders are throughout the funding cycle. By comparing these funders with similar sources in other jurisdictions it is possible to determine where the gaps are and how to address them. In the long run we cannot have a purely government solution and it is not government's function to pick the winners. We do, however, need to determine if there are ways for government to help the capital markets mature in BC.

Key stages of development in the technology environment are:

- Pre-seed – A developing business entity that has not yet established commercial operations and needs financing for research and product development. A pre-seed is usually an entrepreneur or researcher with an idea. The line between the pre-seed stage and basic research often gets blurred.

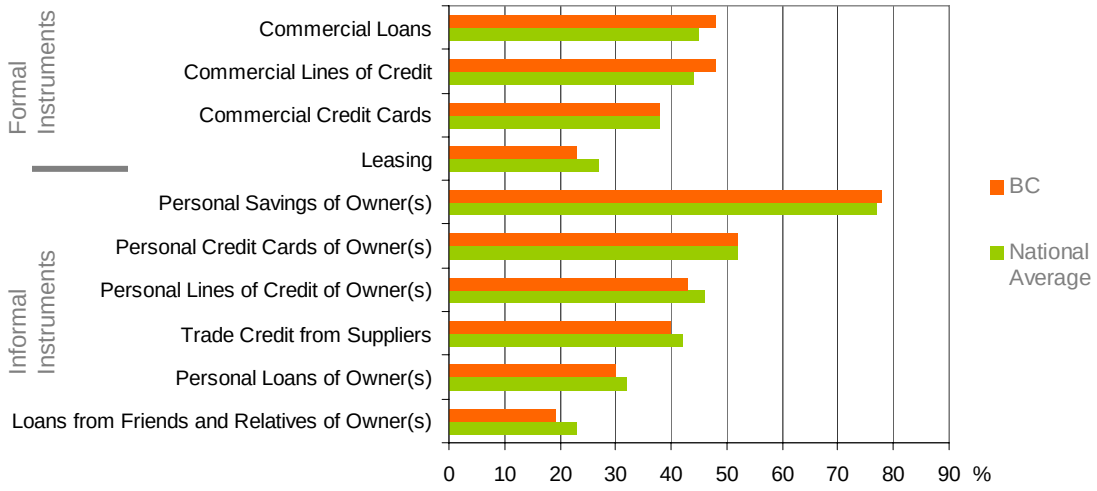
- Seed/start-up – This is a business in the earliest phase of established operations and needs capital for product development, initial marketing and other goals.
- Early Stage – This is a company, usually in business for less than three years, which now has a product in testing or pilot production. In some cases, the product may be commercially available. It may or may not be generating revenues and needs financing to achieve full commercial production and sales.
- Later stage – The product at this stage is in production and commercially available. The company has significant revenue growth but may or may not be showing a profit. It needs capital to expand productive capacity, marketing and sales.

Within these different stages, companies and entrepreneurs can attempt to access capital from different sources. The four types of key investors are FFF (Founders, Friends, Family), Angels, Private Equity/VC and the government.

A. FOUNDERS, FRIENDS, FAMILY

Founders, Friends, Family (FFF) – These investors are exactly what they look like. Entrepreneurs seek resources from friends and family and usually supplement this with their own savings or investments. The Global Entrepreneurship Monitor (GEM) estimated that, in the countries it studied, over 85 percent of private equity invested in a new business is informal investment[115]. On average, the founders themselves provide 66 percent of the start-up financing[116]. What the table below makes clear is that the vast bulk of start up financing comes from the personal assets of the entrepreneurs themselves[117].

Figure 7. Sources of financing used during start-up



Source: Government of Canada (2007), "SME Financing data initiative – Small and Medium-sized Enterprises in British Columbia" p. 9.

B. ANGELS

An angel investor is a high net worth individual, active in venture financing, who normally invests his/her own funds and typically participates at an early stage of growth. Angels usually invest in areas of technology where they have direct experience, often play an active mentorship role, and take shares or equity in the company. Angel investing is perhaps the most important and highest performing investment category in BC's tech community.

According to a key study commissioned by Leading Edge BC, 60 percent to 80 percent of early stage, arm's length equity financing in BC is provided by angels[118]. The study concluded that angel investment is much more important - perhaps twice as important - as formal venture capital for early stage venture finance[119]. These conclusions are supported by a different study which determined that in 2003, the VC community funded fewer than 10 companies, while angel investors funded an estimated 40 registered companies through BC's ECP's Eligible Business Corporation (EBC) program alone, and likely many more to the tune of $355 million dollars[120] [121].

C. PRIVATE EQUITY – VENTURE CAPITAL

Private Equity – The key players in the private equity industry vary according to the particular fund structures and sources of capital supply. In the United States, private equity is dominated by Private Independent Funds, while Canadian activity is diversified across several major groups[122]. These include corporate funds, institutional investors, retail funds (established with the benefit of government tax credits to individuals), private independent funds and foreign investors. Venture capital is a specialised form of private equity invested by recognised venture capital funds. Venture funds invest money obtained from other investors, especially institutional investors such as pension funds[123].

Venture capital (VC) plays a role in the mid and late stages of a company's funding cycle in BC and a limited role in the early stages. Some of the data indicates that VC in BC performs acceptably. When compared with truly strong tech economies like California or Massachusetts, however, or even with some other Canadian jurisdictions, it lags behind.

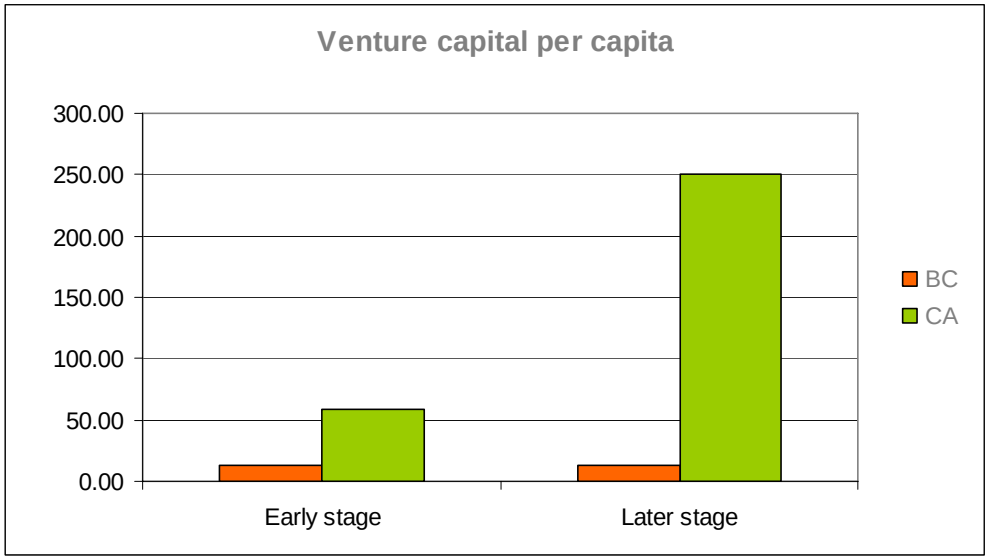
A study of VC by Industry Canada[124] has determined that VC activity in BC has increased since the lows of 2003. In the first three quarters of 2006, investments in B.C. totalled nearly $260 million, more than the total investments for all of 2005. Despite these signs of healthy activity, there are some reports of difficulties in securing VC funding in B.C., particularly for new and early-stage firms. In its 2006 Advocacy initiatives, the B.C. Technology Industry Association[125] points out that the lack of available VC funding and the shortages of

investment opportunities in B.C. are hindering the growth of B.C. businesses.

This concern is borne out by comparing VC activity in BC with other jurisdictions. VC investment in British Columbia, measured per thousand GDP, demonstrates how it could be stronger. Although we rank in 11th place among the top 20 North American VC investment jurisdictions, this is still behind Quebec and Ontario. BC also trails the US average and is well behind California, Washington and Massachusetts. [126]

California and Massachusetts are well developed jurisdictions for venture capital where market imperfections are at a minimum. Accordingly, the values for these regions are probably close to the maximum level of venture capital penetration that can be achieved under the most favourable circumstances[127]. This comparison makes it clear that there is a vast gap in VC funding between BC and California. If BC is going to create more companies and become an important global centre for technology development, then the VC gap must be addressed.

