

Forward

The Bio-Economy Committee was formed in July 2011 to provide advice to Honourable Pat Bell, Minister of Jobs, Tourism and Innovation, on whether there are opportunities for British Columbia (BC) to capitalize on the emerging bio-economy and, if so, what opportunities exist for government to both accelerate the growth of the new bio-economy in this province and to derive greater sustainable economic value from BC's biomass resources. The Committee was composed as follows:

John Yap (Chair)	Parliamentary Secretary for Clean Technology to the Minister of Energy and Mines; MLA Richmond-Steveston
Bob Simpson	MLA Cariboo North
Ron Cantelon	MLA Parksville-Qualicum
John Rustad	MLA Nechako Lakes
Eric Foster	MLA Vernon-Monashee

This report provides a snapshot of the wide range of activities underway across the province and around the world in this emerging sector. The report is intended as a quick scan of the business and economic factors at play and does not represent a comprehensive study of all possible activities under the bio-economy umbrella. From a review of literature and research and from direct engagement with industry and academia, the Committee concluded that there is an urgent need for government to take a leading role in the further development of BC's bio-economy and has formulated a set of recommendations for government to hasten productive economic development of BC's bio-economy sector.

I would like to express thanks to the members of the Bio-Economy Committee for contributing their time and energy to this review. The Committee would also like to express its gratitude to all of the members of industry and academia who made time in their busy schedules to engage with us and provided their perspectives and insights on this important topic. We would especially like to thank Honourable Pat Bell and Deputy Minister Dana Hayden for their foresight and initiative in forming this committee and moving the province towards a position of greater leadership and innovation in the sector.

Sincerely,
John Yap
Chairman, Bio-Economy Committee

Table of Contents

Executive Summary.....1

Introduction3

BC’s Bio-Economy4

 Forest Sector 4

 Wood Pellets 6

 Other Sectors 7

 Agriculture..... 7

 Life Sciences & Clean Technology 7

Other Jurisdictions8

 Ontario 8

 Alberta..... 9

 USA..... 10

 Europe 11

 Finland..... 13

Industry Engagement15

 Our Inquiry 15

 The Response 16

 Vision 16

 Fibre 17

 Technology 18

 Markets 19

 Infrastructure 20

Recommendations22

Appendix A – Committee Engagements 26

Appendix B - References 33

EXECUTIVE SUMMARY

In July 2011, the Bio-Economy Committee (Committee) was formed under the direction of Honourable Pat Bell, Minister of Jobs, Tourism and Innovation (JTI), and tasked with assessing the opportunities for accelerating the growth of the bio-economy in British Columbia (BC). This report provides the findings of the Committee's assessment and presents recommendations for action by the BC government on how we might accelerate the development of BC's bio-economy.

The global economy is attempting to find ways to break its addiction to fossil fuels and develop an economy based on renewable raw materials and energy sources. Biomass is being actively explored as a possible fossil fuel substitute in many jurisdictions. British Columbia is blessed with an abundance of natural resources encompassing both the fossil fuel economy (coal & natural gas) and the bio-economy (forests, marine and agriculture). The question is not *Do we have bio-economy opportunities?* There are ample opportunities all around us. While some progress has been made in recent years, with a focus on developing energy products, it is now widely recognised that energy products are at the low end of the value spectrum of potential bioproducts. The Committee believes that significantly more can be done to develop higher value bioproducts and to create a stronger, more diverse bio-economy in BC.

Likewise, it is not a question of *Should we pursue these opportunities?* The province has already committed to aggressive climate change goals. If we are to sustain and improve our strong economic position, there is no choice, we must transition our economy to a more robust and diverse bio-economy. We must also shift our productive capabilities from being predominantly a supplier of low value raw material commodities to being producers and developers of higher value sustainable bio-products.

Based upon our initial macro assessment of the activities and opportunities in BC, the Committee strongly recommends that government take a more active leadership role in the rapid development of our bio-economy. Specifically, we believe timely action is needed in five key areas:

- 1. Establish a clear, long-term bio-economy vision.** The government must take the lead in the development of a comprehensive, long-term vision for BC's bio-economy. This vision must provide a clear roadmap and guide for the evolution of this sector and must be integrated into major provincial goals and initiatives (such as: Jobs Agenda, Climate Action Plan, BC Energy Plan, Gateway Strategy, etc.) to ensure complementary efforts and to capture synergistic opportunities. It must be based on where we want our communities and our forests to be several decades from now. The vision must also have, as a core principle, a collaborative approach to the development of this sector, as collaboration between BC's existing forest products industry and the emerging bioproducts industry is the desired path to success.
- 2. Improve access to fibre and feedstock.** Government must facilitate a productive dialogue between the existing wood products industry and the existing and emerging bio-economy sector with a view to addressing the critical and complex issues related to securing access to forest biomass. Additionally, more options should be explored for improving the alignment of government's systems for allocating and accessing fibre with our goals for fibre utilization and bio-economy development. Government must also commit resources toward developing a robust inventory of the nature and location of BC's biomass feedstocks; starting with BC's forest biomass resources and expanding this inventory to include municipal solid waste, agricultural, marine and other biomass sources as quickly as possible.

BC BIO-ECONOMY

3. **Establish a technology development strategy.** Based on BC's Bio-economy vision and the analysis of BC's biomass resources, develop a clear technology strategy that will focus government, university and industry research and development activities and align government's funding efforts with its vision. A critical component of this strategy must be early identification of niche markets that BC is well positioned to exploit and a plan for taking advantage of these opportunities. Develop a culture around eliminating waste and use efficiency gains as an avenue to drive innovation and the creation of new value streams.
4. **Develop markets for BC bioproducts and aggressively market BC's advantages.** Build on the success of the Wood First Initiative and BC's China Trade & Investment Strategy to promote BC bioproducts both domestically and abroad. BC's leadership in sustainably managed forests should be highlighted and promoted for the premium value it provides to all of our forest products. It will be critical to leverage government purchasing power as a tool to create initial markets for new innovation and to align product development with provincial policy and vision. The Mountain Pine Beetle (MPB) epidemic presents an opportunity for the province to make fibre available and to test collaborative approaches and innovative technologies that can be applied to assist the overall development of BC's bio-economy sector.
5. **Integrate the bio-economy's infrastructure needs into provincial initiatives.** Developing the means to get our bioproducts to global markets in a safe, efficient and cost effective way will be critical to our overall competitiveness. The government should foster the development of cluster projects that will integrate bio-economy activities in a manner that will improve efficiency, eliminate waste, meet community needs and contribute to the achievement of provincial goals. A workforce development strategy must also be devised to give direction to BC's post-secondary institutions. As part of a collaborative approach to the development of the bio-economy the government should take advantage of existing organizations and networks (such as: NSERC BioConversion Network, Sustainable Chemistry Alliance and our own Fibre Connection BC Network). Whenever possible, government should leverage both the work and the resources being applied to bio-economy advancement around the world in order to stay on the forefront of these developments while maximizing the utility of our limited financial resources.

The Committee also recommends establishing a Bio-economy Team that will formulate and articulate the bio-economy vision for BC. Once this vision has been developed and accepted then resources and responsibilities can be assigned to ensure its successful execution.

The Committee believes there is a sense of urgency for BC to take strong action toward developing its bio-economy in order to provide positive signals to the market and to stakeholders and to help ensure that the competitive advantages we hold today are maximized for the benefit of all British Columbians.

INTRODUCTION

In July 2011, the Bio-Economy Committee was formed under the direction of Honourable Pat Bell, Minister of Jobs, Tourism and Innovation (JTI), and tasked with assessing the opportunities for accelerating the growth of the bio-economy in BC. The Committee was supported by staff from JTI, Ministry of Forests, Lands and Natural Resource Operations (FLNR) and Ministry of Energy and Mines. In carrying out their assignment, the Committee: performed a literature review; identified thought leaders and key individuals across government, in industry, in non-governmental organizations and in academia; and, then engaged directly with those key individuals to learn their perspectives on the bio-economy in BC and around the world.

