

Bio-product Market Development Strategy

**A Scoping Study on Federal Policies for
Creating Market Demand for Bio-products in
Canada**

A Report Prepared for Industry Canada

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Introduction

Bio-products are a wide range of industrial and consumer products that penetrate many sectors of the economy. They are derived from biomass, which is a renewable feedstock, and have the potential to result in significant environmental and socio-economic benefits. With 10 per cent of the world's forests, Canada is well endowed with biomass resources. The BIOCAP Canada Foundation¹ estimates that Canada's reserve of timber resources is equivalent to 69 times its annual consumption of fossil fuels. On an annual basis, the renewable resource residues from forestry, agriculture, and related manufacturing industries are equivalent to approximately 18–27 per cent of the energy Canada derives from fossil fuels.² A recent study by Agriculture and Agri-Food Canada indicated that a 1 per cent per annum increase in bio-fuel utilization over six years across Organization for Economic Cooperation and Development (OECD) countries could increase the net cash income of Canadian farmers by \$2 billion.³

Environmental benefits associated with increased penetration of bio-products have the potential to be significant as reductions in energy use and toxic emissions by chemical process industries are achieved.⁴ A series of case studies published recently by the OECD reported the following range of benefits:⁵

- energy savings of 15–80 per cent
- water savings of 10–50 per cent
- toxic waste reductions of 30–50 per cent
- use of chemical solvents reduced or eliminated

There is growing recognition by the Canadian government that, given the potential economic and environmental benefits associated with bio-products, it is desirable to promote the adoption of bio-products in Canada. Successful adoption of bio-products will facilitate increased industrial productivity and global competitiveness and reduce greenhouse gas and other emissions. Historically, the focus of government policies related to bio-products has been on research and development related to the supply and processing of biomass for the production of biomass-derived heat and electricity. This historical focus has led to numerous technological and supply system improvements. While research and development are still required to bring bio-products fully to market, there is also a growing need to consider demand-oriented policy options, not just including those targeted at biomass-derived heat and electricity, but also policy applications to biomass-derived materials and chemicals. **Thus, the purpose of this study is to identify specific pragmatic and implementable policy options for stimulating marketplace demand for bio-products in Canada.**

This report is organized into distinct chapters. Following this Introduction, the Background defines bio-products and bio-product market demand for the purposes of this study, and it presents a number of the key drivers for bio-products in Canada and elsewhere. The Methodology chapter outlines the key tasks that were completed for this study. The remaining chapters are organized around the various steps of the

¹ <http://www.biocap.ca/>

² <http://strategis.ic.gc.ca/epic/internet/intrm-crt.nsf/en/rm00118e.html>

³ Agriculture and Agri-Food Canada. January 2002. *An Economic Analysis of a Major Biofuels Program Undertaken by OECD Countries*.

⁴ The potential for negative environmental impacts associated with the production of bio-products also exists, including increased emissions, land degradation, and loss of biodiversity. Life cycle value assessments on a case-by-case basis are needed to ensure potential environmental improvements are maximized.

⁵ Organization for Economic Cooperation and Development. 2001. *The Application of Biotechnology to Industrial Sustainability*. Available at: <http://www1.oecd.org/publications/e-book/9301061e.pdf>

methodology. The Barriers chapter describes the key barriers currently limiting bio-product market demand development, and Existing Policies presents details of the bio-product-oriented demand policies currently in place in Canada. The Policy Options chapter presents a number of different policy options that can help overcome existing barriers and describes a set of evaluative criteria against which the policy options are evaluated. The heart of the analysis is contained in the chapter titled Policy Evaluation in which we evaluate 18 different policy options for stimulating market demand for bio-products. The Conclusion summarizes the evaluation and identifies important consideration and areas of future research. A list of relevant references is included at the end of this report. The Appendix provides a sense of the resource potential related to biomass in Canada.

Background

What are Bio-products?

For the purposes of this report, the term *bio-products* includes bio-fuels (ethanol and bio-diesel), biomass-derived heat and electricity, and biomass-derived chemicals and materials. Biomass-derived chemicals and materials include such products as lubricants, polymers, solvents, adhesives, surfactants, emulsifiers, and inks. While other products, such as pharmaceuticals, building materials (wood), and foodstuffs are also broadly considered bio-products, the focus of this study is on biomass-derived materials and chemicals that are capable of replacing comparable fossil-based products.⁶

What is Bio-product Market Demand?

The focus of this study is on policy options for stimulating marketplace demand for bio-products in Canada. We define *demand* as encompassing the distribution and consumption of bio-products. We consider policies targeted at the particular bio-products (end products) as well as technologies associated with those end products (for example, vehicles and electricity- and heat-generating technologies/systems).

Bio-product Drivers

In recent years, substantial progress in the form of increased public awareness and consumer support, as well as improved technological reliability and reduced costs, has been made in the use of bio-products. Notwithstanding the implementation of government policies to promote the production and consumption of such products, several factors are driving continued and increased use of biomass. These factors include the following:⁷

- environmental improvements
- decommissioning of nuclear power plants
- energy security
- economic diversification
- employment opportunities
- export market development
- rural economic development
- off-grid energy supply
- waste management
- development of value-added products
- human health concerns

⁶ The Appendix at the end of this report provides a sense of the resource potential related to biomass in Canada.

⁷ For a complete discussion of the drivers related to biomass developments see, for example, the International Energy Agency's recent publication *Biofuels for Transport: An International Perspective* available at: <http://www.iea.org/>

Methodology

The flow chart in Figure 1, below, summarizes the key tasks that were completed for this study.

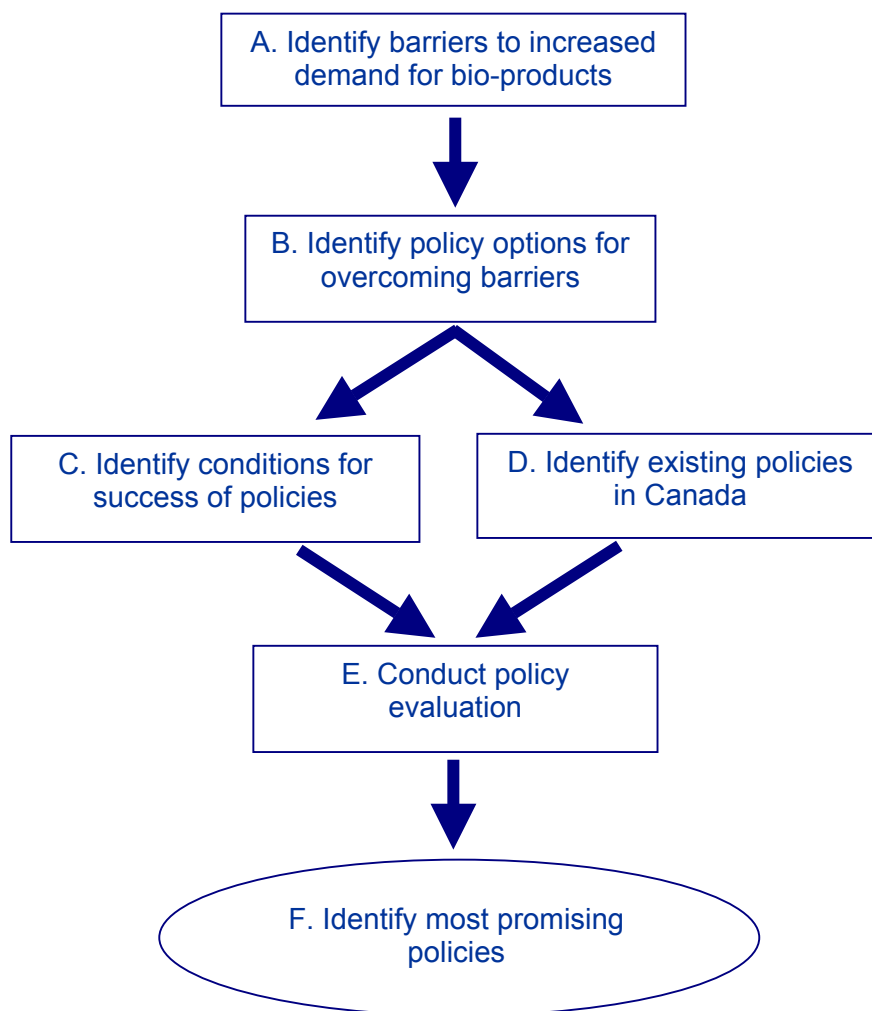


Figure 1 Flow chart of methodology

This study began with the identification of a broad range of barriers (technical, socio-economic, regulatory, and financial) that currently limit the demand for bio-products in Canada. We then compiled a list of specific policy tools that could be used to overcome the barriers, thereby facilitating an increase in the market demand for bio-products. Next, we identified a set of conditions that contribute to the success of policies. We developed the barriers, policy options, and conditions for success by drawing on relevant literature, as well as on experience in other important jurisdictions (including the United States, Sweden, Norway, the Netherlands, the United Kingdom, Australia, Germany, Brazil, and South Africa). Having identified the barriers, policy options for overcoming the barriers, and the conditions for policy success, we identified the demand-oriented policies already in place in Canada and highlighted significant policy gaps that currently exist with respect to marketplace demand for bio-products. With all of this information compiled, we completed a robust evaluation of the various policy options and identified specific policy options that address current barriers, respond to existing policy gaps, and also meet other key conditions for success.

Barriers

Several steps are required to bring bio-products to market. For example, as is shown in Figure 2, a feedstock has to be created and distributed, processing of the feedstock has to take place in order to create the bio-products, and the bio-products need to be distributed, marketed, and sold.⁸

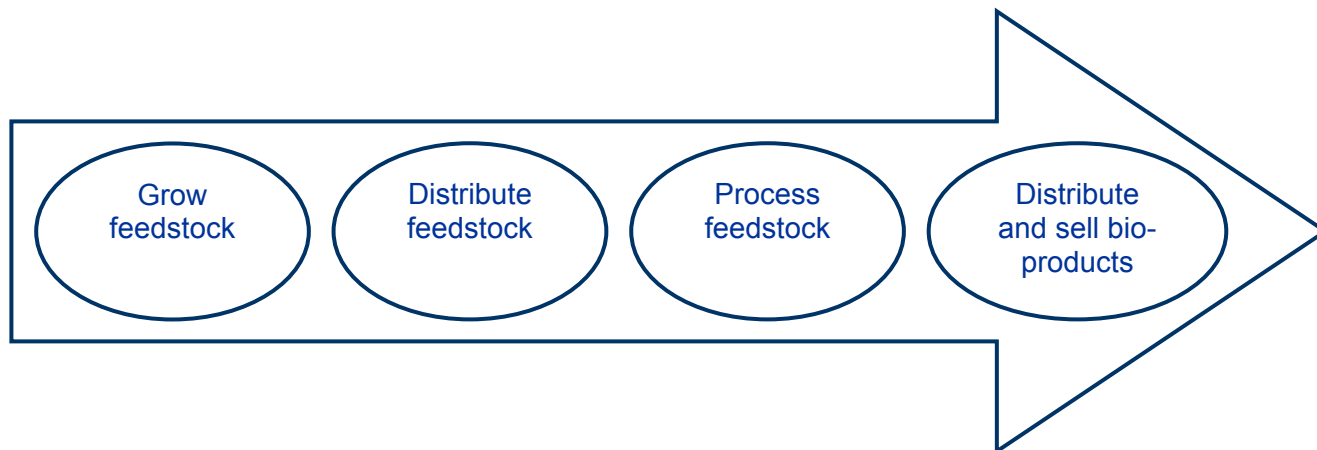


Figure 2 Market development chain to bring bio-products to market

At each of the steps presented above, a number of barriers can hinder the process. Barriers include technical, socio-economic, regulatory, and financial limitations or challenges that restrict fully or in part the market development of particular goods or services. Table 1, below, presents a comprehensive list of barriers specifically related to the bio-products categorized according to the segments of the market development chain to which they apply.

⁸ If we were to show the complete life cycle of bio-products in the diagram, we would include a fourth step characterized by the reuse, recycle, or disposal of bio-products. Consideration of policies geared towards this stage of the life cycle, and to the stages prior to the distribution and sale of bio-products, are beyond the scope of this study.

Table 1 Barriers throughout the market development chain and the segments they affect

BARRIERS	GROW FEEDSTOCK	DISTRIBUTE FEEDSTOCK	PROCESS FEEDSTOCK	SELL AND DISTRIBUTE BIO-PRODUCTS
Cost of biomass feedstock production	X			
Negative impacts on soil	X			
Access to land for biomass production	X			
Variable and/or unfavourable growing conditions	X			
Cost of biomass collection		X		
Complexity of collecting, storing, and combining feedstocks for diverse applications in an environmentally sound manner		X		
Development of infrastructure for handling material, including collection and distribution systems		X		
Locating processing and conversion facilities			X	
Limited knowledge of plant biochemistry and enzymes			X	
Lack of scientific methods to produce and prepare plants and residues so that they meet specifications for end-use applications			X	
Cost of environmentally sound thermo-chemical conversion technologies to convert biomass feedstocks into useful electric power, heat and fuels, and other products			X	
Cost of environmentally sound bio-conversion processes/technologies for commercial application of a range of bio-based fuels and products			X	
Commercialized technologies for bio-refineries that efficiently separate biomass raw materials into individual components and convert these components into marketable products			X	
Access to adequate high-voltage transmission lines for distribution of biomass-derived electricity			X	
Availability of biomass feedstock throughout the year			X	
Lack of awareness amongst designers and product producers of bio-products as alternatives to conventional materials			X	
Uncertainty of the future demand and price of biomass feedstocks and bio-products (leads to limited private investment in new production)			X	
Relatively high initial investment costs and limited access to favourable financing			X	
Limited access to/lack of availability of final products				X
High cost of bio-products relative to conventional products				X
Low consumer confidence in the performance of bio-products				X
Lack of consumer awareness of the products available				X
Difficulty for consumers to differentiate between bio-based and conventional products				X
Lack of consumer awareness of the environmental and socio-economic advantages of bio-products				X

Source: Various sources, including a previous report prepared for Industry Canada by the Pembina Institute titled "Government Policies for Promoting and Managing the Production and Consumption of Bioenergy."