Figure 8. Venture capital (all industries) per capita (2003)



Source: Ference Weicker & Company (2005), "Promoting research and innovation in British Columbia". Report Prepared for BC Ministry of Advanced Education, p. A-13-14.

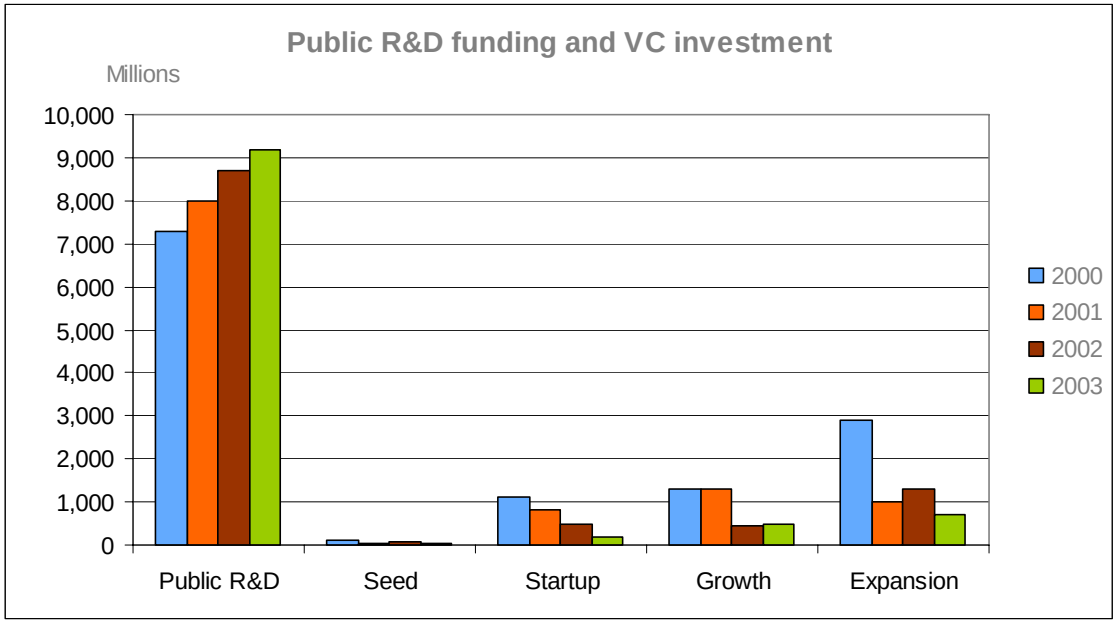
D. GOVERNMENT FUNDING

Government programs in Canada do fund research. Compared to the United States however, our governments do not fund a great deal of commercialisation. Federal government programs include: [128]

- NSERC - Natural Sciences and Engineering Research Council of Canada - the major funder of research at educational institutions in Canada placing more than $60 million annually in BC.
- IRAP - the National Research Council-Industrial Research Assistance Program - funds small-scale industrial research, market assessments for technology products for a total of 12 million in BC in 2002.
- SDTC - Sustainable Development Technology Canada.

While these programs have been extremely successful, the Prime Minister's Advisory Council on Science and Technology has found that only a small portion of Government investment has been made available for scientific research at new, for-profit businesses, especially at the seed stage. The majority of investment goes towards scientific research at universities, hospitals, and other centers as well as to profitable companies that can take advantage of investment tax credits. The result is a serious gap in financing for the commercialisation of new businesses dependent upon investment in scientific research. [129]

Figure 9. Canadian public funding of R&D and VC investment by Stage 2000-2003



Source: Report on the March 17-18, 2004 Roundtable on Seed/Pre-Seed Stage Venture Capital Financing and on Commercialisation Skills Sponsored by the Prime Minister's Advisory Council on Science and Technology (ACST) p. 40

The provincial government in BC sponsors a number of tax credit programs including the Equity Capital Program, the Community Venture Capital program, the New Media Program and the labour-sponsored funds[130]. As of September 2007 the programs have raised over $750 million of equity, invested in over thousand businesses and created over 22,000 jobs.[131]

In the US, a number of programs exist which are in place for the express purpose of aiding the commercialisation of research. These programs include the Small Business Innovation Research - SBIR[132], the Small Business Technology Transfer - STTR[133], and the Small Business Investment Company (SBIC) program.[134]

SBIR is a highly competitive award system which provides qualified small business concerns with opportunities to propose innovative ideas that meet the specific research and development needs of the Federal Government. Depending upon the program phase, the grants can range between $100,000 and $750,000. [135]

STTR is a very similar program that awards a specific percentage of Federal research and development funding for award to small businesses in partnership with non-profit research institutions to move ideas from the laboratory to the marketplace, to foster high-tech economic development, and to address the technological needs of the Federal Government. Exactly how much money is distributed is difficult to determine but the California technology community once again had a very strong showing, receiving more SBIR awards (6,756) from 2000 to 2005 than any other state.[136]

The SBIC supplements the flow of private equity capital and long term loan funds which are administered by the Investment Division, U.S. Small Business Administration (SBA). In 2005, its financings benefited over 2200 companies to the tune of $2.9 billion. Almost a $1 billion went to companies less than two years old. The program is a tremendous success and has provided some 64 percent of all seed financing dollars. [137] [138]

Compared to high-performing jurisdictions like the US, we do not provide adequate funding to get ideas out of the lab. Funding at this stage is critical to bridge the gap between the idea and the prototype or proof of concept, which will then engage an angel or other seed investor. If we want to be truly efficient in our research investment we need to get more ideas off the lab bench.

Recommendations Capital

BARRIER TO LARGE SCALE FOREIGN INVESTORS

In its 8th report, the PTC highlighted the lack of recognition of Limited Liability Corporation (LLC) under the Canada/US Income Tax Convention (the "treaty"). This is still a significant barrier to investments from the US and the importance of the issue cannot be overstated. This is particularly important for funding in the development of Life Sciences. The amount of money required to bring a new molecule to market is astronomical, often $500 million to $1

billion. The VC community in BC ($247 million in 2004) is not large enough projects of this scope so the funds must come from foreign capital pools.

In the United States, most pension and institutional funds pool their capital into a single fund under an LLC that is registered as a tax exempt entity under the US tax law. As a flow-through vehicle, an LLC is not required to file a tax return, and incomes of the LLC are taxed in the hands of its shareholders. The Canada Customs and Revenue Agency, however, has taken a position that LLCs are not recognised under the treaty and are therefore subject to Canadian income tax. A tax return may be required even if there is no tax payable. This rule becomes a "deal breaker" for most LLCs, since a majority of their corporate articles prohibit them from investing in funds if tax returns are to be filed. [139]

A way around this barrier is for LLCs to invest through an offshore holding company, but this process is complex and costly. Considering the significant size of US pension funds and their investment in venture capital, the impact of this red tape on high-tech firms is significant. Worse still, because that investment is unavailable here in Canada, many Canadian companies are forced to move south of the border in order to receive financing from US institutions. [140]

In the federal Canadian federal budget of 2007, the federal government announced that they were going to address this issue. It stated:

> "Representatives of Canada and the United States have agreed in principle to update our tax treaty. The revised treaty will create a more competitive lending market in Canada and lower barriers to the flow of capital between our countries. This will include a complete exemption from withholding tax in respect of cross-border interest payments between the two countries as well as the extension of treaty benefits to limited liability companies commonly used by U.S. venture capital firms. When the revised treaty comes into force, the Government also proposes eliminating Canadian withholding tax on interest paid to all arm's-length non-residents, further expanding funding opportunities for investment." [141]

This has yet to come to fruition, however, and the PTC believes the provincial government should continue to aggressively pursue this issue. It remains as the most serious equity financing issue facing BC companies today.

10.47: That BCIC lead innovation associations in the other key provinces to press for implementation of the changes to the tax treaty.

PROOF-OF-CONCEPT FUNDING

Lack of funding in the commercialisation cycle is particularly significant at the pre-seed stage. During this stage, when the entrepreneurs are still trying to build confidence in their concept or idea, they need funding to develop prototypes and proofs of concept. Because of the funding gap at this level, there are currently more ideas in our research labs that can be commercialised, than there is money to develop them. Providing more funding at this stage will build a bigger pipeline of promising technology companies.

