

# CAIRN POLICY BRIEF

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## CANADA'S SHRINKING BIOPRODUCT INDUSTRY

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### Issue

Canada has the essential ingredients for a thriving bioproduct industry – significant sources of agricultural and forestry biomass, strong research capabilities, a skilled workforce and an industrial sector seeking more sustainable products. However, when it comes to developing a globally competitive bioproduct industry, Canada appears to be falling behind. Our analysis of the Statistics Canada's 2009 Bioproduct Production and Development Survey<sup>1</sup> and comparisons with previous surveys from 2003 and 2006 found that Canada's bioproduct industry continues to contract and is heavily weighted toward one product - ethanol. The research also found that cost savings are an important driver of bioproduct development, particularly in British Columbia.

### Policy Implications and Conclusions

U.S. policy has a clear focus - reduce dependency on foreign oil. To a great extent Canada has followed a similar policy path of supporting biofuels, but without the same incentives or commitment. Canada has plenty of oil and gas and no significant surplus corn for ethanol. Canada needs to rethink its focus on biofuels and broaden its policy incentives for other bioproducts.

It's not simply a matter of flooding the green landscape with public dollars. Porter (2008) contends that a sophisticated consumer is one of the major forces in any market. To date consumers have been relatively unengaged and bio-based customers - industrial and energy firms - have been focused mainly on price and substitution strategies requiring little change to products or processes, time and money (Sparling *et al*, 2011). As the



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<sup>1</sup>The Bioproducts Development Survey was commissioned by Agriculture and Agri-Food Canada and conducted by the Business Special Surveys and Technology Statistics Division (BSSTSD) of Statistics Canada

industry moves forward buyers need to be engaged, informed and balanced in their purchasing decisions. Policy can play a role in building sophisticated demand through leadership, information, and with financial motivators such as rebate programs, tax incentives and market guarantees / feed-in commitments / supply agreements, where the policy focus is on strengthening market demand rather than on research. Government can also help connect disparate groups, programs and funds into a single community that is properly resourced and equipped. The industry is desperate for leadership, vision and unity. Signals from federal and provincial governments – that extend beyond biofuels – would go a long way to engaging industry and making Canada an attractive destination for bioproduct firms.

### Background and Literature Review

Although firms have been making industrial products from biomass for centuries, the bioproduct industry as we know it today began to grow rapidly in the 1990's, built on the growing science of industrial biotechnology. Growing concern over pollution, greenhouse gases and dwindling oil supplies have spurred interest and activity in the bioproduct industry. Biofuels, particularly ethanol, have been central to the growth as farmers sought alternative markets to help clear glutted grain markets and the U.S. sought alternatives to mid-east oil. U.S. ethanol industry (used as an indicator for the larger bioproduct industry) contributed 0.37% of the Gross Domestic Product (GDP) in 2010 (Urbanchuk, 2011, BEA, 2011). In comparison the Canadian

ethanol industry contributed 0.016% of the GDP in 2003 (Mukhopadhyay and Thomassin, 2011, Statistics Canada 2004). The Canadian ethanol industry has expanded considerably since the 2003 snapshot used in Mukhopadhyay and Thomassin (2011) but certainly not the 23 times needed to bring it on par with the U.S. industry. According to the United States International Trade Commission (2008) the Industrial Biotechnology sector in the U.S. was valued at \$41.2-billion in 2007. The industry had grown by over 30% since 2004.

### Analysis and Results

In 2009, an estimated 208 bioproduct firms<sup>2,3</sup> in Canada were 'conducting bioproduct research and development *without* sales of bioproducts' or 'in production *with* sales' (Bioproducts Production and Development Survey 2009,

**Table 1. Selected Canadian bioproduct industry statistics by year**

	2003	2006	2009
Number of firms	232	239	208
Percent of firm population			
Small firms (fewer than 50 employees)	66%	84%	81%
Medium firms (50-149 employees)	17%	8%	7%
Large firms (150 or more employees)	17%	8%	13%
Bioproduct related employment	7851	3974	3019
Revenue from bioproducts	\$3,129,455	\$1,758,309	\$1,333,503
% of total firm revenue	26.3%	23.5%	9.0%
Total bioproduct R&D spending	\$96,327,000	\$84,329,000	\$64,580,000