Of particular interest for this study are the barriers that currently limit, prevent, or discourage the development of market *demand* for bio-products. Table 2, below, presents a focused list of the market development barriers directly relevant to this study.

Table 2 Segments of the market development chain where market demand barriers can be addressed

BARRIERS	SELL AND DISTRIBUTE BIO-PRODUCTS
Limited access to/lack of availability of final products	X
High cost of bio-products relative to conventional products	X
Low consumer confidence in the performance of bio-products	X
Lack of consumer awareness of the products available	X
Difficulty for consumers to differentiate between bio-based and conventional products	X
Lack of consumer awareness of the environmental and socio-economic advantages of bio-products	X

To stimulate market development, government policies can be targeted at specific barriers that currently hinder increased demand, such as those presented above. As is described in the next chapter of this report, a number of such policies already exist in Canada. It is important to note, however, that targeting policies solely at demand-oriented barriers will not, in itself, be sufficient to lead to increased market demand for bio-products. There is a need to address and overcome barriers concurrently that occur early in the market development chain (growing, distributing, and processing the feedstock). Although the focus of this study is on the development of market demand, many of the barriers at this final stage are the result of early barriers that propagate their way through the market development chain. For example, cost can be a barrier for a potential customer, but that barrier could have arisen because of technical or availability complications at any earlier stage in the market development chain. As a result, when considering policy options at the consumer level, it is important to recognize (as Table 1 above has demonstrated) that market development barriers can occur at the customer level or, also, elsewhere in the market development chain, and that policy action should simultaneously be targeted across the life cycle of bio-products. **Ultimately, a combination of 'upstream' (supply and producer) and 'downstream' (distribution and consumption) policy initiatives will be critical.**

Existing Policies

A number of policies already exist in Canada, at the federal level, to help overcome current barriers to bio-product market development. In this section of the report, we present details of policies currently in place that are specifically targeted at demand for bio-products. For each of the policies, we describe the type of initiative, the bio-product target area (i.e., bio-fuels, biomass-derived electricity, biomass-derived heat, or biomass-derived materials and chemicals), the objective, the relevant government departments, and year of implementation. We also present a brief description of the particular policy. For the type of initiative, we place each of the policies into one of the following broad categories: financial incentives (including, for example, tax incentives, grants, loans, and access to capital); market-based regulatory initiatives (policies that have both a price impact and a regulatory component, such as a greenhouse gas cap and trade program that sets a regulatory limit on the total amount of greenhouse gas emissions permitted, but that also allows emitters to trade, for a price, allowances in the market); information programs; procurement, demonstration, and pilot programs; and regulations, standards, and guidelines. Existing policies at the federal level in Canada (presented in the series of tables below) include the following:

Financial incentives:

- Future Fuels Program
- Tax Exemptions for Ethanol Fuel and Bio-diesel
- Renewable Energy Deployment Initiative
- Accelerated Capital Cost Allowance for Class 43.1
- Canadian Renewable and Conservation Expenses
- Renewable Power Production Incentive

Market-based regulatory initiatives:

- Green Tags Program

Information programs:

- Environmental Choice Program

Procurement, demonstration, and pilot programs:

- Refuelling stations
- Green Power Procurement Program

Regulations, standards, and guidelines:

- Ethanol Expansion Program

Following the policy details, we identify cases where policy gaps exist; for each of the barriers identified in the preceding chapter, we summarize the policies that are in place and identify segments of the market development chain not addressed by existing policies.

Details of Current Policies

NAME OF INITIATIVE: Future Fuels Program
Type of initiative: Financial
Bio-product target area: Bio-fuels
Objective: To accomplish a four-fold increase in Canada's annual ethanol production and use, reaching approximately one billion litres per year in 2010, with up to one-quarter of this coming from cellulose feedstocks.
Relevant government department: Natural Resources Canada and Agriculture and Agri-Food Canada

Description: The National Biomass Ethanol Program (NBEP) is the main component of the Future Fuels Program. It provides for \$140 million in contingent loan guarantees to encourage financing for three to six new ethanol plants. As described below, the federal government provides an excise tax exemption on the ethanol component of ethanol-blended gasoline. The NBEP is designed to minimize cash flow impact should the federal government reduce or eliminate this tax exemption. Under the NBEP, ethanol producers will be able to take advantage of the contingent loan guarantees if reduction or elimination of the excise tax exemption impairs their ability to meet scheduled long-term debt servicing agreements. The contingent loans are repayable at commercial rates of interest. In addition to the loan guarantees, the Future Fuels Program includes \$3 million over five years for a public outreach component to provide essential market information to retail consumers. The initiative also provides for such activities as public education on fuel ethanol, analysis of fuel ethanol markets and producer economics, research on a possible renewable fuel standard, and liaison with provinces and industries interested in ethanol plant expansion.⁹

Year of implementation: 2001

NAME OF INITIATIVE: Tax Exemptions for Ethanol Fuel and Bio-diesel

Type of initiative: Financial

Bio-product target area: Bio-fuels

Objective: To increase the supply and use of ethanol blended fuels in Canada.

Relevant government department: Ministry of Finance

Description: The federal government excludes ethanol used as a transportation fuel from the excise tax. This represents a \$0.10/litre exemption for the ethanol portion used in gasoline. Bio-diesel is also eligible for a federal excise tax exemption. Numerous provincial governments also exempt ethanol from fuel taxes. For example, Ontario has a \$0.147/litre exemption; Manitoba has a \$0.25/litre exemption; Alberta has a \$0.09/litre exemption; and Saskatchewan has a \$0.15/litre exemption. The combined effect of the provincial and federal ethanol exemptions is as follows:¹⁰ \$0.289/L in Quebec; \$0.264/L in Ontario; \$0.230/L in Manitoba; \$0.258/L in Saskatchewan; \$0.203 in Alberta; and \$0.262/L in British Columbia.

Year of implementation: Various

NAME OF INITIATIVE: Procurement-Refuelling Stations

Type of initiative: Procurement, demonstration, and pilot

Bio-product target area: Bio-fuels

Objective: To reduce greenhouse gas emissions, demonstrate an alternative fuel technology, and support manufacturers that produce alternative fuel vehicles and fuel suppliers that offer alternative fuels.

Relevant government department: Natural Resources Canada

Description: Natural Resources Canada, Agriculture and Agri-Food Canada, and other Government of Canada departments are now using logen's cellulose ethanol at a rate of about 100,000 litres per year. The Government of Canada operates 13 E85 refuelling stations (85 per cent ethanol and 15 per cent gasoline) and approximately 900 flex-fuel vehicles, which can use up to 85 per cent ethanol.

Year of implementation: 2000

NAME OF INITIATIVE: Renewable Energy Deployment Initiative (REDI)

Type of initiative: Financial

Bio-product target area: Biomass-derived electricity and heat

Objective: To assist in the development of a sustainable market in Canada for reliable and cost-effective renewable energy (RE) systems. The initiative aims to create market awareness and stimulate demand for these systems as well as to support the RE industries with capacity-building and infrastructure development efforts.

Relevant government department: Natural Resources Canada

Description: REDI is a nine-year, \$51-million program designed to stimulate the demand for renewable energy systems for space heating and cooling and water heating, including highly efficient and low-emitting biomass

⁹ Additional information on this program can be obtained at:

http://www.climatechange.gc.ca/english/newsroom/2001/steps/steps_future.asp

¹⁰ These figures include the GST/HST, which is charged on top of any excise taxes.

combustion systems. To encourage the private sector to gain experience with active solar and large biomass combustion systems, corporations are eligible for a refund of 25 per cent of the purchase and installation costs of a qualifying system, up to a maximum refund of \$80,000. In remote communities, businesses, institutions, and other organizations may be eligible for a refund of 40 per cent of the purchase and installation of a qualifying system, up to a maximum refund of \$80,000. As of January 1, 2005, the new terms and conditions for REDI are in place. REDI is now available for qualifying technologies used in industrial processes. An upper limit of 2MW capacity for the size of eligible biomass systems has been established, and the biomass incentive will be phased out gradually over the next two years. In addition, biomass combustion system efficiency measurement requirements, determined by simplified heat losses method, have been introduced, as has a plan for sustainable fuel supply requirement for biomass combustion systems. Finally, the biomass combustion system commissioning report must now include confirmation of the system-specific technical training taken by the system operator and/or availability to the system operator of the operation manual for the system being installed.¹¹

Year of implementation: Announced in 1997 and came into effect in 1998

NAME OF INITIATIVE: Accelerated Capital Cost Allowance for Class 43.1

Type of initiative: Financial

Bio-product target area: Biomass-derived heat and electricity

Objective: To encourage business and industry to reduce energy waste and to use renewable energy sources for energy production equipment.

Relevant government department: Ministry of Finance

Description: The Accelerated Capital Cost Allowance (ACCA) for Class 43.1 provides an accelerated capital cost allowance at a rate of 50 per cent.¹² Eligible investments include co-generation and specified waste-fuelled electrical generation systems, active solar systems, small-scale hydroelectric installations, heat recovery systems, wind energy conversion systems, photovoltaic electrical generation systems, geothermal electrical generation systems, district energy and biogas production systems, and specified waste-fuelled heat production equipment.¹³

Year of implementation: 1998

NAME OF INITIATIVE: Canadian Renewable and Conservation Expense Category

Type of initiative: Financial

Bio-product target area: Biomass-derived electricity and heat

Objective: To encourage investments in energy efficiency and renewable energy projects.

Relevant government department: Ministry of Finance

Description: The Canadian Renewable and Conservation Expenses Category are those fully deductible expenditures associated with the start-up of renewable energy and energy conservation projects for which at least 50 per cent of the capital costs of the property would be described in Class 43.1 (see policy above). Eligible expenses are associated with certain co-generation and specified waste fuelled electrical generation systems. This includes both electricity generation and heat production from the following waste fuels: municipal waste, wood waste, landfill gas, and digester gas. Eligible expenses include the cost of pre-feasibility and feasibility studies of suitable sites and potential markets for projects that will have equipment included in Class 43.1; costs related to determining the extent, location, and quality of energy resources; negotiation and site approval costs; certain site preparation costs that are not directly related to the installation of equipment; and service connection costs incurred to transmit power from the project to the electric utility.¹⁴

Year of implementation: 1996

¹¹ Additional information on this initiative can be obtained at: <http://www2.nrcan.gc.ca/es/erb/erb/english/View.asp?x=455>

¹² The ACCA for environmental technologies was increased from 30 to 50 per cent in budget 2005.

¹³ Additional information on this initiative can be obtained at: http://www.canren.gc.ca/app/filerepository/General-tax_incentives.pdf

¹⁴ Additional information on this initiative can be obtained at: <http://www2.nrcan.gc.ca/es/erb/erb/english/View.asp?x=455>

NAME OF INITIATIVE: Market Incentive Program
Type of initiative: Financial
Bio-product target area: Biomass-derived electricity
Objective: To raise public awareness of green power choices and increase the market share of green power, support promising renewable energy technologies, and achieve greenhouse gas and other air pollutant emission reductions.
Relevant government department: Natural Resources Canada and Environment Canada
Description: This program provides financial support to electricity distributors interested in developing market-based programs that will increase sales of green power in the residential and small business markets. Natural Resources Canada and Environment Canada will provide a short-term financial incentive up to 40 per cent of the eligible costs of an approved project. The total budget for this measure is \$25 million ending March 31, 2006. ¹⁵
Year of implementation: 2000
Sub-sector targeted: Bio-energy market development

NAME OF INITIATIVE: Procurement—Green Power Procurement Program
Type of initiative: Procurement, demonstration, and pilot
Bio-product target area: Biomass-derived electricity
Objective: To help interested utilities gain experience with different electricity products, achieve emission reductions in federal operations, and leverage first purchases to create viable green power markets.
Relevant government department: Public Works and Government Services Canada, Environment Canada, and Natural Resources Canada
Description: The Government of Canada Action Plan 2000 on Climate Change announced a commitment to purchase 20 per cent of federal electricity requirements from emerging renewable energy sources (ERES). The government aims to displace most federal purchases of high-carbon electricity with electricity from ERES. The budget for this Action Plan 2000 initiative is \$40 million over five years, ending March 31, 2006. At this point, the federal government has agreements in place for one-third of their 20 per cent commitment. These agreements are in Saskatchewan (wind), Prince Edward Island (wind), and Ontario (small hydro). There is currently no bio-energy in any of the agreements (although it is eligible). Negotiations for the remaining two-thirds are ongoing. ¹⁶
Year of implementation: 2000

NAME OF INITIATIVE: Ethanol Expansion Program
Type of initiative: Regulations, standards, and guidelines
Bio-product target area: Bio-fuels
Objective: To guide future developments of bio-energy in Canada.
Relevant government department: Natural Resources Canada
Description: The Ethanol Expansion Program (EEP) calls for 35 per cent of gasoline sales to be E10 blends by 2010, which would require approximately 1.4 billion litres of ethanol production capacity. ¹⁷ This program is supported by \$100 million designated for grants to ethanol producers, of which \$78 million was approved in 2003 (Round 1) to help finance 750 million litres of annual ethanol production capacity. Round 2 of the EEP was launched on December 6, 2004. The deadline for proposals is February 22, 2005. Available contributions under

¹⁵ Additional information on this initiative can be obtained at:
<http://www2.nrcan.gc.ca/es/erb/erb/english/View.asp?x=457>

¹⁶ Personal communications, Natural Resources Canada, January 2004.