This report is a snapshot of the wide range of activities underway across the province and around the world in this emerging sector. The findings of the Committee's assessment are presented along with recommendations for action by the BC government on how we might accelerate the development of BC's bio-economy. The report begins with a review of current bio-economy related activity underway in BC and some highlights of significant bio-economy activity happening in leading jurisdictions around the world. Following that is a short description of our method of inquiry and a compilation of responses. The report condenses the responses into major themes and summarizes the key messages. However, a broad sampling of actual comments has been included under each theme to provide the reader with more direct insight on the messages heard.

Finally, the report provides recommendations to government, organized in the same key areas as used in structuring received responses. Both broad recommendations and some ideas for specific action are provided in each category.

Before we can start to talk about the bio-economy we first must define a few key terms that are important to the discussion. For the purposes of this report, we have adopted the following definitions:

Bio-economy refers to the utilization of biological systems to achieve sustainable economic objectives.

Bioenergy is energy which comes from any fuel that is derived from biomass - recently living organisms or their metabolic by-products. Unlike other natural resources such as petroleum, coal and nuclear fuels, bioenergy is a renewable energy source.

Biomass is renewable organic matter from crops, trees, wood chips, aquatic plants, agricultural and municipal waste. Biomass is any type of organic material that is available on a renewable or recurring basis. It may come in the form of raw material or primary crops, by-products left over from a variety of activities and industrial processes or waste material.

Bioproducts are products made from renewable resources (Biomass) and/or biological processes primarily from Agriculture, Forestry, Marine, and Municipal Waste to provide biofuels, bioenergy, biomaterials, and everyday household or industrial products.

Biorefinery is a facility that integrates a variety of technologies to convert Biomass into bioproducts such as bioenergy, biofuels, biogas, and other biomaterials.

BC BIO-ECONOMY

Biotechnology (sometimes shortened to "**biotech**") is a field of applied biology that involves the use of living organisms and bioprocesses in engineering, technology, medicine and other fields requiring bioproducts. Biotechnology also utilizes these products for manufacturing purposes.

The word *bio-economy* covers a very broad range of activities, touching on nearly every aspect of society. For practical reasons, the Committee has focused its assessment of bio-economy opportunities in BC by looking first at the utilization of forest biomass, while remaining cognizant of major activities in other areas.

Biotechnology is revitalizing established Canadian industries, including healthcare, automotive, agriculture, forestry and even traditional manufacturing. According to LifeSciences BC:

“Bioproducts and Bioenergy are sub-sectors within an emerging field of industrial biotechnology, and represent estimated markets of \$175 billion for Bioenergy and \$200 billion for Bioproducts. By 2030, clean energy technologies are estimated to value \$1 trillion. In British Columbia, the renewable energy sector already generates over \$1.9 billion in revenues and accounts for over 18,000 jobs. PricewaterhouseCoopers has identified British Columbia as the 3rd largest Renewable Energy Sector in the world behind California and Germany.”

BC's BIO-ECONOMY

In BC, government, academia and industry are pursuing the bio-economy from a variety of perspectives. Groups such as [Genome BC](#), [LifeSciences BC](#), [ARDCorp](#), [FPIInnovations](#) and the [BC Bioenergy Network](#) are all exploring new technologies and applications through collaborative, dynamic networks.

Until very recently, the provincial drive into the bio-economy for the forest sector was predominantly energy focused. The 2008 [BC Bioenergy Strategy: Growing Our Natural Energy Advantage](#) established a plan of action for leadership in the area of bioenergy. Integral to the Bioenergy Strategy was a projection for bioenergy technology development over time which envisioned a migration from low value energy products to higher value biorefining operations.

The Bioenergy Strategy has achieved some success and efforts continue today. This work has made it clear that in order to accomplish our goals we will need: government commitment at the highest levels, significant allocation of funding through multiple measures, government led cross-sector coordination and implementation supported by legislative and regulatory change. The measures taken to date have been narrowly focused on energy products and energy production. To achieve our full potential in the bio-economy, new measures aimed at realizing higher value bioproducts are required.

Forest Sector

In the forest sector alone, over 800MW of green power generating capacity now exists. The [BC ENERGY PLAN: A Vision for Clean Energy Leadership](#), the Bioenergy Strategy and the *Clean Energy Act* together have produced the following results:

- Created the BC Bioenergy Network (BCBN)
- >1,600 gigawatt-hrs/year new bioenergy power production through BC Hydro power calls
- Promotion of bioenergy and liquid biofuels through Innovative Clean Energy (ICE) Fund calls

BC BIO-ECONOMY

- Facilitated improved access to wood fibre with legislative changes to the *Forest Act*
- Started the process of bringing bioenergy (heat & power) to remote communities
- Developed bioenergy opportunities in First Nations Communities through the First Nations Clean Energy Business Fund and through the efforts of the BCBN (Kwadacha First Nation recently received \$40,000 to develop the Kwadacha Community Biomass Project to help meet the community's power needs and replace the existing diesel power supply)
- Enacted *Greenhouse Gas Reduction (Renewable and Low Carbon Fuel Requirements) Act* and associated Renewable and Low Carbon Fuel Requirements Regulation

BC's forest sector offers great opportunity in the bio-economy with both a vast supply of primary material and decades of industry knowledge in the processing of wood fibre. Wood fibre is composed of three main components: cellulose, hemi-cellulose and Lignin. In recent years, spurred on by developments in Europe, Forest Products Association of Canada (FPAC), FPInnovations and Council of Forest Industries (COFI) have made a strong collaborative effort to identify the technical and economic opportunities available to forest sector companies to convert wood fibre and its components into high-value product streams. Significant federal and provincial funding has supported this Biopathways work.

Biopathways set out to answer some of the fundamental questions underlying bio-economy opportunities in the forest sector, including:

- What raw materials does BC have to support new bioproducts? And where are they best tapped into in the current forest products supply chain?
- What technologies are proven and available today? And which ones are just now being developed?
- Where are the high-potential markets for new bioproducts? What scale of operation is required to make bioproducts production operations competitive?
- What is the business case for action?

By taking a set of 36 demonstrated, commercially viable technologies and mapping them against the traditional forest sector supply chain, the investigation revealed a number of production opportunities. The study then explored potential markets for the new bioproducts to determine appropriate scale and pricing and finally applied the results to operational scenarios to determine where a strong business case existed for various types of forest product operations.

In fiscal year 2011/2012, under contract by JTI, FPInnovations will drill down even further, applying the Biopathways work at the mill level across BC and developing an opportunity set based upon the actual conditions of BC forest operations.

In addition to supporting technology innovation, the Ministry of Forests, Lands and Natural Resource Operations has been facilitating the bio-economy as part of its core mission. FLNR's strategic objectives around the utilization of forest fibre include:

- Increasing the economic value and yield from Crown forests.
- Enhancing forest management through increasing the use of currently underutilized wood fibre and minimizing unused harvest residuals.
- Encouraging business-to-business arrangements that enhance the flow of fibre to those that can utilize it.

BC BIO-ECONOMY

- Promoting sustainable forest management policies by ensuring a close linkage between allowable harvest levels and actual harvested volumes.

These objectives are being pursued through a number of avenues, including: supporting research into evolving bio-economy opportunities; supporting initiatives that connect fibre users with fibre sellers; and offering a collection of new forest tenures and related tools that support the solid-wood, pulp and paper, oriented strand board and bio economy sectors.

In 2010, the Fibre Connections BC (FCBC) Network was formed to link fibre suppliers, manufacturers and investors with each other. FCBC helps improve the flow of fibre from harvesters and other producers to the highest-value processors by linking people and facilitating business-to-business transactions. The network is supported by more than 60 Fibre Officers across the province.