<sup>2</sup>"In order to palliate for non-response, an adjustment factor for weighting was applied to the homogeneous response groups created from the sector of activity. This adjustment factor is used as a final weight to produce estimates."(Statistics Canada, 2011)

<sup>3</sup> Statistics Canada Bioproducts Surveys cover bioproduct activity of Canadian firms. Firms with multiple establishments were asked to complete a separate questionnaire for each establishment engaged in bioproducts production or development in Canada. Authors acknowledge this could result in double counting at the firm level for a small fraction of the sample.

p.3). Survey respondents included any firm involved in the development or production of industrial and consumer products from biomass with the exclusion of food, feed and medicines. This includes products such as biofuels, plastics, chemicals, bioenergy and non-conventional fibres. Biomass is defined as 'renewable biological materials' - from forestry, agriculture, marine and aquaculture source; by-products from processing (agricultural, forestry, food/feed); or recycled bio-materials and waste materials (Bioproducts Production and Development Survey 2009, p. 2).

#### INDUSTRY CONTRACTION

Compared to 2003, the industry is smaller on every dimension - the number of firms, employment in bioproduct related activities, revenue, exports and research and development (Table 1). Small firms continue to dominate the bioproduct industry in number of firms, making up 81% of industry numbers in 2009.

#### GEOGRAPHIC DIFFERENCES

In 2009, Ontario and the Prairie provinces ranked highest based on number of firms (Figure 1) and also by bioproduct gross revenue (BGR). Taken together, Ontario and the Prairies accounted for 79% of the industry total gross revenue. While the number of firms declined in most regions there was notable growth in firm numbers in Ontario.

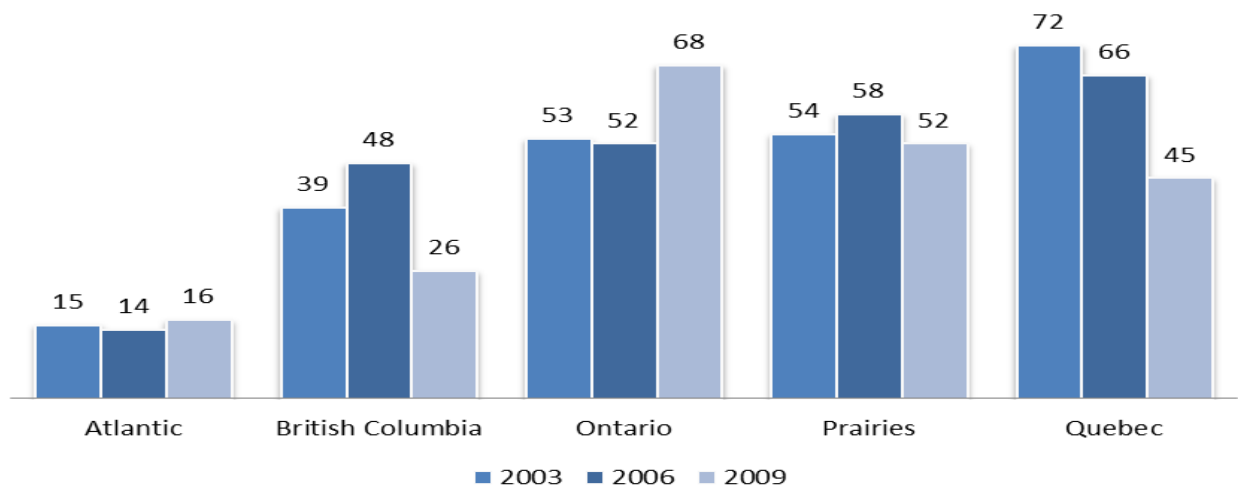
#### BIOMASS

Although the questions changed between the surveys, there appears to be an overall trend to greater use of agricultural biomass. Agricultural biomass was the primary biomass source for 44% of firms in 2009, compared to 23% sourcing forestry biomass, 20% other and 8% food processing. In Ontario and the Prairies agricultural biomass was used by most firms while in Atlantic Canada, British Columbia and Quebec more firms used forestry biomass.