In comparison with the United States, the key reason for the funding gap at this stage is the lack of government funding following the primary research stage. The formal Venture Capital Community does not tend to participate at this stage. Angels will occasionally get involved, but would prefer to see a working prototype or proof of concept. This is why there is such a heavy reliance on Friends, Founders and Family.

The PTC believes there is a role for government to play. An initial pool of capital could be created with $10 million from the Discovery Foundation with matching funds from government. Additional matching funds would be provided by a partner and the fund would be tailored to that partner's needs. Universities, for example, may want to develop funds specific to their university. They could raise capital from their endowments or their alumni and partners. All applications for funding would then be reviewed by an independent group of industry advisors and funds would be awarded in amounts of $50,000 to $250,000. The money would be converted to equity in the case of successful ventures, and returned to the investment fund.

10.48: That government work with the Discovery Foundation to form a set of proof-of-concept funds with a few select partners.

ENCOURAGING ANGEL INVESTMENT IN BC

Angel investors are prepared to step in sooner than formal Venture Capital to provide early stage funding and advice that can be invaluable to a new company. This is crucial because it allows more companies to become stable enough to attract venture capital. Other jurisdictions realise this and are taking steps to encourage greater angel investment. The new National Science Foundation program under the US SBIR is just one example.

In BC, with its smaller and less adventurous VC community, angels are arguably even more important.

The Equity Capital Program has played a strong role in encouraging more angel investment in BC. Currently the Program reaches its limits fairly early in the year, indicating there is

extra demand. These limits should be increased.

10.49: That the provincial government raise the annual investment cap and double the size of the Equity Capital Program to provide the opportunity for more angels to get involved with more money.

BC Innovation Council (BCIC)

This report envisions an expanded role for the BC Innovation Council. It is important to note that Greg Kerfoot, the Chair of the PTC's Innovation and Commercialisation Task Force which compiled this report, is also a member of the Board of BCIC. To acknowledge the twin responsibilities and ensure the recommendations are considered in their proper context, the PTC has created this separate section on BCIC.

INTRODUCTION

Throughout this report, the PTC makes repeated references to the BC Innovation Council (BCIC) which is a Crown Agency of the Province of British Columbia with a mission to create the conditions for top-tier innovation and commercialisation within the province in partnership with government, industry and academia. Its stated strategy is to build on BC's established strengths and recognised abilities.[142]

Since it was formed - by combining the Advanced Systems Institute with the BC Science Council - it has taken time to begin fulfilling the mandate and realising its full potential. The Premier's Technology Council believes that under its newly appointed CEO and new Board, BCIC can be a powerful force for advancing innovation and commercialisation in BC. In particular, the PTC recognises some specific issues that BCIC is best suited to address. These are:

- the need for a facilitator to the technology industry;
- the need for new training and academic programs; and
- the need for entrepreneurial advice and training.

The Ministry of Advanced Education recently commissioned a study of commercialisation in BC by Global Connect. Global Connect identified BCIC as critical, stating, "BCIC would act as an honest, neutral broker to facilitate the active engagement of entrepreneurs, researchers, technology companies, capital providers, service providers, and government agencies to build a community that assists in the mobilisation of knowledge and the formation and growth of technology-based business opportunities throughout the province."[143] In other words, Global

Connect also believes BCIC is the independent agency best suited to identify gaps, provide programming where necessary, and facilitate collaboration amongst all members of the technology community.

CHALLENGES BCIC COULD HELP TO ADDRESS

A. TALENT GAP AND TALENT DEVELOPMENT

The PTC consultations indicated that there was a need for training programs in a number of fairly specific areas, namely technology sales and product management, world class recruiting, virtual company management, and multidisciplinary programs.

Some of the gaps identified - technology sales and product management in particular – stem in part from lack of head offices in BC. Large companies on the leading edge in their respective industries contribute significant resources to train their talent pool. General Electric, for example, is known as a producer of top talent. Goldman Sachs set up a Goldman Sachs University to develop internal talent and encourage its senior partners to put in more effort[144]. McKinsey created a People Committee and boosted its training budget to $100 million[145]. The talent these companies build is also a significant source for new companies. Sun Microsystems was built by the managers from Hewlett Packard. Without this kind of large corporation, there is a void and BCIC is the organisation best suited to identify these gaps and determine how to fill them.

Tech sales

As the PTC identified in its 8th report, one of the challenges technology companies face as they try to commercialise their product is the insufficient pool of marketing and sales talent, especially at a senior level. Most companies do not have formalised product management until they are relatively large and successful. Many companies also struggle through multiple VPs of sales and multiple sales models, before finally developing a winning sales strategy. Often these two problems, or even one in isolation, can be fatal for an early stage technology firm.[146]

More marketing and sales courses need to be offered, not just within academia, but also within industry. Business programs should refocus their marketing curriculum towards marketing practices used in the technology sector and SMEs.

Tech product management

Another challenging area previously identified by the PTC is product management, often overlooked by technology companies until it is too late. New technology companies regularly

make it through multiple rounds of funding without ever undertaking a real product management exercise.[147] The net result is a product that does not interest the consumer.

There is a deficiency of product management courses in academia. Adding such courses to both business and engineering curricula is critical to improving commercialisation. Industry needs access to short courses in product management. The Product Development and Management Association's (PDMA) short programs, or something similar, could be brought to BC. BCIC and local colleges should work with the PDMA to develop programs suitable for BC.

World class recruiting

People are critical in the knowledge economy. As the struggle to attract Highly Qualified Personnel worsens in the face of increasing global competition, BC needs to compete with other jurisdictions. In the talent section, we laid out a number of things that government can do, but the corporate community also has a critical role to play. It needs to practice better recruitment practices in order to compete for staff. The roundtables indicated a strong need to create an understanding of and develop the skills associated with world class recruiting practices in the private sector. This is a role BCIC can play.

Virtual company management - particularly important outside 'Vancouver'

Many regions of BC have small but successful technology companies, but their success is limited by their inability to attract talent to a smaller community. The creation of a 'virtual company' would allow the regionally-based small entrepreneur to access the appropriate skilled people. A virtual company, using computer and telecommunications technologies, would be able to extend its capabilities by working routinely with employees or contractors located throughout the country or the world. Using e-mail, faxes, instant messaging, data and videoconferencing, it implies a high degree of telecommuting as well as using remote facilities.[148]

The skills and practices needed to build a company in this fashion are different from those needed to build a company in which all the participants are proximate. BCIC needs to help identify these skills and develop the training required.

Multidisciplinary business, engineering and science programs

Integration of business education in the science and engineering curriculum at undergraduate, graduate and postgraduate levels would ensure that those who develop the technology have a better of understanding of the rigours of launching a commercial product. Business courses could be added to the programs, internships placed in businesses, or

combined PhD and MBA programs created. On the industry side, developing the marketing and business skills of a company's employees would improve the communication in the product development process and enhance business plan development for new products.

Joint graduate programs

In order to generate new and more marketable ideas, there needs to be more cross collaboration among academic disciplines. This would not only generate innovative ideas but would increase the number of HQP and provide them with a broader knowledge base. In particular universities could offer joint graduate programs in science and engineering. Programs could be created among universities both locally and globally to capture complementary expertise through collaboration. Examples of these kinds of programs are UBC's and SFU's Bioinformatics training program, and the UBC/UNBC Environmental Engineering Program.

B. ENTREPRENEURIAL ADVICE AND MENTORING

Another critical role for BCIC is to encourage and develop advice and mentoring programs. Mentoring is critical. PricewaterhouseCoopers' survey of 140 emerging companies and the 12 largest software companies in Canada shows that approximately 70 percent of the founders are still the CEOs of their emerging companies[149]. The majority of emerging companies have revenues between $1 and 10 million with an average employee pool of 44 people[150]. These CEOs develop professionally through coaching from their peers, investors and board members, followed by reading publications and periodicals[151]. Less than 20 percent of emerging CEOs are looking to their C-suite to assist them in building the skills they need to be effective[152].

One successful CEO level mentoring program is ACETECH[153] which has hundreds of members and has been running for 15 years. It provides an integrated learning and relationship-building environment to enable CEOs to develop personally and professionally by learning from their peers and experienced mentors. It connects CEOs in technology fields through Annual Symposia, CEO Roundtables, Growth Strategy Program, and CEO Speaker Series.