Wood Pellets

Wood pellets are a relatively recent phenomenon for BC's forest sector, developing, in part, in response to government's enforcement of its ban on beehive burners. Pellet production provided a revenue stream in place of a disposal cost for "waste" wood.

In 2009, global annual consumption of wood pellets was approximately 12 million tonnes. Eighty percent (80%) of that demand was in Europe. European Union (EU) 20/20/20 targets (20% reduction in GHG emissions; 20% reduction in energy consumption; 20% share of power from renewable by 2020) are driving an estimated need of 25-40 million tonnes of biomass annually by 2020. In Asia, China has estimated a requirement of up to 50 million tonnes of biomass annually by the end of their current five-year plan and Korea has mandated renewable fuel portfolio standards for its power producers, beginning at 2% in 2012 and steadily increasing up to 10% by 2020. Global utility companies are already coming to BC looking to secure long-term fibre supplies.

With 11 plants and almost 1.8 million tonnes/year of production capacity, BC pellet producers account for the majority of Canada's wood pellet production, and additional capacity is being installed. Almost all of BC pellet production is exported. Canadian pellets hold roughly 15% of the European market.

Technology will certainly play an important role in the pellet industry. Already numerous companies around the globe are developing proprietary technologies for torrefied or black pellets which promise higher energy densities, simplified handling and transportation, ease of use and lower capital investments for existing coal burning power plant customers. These technologies are on the immediate horizon and large global customers are just now in the process of choosing their technology paths. For most, black pellets hold great promise but have not yet demonstrated proven performance on a commercial scale.

Whether in the form of white pellets or black pellets, the demand for pellets is real, opportunities exists for extended off-take agreements, the technology (white pellets) is proven and capital costs are relatively low. All of these factors bode well for pellet producers but may create high barriers for other higher value bioproducts vying for the same fibre supply where capital costs, technology risks and market uncertainty are higher than those for pellets.

BC BIO-ECONOMY

Other Sectors

In addition to the Forest sector, Agriculture and LifeSciences play critical roles in our bio-economy. In much the same way as on the forest side, these sectors tap into BC research institutions and clean technology programming and funds to deliver innovative solutions.

Agriculture

BC's Agricultural sector is especially active in bio-economy development, from plant and animal genetics research to renewable energy generation to the creation of new bioproducts value streams. Activities include:

- Waste to energy feasibility & outreach; e.g. Bakerview EcoDairy's small-scale anaerobic digestion demonstration project
- Exploration of next generation biofuels production; e.g. Catalyst Power Abbotsford – biogas production and upgrading
- Non-food, non-energy high value product development; including \$1.5M Canada-BC Agri-innovation Program under the *Growing Forward* initiative
- Implementation of the Value Chain Development Fund
- BC 2010 *Forum on Food, Fuel and Fibre Systems* was the first cross-government event to focus on the interconnections and interdependencies which underlie our bio-economy. The forum highlighted the converging challenges and opportunities for BC and the related need for cross-sector, integrated systems-thinking; it was supported with participation from 10 ministries.

LifeSciences & Clean Technology

The Bioenergy and Bioproducts Sector of LifeSciences BC has been instrumental in: aligning the sector for collaboration; fostering international partnerships; promotion of British Columbia opportunities; and reaching out to support SME development and commercialization. The awareness and growth of the sector has matured very rapidly with the Canadian clean technology industry achieving a 47% compound annual revenue growth rate during the 2007 to 2009 recession, (2010 SDTC Cleantech report). Total revenues by BC Cleantech industry are forecast to increase by 57% from \$1.6 billion in 2008 to \$2.5 billion in 2011, (KPMG, June 2011, Cleantech Report Card report). The BioCleantech industry is an emerging sub-sector that represents approximately 15% of the total Cleantech economy.

The Clean Technology sector is strongly supported by the Ministry of Jobs, Tourism and Innovations' Investment Capital Branch which oversees the BC Renaissance Capital Fund, the Venture Capital Programs and the International Business Strategy.

B.C. Renaissance Capital Fund

Supporting the Clean Technology and Life Sciences sectors with approximately 70% of its investment portfolio in those sectors

- Funded through the BC Immigrant Investment Fund, which receives federal allocations which must be repaid 5 years after receipt. The Province provides a repayment guarantee of up to \$500M on these funds ; Funds are targeted for economic development and job creation in two main areas:
 - Public sector infrastructure investments – up to \$410M
 - Venture capital investments – \$90M

BC BIO-ECONOMY

- \$90M already committed by the Fund for investments in the Clean Technology, Life Sciences, Digital Media and IT sectors; these funds are invested in six professional fund managers, who manage over \$2.5B of capital
- To date, 15 B.C. companies have received investment of \$127M and employ 850 high-technology professional

Venture Capital Programs

Venture capital financing that supports early stage companies from BC. Since 2003, approx \$153m invested in 95 companies in the bio-energy / life science sectors

- The Programs provide start-up and expansion capital to small businesses engaged in the knowledge-based and value-added sectors of the economy
- Presently up to \$30M of tax credits each year are available to BC investors, which yields \$100M of investment for nearly 200 BC small businesses (based on 2010 activity)
- Approximately 40 of these businesses reside outside of Metro Vancouver and engage in value-added wood manufacturing, destination tourism, and environmental technologies

International Business Strategy

International Business Activity Act (IBAA) legislation and regulation assist select corporations, including Clean Technology and Life Science companies, with tax incentive that support business activity and the recruitment of foreign skilled workers.

OTHER JURISDICTIONS

Around the globe companies, governments and research institutions are focusing their gaze and their resources on finding natural, biological solutions to the major issues facing society (food, energy, health, economy and the environment). The range of measures taken by these organizations is not especially surprising but the magnitude of the efforts clearly indicates that the shift to a bio-economy is real, it is happening now and the results of these efforts are already being leveraged for global competitive advantage.

The excerpts below highlight some of the significant activity occurring in other jurisdictions and provide important contributions to this report in a number of ways. First, they clearly show that the bio-economy is real, its active and jurisdictions around the world are committed to making change, whether BC does or not. Second, it shows us that we are on the right path. Leading jurisdictions are asking similar questions, pursuing similar paths and exploring some of the same policy options that BC is investigating. Finally, it spotlights the opportunities we have as a province not only to capture important niche markets but also to work collaboratively with others right here in Canada, and around the world.

Ontario

- \$15 million to the Ontario Centres of Excellence for investments in lightweight and bio-based materials and the development of alternative fuels
- \$13 million for the Regional Innovation Networks (RIN) program, with five RIN's specifically focused on identifying opportunities for commercializing bioproducts
- \$21 million to Queens University for a regional convergence centre that includes a focus on bioproducts and bioprocessing

BC BIO-ECONOMY

- \$5.9 million for the Ontario BioCar Initiative to increase the use of biofibres and biochemicals in the auto industry
- \$6.25 million to the Ontario BioAuto Council to develop a province-wide R&D and investment strategy that will make Ontario a leader in auto parts made from bio-based materials
 - The Ontario BioAuto Council, headquartered in Guelph, Ontario, is an industry-led, not-for-profit organization established in 2007 to link chemicals, plastics, manufacturing, auto parts and automotive assemblers with agriculture and forestry
 - The Council's membership includes large Canadian auto parts companies who manufacture and sell products around the world. Foreign membership is attracted from multi-national industrial biotechnology, chemical and agri-business companies wanting to partner with Ontario's manufacturing sector. Through these partnerships they hope to accelerate the commercialization of new technologies, build viable supply chains and grow global market demand. The Council also links industry with leading universities and provincial and international centres of research excellence in bioplastics and biocomposites.
 - With initial start-up funding of \$6 million from the Government of Ontario, the Ontario BioAuto Council established a Commercialization Fund in 2007. The fund helps to diminish the risk for companies commercializing bio-based products and processes using emerging green technologies (e.g. biotechnology, nanotechnology, green chemistry and material science).
 - BioAuto was a sponsor at this year's [Chem-Biobased Global Partnering Summit](#) in Houston, TX
- \$6 million to Lakehead University in Thunder Bay, which is building expertise in the bio-economy related to the boreal forest
- \$3 million to the University of Guelph to establish a research chair in bioproducts from agricultural resources
- \$7.5 million to the University of Western Ontario to support interdisciplinary research into chemicals and fuels made from agricultural resources
- [Green Fit](#) The Government of Ontario committed to leveraging its buying power to make Ontario more competitive, innovative, and sustainable. Through its own purchasing, the government is creating opportunities for new green technology companies as they introduce innovative and sustainable solutions into the local and global marketplace.

