

Economic Diversification of Alberta through Bioindustrial Innovation

**Forum Report
(Highlights of What We Heard)**



Innovation Thought Leaders Forum

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1. Background

Alberta, similar to many jurisdictions, is focused on identifying and securing near and long-term economic and sustainable prosperity. Economic diversification enhances economic resilience, ensures balanced and sustained growth, maintains the well-being of communities and provides diverse employment opportunities to retain the skills and talents of all Albertans.

Alberta's large renewable biomass resources, supporting a resilient forestry and agricultural commodity-based sector, represent a potentially significant opportunity to further diversify its economy. Alberta Innovates, the Government of Alberta's research and innovation arm, has been working with key stakeholders and performing research and analysis to test this assertion and ultimately develop strategy for advancing Alberta's bioindustrial sector.

Alberta has invested almost \$300 million since 2006 to support bioindustrial initiatives. Five years later, the time is right to engage a range of thought leaders and experts to assess where Alberta is at and gather input on how the province might best diversify its economy through bioindustrial opportunities. The purpose of the initiative is to develop a strategy to take advantage of Alberta's bioindustrial opportunities in order to enhance the competitiveness of Alberta's resource sector (forestry, agriculture, waste, energy):

"A Ten Year Strategy (focused on a twenty year horizon) for Advancing Alberta's Bioeconomy, with a focus on the bioindustrial sector"

The strategy is intended to target and direct future investment and alignment of resources (by refocusing, redirecting, and attracting investment) to those bioindustrial areas with the most potential return on investment for Albertans. The strategy is to be informed through:

- A **Current State Assessment** detailing the present system and players, industrial and research capacity, incentive structures, and success stories
- A **Retrospective Analysis** showing gaps, constraints and strengths, collected through consultation and interviews with industry/academic/municipal leaders and the additional input from an Industry to Industry Roundtable held on November 1st and 2nd, 2011 in Edmonton, Alberta
- An examination of **Jurisdictional Advantage** highlighting market and economic drivers for Alberta. This was an evidence-based analysis. In addition to the data analysis the project included an interview process with 121 Alberta-based executives.
- Work currently in progress on the **Bio-Resource Information Management System**, an integrated database platform to map and manage biomass inventories.

Participants for the Thought Leaders Forum were provided a backgrounder document intended to inform development of the final strategy; stimulate discussions around the drivers, issues and opportunities; and test or validate the merits of the draft strategic approaches that were developed. A list of related questions to address was provided in the Technical Agenda to speakers and panellists. Detailed meeting notes (i.e. what we heard) were prepared of the Thought Leaders Forum proceedings.

2. Summary of Information Presented to Participants

In trying to better understand Alberta's current state (as it relates to bioindustrial innovation), it became apparent that while the province has some cornerstone infrastructure and systems, it has yet to best position or leverage these to effectively enable the diversification of Alberta's economy through value-added renewable biomass products, technologies, and services. In looking forward, the evidence points clearly towards an intentional focus on a strategy of diversifying through Alberta's core engine: its energy sector (and in particular oil and gas).

Benefits incubated in oil and gas will spill out into other areas of the economy and global markets. This is valid diversification and mitigates risks while stacking on advantages.

Continuing with a focus on the forestry and agricultural sector will require substantial deliberate and intentional analysis with respect to understanding the requirements to establish a healthy "industrial ecosystem" with the necessary value chains.

1. Diversifying the economy through bioindustrials should focus on diversifying within and through Alberta's core engine, the energy sector; particularly in helping to address environmental challenges associated with that sector.
2. Building a thriving bioindustrial sector within Alberta can play a key role in diversifying the provincial economy — a stated goal of the Premier's Economic Council report — and would fulfill the implementation objectives of a suite of other energy and environmental-related strategies and plans that the Alberta government has initiated.
3. Alberta's investments to date have provided solid research capacity to support the growing of Alberta's bioindustrial sector, but cannot effectively do that within a broad innovation system that currently:
 - does not have a clear bioindustrial vision, focus, or supporting goals actively supported by government and industry;
 - lacks coordination, alignment, efficiency, or clear accountability; and

- does not have aligned and cohesive public policy approaches, nor the proper policy instruments, to effectively support the development and commercialization of bioindustrial technologies, products, and services
- does not build from the established, vibrant industrial ecosystem associated with the core engine of Alberta's economy

3. Innovation Models

Context

Innovation is not the same as invention. Innovation is a process, which begins from the conception of an idea to the launching of a new product/process in the market place. Innovation is a critical feature of a bioindustrial strategy. Feedback from sector and innovation system participants was oriented around Alberta's innovation system or model: the set of institutional and built infrastructure that supports commercialization of new and commercially relevant technologies, products, and services. The overarching need identified was to enable a system to rapidly, efficiently, and effectively deploy the best bioindustrial solutions. Alberta government's research and innovation system, Alberta Innovates, is a key part of this. Alberta Innovates is made up of four board-governed provincial corporations that focus on the following strategic areas: bio-industries (i.e. agriculture, forestry, life sciences), energy and the environment, health, and bringing technology to market. Key observations and findings from the [retrospective analysis](http://www.bio.albertainnovates.ca/stratthemes/bioecoadvance/bioe-initiative/thought-leaders-forum/) in regard to Alberta's innovation system can be found online at www.bio.albertainnovates.ca/stratthemes/bioecoadvance/bioe-initiative/thought-leaders-forum/.