¹⁷ This extends on the Action Plan 2000 Future Fuels Initiative, which called for an increase of ethanol production to 1 billion litres per year by 2010. This would have been enough for approximately 25 per cent of gasoline sales to be E10 blends.

Round 2 currently total \$27.5 million. A proposed next step is to set a target of 500 million litres of bio-diesel in use by 2010. There are currently no specific policies in place to support the achievement of a bio-diesel target.¹⁸

Year of implementation: 2000

NAME OF INITIATIVE: Environmental Choice Program–EcoLogo

Type of initiative: Information program

Bio-product target area: Bio-fuels and biomass-derived electricity, heat and chemicals, and materials

Objective: Increased awareness of environmentally sensitive goods and services

Relevant government department: Environment Canada

Description: The Environmental Choice Program (ECP) helps consumers identify products and services that are less harmful to the environment. In order to obtain the EcoLogo, a product or service must be made or offered in a way that includes the following: improves energy efficiency; reduces hazardous by-products; uses recycled materials; is re-usable or provides some other environmental benefit. In addition, certified products or services should meet or exceed any applicable industry-specific safety and performance standards. A key aspect of the certification process is the requirement for third-party verification of compliance to ECP certification criteria as a condition for certification and licensing. Many bio-products are currently eligible for eco-labelling in Canada (including, for example, electricity from biomass, ethanol-blended gasoline, vegetable-based industrial lubricants, biologically-based cleaning and degreasing compounds, and naturally derived phenol substitutes).¹⁹

Year of implementation: 1988

NAME OF INITIATIVE: Green Tags Program

Type of initiative: Market-based regulatory initiative

Bio-product target area: Biomass-derived electricity

Objective: To increase biomass-derived electricity

Relevant government department: Various at the provincial level

Description: Green tags are currently available in many regions in Canada, including Alberta, British Columbia and Ontario. An official certification (Eco-Logo) of low-impact renewable energy exists through the Environmental Choice Program of the federal government. This program certifies production facilities. In addition, a Green Power Certificates certification has been recently established. It makes it possible to trade the environmental benefits associated with low-impact renewable energy.²⁰

Year of implementation: Various

NAME OF INITIATIVE: Renewable Power Production Incentive (RPPI)

Type of initiative: Financial

Bio-product target area: Biomass-derived electricity

Objective: To encourage the use of other renewable power energy technologies such as small hydro, biomass, and landfill gas.

Relevant government department: Natural Resources Canada

Description: To stimulate the installation of up to 1,500 MW of new, renewable energy electricity generation capacity, other than wind, an incentive payment of 1 cent per kilowatt-hour of production for the first 10 years of operation will be introduced for eligible projects commissioned after March 31, 2006, and before April 1, 2011.

Year of implementation: 2005

¹⁸ Additional information on this program can be obtained here:

<http://www.oeenrcan.gc.ca/transportation/fuels/ethanol/eep.cfm?attr=8>

¹⁹ Additional information on this program can be obtained here: <http://www.environmentalchoice.com>

²⁰ A specific example of a green tags program is Vision Quest's certified green energy tags. For information on this program visit <http://www.visionquestwind.com>

Policy Gaps

The series of tables below summarizes the current policies in place in Canada for each of the four main categories of bio-products considered in this report (biomass-derived fuel, electricity, heat and chemicals, and materials). The tables, one for each of the barriers that limit market demand for bio-products, also identify important gaps in the policy framework. Gaps exist in cases where policies designed to stimulate the market demand for particular bio-products or their associated technologies, distribution, and sale are not currently in place. In other words, to the extent that government policies are not targeted at each category of bio-products within each of the relevant barriers, a policy gap exists.

1. Limited access to/lack of availability of final products

FUEL	ELECTRICITY	HEAT	CHEMICALS AND MATERIALS
<ul style="list-style-type: none"> ➤ Current programs: Future Fuels Program; Ethanol Expansion Program ➤ Gaps: policies to increase access to bio-diesel; policies geared at automobile dealerships; policies geared at fuel retailers 	<ul style="list-style-type: none"> ➤ Current programs: CRCE, ACCA, Green Tags ➤ Gaps: policies geared at the consumption and distribution of biomass-derived electricity 	<ul style="list-style-type: none"> ➤ Current programs: REDI, CRCE, ACCA ➤ Gaps: policies geared at residential consumers of biomass-derived heat 	<ul style="list-style-type: none"> ➤ Gaps: incentives to distribute biomass-derived chemicals and materials; consumption targets for biomass-derived chemicals and materials

2. High cost of bio-products relative to conventional products

FUEL	ELECTRICITY	HEAT	CHEMICALS AND MATERIALS
<ul style="list-style-type: none"> ➤ Current programs: Tax exemption for ethanol fuel and bio-diesel; ethanol fuel procurement ➤ Gaps: consumer incentives for alternative fuelled vehicles 	<ul style="list-style-type: none"> ➤ Current programs: Green Power Procurement, CRCE, ACCA, RPPI ➤ Gaps: consumer incentives for biomass-derived electricity 	<ul style="list-style-type: none"> ➤ Current programs: REDI, CRCE, ACCA ➤ Gaps: consumer incentives for biomass-derived heat; procurement for biomass-derived heat 	<ul style="list-style-type: none"> ➤ Gaps: incentives to purchase biomass-derived chemicals and materials; procurement programs for biomass-derived chemicals and materials

3. Low consumer confidence in the performance of bio-products

FUEL	ELECTRICITY	HEAT	CHEMICALS AND MATERIALS
<ul style="list-style-type: none"> ➤ Current programs: Future Fuels Program; Ethanol Procurement; ➤ Gaps: Marketing program for biomass-derived fuels; vehicle performance awareness for consumers, retailers and the vehicle service sector 	<ul style="list-style-type: none"> ➤ Current programs: Green Power Procurement; Market Incentive Program 	<ul style="list-style-type: none"> ➤ Gaps: procurement for biomass-derived heat; demonstration programs for biomass-derived heat; marketing programs 	<ul style="list-style-type: none"> ➤ Gaps: procurement programs for biomass-derived chemicals and materials; demonstration programs for biomass-derived goods; marketing chemicals and materials; consumer awareness

4. Lack of consumer awareness of the products available

FUEL	ELECTRICITY	HEAT	CHEMICALS AND MATERIALS
<ul style="list-style-type: none"> ➤ Current programs: Future Fuels Program ➤ Gaps: Marketing program for biomass-derived fuels 	<ul style="list-style-type: none"> ➤ Current programs: Market Incentive Program 	<ul style="list-style-type: none"> ➤ Gaps: marketing program for biomass-derived heat 	<ul style="list-style-type: none"> ➤ Gaps: marketing program for biomass-derived chemicals and materials

5. Difficulty for consumers to differentiate between bio-based and conventional products

FUEL	ELECTRICITY	HEAT	CHEMICALS AND MATERIALS
<ul style="list-style-type: none"> ➤ Current programs: Environmental Choice Program 	<ul style="list-style-type: none"> ➤ Current programs: Environmental Choice Program 	<ul style="list-style-type: none"> ➤ Current programs: Environmental Choice Program 	<ul style="list-style-type: none"> ➤ Gaps: Environmental Choice Program

6. Lack of consumer awareness of the environmental and socio-economic advantages of bio-products

FUEL	ELECTRICITY	HEAT	CHEMICALS AND MATERIALS
<ul style="list-style-type: none"> ➤ Current programs: Future Fuels Program ➤ Gaps: Education program for bio-diesel. 	<ul style="list-style-type: none"> ➤ Gaps: Education program for biomass-derived electricity 	<ul style="list-style-type: none"> ➤ Gaps: Education program for biomass-derived heat 	<ul style="list-style-type: none"> ➤ Gaps: Education program for biomass-derived chemicals and materials

It is worth highlighting the fact that the policies currently in place in Canada related to bio-products are heavily focused on bio-fuels and biomass-derived heat and electricity. **There are no policies that are explicitly focused on stimulating demand for biomass-derived chemicals and materials.** This is a significant gap in the current policy framework and an area to which future policies should be targeted.

Policy Options

In the previous section of this report, we described the current policy framework related to bio-product market demand in Canada. In addition, we put the policy framework into the context of the barriers that currently limit increased market demand for bio-products and, in doing so, identify a number of policy gaps in the existing policy framework. In this section of the report, we identify a wide range of policy options that can be implemented to fill in existing policy gaps, overcome barriers that limit market demand, and also meet other important "conditions for success." The policy options identified are drawn from available literature on biomass-oriented, demand-related policies and also from experience in other jurisdictions.

The policies that were examined as part of this exercise are grouped under the same headings used to categorize the existing policies: financial incentives; market based regulatory initiatives; information and education; procurement, demonstration, or pilot programs; and regulations, standards, or guidelines. The specific policy options (of which there are 18) are identified and categorized in the bulleted lists below.

Financial incentives:

- grants
- carbon tax
- consumer tax credits
- investment tax credits
- accelerated capital cost allowances
- tax exemptions
- loans

Market-based regulatory initiatives:

- cap and trade program for greenhouse gas emissions
- regulated or fixed price for bio-products
- net metering
- Green Tags Program

Information programs:

- awareness and education program
- eco-labelling initiative

Procurement, demonstration, and pilot programs:

- demonstration projects
- government procurement initiative

Regulations, standards, and guidelines:

- purchasing targets or requirements
- blended fuel requirements
- emission restrictions

For a policy to be successful, a number of important conditions must be met. They will vary by geographic region, level of government, and policy objective, amongst other factors. Ultimately, the particular conditions for success will depend on the specific policy objectives identified for the particular region in which the policy is to be enacted. Potential policy objectives can include, for example, environmental improvements, market penetration, export opportunities, or job creation. In many cases, the policy will be designed and intended to achieve not just one objective, but several.

For the purposes of this report, we have identified a number of "conditions for success" against which the various policy options listed above will be evaluated. The relevant conditions for success, referred to from now on as "evaluative criteria," are as follows:

- appropriate jurisdictional power
- strong incentive effect
- low administrative requirements
- cost effective implementation
- politically feasible goals
- address a barrier
- respond to a policy gap
- environmentally effective results
- international experiences noted²¹

In the next chapter, we evaluate the policies listed above according to these important evaluative criteria.

²¹ While we do not consider international experience with a particular policy to be a necessary condition for success, we feel that such experience can be extremely helpful in informing policy options and design features for Canada and, therefore, include it in this analysis.

Policy Evaluation

In the series of tables below, we evaluate the extensive list of policy options identified in the previous chapter according to the evaluative criteria. The objective of this exercise is to identify the most promising policy options for implementation in Canada for the purpose of stimulating marketplace demand for bio-products.

Evaluative Framework

The table below describes the various criteria that were evaluated and presents the format in which the evaluation was completed.

POLICY OPTION: Name of Policy
Policy description: Provides a brief description of the policy.
Incentive effect: Policies are evaluated according to whether they provide a direct incentive to bio-products or whether they apply more broadly, for example, to any capital investments or a number of environmental technologies. In the case of the latter, the incentive effect would be indirect as opposed to direct. Policies are also evaluated according to their ability to provide an on-going incentive to invest in bio-products, as opposed to a one-time investment.
Barrier(s) addressed: We consider whether the policy is explicitly targeted at a known barrier associated with bio-products (identified earlier in the report) or whether it applies more broadly to various technologies and products.
Cost effectiveness: We provide a brief description of the potential magnitude of the cost of the policy from a government perspective (qualitatively only). We identify cases where costs may be prohibitive or where they may be justifiable and in some cases make note of policy coordination options that could lead to a reduction in costs. ²²
Administrative requirements: A brief description is provided of what would be required from a government administrative perspective to implement the particular policy. We consider whether it would simply be an extension of an existing program, whether the systems needed to support the policy are already in place (for example in the case of EcoLogo), or whether the policy would require monitoring and reporting that are not currently established.
Responds to a policy gap: Based on the review of Canadian policies, presented earlier in this report, we identify cases where policies are able to fill an existing policy gap.
Environmental effectiveness: Some policies will have a greater impact on environmental conditions than others. To evaluate the environmental effectiveness of particular policies, we provide a brief description of the potential scale of impact the policy could have on environmental conditions and the factors that will determine the level of impact.
Political feasibility: The objective for this criterion is to provide a sense of the federal government's stance on the particular policy. We note cases where precedents exist, where the type of policy is under consideration, or where the government has stated that it will not be pursuing the particular policy.
Jurisdictional authority: We note whether the federal government, the provincial government, or both levels of government have jurisdictional authority to pursue the particular policy.
International experience: An example of such a policy that is in place in another jurisdiction (outside of Canada) is presented.

The detailed policy evaluation follows.

²² A complete cost-benefit analysis for each of the policy options would need to be completed to provide an accurate picture of the true costs associated with each of the policy options.

Financial Incentives

The policy options considered in the tables below provide direct financial incentives to investors, distributors, or consumers to purchase bio-products and/or associated technologies.