Another successful mentoring program in BC is MentorLinx,[154] a program set up to mentor regionally-based companies. Generally, these CEOs (mentees) have already utilised the resources available to them in the region and now require expertise and wisdom not locally available. Their companies have been in operation for a period of time, are at revenue or near revenue stage, and have a "growth orientation." They want additional insight to help them achieve that growth. Mentors are volunteers from all parts of the province, with wisdom and business experience they are willing to share. They have hands-on CEO level experience,

usually in technology companies, and at least two to three years' more experience than the mentees.[155] The pilot of MentorLinx has been successful enough to permit expansion.

To encourage the development of local HQP, the amount, extent and reach of mentoring should be increased. Mentoring opportunities should be improved at different levels in the organisation, not only the CEO level. Moreover, mentoring across company borders and industries could be improved. The expertise of ex-CEOs could be used in mentoring SMEs throughout the province.

The Global Connect report clearly indicates that there is more to do here though. The report specifically recommends two other pilot programs for BCIC: [156]

- Meet the Researcher / Meet the Entrepreneur event series: These hour and a half-long events, conceptually similar to the IdeaLinx programs offered by the regional science and technology councils, allow researchers and entrepreneurs to present their current research efforts or general business concepts to a small audience of interested community members (10 to 30 individuals).

- Financial Forum and Springboard-type screening programs - These programs provide an opportunity for entrepreneurs to pitch their companies in front of an audience of other entrepreneurs, investors, researchers, and service providers. Financial Forum events are similar to the presentations made by companies at the various BC angel network meetings, but presented to a larger, more public audience.

Recommendations BCIC

IMPROVE RESEARCH EFFICIENCY

Within the Research section of this report the PTC identified the need to commercialise research more efficiently. We believe BCIC's role should be twofold: it can facilitate the UILO review as recommended in the research section of this paper; and it can also implement the province wide Entrepreneur-in-Residence Program.

10.50: That BCIC facilitate the UILO review.

BCIC is well connected to industry and has extensive access within the university structure. This gives BCIC the tools to attract the most effective people to participate in an Entrepreneur-in-Residence (EIR) program. They would have access to many ideas and would have the resources to help make these ideas commercially viable.

10.51: That BCIC implement a province-wide Entrepreneur-in-Residence program.

Global Connect recommends Financial Forum and Springboard-type screening programs. One model the PTC would like to recommend is a 'virtual board' to act in a mentoring capacity. BCIC could compile a group of industry luminaries who would act as a virtual board for developing companies. Companies from throughout the province would submit their company and business plan for virtual board review. This would help fill both the VC gap and the mentoring gap.

10.52: That BCIC develop a virtual board to support and advise start-up companies in BC.

FACILITATE TALENT DEVELOPMENT

One of the key sources of talent already identified by the PTC in this report is expatriate Canadians. BCIC, with its industry, government and academic connections, can play a key role in tracking and cultivating talent. It can provide ex-pats with contacts in the community and keep them abreast of the best opportunities. BCIC and the proposed new Ministry could partner on this initiative.

10.53: That BCIC partner with the proposed new Ministry to develop a repatriation program.

The PTC has identified a number of key areas where specific training programs are needed. BCIC can either assist in the development of these programs or play an active role in their delivery.

10.54: That BCIC encourage development of technology sales and product management training programs in universities.

10.55: That BCIC encourage development of multidisciplinary programs in universities.

10.56: That BCIC help develop and deliver training programs in world class recruiting and virtual company management.

10.57: That BCIC assist in the expansion of existing mentor programs and in the development and delivery of further mentoring programs.

Conclusion

The PTC has determined that British Columbia has a strong, but relatively immature technology sector. Given the relatively small research investment, the province has created many companies and a number of marketable ideas. The PTC also found, however, that BC does not produce many large companies, and that given the right conditions, it has tremendous potential for future growth. The technology sector is optimistic, but if it is to become a true global force and a driver of a knowledge economy, then it will need more investment, more people, and a larger pool of capital.

Smart and focused investment needs to be made in the area of research, both private and public, and needs to be dedicated to strategic areas according to a specific plan, with closer ties to industry to facilitate the commercialisation of this research.

We also need more talented people. The government of BC has recognised this and is working to address the issue. To compete globally for talent we need to build a plan that not only markets our existing advantages but also creates some specific benefits that government, and the companies that locate here, can use as tools to recruit actively and aggressively.

Finally, if our companies are to get more ideas to market, then we need to address some specific funding gaps. In particular, researchers and entrepreneurs need pre-seed capital to transfer more ideas from the lab bench into the proof-of-concept stage. The sectors that require large, long-term investment beyond the capacity of our local venture capital community need unfettered access to foreign capital.

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Appendix A. List of Roundtable Participants

Bill Adams, Manager
Domtar

Lawrence Alexander, Special Advisor
Ministry of Attorney General

David Andrews, Principal
Cloudworks Energy

Eric Ashby, Vice President
Domtar

Warren Bell, Special Advisor
Deputy Ministers' Policy Secretariat

Janet Benjamin, Consultant

Henry Benskin, Deputy Chief Forester
Ministry of Forests and Range

Mark Betteridge, CEO
Discovery Foundation

Stephen Brydon, Development Officer
BC Transit

Harvie Campbell, Vice President
Pristine Power

David Carter, Vice President
Regional Power

Ray Castelli, President
Nai Kun Wind Development

Jeffrey Ciachurski, CEO
Western Wind Energy Corp

Lisa Coltart, Director
Power Smart

Denis Connor, Chairman
QuestAir

Stuart Croft, Vice President
Summit Power

Annalise Czerny, Manager
Angstrom Power

Jim Dangerfield, Vice President
FP Innovations

Glen Darou, President
Clean Current

Steve Davis, Executive Director
Independent Power Producers Association of BC

Dave Demers, President
Westport

Ken Fielding, President
Delta-Q

Nigel Fitzpatrick, Vice-Chairman
Azure Dynamics

Roger George, Marketing Leader
GE Energy

Dominic Geraghty, President
Tantalus Systems

Lorne Gettel, President
Advanced Lithium Power

Ian Gillespie, President
Westbank Projects

Graham Harrison, Manager
Waterous Power Systems

Cheeying Ho, Executive Director
Smartgrowth BC

Doug Hooper, Director
Canadian renewable Fuels Association

Pat Jacobsen, CEO
Translink

John Jacobson, President
IP Applications

Andrea Johnston, President
NxtPhase

Eric Jordan, Chair
PTC Sustainability & Technology Taskforce

Hugh Kellas, Manager
GVRD

David Kiess, Manager
Run of the River Power Inc

Colin Kinsley, Mayor
Prince George

Dave Kusnierczyk, Manager
BC Hydro

Janice Larson, Director
Ministry of Energy Mines & Petroleum Resources

Warren Mabee, Research Associate
UBC

John MacDonald, President
Day4 Energy

Ross MacLachlan, President
Lignol Innovations

Paul Manson, President
Seabreeze Power Corp

Richard Marchant, COO
Powertech Labs

Brian McCloy, Consultant
BW McCloy & Associates

Donald McInnes, CEO
Plutonic Power

Keith McPherson, Director
Globe Foundation

Anne Murray, Vice President
Vancouver International Airport

Brian Nann, Director
Bentall

Tom Osdoba, Manager
Carbon Trust

Joe Pach, Director
Telus

Andrew Pape-Salmon, Acting Director
Energy, Mines & Petroleum Resources

Doug Pearce, CEO
BC Investment Management Corporation

Alan Pelman, Vice President
Weyerhaeuser

Ron Percival, President
Earth First Energy

Derek Pettingale, Director
Teleflex Power Systems

Al Poettcker, President
UBC Properties Trust

Nigel Protter, CEO
SyncWave Energy Inc.