Alberta currently has capacity and expertise in biomaterials include lignocellulosic feedstock development, pulp and paper, biocomposites, green building materials, textiles and environmental protection products. Biofuels generation in Alberta is more developed than biomaterial while biochemical production is still in its infancy.

However, there continues to be a sense that there is a need to create a more simplified, focused and streamlined innovation model for Alberta which supports and drives a strong innovative business environment that can rapidly deploy technologies, products and services; builds solutions-based relationships between and among industries; supports and enables technology demonstration and promotes commercialization through public/private partnerships; and creates a centre of excellence for bioindustrial entrepreneurship to:

- strategically integrate Alberta's well-established research and innovation capacity,
- focus on clearly understood demand and markets, and
- be directed through industry leadership.

Expert Advice

The next phase for development of the Innovation Model in Alberta should not simply be Alberta Government led. It will require efforts and investment from many players including large industry, small to medium size enterprises (SMEs), post-secondary institutions, the financial sector, and governments at other levels and in other jurisdictions. In the energy sector the Oil Sands Leadership Initiative (OSLI) is an indicator of industry taking a leadership role. The OSLI collaborative model is the future of innovation.

A clear, unified and focused vision is required, with a definition of success and SMART (Specific, Measurable, Achievable, Realistic, and Time bound) goals. An impact and achievability grid is required to identify the areas where we can have an impact and achieve it. Examples of indicators to measure the success of an innovation system were presented from TEKES, the Finnish government's innovation system.

Components that will culminate in a successful innovation system should:

- Take into account “global seismic shifts”
- Demonstrate long term leadership. Champions and leaders must be identified within government and outside government to drive implementation of this strategy to success.
- Build trust and have meaningful cross-system collaboration
- Integrate social innovation
- Create sufficient risk capital to increase deal flow. Increasing deal flow is more about creating new ideas and technologies for people to invest in – more opportunity means more interest.
- Contain the right regulatory environment.
- Encourage development of the right people to ensure no shortage in the labour market, as currently exists.
- Create innovation hubs. Clusters should be sector oriented - not technology oriented.
- Develop and support strong businesses throughout their “life cycle” by mentoring the most promising of them and ensuring increased private leverage as they develop
- Build companies to scale through significant co-investments with industry in top priority areas

In the strategy Alberta has to be careful not to take dollars from one sector within the province to allocate to another sector.

The importance of cross jurisdictional and international partnerships should be highlighted.

An endowment fund, such as the Alberta Government created for carbon capture and sequestration, would create a long term funding model to create certainty.

Within the strategy there may be a need to stage actions so that other opportunities don't get left behind, but will be addressed in later stages.

Regional context needs to be considered in the strategy.

Example: The Michigan Biotech Institute was deemed a great model for innovation approach.

4. Policy

Context

Currently it appears that government policies are developed in isolation from each other and generally on a per sector or per issue basis. Coordination and communication across departments seems limited, with policies appearing at times to be in conflict, leading to unintended consequences (e.g. fossil fuel subsidies leading to inefficient use of fuel as input). This runs counter to a desired outcome of maximizing economic and environmental outcomes across all sectors. Clear feedback indicated that the Government of Alberta must ensure supporting public policies are aligned, integrated and cohesive — across all government departments and industry issues.

- The perception is that Alberta lacks a shared and specific vision for diversifying the economy through bioindustrial and bio-economic initiatives.
- The Alberta Government has both an opportunity and a responsibility to use strong, clear policy in providing guidance, incentives and a level of certainty to which industry and markets can respond.
- Emphasis should be placed on market-based and fiscal policy instruments (as opposed to grants) to incent investment in environmental and bioindustrial opportunities e.g. procurement policies, flow-through tax policy, venture capital funding mechanisms.

Expert Advice

Key points made during these discussion:

- A bioindustrial strategy must clearly align with the identified priorities of government; otherwise it will be difficult to get government support. The development of the strategy should be a collaborative approach.
- Public policy barriers have not been fully assessed in Alberta. There is a need to look at policy drivers and barriers in more detail.