POLICY OPTION: Grants
Description: Grants, in the form of direct financial support, can be awarded for investments in particular technologies or goods.
Responds to a policy gap: Yes. Grants targeted at the purchase of alternative fuel vehicles (including ethanol and bio-diesel), for the establishment of bio-fuel refuelling properties, for dealerships that sell alternative fuel vehicles, for fuel distributors who sell bio-fuels, or for purchases of eligible bio-products would address current policy gaps, especially those related to access to bio-products and the high cost of bio-products.
Administrative requirements: Depending on the scope of such a program, such an initiative can be relatively easy to administer. However, to the extent that grants were only made available to the most environmentally and/or socially beneficial bio-products, eligible goods would need to be identified through a life cycle assessment of environmental and social costs and benefits. Combining this project with an eco-label program would help reduce such expenses.
Incentive effect: Grant programs can provide direct and ongoing incentives to invest in particular technologies and to purchase eligible goods.
Barrier(s) addressed: Such policies can be designed to explicitly address barriers associated with access to bio-products and relatively high costs associated with bio-products.
Likely environmental effectiveness: To the extent that the use of the technologies or the purchase of the goods that are associated with the grants result in emission reductions, improvements in environmental conditions can be expected.
Cost effectiveness: The cost of such programs depend on the value of the grants provided and the magnitude of the barrier that needs to be overcome in order to achieve market penetration. Such costs are usually justifiable.
Political feasibility: The federal government has used grant programs to encourage renewable energy developments in Canada. For example, the Renewable Energy Deployment Initiative, designed to stimulate the demand for renewable energy systems for space and water heating and cooling, including highly efficient and low-emitting biomass combustion systems, offers businesses and institutions a financial incentive of 25 per cent of the purchase and installation costs of a qualified system, to a maximum of \$80,000. Given this and other examples, additional grants to support bio-products seem politically feasible.
Jurisdictional authority: Can be implemented at the federal or provincial level. Grants may need to be designed to be regionally specific to take advantage of explicit bio-product opportunities, which will vary from one region to the next.
International experience: Section 9005 of the United States Farm Bill (2002) directs the Secretary of Agriculture to provide grants to farmers, ranchers, and rural small businesses towards energy efficiency improvements and the use of renewable energy technologies and systems (including systems for biomass-derived electricity). ²³ The Market introduction program for biogenic lubricating oil and fuels in Germany provides investment grants to local authorities and farmers to convert machinery and fleet stations to vegetable oil-based fuels and lubricating oils. ²⁴

²³ Nipp, Terry. September 2004. *United States Support for the Agricultural Production of Biomass: The Challenge of Integrating Energy, Agricultural and Environmental and Economic Policies*. Paris, France: OECD.

²⁴ Reiche, Danyel, ed. 2002. *Handbook of Renewable Energies in the European Union*. Frankfurt: Peter Lang.

POLICY OPTION: Carbon Tax

Description: A carbon tax is levied on fossil fuels according to their relative carbon content (in the form of \$/tonne of CO₂ equivalent). In this way, fuels with comparably higher carbon content become relatively more expensive and their consumption is thus discouraged.

Responds to a policy gap: Yes, depending on the point of application, i.e., upstream or downstream, it could help respond to policy gaps for biomass-derived heat and electricity materials and chemicals.

Administrative requirements: The administrative requirements for implementing a carbon tax in Canada could be substantial. To minimize costs, it would be useful to use a tax framework already in place in Canada, such as that which exists for excise fuel taxes.

Incentive effect: Such a policy would provide a direct and ongoing incentive to purchase low carbon fuels. This policy would not be explicitly targeted at bio-products and would not guarantee an increased demand for such products.

Barrier(s) addressed: A carbon tax would help to reduce the price differential between bio-fuels and competing, conventional fuels, thereby making bio-fuels increasingly competitive in the marketplace.

Likely environmental effectiveness: The impact on total greenhouse gas emissions could be substantial and will be driven by how broadly the tax is applied and the level of the tax that is imposed.

Cost effectiveness: Environmental taxes, such as carbon taxes, are seen as being cost effective in that investments in emission reductions will be realized only to the extent that they are cheaper than the carbon tax itself. Thus, only the most economical emission reduction investments occur.

Political feasibility: A carbon tax is currently not politically feasible in Canada, although several European countries have implemented carbon taxes as a means to reduce emissions and strive towards commitments established in the Kyoto Protocol.

Jurisdictional authority: A carbon tax would be best pursued at the federal level since the federal government has jurisdictional authority to address environmental issues of national or international significance.

International experience: A number of European regions have implemented carbon taxes, including, for example, Denmark, Finland, the Netherlands, Norway, and Sweden. In all of these regions, the most energy-intensive industries are exempt or partially exempt from carbon taxes. In some cases, the exemption is conditional upon participation in a legally binding voluntary agreement for emission reductions, as in the Danish CO₂ agreement scheme,²⁵ or upon investment by the industry in clean technologies. Such exemptions can be phased out over time as technologies for reducing emissions become increasingly competitive and thereby reach a certain threshold of market penetration.

POLICY OPTION: Consumer Tax Credit

Description: Consumer tax credits are offered to individuals who undertake investments in certain goods or activities. Such credits lead to a reduction in annual income tax paid.

Responds to a policy gap: Yes, in the case of consumer tax credits for the purchase of eligible bio-products and bio-product related technologies (vehicles, heat, and energy systems).

Administrative requirements: Examples of such credits already exist in Canada; such a policy would be relatively easy to administer.

Incentive effect: The policy would provide a direct and on-going incentive to purchase eligible goods.

Barrier(s) addressed: This policy would explicitly address economic barriers associated with purchasing bio-products.

Likely environmental effectiveness: To the extent that this policy is successful in addressing economic barriers, increased purchases of bio-products would be realized and environmental improvements achieved.

Cost effectiveness: Costs associated with this policy should be justifiable for a period of time until bio-products achieve minimum levels of consumption and the costs of these new and innovative products decline.

Political feasibility: Precedents of tax credits in Canada are numerous. For example, companies incurring costs related to scientific research and development are able to claim a credit against such expenses.

²⁵ Johannsen, Katja and Mikael Togeby. 1999. *Evaluations of the Danish CO₂ Agreement Scheme*. CAVA Working Paper no. 98/11/7. Paris: European Research Network on Voluntary Approaches for Environmental Protection (CERNA).

Jurisdictional authority: Can be implemented at the federal or provincial level. Credits may need to be designed to be regionally specific to take advantage of explicit bio-product opportunities, which will vary from one region to the next.

International experience: Numerous states in the US offer income tax credits for the purchase of alternatively fuelled vehicles (including, for example, Colorado, Kansas, Georgia, Illinois, Nebraska, New York, Oklahoma, Oregon, Pennsylvania, and Utah).²⁶

POLICY OPTION: Investment Tax Credit

Description: Investment tax credits (ITC) are awarded for a portion of eligible costs associated with investments in specified technologies. Such credits usually amount to 20 to 40 per cent of eligible investment costs and could be made available to investors in renewable energy and heating systems.

Responds to a policy gap: Yes, especially to the extent that ITCs are targeted at investments related to the production and distribution of biomass-derived chemicals and materials.

Administrative requirements: Because such policies are already in place in Canada (for example, the Canadian Renewable Conservation Expenses program described in the Existing Policies chapter of this report), implementing complementary policies, targeted at bio-product technologies, should not result in significant administrative requirements.

Incentive effect: Investment tax credits provide ongoing and direct incentive to invest in eligible technologies. To the extent that bio-product technologies qualified for such an incentive, an increase in the use of such technologies would be likely.

Barrier(s) addressed: Such a policy could be designed to explicitly address cost barriers associated with investing in bio-product technologies.

Likely environmental effectiveness: To the extent that the investment tax credit is sufficiently large and market penetration of bio-products ensues, environmental improvements would be realized.

Cost effectiveness: The cost of the program would depend on the size of the credit required to overcome existing barriers and facilitate market penetration.

Political feasibility: Because such policies already exist in Canada (for example, the Canadian Renewable and Conservation Expenses program) implementing such a policy targeted at bio-product technologies should be politically feasible.

Jurisdictional authority: Can be implemented at the federal or provincial level.

International experience: In Indiana, a taxpayer who is a fuel retailer and operates a service station where blended bio-diesel is sold and dispensed through a metered pump in a taxable year is entitled to a credit of \$0.01 per gallon of blended bio-diesel sold and dispensed through all the metered pumps located at a service station. Similarly, in North Carolina, a tax credit is available for qualified refuelling facilities that dispense bio-diesel, 100 per cent ethanol or ethanol/gasoline mixtures consisting of at least 79 per cent ethanol. The credit is equal to 15 per cent of the cost to the taxpayer of constructing and installing the part of the dispensing facility that is directly and exclusively used for dispensing and storing the fuel, including pumps, storage tanks, and related equipment.²⁷

POLICY OPTION: Accelerated Capital Cost Allowance

Description: Certain investments qualify for accelerated capital cost allowances (ACCA). These allowances specify the rate at which the cost of the investment can be claimed as a deduction for tax purposes over time. Normally, capital investments are written off for the useful life of the particular investments. However, to encourage investments in particular technologies, some investments qualify for accelerated capital cost allowances, which means that the investments can be written off faster than would otherwise be the case. Investments in specified waste-fuelled electrical generation systems and specified waste-fuelled heat production equipment currently qualify for a capital cost allowance of 50 per cent. Increasing this allowance rate would provide additional incentive to invest in such technologies.

Responds to a policy gap: Yes, to the extent that capital investments related to the production of biomass-

²⁶ Energy Efficiency and Renewable Energy, United States Department of Energy. *State and Federal Alternative Fuel Vehicle Incentives and Laws*. http://www.eere.energy.gov/afdc/laws/incen_laws.html

²⁷ Energy Efficiency and Renewable Energy, United States Department of Energy. *State and Federal Alternative Fuel Vehicle Incentives and Laws*. http://www.eere.energy.gov/afdc/laws/incen_laws.html

derived materials and chemicals were eligible. Capital equipment for biomass-derived electricity and heat are already eligible for an ACCA, although the rate could be increased.
Administrative requirements: Because these technologies already receive an allowance of 50 per cent, the administrative requirements with extending the rate would not be significant.
Incentive effect: An increased capital cost allowance for bio-product technologies would provide a direct and ongoing incentive to invest in these technologies.
Barrier(s) addressed: An increased ACCA would help address cost barriers associated with bio-product technologies.
Likely environmental effectiveness: To have a significant effect on environmental conditions, the ACCA for bio-product technologies would have to increase substantially. Otherwise, bio-product technologies would not gain a competitive edge on competing technologies, and market penetration of these technologies would not be enough to have an impact on environmental conditions.
Cost effectiveness: Increasing the ACCA for bio-product technologies should not result in significantly increased costs.
Political feasibility: Precedents have been set with increasing the ACCA in Canada. For example, the 2005 federal budget increased the ACCA for environmentally friendly technologies (including some related to biomass) from 30 to 50 per cent.
Jurisdictional authority: Can be implemented at the federal level.
International experience: Investments in environmental technologies qualify for accelerated capital cost allowances in many countries, including the United Kingdom and France.

POLICY OPTION: Tax Exemption/Reduction/Refund

Description: Sales taxes are paid on the purchase of most goods and services. Similarly, fuel taxes are paid on the purchase of automotive fuel. In some cases, goods and services associated with beneficial environmental attributes are exempt from such taxes, eligible for a tax refund, or qualify for a lower tax rate.
Responds to a policy gap: Partially. This policy is already in place for bio-fuels but could be extended to the purchase of alternative fuel vehicles, to dealerships that sell alternative fuelled vehicles, to fuel retailers who sell bio-fuels, for the purchase of renewable energy and heating systems, and biomass-derived chemicals and materials.
Administrative requirements: Because the tax framework for these taxes is already in place, and tax exemptions (as well as reductions and refunds) for particular purchases are currently common, bio-products could be made eligible for such incentives with relatively few administrative requirements.
Incentive effect: Providing an exemption for bio-products and/or associated technologies from sales and/or fuel taxes would provide an ongoing incentive to invest in bio-products.
Barrier(s) addressed: This policy would address cost barriers associated with bio-products and increase the competitiveness of bio-products relative to conventional goods.
Likely environmental effectiveness: To the extent that this policy is successful in addressing economic barriers, increased purchases of bio-products would be realized and environmental improvements achieved.
Cost effectiveness: Costs associated with this policy should be justifiable for a period of time until bio-products achieve minimum levels of consumption and the costs of these new and innovative products decline.
Political feasibility: There are numerous examples of tax exemptions, reductions, and refunds in place in Canada. For example, as was described in the Existing Policies chapter, the federal government provides an exemption from the fuel excise tax for the ethanol portion of ethanol and gasoline blended fuels. This exemption is also available for bio-diesel. Given this experience, it appears that such initiatives are politically acceptable.
Jurisdictional authority: Can be implemented at the federal and/or provincial level.
International experience: Fossil-based fuels in Sweden are subject to both a carbon dioxide tax and an energy tax. The Swedish carbon dioxide tax was set at about EUR 0.028 (CAN\$0.04) per kg of carbon dioxide in 1991. In 1993, it was raised to EUR 0.036 (CAN\$0.057) per kg, and in 1996 further raised to EUR 0.04 (CAN\$0.063) per kg. In pilot projects in Sweden, ethanol and rapeseed methyl ester (RME) are exempt from carbon taxes and energy taxes. Bio-fuels used for heat and electricity are also exempt from these taxes. In all cases, exemptions are time-limited and will be phased out over time.

POLICY OPTION: Loans

Description: Government entities can provide low-interest loans for the purchase of eligible goods or investments in eligible technologies.

Responds to a policy gap: Yes, although the Future Fuels Program, which is already in place, will provide loans to ethanol producers in the event that the exemption from the federal excise tax for ethanol-blended fuels is removed. To fill existing policy gaps, loans could be made available for the purchase of alternative fuelled vehicles (ethanol and bio-diesel), for the establishment of bio-fuel refuelling properties, for installation and purchase of renewable energy systems, or for purchases of bio-products.

Administrative Requirements: Because other loan systems are in place and administering loans is readily done and easy to manage, the administrative requirements for such a program would not be significant.

Incentive effect: Such a policy, applied to bio-products, would provide a direct and on-going incentive to make investments in bio-products. However, the incentive would not be as significant as in the case of a grant or credit program, as the cost savings for the investor are limited to the difference between the interest rate charged by the government and that which would be obtained through a financial institution.