Juergen Puetter, CEO
Aeolis Wind Power

Greg Reimer, Deputy Minister
Ministry of Energy, Mines & Petroleum Resources

Jonathan Rhone, CEO
Nexterra Energy

John Robinson, Professor
UBC

Chris Sacre, President
Sacre-Davey

Jack Saddler, Dean of Forestry
UBC

Brent Sauder, Assistant Deputy Minister
Ministry of Advanced Education

Jim Scouras, Manager
Power Acquisitions

Kraig Short, Sector Officer
Industry Canada

Gordon Skene, President
Paradigm Environmental

Doug Smith, President
Entropic Energy

Doug Stout, Vice President
Terasen

Greg Sunell, President
Synex International

John Tak, President
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Julian Taylor, Business Consultant
Intuit Strategies

Ian Thomson, President
Canadian Bio-energy Corporation

Joe Thwaites, President
Taylor Munro

Mossadiq Umedaly, Chairman
Xantrex

John van der Burch, President
Southern Railway of BC

Bev Van Ruyven, Vice President
BC Hydro

Otto von Ubisch, President
Poyry

Hu Wallis, Director
Ministry of Environment

Michael Walsh, Director
Brookfield Power Corporation

Kathy Wardle, Director
Busby Perkins & Will

Justin Webb, Vice President
Bell Canada

Jonathan Wilkinson, CEO
QuestAir Technologies

Yoga Yogendran, Director
National Research Council

Tom Zaban, Vice President
Reliable Controls

Anming Zhang, Professor
UBC

Appendix B. Summary of Recommendations

This is a list of recommendations made by the PTC in this and all preceding reports. They are numbered in the order in which they appear in the original report.

9th Report

Citizen Centred Services

In order to implement the technological integration required to achieve the five great goals the PTC believes that:

9.1 Ministries should be directed to share data collaboratively with programs outside their own Ministry and actively seek such opportunities in order to deliver seamless coordinated services to the citizens.

9.2 The role of the Chief Information Officer (CIO) should be enhanced with the authority to set standards, architecture and policy for IT purchases and development across government, and to monitor compliance with those standards. Precedent for this model is in the Office of the Comptroller General. Furthermore, for this CIO to assist the government in achieving its goals it should:

a. be adequately resourced to complete the integration of government systems.

b. be given responsibility for managing privacy considerations on a government wide basis. A Chief Privacy Officer (CPO) should be established in the CIO offices to set guidelines and procedures that protect privacy without unnecessarily hindering data sharing.

9.3 Government should focus on some important key projects to generate early success and grow confidence both with the citizens of BC and within the public service.

e-Learning - Assessment

9.4 That the provincial government consider dedicating the time and resources needed to expand the limited e-examination system with a long term goal of e-examinations as the norm.

9.5 That the provincial government consider developing a 'teach the teachers' program on e-examinations

WINLAB

9.6 That the government support and invest in the WINLAB project.

8th Report

DIGITAL DIVIDE

8.1 That the government commit further funds to addressing "last mile" issues inherent to the Digital Divide. The funds would add value by preparing communities for the arrival of broadband and by equipping them to benefit from its introduction.

FIRST NATIONS

8.2 That the Joint Task Force be constituted as soon as possible and tasked to develop and resource an action plan to bring broadband to First Nations communities in BC.

8.3 That the Premier and government Ministers continue to support the Transformative Change Accord, urge their federal counterparts to support the connection of broadband to First Nations communities in British Columbia, and enter into a partnership with British Columbia and First Nations in this province to accomplish this task.

IDENTITY MANAGEMENT AND SECURITY

8.4 That government define an architecture and an implementation/delivery strategy for service integration and information sharing that spans the public service; that recognises the diversity and mandates of the organisations that participate in delivering public service; and that recognises the complexities of the service integration and information sharing.

8.5 That government ensure a budget and process exist to accommodate the major investments in corporate government infrastructure needed to provide identity management, privacy and security capabilities.

8.6 That government expand its notion of identity management to include the broader public sector (i.e., important registries such as client registries, master patient indexes, health care provider registries, student registries, and social service provider registries). The strategy identified in 8.4 also needs to address how the registries will be cooperatively managed (for example, which one will be the authoritative source).

8.7 That government ensure public sector investment in better information security technologies is done in a way that provides open connectivity for all users that arrive at any public facility or location. This is especially important as organisations look to extend their current wired networks with wireless capabilities.

8.8 That government approach federally sponsored initiatives in an organised fashion. For example, the Ministry of Health and the health authorities are working cooperatively to secure funding from Canada Health Infoway. This will ensure that BC does not build infrastructure to support health solutions in stand-alone silos that increase costs and complexities in integrating these sources into the government's electronic service delivery environment.

8.9 That government pursue these issues and recommendations through stakeholders across the broader public and private sector by utilising a model similar to the NetWork BC project, with the aim of optimising the amount of investment required and increasing the quality of the result for the entire public sector.

PRIVACY

8.10 That government revisit the responsibility structure for privacy management and ensure the authority is appropriately delegated and that there are sufficient resources available for the development, implementation and monitoring of policies and procedures.

8.11 That government clearly communicate to the public how it manages privacy and educate public service employees on privacy management in an electronic environment.

8.12 That government ensure all ministries deliver on their legislative requirement to conduct privacy impact assessments. These privacy impact assessments must be conducted at the onset of new e-government initiatives and be reviewed periodically to ensure that the privacy considerations have been addressed in the design and continue to be addressed successfully in production.

8.13 That government periodically review privacy and program legislation to ensure that it anticipates technological advances and is not rendered obsolete by them.

8.14 That government ensure a secure electronic infrastructure to protect privacy.

TECHNOLOGY AND EDUCATION

8.15 That government ensure the investment in the BCeSIS system to finalise its installation and provide as rapid implementation as possible.

CAPITAL AND INVESTMENT

8.16 That the provincial government expand the SR&ED program to provide the provincial refundable tax credit to all companies in BC.

8.17 That the provincial government work with the federal government to remove any administrative and fiscal constraints that hinder foreign capital investment into BC's companies and venture capital pools.

8.18 That the provincial government work with the federal government to recognise tax-exempt corporations under the Canada/US Income Tax Convention to encourage foreign capital investment into BC, and Canada in general.

POWER TECHNOLOGY

8.19 That the government support and implement the initiatives outlined by the Alternative Energy and Power Technology Task Force.

NEW MEDIA

8.20 That government support and invest in the development of the Master of Digital Media program and the World Centre for Digital Media located at the Great Northern Way Campus.

7th Report

DIGITAL DIVIDE

7.1 That the provincial government work with the federal government to create a Joint Task Force with the expertise, authority and resources to provide broadband and related services to First Nations communities in British Columbia wherever reasonably possible. The Task Force must also have First Nations representation.

E-HEALTH

7.2 Define a provincial strategy and architecture for the Electronic Health Record and commit to its implementation. The PTC recommends that the provincial government:

- Give the highest priority to establishing architecture for the Electronic Health Record, giving consideration to the best industry practice using Internet technology. A defined EHR solution that aggregates existing information in the healthcare system will determine the appropriate standards and interface to ensure that the evolution of systems are properly directed.
- Ensure that the EHR strategy incorporates features to empower patients to better manage their own health and to interact with the health care system electronically.

7.3 Create a business model and data exchange standard to integrate the EHR with private practice physicians' internal Electronic Medical Records (EMR). To do this, the Council recommends:

- That a task force be established to determine a single business model and data exchange standard that will allow electronic information exchange with private practice physicians and their internal EMR while respecting patient privacy rights. Priority should be given to the electronic delivery of information to private practice physicians (for example, to improve chronic disease management), and the collection of private practice physician information should be deferred until a definitive plan is determined.
- That this strategy and business model incorporate a method to encourage private practice physicians to acquire broadband network connections for their offices, principally via demand for the "content" made available from the health authorities EHR.

7.4 Establish preferred standards for the regional implementation of clinical systems and give priority to optimising clinical workflow on an enterprise basis across regions, as distinct from workflow bounded at each facility. To do this the Council recommends:

- That the eHSC and its working committees establish a policy for the preferred architecture for the deployment of clinical systems, as a basis for making future investments and joint procurement purposes.
- That the health authorities give priority to adopting the preferred architecture and undertake projects to optimise workflow within the next three years.

7.5 Continue infrastructure investment. The PTC recommends that the provincial government:

- Complete broadband network services to acute care facilities, expand the network to all government-managed

care facilities, and consider a network platform that connects service provider groups within the health authorities.