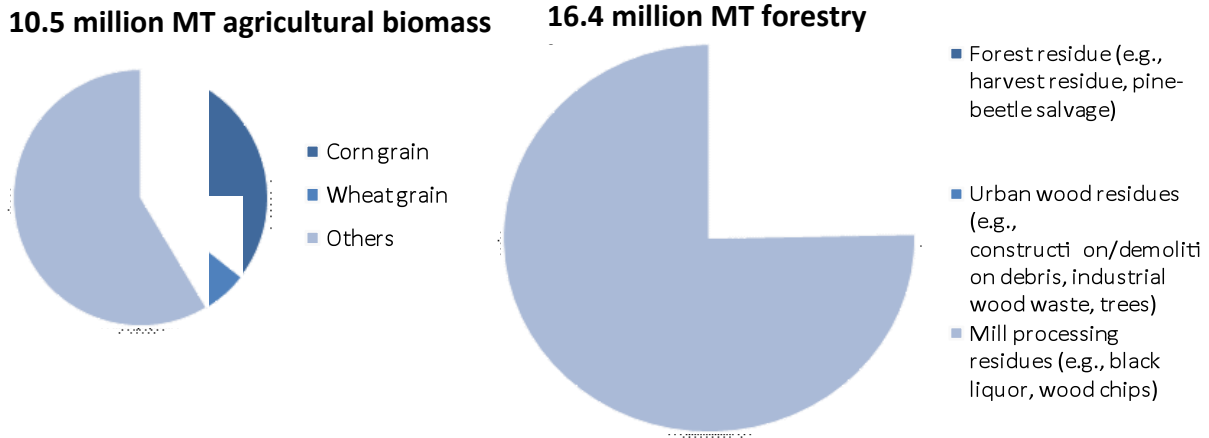
Although fewer firms used forestry biomass, they used more, an estimated 16.44 million metric tonnes compared to 10.6 million metric tonnes of agricultural biomass (Figure 2).

#### FINANCIALS

The significant declines in bioproduct revenue, exports and R&D present a disconcerting counter-point to the general perception that Canada is moving rapidly toward a new bioeconomy. Although total revenue for firms involved in bioproducts increased over the 2003-2009 period, revenue from bioproducts decreased by roughly two-thirds in 2008 and then recovered somewhat in 2009 (Table 2). Firms were increasingly concerned about the steep rise in biomass input costs and its impact on gross margins<sup>4</sup>. Spending on biomass increased significantly between 2006 and 2009, reflecting higher global grain prices and the greater use of bioenergy.



**Figure 1. Number of firms by region and year**



**Figure 2. Breakdown of biomass by source and weight, Canada 2009**

The drop in bioproduct research and development spending is a concern, given the early stage of the industry. However, in addition to the \$50-million spent internally on bioproduct research in 2009, firms also contracted out \$9.4-million and spent \$14.4-million on biomass research.

In 2009, a new question asked firms whether they used the bioproducts they produced in their internal operations, and the cost savings resulting from that use. Only 39 firms (16 large and 23 small firms) reported using bioproducts internally; 5 in British Columbia, 14 in Ontario and 11 in Quebec. The estimated savings were \$981-million, with \$614-million estimated savings by BC firms, \$204-million by Ontario companies and other data suppressed. It is likely that most, if not all, of the five BC firms were large forestry firms. Cost savings from internal bioproduct use represent significant economic benefits that are not

accounted for in revenue and may be a critical factor in bioproduct profitability.

#### PRODUCTS

When ranked according to number of firms involved in developing and/or producing particular products, *bioenergy* was the top category in Canada in 2009 followed closely by *biodiesel*, *other organic chemicals* and *ethanol*. However, ethanol was the overwhelming leader in bioproduct gross revenue (BGR), contributing 68.2% of bioproduct industry revenue and over 93% of the revenue of medium sized firms. The remaining bioproduct industry revenue is derived primarily from *other organic chemicals*, *bioenergy* and *polymers*.

In 2009, while small firms dominated the industry landscape in terms of numbers, medium-sized firms generated larger bioproduct gross revenue (Table 3). The stark contrast between the importance of bioproducts for small and medium firms and the

minor role they play in large firms is evident in the differences in bioproducts as a percentage of total firm revenue. However, the benefits for large firms may come primarily from internal use of bioproducts, something that is a minor factor for smaller firms.