Barrier(s) addressed: This policy would help to overcome economic barriers associated with bio-products. It would also facilitate increased access to capital and would reduce the risk to investors, as they would be liable for relatively lower interest rates.

Likely environmental effectiveness: To the extent that this policy is successful in addressing economic barriers, increased purchases of bio-products would be realized and environmental improvements achieved. However, the environmental impact would not be as significant as in the case of a grant or credit program where the impact of the policy is expected to be greater.

Cost effectiveness: The costs associated with this policy are very reasonable and are limited to the difference between the interest rate charged by the government and that charged by financial institutions multiplied by the amount of the loan.

Political feasibility: As the risk to government is low with this policy and the costs associated with it are relatively minor, this policy has a high degree of political feasibility.

Jurisdictional authority: Can be implemented at the federal and/or provincial level.

International experience: Section 9006 of the United States Farm Bill (2002) directs the Secretary of Agriculture to provide loans to farmers, ranchers, and rural small businesses towards energy efficiency improvements and the use of renewable energy technologies and systems (including systems for biomass-derived electricity).²⁸

Market-based Regulatory Initiatives

As was described previously, the market-based regulatory initiatives considered in the tables below have both a price impact and a regulatory component. For example, a greenhouse gas cap and trade program (described below), sets a regulatory limit on the total amount of greenhouse gas emissions permitted, but also allows emitters to trade (for a price) allowances in the market.

POLICY OPTION: Greenhouse Gas Cap and Trade

Description: This measure would establish an overall cap on greenhouse gas emissions and allocate emission allowances among emitting entities. The allowances could then be traded such that the total emissions remain at or below the specified cap. Entities would be encouraged to invest in emission-reducing activities and technologies to the extent that such investments are more economical than the value of the emission allowances.

Responds to a policy gap: Partially. While this policy could help respond to policy gaps for biomass-derived heat and electricity, it would not respond to policy gaps for biomass-derived chemicals and materials.

Administrative requirements: The administrative requirements depend on the scope of the trading scheme—i.e., whether the policy applies just to large industrial emitters or to all emitters—and could be substantial.

Incentive effect: Depending on design, this type of policy can provide incentive to invest in energy-efficient

²⁸ Nipp, Terry. September 2004. *United States Support for the Agricultural Production of Biomass: The Challenge of Integrating Energy, Agricultural and Environmental and Economic Policies*. Paris, France: OECD.

and renewable energy technologies. Such a system will not guarantee investments in bio-products or associated technologies, as emission reductions can be achieved in a number of different ways.
Barrier(s) addressed: While this type of policy will encourage investments in technologies and processes that reduce greenhouse gas emissions, it will not explicitly address an existing barrier associated with bio-products market development.
Likely environmental effectiveness: The environmental effectiveness of this policy depends on the scope of the program as well as the level at which the total greenhouse gas emissions for those participating in the trading program are capped. The impact on emissions could be significant.
Cost effectiveness: Cap and trade programs are considered to be cost effective in that only those emission reductions that are most cost effective (i.e., cheaper than the cost of buying an allowance) are realized.
Political feasibility: The federal government in Canada is currently developing a cap and trade program for large final emitters of greenhouse gases as a means to reduce greenhouse gas emissions. The political feasibility of such a program depends largely on the design and scope of the program.
Jurisdictional authority: Can be implemented at the federal and/or provincial level but is more appropriate at the federal level (to ensure that on a national scale the emission reductions that occur are the most cost effective).
International experience: The United Kingdom implemented the first economy-wide greenhouse gas emissions trading scheme in March 2002. ²⁹ In the first year, direct participants in the program achieved emission reductions of 4.64 million tonnes CO ₂ e (carbon dioxide equivalent) against their baselines, and in the second year they achieved emission reductions of nearly 5.2 million tonnes CO ₂ e against their baselines.

POLICY OPTION: Regulated/Fixed Price

Description: A regulated price policy establishes a fixed price for particular goods or services. Such policies can be thus used to set prices for biomass-derived energy, heat, or products so that they are increasingly competitive with conventional options and provide certainty to the market for such products.
Responds to a policy gap: Not necessarily. Because of regional variations, the prices chosen for particular bio-products may not provide the necessary incentives needed to fill policy gaps related to the high cost of bio-products.
Administrative requirements: This kind of direct intervention in the market would be difficult to administer at the federal level. Renewable energy sources vary significantly between regions in Canada, and establishing a fixed price would have to be done on a region-by-region basis. Concerns about fairness between regions would inevitably result. There are also significant cost differences for heat between regions in Canada, and variations in the cost of bio-products between provinces would also be a concern.
Incentive effect: Given significant variations in prices (for energy, heat, and bio-products) setting a national price for each of these would by no means guarantee that bio-products would become or remain competitive in each region of Canada. Furthermore, such a policy does not provide an ongoing or direct incentive to invest in bio-products in particular.
Barrier(s) addressed: This policy would help to reduce the cost differential between bio-products and competing goods and services.
Likely environmental effectiveness: The environmental effectiveness of this policy depends on the level at which the price for bio-products is set and the extent to which the price gap between bio-products and competing goods and services is reduced.
Cost effectiveness: Such programs, especially when implemented nationally, can prove to be extremely expensive, as governments become liable for any shortfalls resulting from differences between true costs of production and the established price.
Political feasibility: Given the high level of market intervention that would be required to establish such a program for bio-products at the federal level and significant regional differences between the cost of heat, electricity, and goods between provinces, as well as differences in the availability of biomass feedstocks between regions, such a program does not seem politically feasible at the national level.
Jurisdictional authority: Provincial authority
International experience: Brazil's national alcohol fuel program (PROALCOOL) includes the following policy

²⁹ Information on this program is available at:
<http://www.defra.gov.uk/environment/climatechange/trading/uk/index.htm>

initiatives: guaranteed purchase of all of the fuel ethanol that was produced by the state-owned oil company Petrobras; a fixed producer price for ethanol; low interest rate loans for agro-industrial enterprises willing to produce ethanol; minimum ethanol content in gasoline of 22 per cent anhydrous ethanol in gasoline; the pricing of hydrous ethanol to make it attractive to consumers; the price of hydrous ethanol fuel at the pump head was set at only 59 per cent of the price of gasoline;³⁰ reduced tax on ethanol; and tax incentives for consumers to purchase ethanol-only vehicles.

POLICY OPTION: Net Metering

Description: Net metering for the residential sector allows the electricity meters of customers with generating facilities (for example, in the case of electricity-produced from biomass) to turn backwards when the generators are producing energy in excess of the customers' demand. Under such a scheme, customers receive retail prices for the excess electricity they generate and distribute onto the electrical grid.

Responds to a policy gap: Yes. This policy would respond to the lack of consumer incentives for biomass-derived electricity. However, this policy would only apply to small-scale distributed residential biomass power generation, the application of which is limited (photovoltaic and small-scale wind are much more applicable in the residential sector).

Administrative requirements: Administrative requirements related to net metering are relatively minor. In provinces where guidelines have already been developed, implementing formal regulations to ensure or allow that net metering takes place would be fairly straightforward.

Incentive effect: Net metering provides a direct and ongoing incentive for distributed generation to produce electricity and feed it onto the grid system. To the extent that electricity from biomass was included in the types of electricity generation encompassed by a net metering policy, such a policy would provide an ongoing incentive to invest in such capacity. Under a net metering policy, there would still be no guarantee that the electricity would come from biomass, since this type of policy would also provide an incentive to other forms of electricity generation (wind, solar, etc.).

Barrier(s) addressed: This policy helps create a market for electricity from biomass (as well as other renewable sources) and provides a financial incentive to participants to generate renewable energy in excess of their own consumption needs.

Likely environmental effectiveness: The environmental impact from such a policy could be significant and will vary by region depending on the source of electricity in the particular region (i.e., hydro versus coal).

Cost effectiveness: Once implemented, the costs associated with a net metering program are not substantial. Such a program does require that advanced meters be installed on properties participating in net metering programs.

Political feasibility: A minimum level of net metering is not currently mandated by any province in Canada. It is, however, of growing interest in a number of regions, such as Manitoba and Ontario. In Ontario, each distribution utility has the discretion to set its own interconnection and net metering standards. Provincial guidelines have been developed for net metering, but no formal regulation requiring that it take place are currently in place.

Jurisdictional authority: Provincial authority

International experience: Several US states have net metering policies. For example, in Connecticut, utilities must offer net metering to residential customers generating electricity with solar, wind, hydro, fuel cells, or sustainable biomass.

POLICY OPTION: Green Tags

Description: Consumers wishing to support investments in low-impact renewable energy and heating systems can buy green tags. Green tags are created when low-impact renewable energy and heat sources are substituted for energy and heat produced from fossil fuels. Green tags represent the real reductions in CO₂ and other pollutants that occur when green power and heat replaces the burning of fossil fuels. Green tags can be used in combination with a renewable portfolio standard and an eco-labelling program and can

³⁰ The Brazilian government managed the national fuel market by controlling the price of gasoline, which was approximately double the US price for gasoline at the time the national fuel alcohol program was implemented.

be traded between entities.
Responds to a policy gap: No. Green tag programs are already established in Canada. ³¹
Administrative requirements: Green tags require a certification process to verify investments in renewable energy and heat sources. Such schemes are already in place and available in Canada.
Incentive effect: Green tags are generally linked to renewable energy production in general, i.e., not to renewable energy from a particular source such as biomass. The incentive effect will depend, therefore, on whether the policy is specifically targeted at biomass-derived heat and power (very direct and ongoing incentive) or renewable heat and power more generally (less direct but still a substantial and ongoing incentive effect).
Barrier(s) addressed: This policy helps increase awareness around the impact of fossil fuels and the alternative, more environmentally sensitive, consumer options that exist.
Likely environmental effectiveness: When such a policy is combined with a financial incentive to consumers, such that the cost of the tags is reduced or made competitive with conventional energy and power sources, the environmental effect can be significant.
Cost effectiveness: Establishing a green tags program is a relatively inexpensive policy option especially when a certification program (such as Canada's Environmental Choice Program) is already established.
Political feasibility: Green tags are currently available in many regions in Canada, including Alberta, British Columbia, and Ontario. An official certification (EcoLogo) of low-impact renewable energy exists through the Environmental Choice Program of the federal government. This program certifies production facilities. In addition, a Green Power Certificates certification has been recently established. It makes it possible to trade the environmental benefits associated with low-impact renewable energy.
Jurisdictional authority: Can be implemented at the federal or provincial level. A federal level policy will allow for trading of tags between jurisdictions.
International experience: In the United Kingdom, the Renewables Obligation is a key policy mechanism to encourage growth to meet these targets. Under the terms of their operating licence, all electricity suppliers are contracted to supply a specific proportion of their electricity from renewable sources, with targets increasing year on year to 2010. This is managed through a system of registered Renewables Obligation Certificates, or green tags, that have a financial value and can be traded with those unable to meet their obligation. ³²

Information Programs

The information and education programs described below strive to increase awareness of environmentally significant technologies and goods and to differentiate such goods from conventional, competing options.

POLICY OPTION: Awareness Programs
Description: Awareness (education) programs are often introduced to overcome barriers related to public confidence and understanding. Such policies, which include the distribution of information to consumers and investors, are needed to increase knowledge and awareness of new and cutting-edge technologies, goods, and services and to provide consumers with the information they need to make informed investment decisions.
Responds to a policy gap: Yes. The main education program currently in place in Canada is the Future Fuels Program, the focus of which is limited to ethanol. More extensive education programs targeted at other bio-products are lacking.
Administrative requirements: Administrative requirements related to such programs depend largely on the

³¹ In fact, the Forest Products Association of Canada (FPAC) says that its member companies are seeking Environmental Choice Program or EcoLogo certification for their biomass cogeneration sites. The certification will allow FPAC members to market green tags to third parties. The certification is expected to be complete by the end of April 2005. For details see http://www.earthvision.net/ColdFusion/News_Page1.cfm?NewsID=27514

³² Askew, Melvyn F. 2004. *United Kingdom Government Energy Policy: Aims and Support for Sustainable Energy Production*. Biomass and Agriculture: Sustainability, Markets and Policies Conference. Paris: Organization for Economic Cooperation and Development.

design and scope of the particular program. Implementing a program that is targeted at a particular group (for example, energy producers) will be much less administratively onerous than implementing a program that is targeted more broadly at all industrial users, for example.
Incentive effect: An awareness program would not provide an ongoing incentive to invest in bio-product technologies or purchase bio-products. However, by increasing understanding of such technologies, services, and goods, they can lead, indirectly, to increased market penetration.
Barrier(s) addressed: Such a program helps to address barriers associated with the performance of bio-products, the availability of bio-products, and the environmental benefits of bio-products. An information and education program related to bio-products targeted at financial institutions or potential investors could help to overcome barriers associated with accessing financing and capital investments. Such a program would also help to address consumer confidence and understanding.
Likely environmental effectiveness: Without the support of complimentary policies targeted at bio-products, an information and education program is unlikely on its own to have a significant impact on environmental conditions.
Cost effectiveness: Depending on the scope of such policies, they can be relatively inexpensive to administer.
Political feasibility: Information and education programs are considered low risk and tend to be politically feasible.
Jurisdictional authority: Can be implemented at the federal and/or provincial level.
International experience: AgSTAR is a voluntary education program jointly sponsored by the US Environmental Protection Agency, the Department of Agriculture, and the Department of Energy. The program encourages the use of methane recovery (biogas) technologies at confined animal feeding operations that manage manure as liquids or slurries. Use of such technologies is largely encouraged by the production of the <i>Industry Directory for On-Farm Biogas Recovery Systems</i> , which provides information on system designers and developers, and equipment manufacturers and distributors.