- For the bioindustrial sector to grow, related policy needs to become an overall government priority, with efforts and impacts being addressed across a multiple of departments rather than being handled as “silo” projects.
- It is important to ensure that policy is consistent through more than one administration.

Government policy action can create incentive for investment in new bio-based technologies and this is required as a way to help not-yet-optimized technology. Federal/provincial tax based systems (e.g. exploration tax exemption) create stability as tax programs, unlike program funding, aren’t as likely to fluctuate with annual budgets. This type of incentive is better than winners/losers type program grants as it supports all innovation/technology development.

Some policy examples cited were:

1. Canadian Innovation Commercialization Program.
2. Green Procurement Program.
3. Government of Alberta Request for Proposals (RFP) for green power: originally it aimed to receive enough applications to cover 20% of Alberta’s power load from green sources, but ended up getting 95%.
4. Industrial regional benefits program where companies receiving grants/support must buy from Canadian suppliers.
5. Policy instruments like the Science, Research, and Experimental Development (SR&ED) tax credit (tax credits that support R&D for companies) are very effective and should be maintained and enhanced.
6. The Small Business Innovation Program in the US has been a very effective tool for innovation and new solutions

5. Jurisdictional Advantage Assessment

Context

Jurisdictional Advantage assessment is a conservative approach to investment options analysis. It is an evidence-based process that identifies the unique strengths, weaknesses and opportunities that define the province’s sustainable advantages.

The principle idea behind the analysis is to find core engines in the economy (those areas that drive growth and sustain the province over the long term) that can incubate diversification opportunities. Diversity within the core will spill out and create a future for Alberta beyond that core engine. By focusing on the core, resulting strategies minimize risk, stack odds of success and put emphasis on strengths rather than fliers.

The economic analysis within the Jurisdictional Advantage assessment covered six elements for each major industry in Alberta:

1. A general economic overview
2. The natural resources supporting each industry
3. Each industry's unique technologies, skills, and abilities
4. The supporting institutions around each industry
5. The investment and policy environment for each industry
6. The innovation ecosystem around each industry

Alberta's best near-term prospects are in its oil and gas plays. Opportunity exists in the environmental issues those industries create, in the inefficiencies within current processes, in the abandoned well sites and unproduced resources that remain in the ground, in the operations of the manufacturers that feed the industry, in the chemical producers that buy from and sell to the sector, in the waste that "big energy" in Alberta produces and in the energy that the sector demands. Successful companies in Alberta within the bioindustrial sector provide reclamation services, clean up wastewater, design bio polymers to fix tailings ponds, gasify polluted waste streams, and guide ecological services.

Conclusions of the jurisdictional advantage assessment:

- Oil and gas and associated manufacturing offer rich industrial ecosystems, strong market opportunities and broad global applications. Ignoring this market seems to be the consequence of a too narrowly defined notion of diversification.
- Certainly diversification includes developing opportunities outside the core engine of the economy. But it also includes, and should place heavy emphasis on, the opportunity to diversify in and through the core engine.
- Opportunities that exist in advanced materials, environmental services, waste management, biochemicals (some longer term than others), and benefaction and are incubated in oil and gas will spill out into other areas of the economy and global markets. This is valid diversification and mitigates risks while stacking on advantages.
- Diversification through the core is a thoroughly viable development strategy. It benefits and builds from the established, vibrant industrial ecosystems in the province. It is an important, initial step in creating a tangible bioindustrial economy in Alberta.

Expert Advice

The concept of working through the core engine of Alberta's economy, the energy sector, was considered a good short term strategy. For the longer term component of the bioindustrial

strategy should address diversification opportunities that flow from, and are outside of, that sector.

Alberta has abundant biomass but it is dispersed over large areas and away from where potential demand is located. Economically viable access to feedstock is a problem, and infrastructure is required. There is a need for a facilitated dialogue between sources of supply of biomass feedstock, potential users of biomass and other segments of the value chain. There is a need to understand where Alberta sits, globally, in terms of biomass production, accessibility and technology relative to other jurisdictions.

Alberta must redefine our thinking on evaluating the value of biomass and better understand trade-offs between different uses. Value comes from multiple sources- bioindustry, timber, functioning ecosystems, water storage, etc. Decisions will be needed on allocation of biomass to these different uses.

Focusing on supporting small to medium size companies will be a critical enabler of the strategy, including how to facilitate collaboration rather than competition between them.

There was agreement that established value chains for bioindustrial opportunities from Alberta do not exist yet.

- This is a critical gap in having private capital flow into these opportunities.
- The supply and value chains must be looked at together to understand where the opportunity is and to what extent processing/value adding should be completed.
- This is a big issue and a place for government to help build the infrastructure. Government helped initially develop this for the natural gas industry in Alberta.
- Representatives of companies from different parts of the value chain should be brought together to speak to each other. Alberta seems good at the early stage of the value chain.
- Medium sized biochemical companies are a chance to develop a sector that is further up the value chain.