Top industry sectors for small firms were biodiesel, bioenergy, ethanol and bio-pesticides. Medium firms were largely in ethanol (71% by number of firms and 93% by revenue), while the majority of large firms were engaged in bioenergy production, possibly for internal use. Small and medium firms primarily used agricultural biomass – in fact medium firms sourced only agricultural biomass. The majority of large firms used forestry biomass.

#### Concluding Remarks

For almost a decade Canada has been promoting the opportunities for growing the bioeconomy. Companies, universities, non-governmental organizations and

<sup>4</sup> Defined as revenue from bioproducts minus biomass input costs

**Table 2. Key revenue and R&D summary statistics 2003, 2006 and 2009.**

	2003	2005	2006	2008	2009
	\$ thousands				
<b>Canada</b>					
Total firm revenue (all sources)	11,914,662	7,081,904	7,486,339	19,685,698	14,898,795
Revenue from bioproducts	3,129,455	1,697,799	1,758,309	1,047,418	1,333,503
Bioproduct/total revenue	26.3%	24.0%	23.5%	5.3%	9.0%
Total cost of biomass inputs	–	319,886	343,373	1,731,080	1,852,135
Revenue from bioproducts minus cost of biomass inputs	–	1,377,913	1,414,936	-683,662	-518,632
Total R&D spending	242,371	241,227	242,299	305,924	127,389
R&D spending on bioproduct development	96,327	88,091	81,329	49,934	50,152
R&D spending on biomass development	–	5,236	3,000	14,540	14,428
Bioproducts R&D spending contracted out	<u>10,295</u>	<u>3,761</u>	<u>6,014</u>	<u>13,497</u>	<u>9,438</u>
Total bioproduct and biomass R&D expenditure	106,622	97,088	90,343	77,971	74,018
R&D as a % of revenue	2.03%	3.41%	3.24%	1.55%	0.86%

governments at every level have waved the bioeconomy flag as a means of attracting interest, partners and ultimately investment. The survey results to 2009 can only be described as disappointing and suggest that somehow Canada is missing its potential in bioproducts. Policies for biofuels, particularly mandated biofuel content for transportation fuels, have allowed a handful of ethanol and biofuel companies to build their businesses on a combination of private investment and government grants and loans. Some argue that these large scale investments in the biofuels sector have resulted in a viable processing foundation for the creation of additional bio-based

chemicals beyond the commodity fuel products on the market today. This certainly appears to be the trend globally, as large multinational enterprises move into the industrial biotechnology and bioproduct space. Bio-based chemicals are the growing focus of chemistry firms for reasons ranging from cost and assurance of supply to environmental impact.

Although the results show a shrinking industry when one would expect expansion, the specific reasons for that decline are unclear. Future research needs to better capture the nature and scale of demand for the industry. Several questions persist around the sample frame of the

survey and the accuracy of the data presented by Statistics Canada.<sup>2</sup> Future research on this sector should be undertaken with the goal of building reliable broad industry data supplemented by additional primary research.

Many speculate that the rapidly growing interest in bio-based products will continue in the near future, spurred by two underlying trends. First, the depleting supply of oil and the increased cost and price volatility is creating market opportunities for bio-based alternatives. Second, public pressure for environmental sustainability is resulting in policies and regulations to support the development of bio-

**Table 3. Summary industry sectors, revenue and biomass source by firm size, 2009.**

	Small firms	Medium firms	Large firms
Number of firms	169	14	26
Bioproduct Gross Revenue (BGR)	\$523-M	\$636-M	\$175-M
Top industry sectors (by no. of firms, all stages of development)	Biodiesel, bioenergy, ethanol, biopesticides	Ethanol, solid fuels, other organic chemicals	More than half in bioenergy, none producing ethanol
Leading industry sector by BGR	Ethanol (60%)	Ethanol (93.6%)	Undisclosed
Primary biomass source	Majority using agricultural biomass	Agricultural biomass (100%)	Majority using forestry biomass
Percentage of firms producing for internal use	13.6%	0	61.5%
BGR as percent of total firm revenue	58.5%	60.1%	1.3%

based products. As a result bio-based products, including chemicals and materials, have moved higher on the strategic agendas of many industrial value chains. However the question remains, what role will Canada – its businesses, consumers and governments – play in the global shift toward bio-based industrial production and how can policy focus be expanded to take full advantage of the broad spectrum of opportunities?

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