POLICY OPTION: Eco-labels
Description: Eco-labels identify or specify environmental attributes for goods and services. Such labels are intended to provide guidance to consumers so that they can make more informed investment decisions and differential environmentally sensitive goods and services from their competitors.
Responds to a policy gap: No. The current Environmental Choice labelling programs include biomass-derived fuel, electricity, heat, and chemicals and materials. However, an eco-label program could be developed, as is being done in the United States, specifically for bio-products.
Administrative requirements: To be truly legitimate, eco-labels need to be verified for compliance with strict ecological and performance criteria by independent, registered bodies. Third-party verification is already required for the Environmental Choice program in place in Canada.
Incentive effect: While an eco-labelling program does not provide an ongoing or direct incentive to purchase bio-products, this type of program does provide the opportunity to distinguish these goods from their competition.
Barrier(s) addressed: This program helps to overcome barriers associated with consumer confidence and product awareness.
Likely environmental effectiveness: Unless a program such as this is used in combination with other programs, which reinforce environmental objectives, it is unlikely that such a program would have a significant effect on environmental conditions.
Cost effectiveness: The costs associated with such a program should not be prohibitive, although third-party verification increases costs.
Political feasibility: Based on experience with existing eco-label programs in Canada (for example the Environmental Choice EcoLogo, the Green Leaf program, and the Energy Star label), such programs are considered politically feasible.
Jurisdictional authority: Can be implemented at the federal and/or provincial level but better to have a national labelling program.
International Experience: The United States Farm Bill established a new program to encourage federal agencies to use bio-based products whenever possible and established a voluntary labelling program for bio-based products that authorized producers of bio-based products to use the label "USDA Certified Biobased

Product." The bill authorized \$6 million over six years for product testing to carry out this program.³³

Procurement, Demonstration, and Pilot

Procurement, demonstration, and pilot programs, such as those described in the tables below, occur when governments make direct investments in goods or technologies to increase the market penetration of associated goods or exhibit the use of particular technologies in real life circumstances.

POLICY OPTION: Demonstration (Pilot) Projects
Description: Through pilot or demonstration projects, governments ensure that certain technologies, services, and/or goods are developed and tested in real world circumstances by assuming a portion, or all, of the associated costs and risks.
Responds to a policy gap: Yes, to the extent that they target biomass-derived heat and chemicals and materials.
Administrative requirements: The administrative requirements of such a program are not onerous, although governments do have to decide what technologies, services, or goods are most worthy of investment.
Incentive effect: Such programs do not provide a direct or ongoing incentive to consumers to purchase or invest in bio-products. They do, however, increase consumer confidence in the technologies, services, and/or goods that are demonstrated.
Barrier(s) addressed: Such programs help address technological hurdles for chosen products. The information gained through demonstration projects can help to reduce costs and make technological improvements. They also help increase consumer confidence and awareness.
Likely environmental effectiveness: Because only a limited number of products are covered by pilot or demonstration projects, they do not generally have a significant effect on environmental conditions.
Cost effectiveness: Because such programs focus on getting particular products to an implementation stage, they do not generally require ongoing, long-term funding and are thus not cost prohibitive.
Political feasibility: Examples of such projects are numerous in Canada, including government support for Vancouver's fuel cell transit bus demonstration project.
Jurisdictional authority: Can be implemented at the federal and/or provincial level.
International experience: In the United Kingdom, the bio-energy Capital Grants Scheme is a competitive program designed to encourage biomass and crop production for energy by stimulating development of biomass-fuelled heat and electricity generation projects and technology demonstration projects, reducing the risk and costs involved in such developments. ³⁴

POLICY OPTION: Procurement
Description: Procurement policies secure support for a set of technologies or goods in the form of guaranteed purchases of those goods or technologies. In many cases, government entities will secure the particular goods for their own use or consumption, often at a premium price. In doing so, they increase commercialization of new and innovative technologies and goods, and prices decline over time.
Responds to a policy gap: Yes, the government could expand purchases of alternatively-fuelled vehicles and biomass-derived fuel, electricity, and heat and also commit to purchasing biomass-based office supplies and other biomass-derived chemicals and materials.
Administrative requirements: Depending on the design of the program, administrative requirements related to procurement programs can be relatively minor. However, to the extent that product testing and verification

³³ Information on the United States Farm Bill (2002) can be obtained here: <http://www.usda.gov/farbill/>

³⁴ Askew, Melvyn F. 2004. *United Kingdom Government Energy Policy: Aims and Support for Sustainable Energy Production*. Biomass and Agriculture: Sustainability, Markets and Policies Conference. Paris: Organization for Economic Cooperation and Development.

is required to ensure that particular products meet environmental criteria, administrative requirements can increase significantly. This program can be combined with an eco-labelling program to reduce such costs. ³⁵
Incentive effect: While procurement programs do not provide an ongoing incentive to invest in particular technologies or goods, they do guarantee a specified level of investment and, in doing so, provide security to manufacturers that a portion of their goods will be supported.
Barrier(s) addressed: A procurement program would help overcome existing barriers by providing opportunities for bio-products to be used in "real life" settings. Lessons learned through such a program could help overcome technological barriers while at the same time lead to a reduction in costs. As well, as higher market penetration takes place due to procurement programs, costs are likely to decline.
Likely environmental effectiveness: The environmental impact of a procurement program focused on bio-products depends on the level of commitment towards the goods and could be substantial in the long run.
Cost effectiveness: The cost of such policies depends on the level of commitment that is made toward the technologies and goods and is usually justifiable.
Political feasibility: Procurement programs are politically feasible and provide opportunities for governments to take on leadership roles in facilitating market penetration of new and innovative technologies and goods. Procurement policies in Canada currently support a number of renewable energy initiatives. For example, the Government of Canada Action Plan 2000 on Climate Change announced a commitment to purchase 20 per cent of federal electricity requirements from emerging renewable energy sources.
Jurisdictional authority: Can be implemented at the federal and/or provincial level.
International experience: Section 9002 of the United States Farm Bill, the Federal Procurement of Biobased Products Act, that requires that federal agencies will do the following: give preference to products with highest bio-based content relative to availability, performance standards, and price; ensure that bio-based content is incorporated as a procurement specification; develop a procurement program that will ensure bio-based products are purchased to the maximum extent practicable; develop an agency promotion program; annually review and monitor the effectiveness of the preferred procurement program. ³⁶

Regulations, Standards, and Guidelines

POLICY OPTION: Targets
Description: In many jurisdictions, targets for the consumption of particular goods and services have been established. Generally, these targets increase over time.
Responds to a policy gap: Yes. Although targets have been established for ethanol and bio-diesel, they are lacking for other bio-products (electricity, heat, and biomass-derived chemicals and materials).
Administrative requirements: To minimize administrative costs, a program such as this would be best combined with an eco-label program whereby consumers could subscribe to purchase certain quantities of eco-certified heat or power. Progress towards achieving the target could thus be easily measured.
Incentive effect: This program would not provide a direct or ongoing incentive to consumers but would establish clear targets against which progress could be monitored.
Barrier(s) addressed: Setting targets can increase consumer confidence, increase awareness of available products, and compliment long-term plans to increase access to bio-products over time.
Likely environmental effectiveness: The impact on the environment will depend on how aggressive the established targets are and on what accompanying (supportive) policies are also implemented.
Cost effectiveness: The establishment of realistic consumption targets will not result in high costs to government.
Political feasibility: The Government of Canada has established consumption targets in the past and doing so is politically feasible.
Jurisdictional authority: Can be implemented at the federal or provincial level. Best to have targets

³⁵ The designation of existing items for purchase in the United States as part of the United States US Farm Bill procurement program is expected to take several years, possibly until 2010. For additional details see <http://www.gao.gov/highlights/d04437high.pdf>

³⁶ Nipp, Terry. September 2004. *United States Support for the Agricultural Production of Biomass: The Challenge of Integrating Energy, Agricultural and Environmental and Economic Policies*. Paris: OECD.

established at the provincial level and have federal government play a coordinating role.

International experience: Biomass has been identified by the European Union as a significant contributor to its 12 per cent renewable energy target and to its ambitious goal of substituting 20 per cent of road transport fuels with alternatives, including bio-fuels, by 2020.³⁷

POLICY OPTION: Blended Fuel Requirements

Description: This policy requires that automotive fuels distributed by fuel retailers contain a minimum level of fuel derived from biomass.

Responds to a policy gap: Yes. This policy would address gaps related to access to bio-diesel and ethanol.

Administrative requirements: This policy would require a degree of enforcement but would otherwise not require ongoing administration.

Incentive effect: While this policy would not create an ongoing incentive for retailers to provide blended fuel, or for consumers to purchase such fuel, it would guarantee that a minimum level of blending take place.

Barrier(s) addressed: This policy would help create economies of scale and, in doing so, would lead to reduced costs for producers.

Likely environmental effectiveness: Depending on the level of blending required, the impact could be substantial.

Cost effectiveness: The cost to government for implementing such a policy would not be prohibitive (would require monitoring and verification that requirements were being met). However, the higher the minimum level of blending required, the higher the production costs, which means the higher the cost to consumers. Combining this policy with a consumer or producer incentive would help to reduce cost impacts.

Political feasibility: Such standards are in place in several jurisdictions. In Ontario, effective January 1, 2007, wholesalers' annual gasoline sales must achieve an average of at least 5 per cent ethanol content.³⁸ This may be accomplished by the actual blending of ethanol or through the trading of renewable fuel credits. The established mandate is for the entire province (i.e., 5 per cent on average), but wholesalers are free to trade amongst each other and within their own operations (e.g., wholesalers could sell half of their gas at E10 and the other half as pure gasoline to lessen distribution costs to themselves).³⁹

Jurisdictional authority: Can be implemented at the federal and/or provincial level. Would be good to establish provincial standards and have federal government play a coordinating role.

International experience: The European Commission's directive on the promotion of the use of bio-fuels and other renewable fuels for transport established a minimum level of bio-fuels as a proportion of all gasoline and diesel sold, starting with 2 per cent in 2005 and reaching 5.75 per cent in terms of the energy content of all fuels sold in 2010 in the EU.⁴⁰

POLICY OPTION: Emission Restrictions

Description: This regulatory-based policy would limit emissions from entities or technologies and, in doing so, require some entities to invest in emission-reduction technologies, alter investment decisions, and facilitate technological innovation. For example, strict emission requirements for utilities may lead to increased investments in renewable energy sources. Similarly, emission restrictions could be established for vehicles.

Responds to a policy gap: Partially. Emission restrictions are currently in place in Canada, but current automobile manufacture requirements do not lead to significant reductions in emissions.

Administrative requirements: Because emission restrictions are already established in Canada, administering such a policy would not be difficult. The infrastructure for such a system is already in place. Emission restrictions require regular monitoring and enforcement.

³⁷ Sims, Ralph E.H. September 2004. *Biomass, Bioenergy and Biomaterials: Future Prospects*. Paris: OECD.

³⁸ Ontario's 2007 target for ethanol would be equivalent to taking 200,000 vehicles off the road or reducing annual greenhouse gas emissions by about 800,000 tonnes. The target has the potential to spark 3,000 new jobs and as much as \$500 million in new investment in rural Ontario.

³⁹ <http://www.premier.gov.on.ca/english/news/CleanerGas112604.asp>

⁴⁰ Maniatis, Kyiakos. September 2004. *European Commission Policies for the Promotion of Bioenergy*. Paris: OECD.

Incentive effect: Emission restrictions provide an indirect incentive to invest in technologies and activities that can lead to reductions in emissions. Investments in renewable energy sources, such as biomass, would be only one way to meet emission restrictions and, thus, there is no guarantee that such investments would result.
Barrier(s) addressed: This policy could increase access to certain biomass-oriented technologies. For example, increasingly stringent restrictions on automobile manufacturers to limit emissions from vehicles would increase consumer access to low-emission vehicles.
Likely environmental effectiveness: Strict emission restrictions could have significant impact on environmental conditions.
Cost effectiveness: Depending on how aggressive the emission restrictions are, they can be expensive to meet. From a government perspective, they are not expensive to establish but, as is described above, they do require monitoring and enforcement.
Political feasibility: Emission restrictions are already established in Canada. However, current permitted emission levels do not provide significant incentive for ongoing investments in technologies/activities to reduce emissions and increasing them to the point where such incentives are provided may be difficult.
Jurisdictional authority: Provincial jurisdiction for utilities and federal for automobiles.
International experience: In September 2004, the California Air Resources Board (ARB) approved a regulation that requires automakers to begin selling vehicles with reduced greenhouse gas emissions by model year 2009. The regulation sets limits on the amount of greenhouse gas emissions that can be released from new passenger cars, sport utility vehicles, and pickup trucks sold in California starting in model year 2009. According to ARB staff, the average reduction of greenhouse gases from new California cars and light trucks will be about 22 per cent in 2012 and about 30 per cent in 2016. ⁴¹

Policy Evaluation Summary

In Table 3, below, we describe the requirements needed for each of the policy options considered above to meet the evaluative criteria employed in this analysis. Note that we have not included international experience in the table below, as it is not a necessary condition for success.

Table 3 Evaluative criteria and necessary requirements

EVALUATIVE CRITERIA	NECESSARY REQUIREMENTS
Responds to a policy gap	The policy option responds to one or more policy gaps identified earlier in this report.
Administrative requirements	Government administrative requirements are reasonable and/or can be met partially or totally through existing policy frameworks.
Incentive effect	Policy provides an ongoing incentive to invest and/or purchase bio-products and/or associated technologies.
Barrier(s) addressed	Policy directly addresses one or more of the barriers identified earlier in the report.
Likely environmental effectiveness	Positive environmental changes can be expected.
Cost effectiveness	Costs appear justifiable and not prohibitive, or can be addressed through careful policy design, or by combining the particular policy with other supportive policy options.
Political feasibility	Based on existing experience with such policies or precedents already in place in Canada, policy appears to be politically feasible at the federal level in Canada.
Jurisdictional authority	Federal government has the appropriate jurisdictional authority to implement policy.