- Invest to execute on the strategy for a client registry with the ability to uniquely identify each client. This will provide a critical resource for the establishment of the Electronic Health Record. Furthermore, collaboration managed through the eHSC should establish operational methods to add new persons to the client registry and to manage identity records efficiently. The client registry should be considered as a resource for the potential integration of client identity for other social services.
- Continue to invest in the execution of its implementation plan for the provider registry, in consultation with the College of Physicians.
- Invest in the continuing development of a detailed architecture and operational plan built on the common "active directory" security access standard. This would be used to develop a comprehensive system access standard that will be inter-operable (single sign-on) across regional systems. It would also meet national security and privacy standards. Preference should be given to the harmonisation of regulations with the standards primarily adopted by major software systems.

7.6 Continue to develop telehealth initiatives. The PTC recommends that:

- The relevant agencies move expeditiously to expand fee codes to cover all billing categories, except where there is a specific medical reason where they should not apply.
- Under the guidance of the eHSC, there be continuing evaluation of opportunities to implement specific telehealth services that achieve positive clinical and economic outcomes.

7.7 Governance and management. The PTC recommends that the leadership of health authorities and Ministry of Health Services collectively:

- Place priority on collaboration to achieve significant progress in the development of the e-health system.
- Ensure that development of the e-health architecture is within the context of best industry practice, and also establish a process of independent evaluation of the effectiveness of all e-health technology deployed.
- Invest in resources to effectively lead the process of change management of a system required to successfully implement technology that will automate the delivery of healthcare in the province.

IT PROCUREMENT

7.8 That the provincial government continue its procurement reform initiative in cooperation with industry to ensure the most effective process possible. It should consider the issues and the suggested solutions identified at the procurement symposium and further examine those that did not receive due attention.

CAPITAL AND INVESTMENT

7.9 The PTC recommends that government continue its existing programs under the *SBVC Act* and work with federal government to secure federal funding for the program.

HUMAN RESOURCES

7.10 That the provincial government work with industry to develop an accurate inventory of the province's current and projected technology sector skills and then execute on strategies designed to close critical skills gaps that impair growth of designated technology clusters.

7.11 That the provincial government work with industry to develop immigration policy recommendations to the federal government targeted at attracting the senior management required to grow BC's technology sector.

7.12 That the provincial government work with industry and the federal government to define modifications to the *Income Tax Act* that would improve industry's ability to attract top senior talent to BC's technology sector.

POWER TECHNOLOGY

7.13 The PTC recommends that the government pursue the strategies outlined in the report (*A Vision for Growing a World-Class Power Technology Cluster in a Smart, Sustainable British Columbia*) to advance the power technology industry and secure BC's position as a world leader.

NEW MEDIA

7.14 That the government work with industry to extend the DAVE tax credit to include the new media sector.

7.15 That the government establish a world class, graduate-level program in digital entertainment technology.

6th Report

DIGITAL DIVIDE

6.1 The PTC recommends that government:

- Keep up the momentum to extend broadband to the remaining communities as quickly as possible.
- Work with communities to identify last mile solutions.

INDUSTRY DEVELOPMENT

6.2 The PTC recommends that government:

- Recognise and support the important role that regional technology councils play in fostering innovation and small business development within their region.
- Support the formation of a regional technology council in the Northwest.
- Provide incentives to encourage growth and development of technology companies in the regions.
- Market the technology innovations and opportunities for the province as a whole through Leading Edge British Columbia.

E-LEARNING

6.3 The PTC supports the PLNet initiative and recommends that its installation and capacity review continue to receive top priority to ensure it has the ability to meet ever-expanding needs.

6.4 The PTC recommends that government, through the Ministry of Education, in cooperation with industry and the school districts, support the goals and financing needs of BCEd Online, and that the Ministry continue to monitor and promote the expansion of its activities to all school districts in the province.

6.5 The PTC recommends that the Ministry of Education:

- Continue research in e-learning for K-12 to include funding for school districts to use IP video and other telecommunications technology delivery systems.
- Conduct education programs for teachers to provide them with the skills necessary to utilise e-learning technology.
- Promote the use of technology in school districts.
- Continue to work with other provinces to research, evaluate and test, and cost-share in the implementation of e-learning strategies in the provinces K-12 system.

6.6 The PTC recommends that the Ministry of Education investigate providing a capability to encourage and assist students to enter high-tech careers. The Australian Skills Hub distance learning program, located on the web at www.itskillshub.com.au, is a good example of a resource that has been very successful.

6.7 The PTC recommends that government, through the Ministry of Advanced Education, continue to encourage and support the BCcampus initiative as the leading organisation to promote e-learning concepts at the post-secondary education level.

6.8 The PTC recommends that government, through NetWork BC, in cooperation with other ministries, lead a process whereby a comprehensive and focused team (possibly federal/provincial) work with First Nations to address digital divide issues and government services such as e-learning and e-health.

6.9 The PTC recommends that the government work with BC universities, both the federal and provincial governments and large and small business to promote the establishment of an R&D facility to advance the e-learning industry in BC.

E-HEALTH

6.10 The PTC recommends that government support the adoption of a fee code structure that allows health care providers to bill for e-health procedures.

6.11 The PTC recommends that the government establish a governance structure dedicated to the development and implementation of the EHR. Its structure and accountabilities would involve the following:

- A pre-determined term (24-36 months, for example) be set, and clear, reasonable success criteria developed.
- A team leader who is a member of the ministry executive reporting to the deputy minister.

- Positioning so that it is acceptable to the entire community (the health ministries, health authorities and practitioners).
- A direct link between the success of the team and the success of the EHR implementation.
- A funding model utilising resources from other bodies such as Canada Health Infoway. The model must allow for central decision making on the common or province-wide EHR infrastructure but also provide continued funding for specific health authority equipment and software.
- An advisory group with members from the ministry, health authorities and practitioners to guide development activities.

CAPITAL AND INVESTMENT

6.12 The PTC recommends that government expand the tax credits under the *SBVC Act*. Further, government should change appropriate regulations so that the tax credits exist as a total allocation over multiple years and unused credits can be transferred between programs.

HUMAN RESOURCES

6.13 The PTC recommends that government, through Leading Edge British Columbia, undertake special marketing initiatives to assist in recruiting talent for high-tech companies throughout the province.

ALTERNATIVE ENERGY: FUEL CELL

6.14 The PTC recommends that government build on the record of success and work with the energy technology sector to complete the "Hydrogen Highway™" prior to the 2010 Olympics and to further develop the sector.

5th Report

CAPITAL AND INVESTMENT

5.1 That the provincial government extend the British Columbia SR&ED tax credit program beyond its current expiration date (September 1, 2004) and make it an ongoing program with periodic reviews.

5.2 That the provincial government initiate an advocacy program with the federal government to:

- Review and modify the rules within the SR&ED program that restrict tax credits to companies having investment from public companies and/or non-residents. This would ensure that firms that have obtained capital from legitimate sources are not being excluded from other important and appropriate financing sources.
- Review and modify restrictions in the program, mandated at a federal level, with respect to differences in the treatment of public (20% tax benefit carry forward) and private (35% tax credit carry forward) companies.

5.3 That the provincial government develop and implement an equity participation incentive to attract technology companies, senior management, key employees and head offices to British Columbia. The incentive must lower and/or eliminate the provincial tax payable on the exercise or disposition of stock options. The incentive would be applicable to:

- All employees who are residents of BC at the end of the calendar year and file for a BC tax return,
- All forms of equity compensation such as stock options and restricted stock, and
- The gain in value between the fair market value on the date of grant and the price on disposition.

The incentive would provide a tax credit equal to 50% of the provincial tax payable if the option is held for greater than 1 year but less than 2 years and a tax credit equal to the provincial tax payable if the option is held for more than 2 years.

5.4 That the provincial government work with the federal government to explore the issue of double taxation by nations whose citizens are working in Canada and ensure that all parties honour both the intention and letter of the appropriate treaties, and that the federal government, when acting upon new tax treaties, pay particular attention to double taxation clauses.

5.5 That the provincial government work with the federal government to extend the loss carry-forward provision from the existing 7 year period to 20 years (the newly enacted US limit).

5.6 That a thorough review of all regulations and taxation involved with foreign pension and investment fund investment in venture capital and entrepreneurial growth business be undertaken by the province in cooperation with the federal government.

5.7 That the provincial government undertake a study to investigate the under-investment of pension funds and other investment portfolios in venture capital,

determine the key drivers (particularly educational and training) that would enhance such investment, and work with the venture capital industry and appropriate industry associations to encourage and/or secure further investments by such portfolios in venture capital funds within the province.