Alberta

- Investments of more than \$300 million in feedstock development, bioconversion technologies and product commercialization
- **Nine Point Bioenergy Plan** (\$239 million) The Nine Point Plan was specifically developed in 2006 to develop, expand and strengthen Alberta's bioenergy production capacity as well as leverage industry funds on commercialization and capacity building. Through this plan, industries have access to support for feasibility and capital costs as well as producer credits.
- **Alberta Biomaterials Development Centre** (ABDC) Established in 2009, ABDC is a provincial initiative with the mandate to establish Alberta as an innovation and commercialization leader in the growing field of agriculture and forestry-based biomaterials. ABDC helps companies bring products and services to market more quickly and efficiently through technology support, offering business development services and providing information on up-and-coming biomaterial markets. The centre is a joint provincial initiative between Alberta Advanced

BC BIO-ECONOMY

Education and Technology, Alberta Agriculture and Rural Development, Alberta Sustainable Resource Development and Alberta Innovates Technology Futures.

- **Climate Change Strategy**

The Climate Change Strategy established the following targets for Alberta:

- By 2020 – stabilize greenhouse gas emissions - 50 megatonnes reduction
- By 2050 – emissions reduced 50 per cent below business as usual level. This equals 200 megatonnes or 14 per cent below 2005 levels.

A number of goals and actions were included in this strategy, including the launch of the Climate Change and Emissions Management Corporation. Industrial emitters can contribute \$15 per excess tonne of greenhouse gas emissions into a fund managed by the corporation, which has resulted in more than \$260 million available to invest in clean technologies.

- **Biorefining Conversions Network**

Based out of the University of Alberta, the Biorefining Conversions Network (BCN) is an organization working to support provincial research communities in the areas of biorefining and biomass conversion technologies. By striving to form strong partnerships between academia and industry, the BCN promotes research programs that are structured towards achieving commercializable outcomes. The BCN's primary mandate is to play a pivotal role in cultivating Alberta's bio-industrial sector by facilitating development of novel, commercially viable biomass conversion technologies and value-added products.

- **Alberta Innovates**

To deliver on the research and innovation vision, goals and strategies of the Government of Alberta, four corporations and an advisory body were created on January 1, 2010. Established through the Alberta Research and Innovation Act, the five organizations, which include **Alberta Innovates: BioSolutions**, report to the Ministry of Alberta Advanced Education and Technology.

- BioSolutions

Value Chain Sustainability Research and Innovation Program

<http://bio.albertainnovates.ca/>

This three-year program with base funding of \$3 million was launched on August 12, 2011 by Alberta Innovates Bio Solutions and its funding partners aimed at increasing competitiveness and profitability of Alberta's agriculture and forestry sectors through decreased cost of production or increased value of products.

It is worth noting that Dr. John (Jack) Saddler, Professor of Forest Products Biotechnology/Bioenergy Former Dean, Faculty of Forestry, University of British Columbia is a member of the Board of Directors for Alberta Innovates: BioSolutions.

USA

- The scale of markets, portfolio of large corporations, skilled workforce, high caliber research institutions and tremendous economic resources available to government make the United States (US) a driving force in bio-economy development.
- Across the US, and especially in the southeast, there exist an abundance of readily available woody biomass. A suite of government measures, including at one point subsidies on harvesting and utilization, have made accessing forest biomass from government lands easier and more profitable.

BC BIO-ECONOMY

- Both the pellet industry and biomass power conversions have seen tremendous growth in recent times, with several new large-scale pellet operations in the range of 500K -750K tonnes per year output capacity. For export oriented businesses, east coast access provides a logistics advantage in serving European markets.
- The US federal government, as well as various state governments, have strongly incented liquid biofuels production. Large US pharmaceutical, agrichemical and petrochemical corporations are able to leverage their assets and infrastructure to build upon new technologies and new bio-economy opportunities. The Chemical industry is large, diverse and well networked globally. Green chemicals and bioproduct opportunities are being actively explored in nearly every sector of the chemical industry.
- The US is home not only to large producers but also to large domestic markets. Corporations such as Walmart, 3M, Boeing and General Electric are able to create market pull for new bioproducts and set new product standards that impact entire supply chains.

Europe

- In September 2010, the European Union issued the report [*The Knowledge Based Bio-Economy \(KBBE\) in Europe: Achievements and Challenges*](#). The report noted “It is estimated that the European bio-economy currently has an approximate market size of over 2 trillion Euro, employing around 21.5 million people, with prospects for further growth looking more than promising” and contained eight major recommendations (shown below). This provides a good general indication of both the current perspectives and future efforts on bio-economy in Europe.

KBBE Recommendation - 1. Need for an integrated policy for the KBBE

To achieve a competitive KBBE, broad approaches, such as creating and maintaining markets for environmentally sustainable products, funding basic and applied research, and investing in multi-purpose infrastructure and education, will need to be combined with shorter term policies.

KBBE Recommendation - 2. Research and innovation

- the level of R&D funding in the bio-economy should be increased through multidisciplinary research programmes at both national and European level.
- In addition, cooperation between private and public sectors should be a focus for further improvement.
- Special attention should also be placed on specific key areas, such as the development of efficient and robust enzymes particularly for the conversion of lignocellulosic material.
- Integration of the individual KBBE sectors should support pre-competitive research covering the entire value chain – from feedstock to end-product – as this will help to stimulate innovation and encourage the uptake of its results by the industrial partners involved.
- One of industry’s remaining major challenges is to translate research to products, including the development of new product applications.
- Stimulating the construction of demonstrators via public-private partnerships is one of the most important measures that can be taken in the development of the bio-

economy, as they are able to close a critical gap between scientific feasibility and industrial application.

KBBE Recommendation - 3. Toward economic-sustainable and innovative SMEs

- Spin-offs and high-tech SMEs are key for technology and knowledge development, and investing in research and innovation is the only way for these enterprises to survive
- One of the weaknesses of the many SMEs in the more “traditional” sectors (such as agriculture, forestry, aquaculture, food sector) is that many of them do not have the in-house technical skills to take up the results of innovation.
- Supporting tech transfer or stimulating SMEs to participate in “open innovation” programmes could therefore be a way to overcome this problem.

KBBE Recommendation - 4. Communication and education

It is of critical importance for the bio-economy to have a multi- and interdisciplinary work force, in order to ensure that it keeps up-to-date with new knowledge and techniques. There is therefore a need for multidisciplinary education, good international training programmes and efficient lifelong learning.

KBBE Recommendation - 5. A strong EU common policy for agriculture: the new CAP (post 2013)

- It is essential that the new CAP promotes sustainable and competitive agricultural production, and ensures balanced access to raw materials for the food and feed sectors, as well as for industrial applications, without disrupting food supply.
- The new CAP should ensure the possibility to maintain a competitive supply of raw materials that meets EU standards, notably in the areas of safety, environmental sustainability, and animal welfare.
- In order to stimulate the development of local biorefineries and to support rural development, it is important to develop and maintain a reliable upstream supply chain.
- It is also important to invest in local and regional infrastructures and in logistical capabilities to allow all biomass, including agricultural, forestry and waste-based raw material, to be utilized.