⁴¹ Additional details for this regulation can be obtained from the California Air Resources Board web site at <http://www.arb.ca.gov/homepage.htm> .

Using the framework described in the table above, below we identify the specific policy options that met the evaluative criteria. The policies with the (check mark) '✓' beside them are the ones that met all of the criteria.

Table 4 Summary of policy evaluation

EVALUATIVE CRITERIA	RELEVANT POLICIES
Responds to a policy gap	Grants ✓, Consumer Tax Credit ✓, Investment Tax Credit ✓, ACCA✓, Tax Exemption ✓, Loans ✓, Net Metering, Awareness and Education, Demonstration, Procurement, Blended Fuel Requirements, Emission Restrictions
Administrative requirements	Grants ✓, Consumer Tax Credit ✓, Investment Tax Credit ✓, ACCA✓, Tax Exemption ✓, Loans ✓, Net Metering, Awareness and Education, Green Tags, Eco-labels, Demonstration, Procurement, Targets, Blended Fuel Requirements, Emission Restrictions
Incentive effect	Grants ✓, Consumer Tax Credit ✓, Investment Tax Credit ✓, ACCA✓, Tax Exemption ✓, Loans ✓, Net Metering, Green Tags
Barrier(s) addressed	Grants ✓, Consumer Tax Credit ✓, Investment Tax Credit ✓, ACCA✓, Tax Exemption ✓, Loans, Net Metering, Awareness and Education, Green Tags, Eco-labels, Demonstration, Procurement, Targets, Blended Fuel Requirements, Emission Restrictions
Likely environmental effectiveness	Grants ✓, Carbon Tax, Consumer Tax Credit ✓, Investment Tax Credit ✓, ACCA✓, Tax Exemption ✓, Loans ✓, GHG Cap and Trade, Net Metering, Green Tags, Procurement, Blended Fuel Requirements, Emission Restrictions
Cost effectiveness	Grants ✓, Carbon Tax, Consumer Tax Credit ✓, Investment Tax Credit ✓, ACCA✓, Tax Exemption ✓, Loans ✓, GHG Cap and Trade, Net Metering, Awareness and Education, Green Tags, Eco-labels, Demonstration, Procurement, Targets, Blended Fuel Requirements
Political feasibility	Grants ✓, Consumer Tax Credit ✓, Investment Tax Credit ✓, ACCA✓, Tax Exemption ✓, Loans ✓, GHG Cap and Trade, Net Metering, Awareness and Education, Green Tags, Eco-labels, Demonstration, Procurement, Targets, Blended Fuel Requirements, Emission Restrictions
Jurisdictional authority	Grants ✓, Carbon Tax, Consumer Tax Credit ✓, Investment Tax Credit ✓, ACCA✓, Tax Exemption ✓, Loans ✓, GHG Cap and Trade, Awareness and Education, Green Tags, Eco-labels, Demonstration, Procurement, Targets, Emission Restrictions

To summarize the above table, the policies that met all of the criteria include the following:

- grants
- consumer tax credits
- investment tax credits
- tax exemptions
- accelerated capital cost allowances (ACCA)
- loans

These policies should be considered key priorities for stimulating marketplace demand for bio-products in Canada. However, a number of other policies considered in this study will also prove important to the establishment of significant demand for bio-products in Canada. Such policies can reinforce and support the objectives associated with the priority policy options. Specifically, it will be critical for the federal government to continue to expand demonstration and procurement programs. This is essential to demonstrate government leadership, increase consumer confidence, and demonstrate the use of these products and technologies in real world situations. Demonstration and procurement

programs are especially important within the context of biomass-derived chemicals and materials to which demand-oriented policies are currently not targeted. In addition, clearly defined and widely accepted consumption targets that increase over time and are well known by all relevant entities will be critical to increasing the market demand for bio-products. Finally, without accompanying education and information programs, increasing access to bio-products and reducing the cost of bio-products will still not guarantee increased demand. Consumers need to be aware that such products exist, be confident in the products' performance, and understand the environmental benefits of their use. Given the recent announcement in California of regulatory restrictions of emissions of greenhouse gases from vehicles, we also recommend that Canada investigate the implementation of such a program here.

Table 5, below, summarizes the recommended policies for stimulating marketplace demand for bio-products in Canada. Recall that there was a significant lack of current policies in place related to biomass-derived materials and chemicals. This is an area particularly worthy of policy intervention, given the policy gaps that exist in relation to these products.

Table 5 Recommended policies for stimulating market demand for bio-products in Canada

PRIORITY POLICIES	SUPPORTIVE POLICIES
<ul style="list-style-type: none"> ➤ Grants ➤ Consumer tax credits ➤ Investment tax credits ➤ Tax exemptions ➤ Accelerated capital cost allowances ➤ Loans 	<ul style="list-style-type: none"> ➤ Demonstration programs ➤ Procurement ➤ Consumption targets ➤ Information programs ➤ Emission restrictions for vehicles

While it was beyond the scope of this study to analyze and make recommendations on specific design and implementation features for each of the policies identified in the table above, it is useful to consider key factors that have contributed to the success of policies in other regions. As was described in the Methodology chapter, the barriers, policy options, and conditions for success presented in this report were developed by drawing on relevant literature, as well as from the experiences in other jurisdictions. Through this research, we were able to identify a number of factors (presented in the Table 6, below) that directly contributed to the success of particular policies in other regions. The list of factors is not meant to be comprehensive but, rather, indicative and a starting place for future research in this area. It is useful to note that the factors and specific examples presented below are not drawn exclusively from bio-product oriented policies but would nonetheless be applicable to the policies identified above in the context of bio-product market development.

Table 6 Key factors that contribute to the success of policies—From international experience

FACTOR	CONDITIONS FOR SUCCESS	SUPPORTING EXAMPLES
Time horizon	Sufficiently long-time horizons for policies to increase investor and consumer confidence and justify potentially higher upfront investments.	<p>United Kingdom: The continuation of the Renewables Obligation⁴² up to 2027 offers investors confidence that demand for electricity from renewable sources will continue in the future.⁴³</p> <p>Germany: The Electricity Feed Law, with guaranteed prices for 20 years, minimizes investment risk in Germany.⁴⁴</p> <p>Netherlands: Shorter time horizons in the Netherlands have restricted investments in renewable technologies there.⁴⁵</p>
Policy certainty	<p>Policy certainty may be as important or more important than policy specifics.⁴⁶</p> <p>Targets are needed to provide long-term investment security.⁴⁷</p> <p>Mandated investments or purchases can also increase policy certainty.</p>	<p>Brazil: Mandated ethanol blended gasoline for all gasoline sold in the country and requiring all gas stations to sell pure ethanol made it commercially viable for the automotive industry to produce ethanol-only cars.⁴⁸</p> <p>United Kingdom: The production of a bio-plastic (called Natureworks) became competitive with conventional plastics when millions of tonnes of production were guaranteed.⁴⁹</p>
Environmental citizenry	Public awareness of environmental concerns and the role that various environmental products, such as bio-products, can play in addressing those issues.	<p>Netherlands: In their country report about the Netherlands, the International Energy Agency emphasized that there is a high level of sentimental consciousness and "a willingness to pay higher prices for renewables" in the Netherlands. This was confirmed when 13 per cent of the Dutch households signed up for green electricity in May 2002.⁵⁰</p>

⁴² The Renewables Obligation (RO) requires licensed electricity suppliers to source specified percentages of the electricity they supply from renewable sources. For more information on the RO, see http://www.dti.gov.uk/renewables/renew_2.2.1.htm .

⁴³ Reiche, Danyel, ed. 2002. *Handbook of Renewable Energies in the European Union*. Frankfurt: Peter Lang.

⁴⁴ Wustenhagen, Rolf and Michael Bilharz. 2004. *Green Energy Market Development in Germany: Effective Public Policy and Emerging Customer Demand*. Energy Policy.

⁴⁵ Reiche, Danyel, ed. 2002. *Handbook of Renewable Energies in the European Union*. Frankfurt: Peter Lang.

⁴⁶ Moore, Curtis and Jack Ihle. 1999. *Renewable Energy Policy Outside the United States*. Renewable Energy Policy Project Issue Brief, October 1999, No. 14.

⁴⁷ European Conference for Renewable Energy—Intelligent Policy Options. Conference Conclusions and Recommendations to the International Conference for Renewable Energies in Bonn, *renewables2004*. <http://www.erec-renewables.org/Berlin2004.htm> .

⁴⁸ Beck, Fred and Eric Martinot. 2004. *Renewable Energy Policies and Barriers*. [MISSING PUB DATA]

⁴⁹ Centre for Advanced and Renewable Materials. 2002. *Renewable Feedstocks for Sustainable Materials—Bioproducts—Their Importance to Wales: A Scoping Study*. Report prepared for Mr. Anthony Armitage, The Welsh Development Agency.

⁵⁰ Reiche, Danyel, ed. 2002. *Handbook of Renewable Energies in the European Union*. Frankfurt: Peter Lang.

Table 6 Continued, Key factors that contribute to the success of policies—From international experience

FACTOR	CONDITIONS FOR SUCCESS	SUPPORTING EXAMPLES
Level playing field	Ensuring a level playing field between renewable and conventional goods and services. ⁵¹ Appropriately placed incentives and disincentives can adjust prices to better reflect environmental costs and benefits.	Denmark, Germany, and the United Kingdom: Policies in these countries (including production and consumption incentives and charges on the use of fossil fuels) have lowered the price of renewable forms of energy (especially wind) and raised the price of fossil-fuel-based energy to the point where renewables can begin to compete on a cost per kilowatt basis. ⁵²
Inter-departmental coordination	The development of a one-stop shop for enquiries, marketing, governance, research and development, and networking. ⁵³	United States: The United States has been successful in establishing formal interdepartmental cooperation and in specifying roles for relevant departments with respect to bio-product market development. ⁵⁴
Policy monitoring	Policy monitoring and evaluation leads to policy improvements and refinements over time.	Germany: The system of feed-in tariffs was introduced with the feed-in law of 1991, updated in the renewable energy law of 2000, and amended in 2004. ⁵⁵ It is now the main policy instrument for facilitating renewable energy developments in Germany. Other: A recent study found that many national programs related to energy technologies were adjusted as they proceeded when problems were revealed, and improvements were made. ⁵⁶
Supporting policies	Complementary policies such as those targeted at reducing greenhouse gas emissions, reducing waste going to landfills, or improving environmental conditions (increased production on low VOCs paint for example).	United Kingdom: The Climate Change Levy has driven the need for energy conservation and new non-petrochemical-derived feedstocks. ⁵⁷ Australia: Requirements to reduce waste going to landfills are driving the utilization of renewable organics. ⁵⁸ Sweden: The phase-out of nuclear power is spurring investments in renewable energies in Sweden. ⁵⁹

⁵¹ European Conference for Renewable Energy—Conference Conclusions and Recommendations.

⁵² Moore, Curtis and Jack Ihle. 1999. *Renewable Energy Policy Outside the United States*. Renewable Energy Policy Project Issue Brief, October 1999, No. 14.

⁵³ Centre for Advanced and Renewable Materials. 2002. *Renewable Feedstocks for Sustainable Materials—Bioproducts—Their Importance to Wales: A Scoping Study*. Report prepared for Mr. Anthony Armitage, The Welsh Development Agency.

⁵⁴ U.S. Office of the Press Secretary. 1999. *Executive Order: Developing and Promoting Biobased Products and Bioenergy*. <http://ceq.eh.doe.gov/nepa/regs/eos/eo13134.html>

⁵⁵ Wustenhagen, Rolf and Michael Bilharz. 2004. *Green Energy Market Development in Germany: Effective Public Policy and Emerging Customer Demand*. Energy Policy.

⁵⁶ International Energy Agency. 2003. *Creating Markets for Energy Technologies*. Paris: Organization for Economic Cooperation and Development.

⁵⁷ Centre for Advanced and Renewable Materials. 2002. *Renewable Feedstocks for Sustainable Materials—Bioproducts—Their Importance to Wales: A Scoping Study*. Report prepared for Mr. Anthony Armitage, The Welsh Development Agency.

⁵⁸ Meinhardt PTY Ltd., et. al. 1999. *Environment Australia Organics Market Development Strategy*. Prepared for Environment Australia. [PUBLICATION DATA MISSING]

⁵⁹ Reiche, Danyel, ed. 2002. *Handbook of Renewable Energies in the European Union*. Frankfurt: Peter Lang.

Table 6 Continued, Key factors that contribute to the success of policies—From international experience

FACTOR	CONDITIONS FOR SUCCESS	SUPPORTING EXAMPLES
Industry standards	Appropriate standards for the use of bio-products in specific uses.	United States: Approval processes related to the use of bio-products focus on specific feedstocks rather than end-uses. This is in contrast to the system employed in the EU, where it is a requirement to cover and register each and every end-use application, even in cases where the same material is employed in numerous applications. The additional burden of individual registration is seen as a major disadvantage to bio-product market development in the EU. ⁶⁰

⁶⁰ Centre for Advanced and Renewable Materials. 2002. *Renewable Feedstocks for Sustainable Materials—Bioproducts—Their Importance to Wales: A Scoping Study*. Report prepared for Mr. Anthony Armitage, The Welsh Development Agency.

Conclusions and Future Research

This analysis has identified a number of specific policy options appropriate for stimulating marketplace demand for bio-products in Canada. The policy evaluation was based on the barriers that currently limit increased demand for bio-products, the policies that are currently in place, the policy gaps that exist, and a set of conditions that should be met in order for policies to be successful.