5.8 That the provincial government remove the individual annual limit in the provincial *Income Tax Act* for angel investors in eligible small businesses under the *Small Business Venture Capital Act.*

5.9 That the provincial government develop programs to focus on attracting and/or building 2 to 3 new, venture capital funds per year, staffed with experienced venture capital players, in British Columbia. The new funds would be required to:

- Be associated with a top tier world class venture capital player that is establishing a new fund in BC,
- Be a new fund primarily directed at investment in BC which counts among the principals in the new fund individuals with extensive venture capital experience.

Any new funds must:

- Establish their funds locally: a BC office and general partners in BC,
- Target its investments in BC companies, and
- Raise private capital before accessing the BC programs.

5.10 That immediate steps be taken to identify an appropriate and targeted campaign for creating greater awareness of British Columbia as a high technology jurisdiction and to make clear the entrepreneurial opportunity that lies within it. The campaign should be designed to be undertaken with existing provincial high technology and biotech players so that it benefits both the companies and the region.

5.11 That the provincial government work with the venture capital industry, successful high technology and biotech businesses, and appropriate trade associations to host small group meetings in the key investment centres of New York, London, Boston, Frankfurt and San Francisco.

5.12 That the provincial government work with industry and the financial and academic communities to invite the management teams of the top 20 global venture capital and private equity funds to visit the province on fact-finding tours. This should be executed within the year, in an effort to build momentum in the venture community.

5.13 That the provincial government work with the universities and institutes to ensure that British Columbia is receiving its fair share of federal funding for innovation, as well as any available industry funding. In addition, the PTC recommends the province work with industry and the academic sector to ensure that BC-based companies, or those having significant satellite plants in the province, are actively investing in innovation in the province.

HUMAN CAPITAL FOR AN INNOVATION ECONOMY

5.14 That the provincial government work with industry to develop a means to raise awareness of the opportunities available in an information-based economy and assist citizens to enter technology-related careers.

5.15 That the Ministry of Education continue to develop its K-12 e-learning strategy through the BCEd Online initiative to ensure that consistent, province-wide standards and content are developed and maintained.

5.16 That the provincial government fully implement the BCcampus initiative.

5.17 That the provincial government revise the definition of a "high technology professional" to provide:

- Enhanced clarity for employees and employers to minimise disputes and costly resolution processes.
- Greater clarity as to what occupational activities are included as opposed to defining specific occupational titles that limit interpretation.
- Inclusion of all occupational activities related to the full product and service life cycle, including sales and marketing.
- Clear inclusion of other high technology sectors such as new media, alternative energy (fuel cells), and biotechnology. The definition should also leave room to include new technologies as they emerge.

4th Report

THE PTC PRIORITY RECOMMENDATIONS

4.1 Continue to work to implement all previous PTC recommendations with priority consideration of the following by government in the coming year:

a. Broadband

Provide broadband services to all British Columbia communities. Work with the federal government to accomplish this in the next three years.

b. Government Operations - Telehealth

Make telehealth a top priority and continue work to adopt and implement common health information technology infrastructure and standards, and establish an e-Health Task Force.

c. Industry Development

1) Venture Capital -
Work to pass the PTC's previously recommended amendments to the *Small Business Venture Capital Act* (*SBVC Act*).

2) Promoting British Columbia -

Develop a provincial marketing strategy and take every opportunity possible to promote the province. This includes:

a) Marketing and promotion missions led by the Premier

b) A marketing and promotion plan developed from government analyses of the five key emerging industry sectors in British Columbia – information technology, life sciences, new media, alternative energy and wireless. The plan would provide for a sustained marketing effort of the province's technology industry and business climate. Among other things, it would include:

   i. Developing and executing a branding strategy and marketing plan for the British Columbia technology community.

   ii. Creating an inward-bound information centre for prospective corporate recruits to the province.

ALTERNATIVE ENERGY

4.2 Combine the strengths of the provincial and federal governments, industry and academia to develop and implement an aggressive British Columbia Fuel Cell Strategy that parallels and builds on a similar National Fuel Cells Strategy. Activities in the provincial strategy should include:

a) Enhanced support for research and development carried out by the private sector and in public institutions (in collaboration with industry).

b) Support for market focused demonstration projects in both public and private sector applications. This should include real life situations that validate product reliability and output, "ruggedize" the product, provide quality assurance data, and help manufacturers make the necessary alterations to earn commercial success.

c) The British Columbia government becoming an early adopter of fuel cell products. Government departments and crown corporations being real customers raises the profile and supports the development of markets.

d) Accelerate the development of harmonised codes and standards. Government and industry collaboration is necessary to remove regulatory obstacles to the introduction of fuel cell products and systems.

e) Incentives that support and reward growth and investment such as:

   1) Encourage the early adoption of fuel cell and related products and systems by providing fiscally neutral tax based incentives, such as the income tax payback approaches used in Michigan.

   2) Consider programs having an initial cost but longer term substantial savings to the treasury.

f) Development of infrastructure which includes building upon investments already made by BC Hydro and others.

g) Ensure the availability of a highly skilled, well-trained workforce. This involves conducting industry and government collaboration with secondary and post-secondary institutions to define and implement appropriate education and training at all levels in the post-secondary system.

REWARDING INNOVATORS IN THE PUBLIC SERVICE

4.3 Accelerate and reinforce desirable change in the public sector by adopting the Premier's Awards in all the proposed categories (leadership, service excellence, innovation and partnership), especially the innovation category.

3rd Report

IT PROCUREMENT

3.1 Examine the scope of its current procurement reform initiative to ensure it adequately addresses the unique nature of IT procurement and permits adoption of a benefits-driven procurement model based, above all, on the business objectives rather than the technology requirements of government.

3.2 Identify a senior government official to drive both a strategy and implementation process around IT procurement reform. This official will also be responsible for fostering development and adoption of new IT procurement tools and models; facilitating government-wide and industry education; and championing support throughout government.

3.3 Create a joint government and industry task group to address the wide range of issues associated with IT procurement reform, with particular attention to the prioritized list of issues and proposed solutions emanating from the Procurement Symposium as well as the larger list of tactical and strategic issues identified by the PTC during its consultative process.

3.4 Continue the momentum. Hold a follow-up IT procurement symposium within 120 days. The joint industry/government event should include a progress report from government outlining its response to the set of recommendations contained within this report, as well as future plans, deliverables, and timelines.

E-HEALTH

3.5. Establish an e-Health Task Force composed of both government representatives and health care professionals to address the recommendations arising from the e-Health Roundtable. In addition, the mandate of the e-Health Task Force would include:

- coordinating and leveraging current e-health initiatives, including clinical and educational telehealth projects;
- the implementation of an Electronic Health Record (EHR), in conjunction with other levels of government and across ministries. This standard EHR would be adopted by all Health Authorities, institutions and businesses providing health care services in the province;
- address the licensure, liability and billing issues and the resulting changes required to existing policy or legislation to enable health care givers to participate in telehealth; and
- conduct a community consultation

- process to identify specific telehealth applications that will address critical needs in each community.

VENTURE CAPITAL

3.6. To meet the acute need for seed and early stage venture capital within the province, the PTC strongly recommends that the proposed amendments to the *SBVC Act* be passed by the legislature prior to the beginning of 2003. Failure to do so will discourage and inhibit the facilitation of more early stage capital within British Columbia, and will put us further behind other jurisdictions.

Second Quarter Report

UTILIZING SPAN/BC NETWORKS

2.1 Upgrade and extend SPAN/BC so it is capable of delivering advanced broadband network infrastructure to the communities of British Columbia.

2.5 Find ways to open up SPAN/BC to allow communities to take advantage of the government's broadband infrastructure in those communities where the private sector is unlikely to provide high speed Internet access to citizens and businesses.

PRIVATE SERVICE PROVIDERS' NETWORKS

2.4 Investigate all potential levers including – but not limited to – aggregating public demand, so that it can prompt service providers to extend and update their current telecommunications network infrastructure.

2.6 Reform procurement policy to allow for flexible, creative and competitive procurement models that will stimulate the private sector to upgrade and expand their broadband network infrastructure, as well as encourage the entry of local service providers, such as community-based networks, into the marketplace. To this end, two or three communities should be identified as pilot sites for further detailed planning, and implementation.