KBBE Recommendation - 6. Support reconversion towards low-carbon renewable-based production systems

Investments required for building a new bio-industrial facility - especially if it competes with the conventional one - might be a significant barrier to the development of the KBBE. For SMEs, such an investment might represent an even more difficult hurdle to overcome. Governments aiming to support biorefineries for reasons of environmental sustainability, energy security and innovation leadership will therefore need to support market growth, and carefully regulate the industrialization process in order to stimulate and encourage private sector investments.

KBBE Recommendation - 7. Policies stimulating the market for KBBE products

Decision makers can help provide the necessary motivation by implementing a regulatory framework of incentive based and demand stimulating policies. Mandates, subsidies and

incentives are provided by governments all over the world to stimulate the demand of sustainable bio-based products. The European Commission's Lead Market Initiative for bio-based products represents a good example of such a scheme and moving forward, this should be further developed and built upon. In the future, a similar initiative could be developed for the food sector or for the KBBE as a whole.

KBBE Recommendation - 8. Science based sustainability criteria

Sustainability criteria addressing the different KBBE sectors should aim to measurably reduce the key impacts associated with feedstock production, consumption and use.

Implementation of measures involve the active participation of all stakeholders involved in the supply chain. Recent developments in the biofuel sector in the EU will make it possible to use private standards to prove compliance with sustainability requirements. While some schemes have ambitious sustainability criteria going beyond the minimum EU requirements, most of these only address a fraction of the overall concerns. Wider sustainability concerns will need to be addressed by governments in partnership with the private sectors.

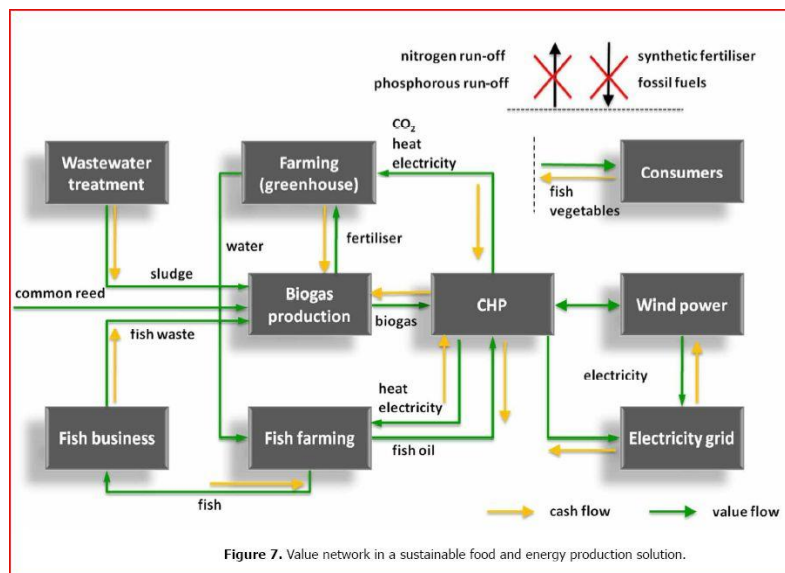
In addition, feedstock producing countries - especially in the global South - will need significant technical and financial support to implement adequate safeguards.

Finland

- In March of this year, [Sitra](#), the Finnish Innovation Fund, issued a report entitled [Sustainable Bio-economy: Potential, Challenges and Opportunities in Finland](#) which is remarkably similar, in its intent, to the bio-economy review undertaken by this Committee. Finland, with model biorefining companies such as [Borregaard](#), has long been considered a benchmark leader in biorefining and forest biomass innovation. The bullet points below are direct excerpts from the report and give excellent insight on another leading jurisdiction's assessment of and approach to the bio-economy.
 - "Since biomass has a lower energy density than fossil fuels, it limits the transport distance so that the refining or unit of consumption needs to be close to the source. The production facility also needs to be small because the amount of biomass within a transport radius is limited. However, the number of biomass sources is much higher."
 - "As a significant number of new biotechnology and cleantech solutions, which are the elements and basis for the bio-economy, are now being proposed, it makes it difficult to choose the direction of development on the country level and for financing institutions to make investment decisions. Therefore in the scope of this study the credibility of the bio-economy and its concrete elements, or solutions, is addressed."
 - "Thus, a bio-economic solution is credible if it has a well-grounded potential to be implemented and is sustainable according to all three dimensions of sustainability [social, economic and environmental]."
 - "The following supporting factors were commonly identified in the policies and reports on the bio-economy:
 - High-level political commitment

- Broad R&D support
 - Promotion of market pull by financial incentives and standard setting
 - Targets for government purchase of bio-based products
 - Knowledge sharing.
- It is important to underline that the research on industrial symbiosis shows that though a regulating force is needed to organise the waste and by-product exchanges between various companies, the major driving force is always the business interest. The role of trust should not be underestimated.”
 - Though the cooperation between various actors in the biotech industry is promoted, often the industry structure remains the same, focusing on single products’ development rather than bio-economic joint business models.
 - Taking biofuel plants as an example, the currently preferred scale and structure of the plants leave no chance for Finnish biofuel production to be competitive, since the transportation of biomass over long distances is not feasible. Therefore there is a need for local medium-sized biofuel plants, collecting the local biomass and producing value-added main and by-products, such as biofuels, fertilisers, medical products, etc. A bio-economy that is distributed has greater viability and is generally more sustainable, as there are less transportation costs involved. Another main characteristic that, according to Sitra (2011), should belong to the Finnish bio-economy is a tight connection to waste management, ensuring that there is a “double” benefit coming from utilising waste for value-added applications
 - The Natural Resource Strategy for Finland (Sitra, 2009) is acknowledging that Finland has significant amounts of biomass and the base for developing expertise in its efficient and high-value application. This strategy proposes that this is to be realised through four key strategic goals:
 - Finland has a thriving bio-economy generating high added value.
 - Finland utilises and recycles material flows effectively.
 - Regional resources generate both national added value and local wellbeing.
 - Finland takes initiatives and leads the way on natural resource issues.
 - These strategic goals set the requirement for a Finnish bio-economy to use the resources efficiently and to create high-value products. The idea of knowledge export is also repeated in the Natural Resource Strategy, showing that intangible value in the bio-economy is the key goal for Finland in order to stay competitive.
 - It was noted in the interviews with the companies involved in the focal bio-economic solutions that although funding for developing biotechnology is available, the need for research of business concepts and their integration in such solutions is underestimated and therefore poorly financed.
 - The companies that are striving to be key actors in driving the bio-economy need to develop business models that are outward-oriented. Rather than simply developing a technology or process and expecting other stakeholders to adapt, companies should develop services which will lower the threshold for other stakeholders to join bio-economic solutions.

A key objective for Finland is the development of a bio-economy which supports its rural communities. Sitra concluded that cross-sector integration and the development of bio-economy value networks would be a critical part of achieving their goal. They identified and explored a number of high-probability-of-success value networks. In each case, there is an integration of flows across social/industrial sectors and a design that meets multiple social/environmental/economic needs; always there is a focus on efficiency and the elimination of waste. The diagram below is an example of a bio-economy value network.



Source: Sustainable Bio-economy: Potential, Challenges and Opportunities in Finland

INDUSTRY ENGAGEMENT

In order to get both a broad perspective and specific insights on the issues and opportunities related to BC's bio-economy, the Committee engaged with a wide range of stakeholders through face-to-face meetings, conference calls and written correspondences (for international players where direct contact was impractical). The Committee heard from foreign and domestic forest products companies, chemical companies, leading academics, research institutions, financial institutions and venture capitalist, non-governmental organizations, community groups, major consultants, BC Hydro and government experts. A complete list of Committee engagements is provided in Appendix A.