Table 7, below, presents the recommended policies for further consideration in Canada. The priority policies listed are those that meet all of the evaluative criteria presented earlier in the report. The supportive policies are those that will reinforce and compliment the priority policies to provide a more comprehensive and effective national policy framework for developing a market demand for bio-products. This analysis has revealed a need for such policies to target bio-products, including biomass-derived heat, electricity, and fuels, especially biomass-derived materials and chemicals, given the complete lack of policies currently targeted at these latter bio-products at the present time.

Table 7 Recommended policies for further consideration in Canada

PRIORITY POLICIES	SUPPORTIVE POLICIES
<ul style="list-style-type: none"> ➤ Grants ➤ Consumer tax credits ➤ Investment tax credits ➤ Tax exemptions ➤ Accelerated capital cost allowances ➤ Loans 	<ul style="list-style-type: none"> ➤ Demonstration programs ➤ Procurement ➤ Consumption targets ➤ Information programs ➤ Emission restrictions for vehicles

In this analysis, we also identified and presented a number of factors that have contributed to the success of policies in other regions. The key factors identified in this study include the following:

- Time horizon
- Policy certainty
- Environmental citizenry
- Level playing field
- Interdepartmental cooperation
- Policy monitoring
- Supporting policies
- Industry standards

Although it was outside the scope of this study to evaluate and make recommendations on specific policy design and implementation features, a number of **additional conclusions** are warranted:

- A number of the policies considered in this study can be implemented at the provincial and/or federal level. In many cases, implementing such policies in a coordinated and supportive manner at both levels will reinforce the policy objectives and increase the effectiveness of the policy. Consideration should therefore be given to pursuing key policies at both the federal and provincial levels to maximize the impact of the policy.
- Policy objectives are more likely to be realized when a suite of complementary policies targeted at different entities is implemented. For example, it is appropriate to target consumer tax credits at the purchase of end products (alternative-fuelled vehicles, the purchase of biomass-derived heat, electricity, chemicals, and materials), and investment tax credits at bio-product related technologies (waste or electricity generating systems). These policies can be pursued in concert with each other.

- The impact of the demand-oriented policies will be greatly increased if they are combined with information and education programs to inform consumers of the products available, increase confidence in the performance of such products, and educate consumers on the benefits (environmental and socio-economic) of such products.
- Demand-oriented policies need to target both the distribution *and* consumption of bio-products (dealerships, fuel retailers, as well as end-users). A key barrier to increased bio-product market demand is consumer access to bio-products. It will be necessary to target policies at the distribution level of such products in order to address, at least in part, this barrier.
- Demand-oriented policies in place in Canada are heavily focused on bio-fuel and biomass-derived heat and electricity. Specific policies targeted solely at biomass-derived chemicals and materials are non-existent. A combination of supply (including processing) and demand policies will be needed to spur the market for such products. From a demand perspective, a combination of policies targeted at bio-refineries (Accelerated Capital Cost Allowances, grants, investment tax credits) and consumer (consumer tax credits, tax exemptions, grants) will be needed. These policies will have to be supported by information and education programs, government procurement initiatives, and demonstration projects. The United States 2002 Farm Bill includes all of these elements.
- While the focus of this study is on the barriers and policy options associated with selling and distributing bio-products, the government will need to concurrently address and overcome barriers that exist early in the market development chain (growing feedstock, distributing feedstock, and processing feedstock). Many of the barriers at the final stage are the result of early barriers that propagate their way through the market development chain. As a result, when considering policy options at the consumer level, it is important to recognize that market development barriers can occur at the customer level or also elsewhere in the market development chain. Consideration should also be given to reuse, recycling, and disposal of bio-products. Ultimately, the government should consider and pursue appropriate policies over the entire life cycle of bio-products.

Future Research

Given the policy options identified in this study, and assuming that other research is being completed on the various policy options for overcoming barriers at other points in the market development chain for bio-products, future research should consider specific policy design features and options for the policies identified in this analysis. More specifically, additional research could concentrate on answering the following questions:

- What are the specific design features of the various policies that will maximize the impact of the policy?
- Are the impacts of the policies measurable? How can the policy be designed such that measurable impacts result?
- How can the policies identified above be designed and implemented to provide broad performance-based incentives so that the government does not have to choose "technology winners" but can create a policy framework in which the market will also favour those technologies that are most environmentally sensitive?
- How can the policy options be designed and implemented to stimulate continuous innovation in bio-products, associated technologies, and other environmentally sensitive technologies and goods?
- How can negative impacts on competitiveness be addressed and how can we maximize global competitiveness to increase Canada's advantage?

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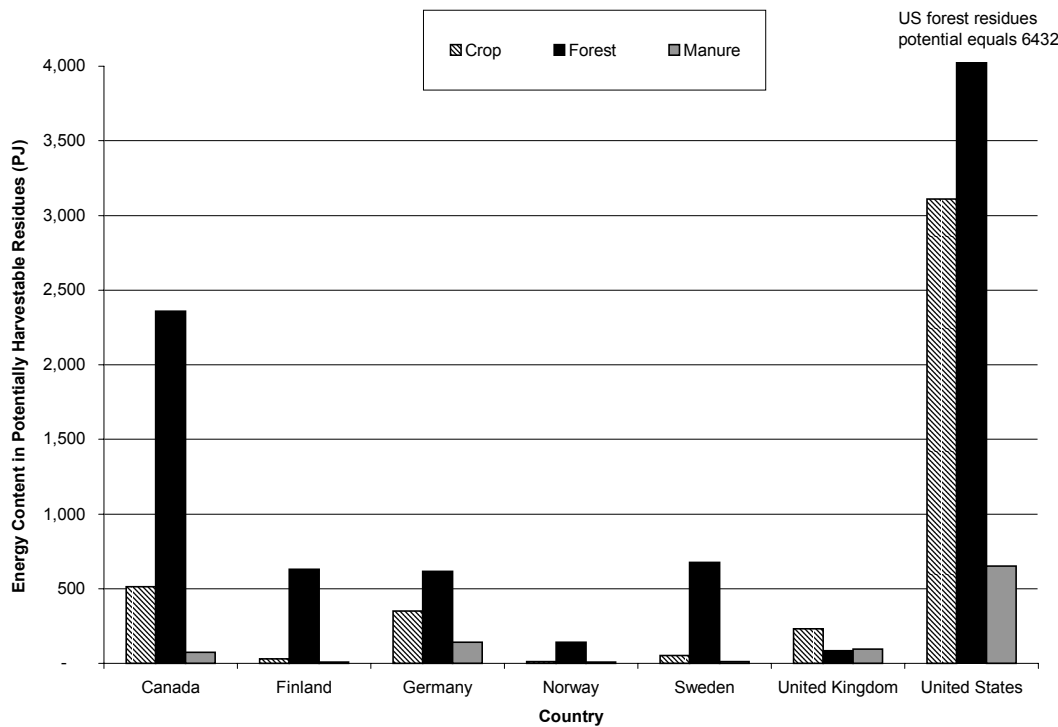
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Appendix: Biomass Resource Potential in Canada

Research suggests that the use of biomass as a source of electricity has great potential, especially in Canada. The following figures demonstrate the energy potential that exists in selected Organisation for Economic Cooperation and Development (OECD) countries. The first two figures show energy potential from residues and plantations, respectively. The third figure shows potential electricity production from biomass in selected OECD countries. Together, the graphs demonstrate that the potential to use biomass as a source for energy in Canada is particularly substantial.

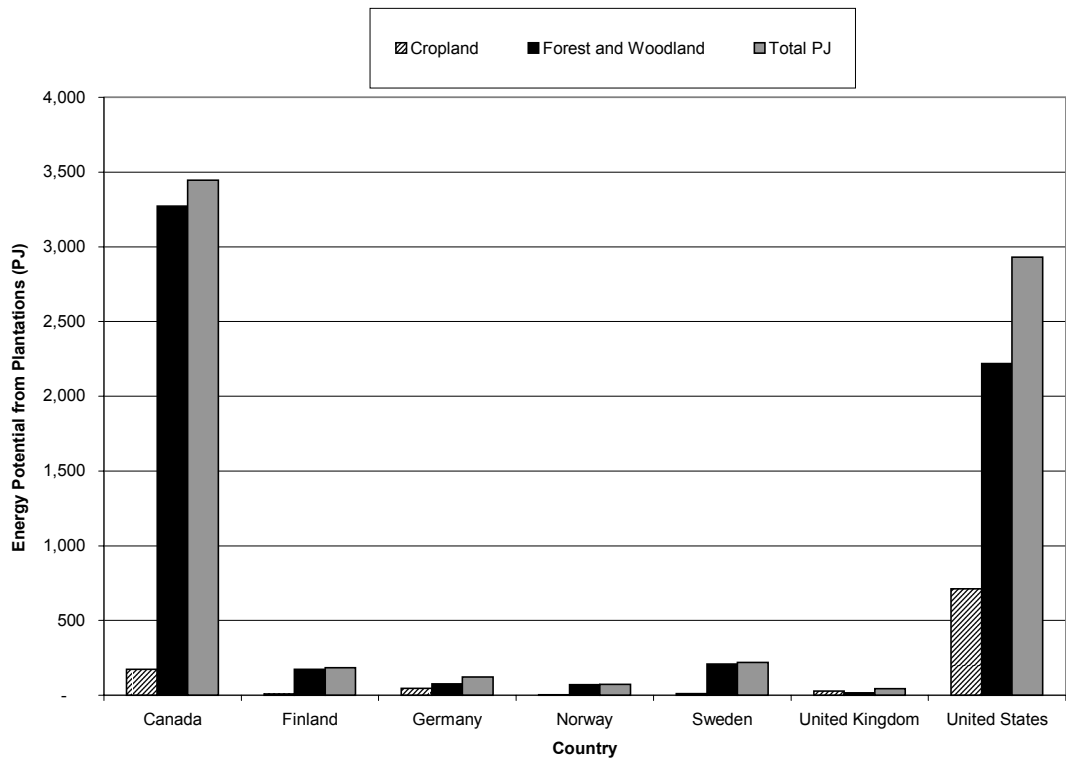
Electricity Potential from Residues (Crop, Forest, and Manure) in Selected OECD Countries



Source: Bauen, Ausilio, Jeremy Woods, and Rebecca Hailes. 2003. *Bioelectricity Vision: Achieving 15% of Electricity from Biomass in OECD Countries by 2020*. Brussels: WWF.

Of the countries presented above, only the United States has greater potential than Canada to generate electricity from residues. In Canada, energy from forest residues is the largest resource for electricity generation.

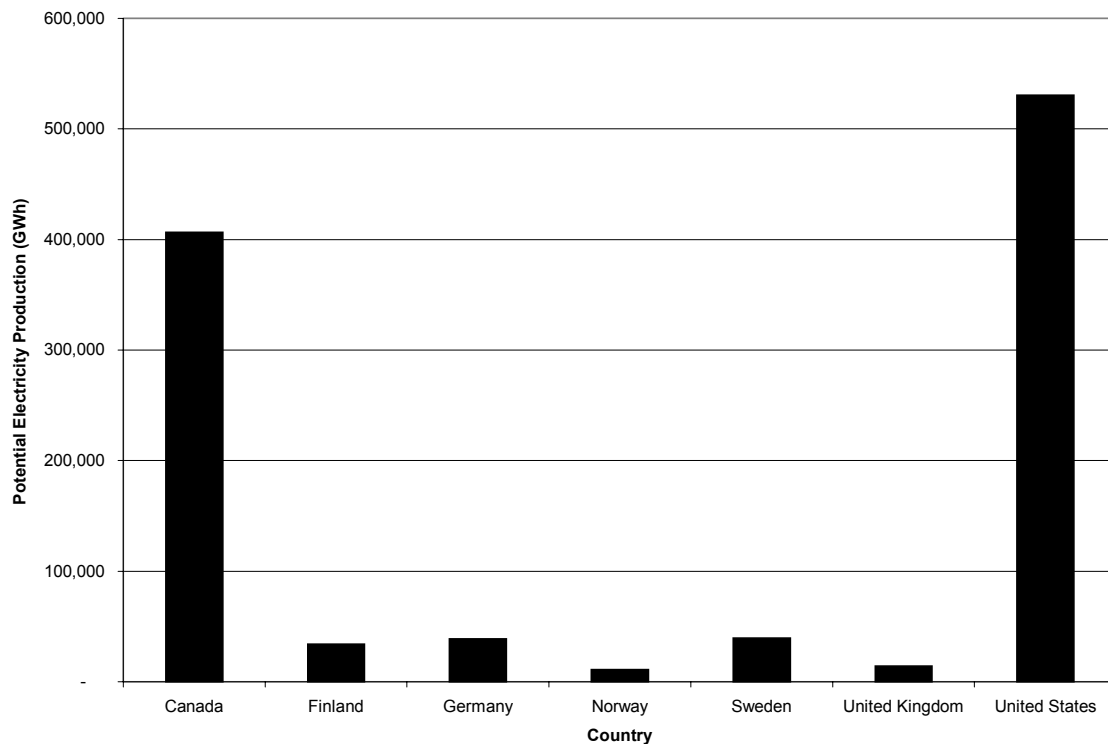
Electricity Potential from Energy Plantations in Selected OECD Countries



Source: Bauen, Ausilio, Jeremy Woods, Rebecca Hailes. 2003. *Bioelectricity Vision: Achieving 15% of Electricity from Biomass in OECD Countries by 2020*. Brussels: WWF

The potential to generate electricity from plantations in Canada is significantly more than any other country presented above. Practically all of the potential in Canada is from forest and woodland plantations.

Potential Electricity Production from Biomass in Selected OECD Countries



Source: Bauen, Ausilio, Jeremy Woods, and Rebecca Hailes. 2003. *Bioelectricity Vision: Achieving 15% of Electricity from Biomass in OECD Countries by 2020*. Brussels: WWF.

The figures above demonstrate the vast potential to use biomass as a source of energy, particularly in Canada, and are indicative of the potential for other bio-products.