2.7 Conduct a Request for Information that solicits vendor and community stakeholder reaction to these recommendations, and taps into the innovative and creative potential for public-private partnerships that exists in the marketplace.

BROADBAND - DEMAND AGGREGATION

2.2 Aggregate total public sector demand (including core government, health authorities, schools, etc) where feasible to upgrade and expand SPAN/BC so that it will be capable of providing next-generation broadband infrastructure to the communities of British Columbia.

2.3 Investigate fully the economics as well as the potential benefits or obstacles inherent in aggregating public sector demand.

PUBLIC ACCESS AVAILABILITY

2.8 Make sure that there is public access to the Internet in every community in British Columbia.

2.11 Develop a complete map-based inventory of all public access sites by community to determine if the levels of public access and location of sites are appropriate for the size and demographics of the population.

2.14 Work with the First Nations of British Columbia and the federal government to bring information technology, including public Internet access, to remote First Nations communities in British Columbia.

2.15 Determine if the province's 58 sCAT locations and if existing PLNet facilities could be used by the public to access the Internet.

PUBLIC ACCESS SUSTAINABILITY

2.9 Work closely with the federal government to coordinate the allocation of scarce public dollars for public access.

2.10 Find ways to sustain existing public access sites in the province and meet the growing public demand by increasing, where necessary (based on demographics and usage patterns), the number of sites, the number of public access terminals, the available bandwidth, and the hours of operation.

2.13 Increase staffing levels at public access sites through programs like Youth@BC, through partnering with Industry Canada's CAP Youth program, or through use of the Labour Force Development Agreement with the federal government to train unemployed individuals to work at access sites

IMPROVE AWARENESS ON PUBLIC ACCESS

2.12 Improve awareness and visibility of public access.

PROVINCE-WIDE HEALTH IT STANDARD

2.16 Continue meetings between the executive of the new Health Authorities and the Ministry of Health Services and Ministry of Health Planning to discuss province-wide health information and information technology standards that will apply to all six Health Authorities as they move to restructure and consolidate.

2.17 Ensure each of the Health Authorities appoints a person to be responsible for information management and technology with the task of implementing the appropriate standards in collaboration with the Ministry of Health Services and the other health authorities.

2.26 Extend its standards beyond just ministries to its agencies and other government service providers.

Ensure that the designated chief information and technology officers of each authority work with the Ministry of Health Services and Ministry of Health Planning and other appropriate ministries to establish integrated technology standards province-wide. At a minimum these information and technology officers should:

2.18 Establish a consolidated provincial strategy for Health Information Management and Information Technology (IM/IT).

2.19 Adopt and implement common health information technology infrastructure and standards.

2.20 Evaluate and seize opportunities for moving towards shared services where practical and cost-effective.

2.22 Identify policy changes needed to support the electronic delivery and management of health services.

2.23 Recognise information technology development as a strategic investment.

E-HEALTH AND TELEHEALTH STRATEGY

Ensure that the designated chief information and technology officers of each authority work with the Ministry of Health Services and Ministry of Health Planning and other appropriate ministries to establish integrated technology standards province-wide. At a minimum these information and technology officers should:

2.21 Develop a provincial strategy to facilitate Telehealth and electronic health record initiatives in consultation with medical and continuing education units of the colleges and universities.

2.24 Facilitate the advancement of key e-health and Electronic Health Record initiatives.

2.25 Establish a British Columbia e-Health Think Tank composed of e-health visionaries, not senior IT staff, who will examine the applications side of e-health, since it will be compelling applications that drive down costs and improve the delivery of health services to the remote and rural regions of the province.

IT PROCUREMENT

2.39 The provincial government should expedite its efforts to rewrite its Policy and Legislative Framework around Procurement Reform so as to result in more streamlined, flexible, and cost-effective processes for both government and the British Columbia supplier community, ensuring fair and open procurement throughout the province. The government should also develop procurement policies and educational programs for both ministries and the supplier community which will provide British Columbia-based technology companies with the tools and skills required to compete more effectively for government contracts.

VENTURE CAPITAL - CHANGES TO *SBVC ACT*

Accelerating 'Early Stage' Technology Investment

The provincial government should proceed promptly with the following streamlining amendments to the *SBVC Act* to address the need for early stage capital investment in technology companies:

2.27 Expand the tax credit budget legislated under the *SBVC Act* from $50 million to $100 million annually.

2.28 Introduce an investment model under the *SBVC Act* that does not require the registration of a separate VCC to facilitate

investment and tax credits under the programs in order to allow direct investment, cut red tape and reduce program registration costs.

2.29 Increase the total amount of capital one business may receive under the program (beyond the current $3 million) to better reflect the capital needs of many early stage technology companies.

2.30 Increase the employee threshold limit for a small business from 75 to at least 150.

2.31 Allow approval for common investment regimen, such as multi-tranche investments over multiple years based on attainment of established milestones.

Leveling the Playing Field for Tax Credit Investment in British Columbia

The provincial government should enable small businesses and venture capital managers participating under the *SBVC Act* to raise and invest venture capital, with the assistance of tax credits, under the same conditions that are presently offered to the one Labour Sponsored Venture Capital Corporation (LSVCC) operating in British Columbia and other LSVCCs operating throughout Canada.
To achieve parity with labour sponsored funds, the task group recommends the following amendments be made to the *SBVC Act*:

2.32 Allow program investors the option to invest directly from their self-directed retirement savings plans.

2.33 Make the tax credit incentives available for program investment within 60 days after the calendar year.

2.34 Increase program flexibility in program capital investment beyond simple common or preferred shares.

2.35 Provide VCC investors up to 24 months to complete investments.

2.36 Open up the tax credits provided to the sole LSVCC to competition by allowing other venture capital firms to enter the market to create a more dynamic venture capital community.

RESEARCH AND DEVELOPMENT

2.37 The provincial government should take steps to create an e-learning chair at one of BC's universities.

ATTRACTING TALENT TO BRITISH COLUMBIA (RECRUITMENT)

2.38 The provincial government should work with the federal government to change immigration rules so that spouses of employees moving to British Columbia can work here automatically.

BRITISH COLUMBIA PROVINCIAL BRANDING

2.40 Develop a provincial branding and marketing strategy that feature technology and innovation as key drivers supporting British Columbia's image as a place with a sustainable and vibrant economy, including resource and knowledge-based industries, and an unparalleled quality of life.

2.41 Develop a strong macro-image positioning British Columbia as a desirable technology destination for investors, employees and site selectors.

2.42 Develop and execute its provincial branding strategy in consultation with the technology community.

MARKETING BRITISH COLUMBIA

2.43 Target its technology industry marketing effort at key audiences that include decision makers in technology investment, site selection and highly skilled workers.

2.44 Focus its technology industry marketing strategy initially on four sectors known as areas of strength within the province: biotechnology, wireless, alternative energy and new media.

2.45 Focus its marketing strategy to attract highly skilled workers or those individuals that may be predisposed to move to Canada such as expatriate Canadian and British Columbia technology workers and members of communities that are already represented in British Columbia.

First Quarter Report

PUBLIC AWARENESS ON THE BENEFITS OF E-GOVERNMENT

1.8 Educate British Columbians about the benefits of being fully connected, including access to relevant Internet-based applications and information, and increasing e-government services.

RESEARCH AND DEVELOPMENT

1.1 Double the number of computer science and electrical engineering graduates from British Columbia post-secondary institutions.

1.2 Establish 20 British Columbia Research Chairs in the fields of medical, social, environmental, and technological research.

ATTRACTING TALENT TO BRITISH COLUMBIA (RECRUITMENT)

Attract senior professionals to accelerate industry growth by:

1.3 Making changes to immigration policy.

1.4 Establishing an Info-Office to aid in the recruitment of out of province technology workers and relocation of technology companies to British Columbia.

1.5 Implementation of a competitive provincial stock option program for British Columbia workers.

1.6 Resolution of cross-boarder security issues with the US.

MARKETING BRITISH COLUMBIA

1.7 Establish a domestic and international campaign to promote British Columbia's quality of life, superior infrastructure, education system, technology community and business-friendly environment.

Appendix C. PTC Members, Staff & Acknowledgements

PTC Members

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