Our Inquiry

Through these engagements, the Committee garnered the general perspectives from all those queried on: the bio-economy opportunities and issues in BC; the barriers preventing accelerated growth in this area; the utility of government's programs and services to date; and, input on the desired role of government going forward.

BC BIO-ECONOMY

Additionally, the Committee sought to leverage each group's or individual's specific experience and expertise to gain an in-depth understanding in key aspects of the bio-economy, such as: financing and investment; fibre supply; research & technology developments; skills & infrastructure requirements; global product markets & demand; and individual corporate strategies. A sample of the types of questions asked by the Committee is shown below:

- Are global investors looking to BC and are they aware of BC forest-sector opportunities?
- What measures by the BC government would make identifying and connecting with BC forest sector opportunities easier for potential investors?
- How can BC's government and BC's industry frame the opportunities that exist in BC to better attract partnerships and investment?
- Do local markets play an important role in industry's bio-economy efforts?
- How important is scale for forest biomass projects?
- What role has partnerships with companies outside of the forest sector played in your bioproducts development?
- What new measures by the BC government would be most useful with respect to accelerating or facilitating bio-economy investments in BC?
- What is the biggest barrier to new bio-economy growth and investment in the Agriculture sector?
- Is BC's forest sector motivated to pursue new bioproducts opportunities?
- Who are the leaders around the world in biorefining and forest fibre utilization?
- What should be government's role in facilitating cross-sector collaboration and partnerships for bio-economy development?

The Response

Naturally, the responses to our inquiries were as wide ranging as the questions themselves. However, the Committee observed some significant areas of commonality. The main, overarching comments received by the Committee have been aggregated into five key categories: Vision, Fibre, Technology, Markets and Infrastructure. The Committee recognizes that the issues at hand are complex, multi-dimensional and integrated and therefore not every comment or recommendation fits neatly into just one of our defined boxes. Our choices for aggregation of the inputs allows for a broad, high-level analysis of the big picture:

Vision

The message heard was unambiguous; BC needs a clear, longer-range vision for the bio-economy that we want to see developed. Communities, industry and investors want to understand government's objectives and need to know that programs and policies will endure and can be relied upon as planning guides for investment, development and even forest management.

A key companion message was the need for **collaboration**. This notion was nearly a universal response and is embedded within the comments and recommendations in each of our five categories. From the perspective of the bio-economy vision, respondents were looking for coordination and alignment between the federal government and the Province and within the province for alignment of policy and action across all sectors of government.

BC BIO-ECONOMY

Another underlying theme relates to waste and efficiency. Communities, researchers and industry leaders alike all recognize the fundamental need for greater efficiency in our operations and in our supply chains and for a shift in attitudes to a position where waste is recognized and aggressively eliminated.

Comments received include:

- Company has been exploring fibre opportunities for the last 2 years and Canada is the #1 place of interest (BC in west, QE/ONT in east)
- Broaden the bio-economy vision
- Create a comprehensive policy framework with very specific goals
- The biggest issue for the growth of a true bio-economy in British Columbia is having a fully committed industry, government and population
- Encourage an integrated resource mindset in forestry, municipalities and agriculture
- Government programs need to be longer-term so that industry can plan around them
- Looking for fed/provincial alignment on a comprehensive energy strategy; looking for national vision
- “We’ve got to be about more than the extraction and export of resources”

- Utilize waste streams to displace fossil fuels (industrial & municipal)
- Integrated solution – waste heat stream for greenhouse application (create integrated food/produce business with multiple social and economic values for remote communities)
- Need rigorous analysis, built from impact assessment up; won’t work if it is cost to govt.
- Train leaders in biomass – through collaboration with research and academic institutions
- Their approach requires education and training; proving of the business models for both the energy side and the greenhouse business; need access to capital

- Biomass generation projects have a greater positive impact on the BC economy than other similar scale [power] supply contracts
- Bioenergy projects are typically located within communities and create local economic activity
- Most of the biomass power projects under development are in communities with high unemployment and high rates of dependency on income assistance

Fibre

One of the greatest challenges highlighted during the bio-economy review is the basic dependency of all bioproducts production activity on the availability of economic fibre supply. At the time of FPAC’s Biopathways work, none of the evaluated “new” technologies had business cases which could support accessing fibre from the forests on its own; all were dependent upon sharing harvesting and associated forest management costs with more traditional forest products operations. Some were economically viable only when their feedstocks were no cost ‘waste’ streams or where biomass utilization facilitated avoidance of waste disposition costs.

As new technologies emerge and evolve, the economic business cases for new bioproducts will continue to get stronger. However, for the foreseeable future, a collaborative approach will be required and both new entrants and primary harvesters or primary manufacturers will have to find better ways to connect and to work together. Government can and should take a more proactive role in facilitating this collaboration.

BC BIO-ECONOMY

We heard that government has already taken a number of steps to facilitate improved access to residual wood fibre and continues to explore additional new tenure options that might be deployed. These efforts could be accelerated and expanded.

Mountain pine beetle (MPB) affected forests represents a unique case with respect to fibre supply. While this fibre is currently in abundant supply the cost of accessing this fibre is generally too high for bioproducts production. Hard hit areas that cannot support profitable saw log harvesting are not being cut. So, any bioproducts utilizing this fibre must cover the full cost of harvesting. Additionally, affected trees have a relatively limited shelf life that, in some cases, is already a decade old. New projects undertaken with economics based on MPB fibre utilization will need to have appropriate project lifetimes factored in. Communities, government and industry have all been collaborating on solutions to this issue but much more needs to be done.

Also highlighted in the review were the opportunities that bio-economy efforts could provide for improved forest management. Creating economic demand for currently underutilized fibre can produce significant forest management benefits such as, a reduction of forest fire risk around communities and the promotion of greater species diversity for forest regeneration.

Comments received include:

- Encourage maximum use of forest industry sawmill residuals and harvest waste to produce a range of bioproducts
- New forms of fibre security need to be made available to pursue bioenergy development
- European customers see availability of biomass in BC as an issue
- Current logging practices leave an estimated 5-7 million tonnes of slash and tops in the woods
- Estimate 1.5 billion m³ of residual volume (assuming full harvesting of allowable cut) that could be used to some degree to support the bio-economy; much of this is located >60km from a processing facility
- Need collaboration

Technology

Both federal and provincial governments have had a number of research and technology oriented programs and incentives to support new bio-economy activity. These efforts, especially at the provincial level, have been highly focused on bioenergy outcomes. Both the Biopathways work and our scan of leading jurisdictions indicated that, while bioenergy is an important product to have in the bioproducts suite, development of more value-added bioproducts will generate greater economic value, and deliver broader social value, as well.

Bringing new technologies into the market can be high risk and capital intensive. The Committee heard repeatedly about the need for more financial support from government for technology pilots and demonstration projects. The Innovative Clean Energy (ICE) Fund was highlighted by industry for both its positive aspects (excellent support for demonstration of proven technologies) and its shortcomings (transient program with high levels of uncertainty).

It can not be over emphasized that, while there is an abundance of wood fibre available in BC forests, fibre will not be harvested or recovered from the forests unless there is a strong business case for doing

BC BIO-ECONOMY

so (i.e. it can be done economically). The economics of BC's current suite of forest products continues to leave much of the available biomass in the forests because it is not profitable to bring the fibre out. New technologies and new product applications will play a critical role in creating higher value end products that can carry the cost of accessing this otherwise untapped volume of fibre.

An important aspect to consider for any new biotechnology is scale. The scale, and scalability, of technology will impact risk, capital costs, market accessibility, fibre supply requirements and timing. A number of efforts are underway to find smaller scale solutions, especially for bioenergy, which can better meet the needs of communities and businesses and help address some of the risk and capital cost issues.