Regarding biofuels:

- Next generation technologies should be looked at because this product has become commoditized and highly competitive.
- The RFS (Renewable Fuel Standard) does not make us globally competitive.
- Biofuels create a good starting point for other bio industrial innovations which may provide other opportunities and applications.

Under-utilized products/processes in Alberta include fatty acid sources for biochemicals and fermentation conversion.

If a prospective technology is discovered, companies should not necessarily look to develop it themselves as that may mean catching up, but instead look to partner. Partnerships, domestic or international, should be developed with those that will bring what's missing for success.

Genetic understanding is evolving very fast – this is creating innovation and opportunities in the bioindustrial space very quickly.

The four “buckets” within the bioindustrial sector (bioenergy, biochemicals, biomaterials, and environmental services) are unique enough that they may need their own strategies.

Product/service development must be based on solving a problem rather than providing a substitute. The offer must be unique and not one that will have early obsolescence. Otherwise the market will not be sustainable. The use of bioindustrial products must make economic sense, e.g. feedstock price stability or allows for incremental expansion of production without huge capital investment.

An important step of the strategy will be to identify which bio based chemicals can be easily and economically brought to market.

6. Environmental Entrepreneurship

Context

Alberta's major trading partners are increasingly developing environmental targets. Environmental responsibility and a demonstrable commitment to ecological stewardship are now requirements for a successful resource-based economy. Global and local environmental drivers are in turn generating potentially significant economic opportunities in the form of bio-based products and environmental services. Importantly, such products and services must demonstrate they deliver genuine net life cycle environmental benefits. To be branded or labeled as such will come with extensive validation and verification requirements.

Environmental entrepreneurship can assist Alberta in re-establishing its reputation for leadership in environmental policy and management, particularly in the oil and gas sector.

Enabling a voluntary approach for communities to create and implement zero-waste goals, with appropriate policies and programs to support this, is a clear opportunity.

Alberta should partner with suppliers, consumers and non-government organizations to establish processes and standards to enable environmentally sound “green certification”.

Expert Advice

The bioindustrial sector in Alberta may assist with solidifying and re-establishing the oil sand industry's social license to operate. In addition, oil and gas has regulatory responsibility for some things that they have limited expertise in for which they contract or outsource. The bio-based sector could provide the expertise that is needed in certain areas.

A lifecycle analysis of the many processes associated with bioindustrial opportunities has not been completed and needs to be.

Hard consideration needs to be given to the sustainability of new technologies and ideas. Understanding of cumulative impacts and management is an emerging driver that needs to be linked within the bioindustrial strategy.

Sustainable positioning can make a company a more compelling employer and consequently an employer of choice for high quality people.

The four "pillars" of the Alberta economy (energy, agriculture, forestry and tourism) all have growth mandates and this growth is all expected to occur on the same land base. Alberta often allocates resources independently of each pillar. Each pillar has rights to access the resource on the surface. This can create business to business conflicts.

Waste Management is an area that Alberta is leading so making that a focus in Alberta and expanding the capacity in the province may make sense.

7. Additional Insights from the Experts

The creation of public acceptance and support will be a critical component of the development and implementation of the strategy.

Universities may not be very interested in applied research and may be difficult to motivate to do that type of work. Some culture management or change is needed to remove this potential barrier. Some institutions or programs have a culture that is very well developed - it will be slower at other institutions. The University of Waterloo is a good model to examine, including their approach to intellectual property policy.

Ontario Centres of Excellence has a successful program to support students at the end of their program so they can do their own start-up.

We need to understand brand, what branding works, what brands exist already, and when branding gets in the way. Only 18% of the people in the world know the Canada brand while only 0.2% know Alberta - so any Alberta brand needs to be closely linked to Canada.

There is a need to have more energy industry people involved in the development of the bioindustrial vision and strategy.

The evolving ideas about open innovation are consistent with working more closely with the oil and gas industry.

At the National Research Council a major transformation has been initiated to move it from an institute to a program-oriented organization. There will be four areas of interest, three of which will have a bio focus: industrial biomaterials, algae, carbon conversion and wheat improvement.

Alberta has a new land use policy that is intended to deal with cumulative effects and make tough choices - value choices. In that business there are winners and losers.

Health/life sciences may have a place in the bioindustrial strategy. There are lots of medical companies that have very real challenges and issues that are blocking their opportunities to innovate and bring problem solving technologies to the market.

Following a “keep it simple” principle here is important. E.g. Austin, Texas kept it focused to one thing, building a high-tech cluster in Austin.

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