Comments received include:

- Take Biopathways down to the regional level – make potential business partners better aware of the opportunities that are there (thereby making it easier for them to access capital)
- Leverage existing industrial clusters
- Smaller scale is likely the best solution for CHP [combined heat and power]
- Need technology pilots and demonstrations
- Need better connection and collaboration (information, technology, research and development)
- This raises the question of whether there will be biomass available for other higher value bioproducts, with less proven technologies and higher risk profiles.
- Need funding at the right stage of technology/project development
- Support CHP woody biomass systems in off-grid communities
- Promote biochemical production demonstration projects for biomethane, ethanol, biodiesel and high value chemicals
- R&D follows manufacturing; not the other way around
- A green solution is not enough; a new product has to be better (provide additional economic value to drive the switch); everyone says they want green but most are unwilling to pay to be green
- Scale is very important
- Pursue bioenergy for heat; Off-the-shelf technology; Keeps the economic spend local
- Need rigorous analysis, built from impact assessment up; won't work if it is cost to govt.

Markets

The historical approach to the developing a bio-economy, for both the Province and for the federal government, has been highly biased towards technology research and development. Programs such as the federal *Investments in Forest Industry Transformation* (IFIT) program, and even the Biopathways work, facilitate and encourage “bolt-on” technologies to create new production capacity. Producing a product however is only part of the business case. New bioproducts, such as green chemicals and bioplastics, require new customers, new markets, new applications and new sales channels.

Organizations such as the National Research Council of Canada and FPAC are recognizing this gap and starting to shift their research and development focus to innovation (product application and market development) to complement invention (technology development). In BC, the highly successful Wood First Initiative and our Trade & Investment Strategy for China provide ready models for: broad government/industry collaboration; creating and opening new markets; educating the world on product applications; and supporting the efforts with solid research and testing.

BC BIO-ECONOMY

Here again, collaboration is critical. Collaboration is needed in identifying the fibre and investment opportunities that exist in BC, and then again in proactively marketing those opportunities to the world. And collaboration is needed across government, industry and academia to engage new sectors in a productive way to identify both market and investment opportunities.

Comments received include:

- Attracting partners and investment will likely only be achieved through both public and private sector collaboration
- The Pine Chemical Association is already a well established group of companies utilizing forest biomass for the production of chemical – they successfully operate without government subsidies and without long-term assurance of raw materials. The sector attracts capital because it is profitable and has grown over a long period of time.
- Collaborate with large companies that can make a difference.
- Need greater awareness
- Opportunities to improve transparency of price and availability of biomass should be a priority
- European Union (EU) 20/20/20 targets (20% reduction in GHG emissions; 20% reduction in energy consumption; 20% share of power from renewable by 2020) drive an estimated need of 25-40 million tonnes of biomass annually by 2020.
- China has determined a requirement of 50 million tonnes of biomass annually by the end of their current 5 year plan.
- Utilities are already coming to BC looking to secure long-term fibre supplies.
- Need long-term contract; no interest in anything <5 yrs
- Likes govt. incentives such as accelerated capital depreciation; royalty schemes; accelerated processing of project application & permits
- Exploring potential of small, scalable bio-energy unit for off-grid communities; could represent manufacturing and export opportunities as well as green energy
- For biomass heat opportunities, jobs are tied to the utility market and therefore more stable than forest industry jobs as a whole
- You have to look deeply at downstream products/applications
- Need rigorous analysis, built from impact assessment up; won't work if it is cost to govt.

Infrastructure

Infrastructure is critical for all economic development, and the bio-economy is no different. Economic growth typically occurs around an infrastructure backbone (transport, communications, power, education/research, etc). Comments voiced repeatedly to the Committee by the pellet industry indicate that, while the markets appear to have tremendous growth potential, wood pellet export growth from northern BC will be severely constrained by limitations in rail service and port capacity.

In a broad sense, infrastructure also includes our skilled workforce. Industry, communities and educational & research institutions all highlighted the talent and training that supports a workforce capable of moving the province into and forward with a new bio-economy. From community planners, project managers, scientists, engineers, farmers and trades people – the province will need educational, labour and community support programs that are aligned with the overall bio-economy vision.

BC BIO-ECONOMY

Another aspect of infrastructure often mentioned during Committee engagements was collaborative networks. A large number of bio-economy related networks already exist today; some guided by leading experts at BC institutions such as University of British Columbia; some led by government. The Ministry of Forests, Lands and Natural Resource Operations' Fibre Connection BC network, which connects fibre users with fibre suppliers and acts as a link for potential forest sector investors, is a prime example. What is lacking is the overarching connection that allows interested parties to quickly and easily see what networks exist, what roles they play and how to connect to or participate in those networks.

Comments received include:

- Development of the bio-economy would benefit from an increase of people in the sector who understand the research and synthesize it into a form that can be used by industry. These professionals include engineers, chemists, mathematicians, biologist, etc.
- Develop logistics and infrastructure that will accommodate growth and provide access to markets;
 - improved rail and port capacity and service is crucial for the pellet industry in northern BC
 - Bioenergy & bioproducts projects don't fit with our current system (i.e. electricity infrastructure, forest tenures, air-permitting)
- Need capacity within communities to manage partners and lead projects
- Top issues: Port capacity & rail monopoly
- Biomass heat lacks support even from non-governmental organizations
- Should tie-in [bio-economy efforts] with wildfire abatement programs (e.g. Burns Lake, Sicamous)
- The most pressing matter is the ability of our current Wood Pellet manufacturers to reach European and Asian markets. Both rail and port capacity are limiting their export potential today and will greatly impact their ability to grow in the near-term (next 6-36 months).
- Government programs need to be longer-term so that industry can plan around them

RECOMMENDATIONS

Based upon our initial macro assessment of the activities and opportunities in BC, the Committee strongly recommends that government take a more active leadership role in the rapid development of our bio-economy. Specifically, we believe timely action is needed in five key areas.

The need for collaboration in every aspect of the bio-economy development cannot be overemphasized. The nature of the bio-economy is characterized as a highly integrated, network of information, material and financial flows. Active participation and contributions are required from across government, across sectors and across society.

Additionally, the Committee recognizes that government has both an opportunity and a responsibility to use strong, clear policy in providing guidance, incentives and a level of certainty that industry and markets can respond to. The move to a stronger bio-economy is a transformative change. Government can provide influence all along the transformation curve, moving from core research, to technology demonstration, to market creation and ultimately ending with regulations; which completes and secures the transformation and opens new opportunities for government to apply their resources to the next transformative challenge.

To move forward on these recommendations the Committee suggests first establishing a Bio-economy Team that will formulate and articulate the bio-economy vision for BC. Once this vision has been developed and accepted then resources and responsibilities can be assigned to ensure its successful execution.

The Committee believes there is a sense of urgency for BC to take strong action toward developing its bio-economy in order to provide positive signals to the market and to stakeholders and to help ensure that the competitive advantages we hold today are maximized for the benefit of all British Columbians.

Key areas for action:

- 1. Establish a clear, long-term bio-economy vision.**

The government must take the lead in the development of a comprehensive, long-term vision for BC's bio-economy. This vision must provide a clear roadmap and guide for the evolution of this sector and must be integrated into major provincial goals and initiatives (such as: Jobs Agenda, Climate Action Plan, BC Energy Plan, Gateway Strategy, etc.) to ensure complementary efforts and to capture synergistic opportunities.

Our vision should be based on where we want our communities and our forests to be several decades from now. The time horizon for our vision needs to be aligned with the timescales typically associated with forest growth and forest management planning, major project and community planning, climate change forecasting and adaptation efforts and carbon project programming. It should be a vision based on solid principles, such as sustainability, transparency and quality, and pursued with actions that are supported by rigorous science.

Collaboration is critical. The vision must also have, as a core principle, a collaborative approach to development of this sector, as collaboration between BC's existing forest products industry and the emerging bioproducts industry is the desired path to success.

2. Improve access to fibre and feedstock.

Government must facilitate a productive dialogue between the existing wood products industry and the existing and emerging bio-economy sector with a view to addressing the critical and complex issues related to securing access to forest biomass. For new entrants bringing innovation, technology or new markets there is a desire to ensure secure access at competitive prices to the primary materials (usually wood fibre) required by their process or technology on a time scale that makes their investments worthwhile. On the opposite side, existing forest products players with secured harvesting rights use their access to fibre as a competitive advantage and are reluctant to enter long-term supply agreements, especially where the technology involved is not well proven from an operational or economic perspective. Concerted efforts are needed to facilitate productive engagement between our existing industry and new bio-economy entrants and government must play a leadership role in connecting these groups.

Thoroughly explore more options available to government to drive optimal utilization of forest fibre. The current systems in place for allocating and accessing fibre are inadequate to support a timely transformation to an industry which produces a significantly broader range of bio-products than we have today, including more high-value products. Although new forest licence schemes have been initiated recently, with the aim of improving access to residual fibre, these measures do not solve some of the key fibre issues. While economic forces are the primary driver of industry investment, and sustainable change cannot be achieved through government incentive alone, the Committee believes that significant opportunities for the economic utilization of forest biomass are being missed today and systemic changes can help capture the value of these opportunities.

Government must commit resources toward developing a robust inventory of the nature and location of BC's biomass feedstocks; starting with BC's forest biomass resources and expanding this inventory to include municipal solid waste, agricultural, marine and other biomass sources as quickly as possible. Just knowing that fibre exists is not enough to drive investment. Investors need reliable information on location, quality, volume and costs. Similarly, municipal waste streams potentially provide significant captive opportunities for bioenergy and bioproducts production. However, in order to reasonably integrate the technologies needed to exploit these opportunities into an overall bio-economy technology plan, these waste streams need to be identified and characterized. In parallel with efforts to inventory available forest biomass, government should continue its ongoing research to determine forest biomass levels required to ensure healthy, sustainable forests.

Expand efforts to provide communities and industry an easier mechanism for connecting fibre suppliers with fibre users. This could be accomplished through the Bridges Value-added project on the new [WoodSourceBC](#) website or as part of the Ministry of Agriculture's [Biomass Trader](#).

3. Establish a technology development strategy.

Based on BC's Bio-economy vision and the analysis of BC's biomass resources, develop a clear technology strategy that will focus government, university and industry research and development activities and align government's funding efforts with its vision.

Exploit BC's natural advantages. A critical component of the technology strategy must be early identification of niche markets that BC is well positioned to exploit and a plan for taking advantage

of these opportunities. For some niche market products, timing is everything and being first to market is critical. For other technologies, the risk profile and resource requirements for being first to develop will not be appropriate for government support.

Include in the technology plan an investigation of small scale cogeneration technologies. This type of technology would not only have abundant application here in BC (off-grid communities, industry, municipal buildings, etc.) but likely significant export market opportunities, as well.

Develop a culture around eliminating waste and use efficiency gains as an avenue to drive innovation and the creation of new value streams. Highly successful bio-economy companies are also highly efficient companies; they use their efficiency gains as an opportunity point for the application of new technology and new value streams. An initiative of this sort could have tremendous economic, social, and environmental benefits and would create the necessary mindset to drive bio-economy innovation.

4. **Develop markets for BC bioproducts and aggressively market BC's advantages.**

Build on the success of the Wood First Initiative and BC's Trade & Investment Strategy for China and use similar efforts to promote BC bioproducts both domestically and abroad. The BC government has the knowledge, experience and expertise to lead a collaborative, multi-faceted marketing effort. That ability should be applied to growing our bio-economy. Additionally, BC's leadership in sustainably managed forests should be highlighted and promoted for the premium value it provides to all of our forest products. Government should also use the lessons learned from the Ministry of Agriculture's *Value Chain Development* work and apply that knowledge toward new bioproducts development, especially in the forest sector.

Leverage government purchasing power to create initial markets for new innovation. This is a tool that government is uniquely positioned to employ and one that is critically important for the success of new technology start-ups. Leveraging government purchasing power also provides a means of aligning product development with provincial policy and vision (e.g. adoption of green packaging purchasing initiatives could tie in with provincial policy and regulations on waste material disposition).

Apply FII expertise in marketing BC pellets. BC pellets are some of the highest quality pellets in the world yet most producers receive no premium for that quality. Additionally, the major driving force behind pellet industry growth is greenhouse gas emissions reduction and sustainability. BC's forests, and therefore BC's pellets, are backed by the highest levels of certification but as a province we could do much more to sell that sustainability aspect to the world. We could take the lead on marketing our pellet opportunities to both domestic and export markets rather than reacting to ad hoc inquiries. As technologies progress, this effort could migrate towards torrefied pellets and perhaps other products.

Develop MPB investment opportunities. The province has done an excellent job at advertising our MPB situation to the world and global investors have shown interest. The next step is to develop specific opportunities that can be advertised and promoted to these investors; this will require collaboration with industry and communities and should be reflected in the overall vision. As part of the fibre inventory and characterization efforts, specific MPB opportunities could be identified, described and marketed through FII, JTI foreign trade networks and FCBC.

Identify and promote First Nations' biomass opportunities in a coordinated manner and integrate the marketing of those opportunities into highly visible channels (such as the FII or the FCBC website/network). First Nations' forest sector opportunities are an important and growing part of BC's forest industry and will be an essential component of the overall bio-economy vision.

5. Integrate the bio-economy's infrastructure needs into provincial initiatives.

Address transportation and port infrastructure issues as an integral part of our Gateway Strategy.

Producing new bioproducts is only part of the challenge. Developing the means to get our bioproducts to global markets in a safe, efficient and cost effective way will be critical to our overall competitiveness. For our growing pellet industry this was identified as a major issue.

Explore the feasibility of bio-economy clusters in BC. The government should foster the development of cluster projects that integrate bio-economy activities in a manner that will improve efficiency, eliminate waste, meet community needs and contribute to the achievement of provincial goals. The development of industrial clusters not only facilitates greater resource utilization efficiency but also provides a foundation for evolving economic activity to sustain our communities.

Develop a workforce strategy to give direction to BC's post-secondary institutions. Work with industry and academia to identify the critical skills requirements needed to support our envisioned bio-economy and integrate those needs into labour market programs designed to train and attract skilled workers. Together with secondary and post secondary educational institutions, develop the curricula, the trades and degree programs and the research opportunities needed to produce such a skilled workforce. This initiative should also include measures to help develop the forest industry leadership required to successfully operate in the bio-economy.

Build upon existing networks. As part of a collaborative approach to the development of the bio-economy the government should take advantage of existing organizations and networks (such as: NSERC BioConversion Network, Sustainable Chemistry Alliance and our own Fibre Connection BC Network). Whenever possible, government should leverage both the work and the resources being applied to bio-economy advancement around the world in order to stay on the forefront of these developments while maximizing the utility of our limited financial resources.

Appendix A - BC BIO-ECONOMY COMMITTEE ENGAGEMENTS

July 26, 2011

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Appendix A - BC BIO-ECONOMY COMMITTEE ENGAGEMENTS

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The Bioenergy Dialogue Group (unofficial name)

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Appendix A - BC BIO-ECONOMY COMMITTEE ENGAGEMENTS

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Appendix A - BC BIO-ECONOMY COMMITTEE ENGAGEMENTS

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Appendix A - BC BIO-ECONOMY COMMITTEE ENGAGEMENTS

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Appendix A - BC BIO-ECONOMY COMMITTEE ENGAGEMENTS

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Appendix A - BC BIO-ECONOMY COMMITTEE ENGAGEMENTS

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Appendix B - BC BIO-ECONOMY COMMITTEE REPORT REFERENCES

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