



**The Quebec Energy Sector:
background, issues, questions**

Committee on Labour and the Economy

Position Paper

Bio diesel

Presented by:
Le Conseil québécois du biodiésel (CQB)

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Summary

This paper outlines the position that the Conseil québécois du biodiésel (CQB) intends to submit to the Commission sur l'avenir énergétique du Québec.

First, the CQB believes that any sustainable development strategy the government adopts must certainly take into account renewable energy. To reduce our energy dependence and catch up with other industrialized countries Quebec needs, now more than ever, to take an active interest in the issue. Of the potential renewable energy sources, biofuels such as biodiesel are a precious resource because, among other things, they can help diversify our fuel sources, mitigate the pollutant properties of fossil fuels and reduce our dependence on them.

This paper explains the key features and many advantages of biodiesel. This biofuel has already proven itself, not just as an additive but as an alternative to petrodiesel. It is reliable, non-toxic, biodegradable, and can be produced from local and renewable resources. In Quebec it has the advantage of being produced from reclaimed waste materials; this fits in perfectly with the government's sustainable development strategy. It can easily be used for transportation, without converting engines or changing the distribution infrastructure. Since transportation accounts for 38.9 percent of Quebec's greenhouse gas emissions, it must be the cornerstone of Quebec's greenhouse gas reduction strategy. The development, production and consumption of biodiesel would result in an impressive number of positive effects: i.e. on the greenhouse effect, air pollution and thereby the environment, climate and public health. It would help reduce Quebec's energy dependence; promote technological advances, create wealth and jobs, etc.

For all these reasons, Quebec must waste no time strategically positioning itself as a promoter, producer and user of biodiesel. The United States, a number of European Union countries, and some Canadian provinces already have a head start in this area. Because biodiesel costs more than fossil fuels, these countries and provinces have implemented tax incentives to promote its development. These measures have helped promote and establish biodiesel markets wherever they are introduced.

The Quebec government must follow this example and introduce suitable tax incentives to promote sustainable biodiesel production in the province. It is an especially good time to do this, because the opening of a new Rothsay plant in Ville Ste-Catherine will put Quebec in an excellent position to meet its current and future biodiesel needs. If tax incentives are not quickly implemented to make the product's market price more competitive, Rothsay will set up its facilities outside the province where such measures exist. Given the inevitable future demand for biodiesel, it would be regrettable if in a few years Quebec had to import a renewable fuel that it produced in sufficient quality and quantity on its own territory.

For this reason, the CQB recommends that the government of Quebec take immediate measures to encourage and promote the production and use of biodiesel in Quebec by implementing a differentiated tax incentive.

To make the price of biodiesel immediately competitive, the incentive should take the form of a tax exemption (i.e. elimination of applicable fuel tax on fuel oil), followed – while allowing a reasonable time frame for the industry – by a mandate inducing oil companies to incorporate five percent biodiesel into their products. This paper demonstrates that this would be a good investment for Quebec because its impact on government revenues would be limited, given that the quantities of biodiesel affected by such a measure would be marginal compared with those of petrodiesel.

The CQB also recommends taking concrete initiatives to encourage public transit companies to quickly switch to biodiesel, in the concentrations of their choice, up to a maximum of B20.

Lastly, the CQB recommends that the government set an example by making biodiesel the fuel of choice for its own fleet.

In conclusion, the CQB would like all avenues explored, all biodiesel's costs and benefits (along with the leading research in the field) put on the table, and concrete initiatives taken to establish Quebec's leadership in the development of this "green" fuel for the transportation sector.

Introduction

The Conseil québécois du biodiésel (CQB) was established in 2004 to promote the use of biodiesel as an alternative to petrodiesel for transporting people and goods in Quebec.

We believe Quebec has everything to gain by adopting biodiesel, not just for environmental reasons but to ensure a secure energy supply.

Biodiesel is widely recognized for its role in reducing greenhouse gases, while the Kyoto Protocol commits nations to taking effective measures to cut global emissions in half by 2050.

Biodiesel in Quebec has the added advantage of being produced largely from reclaimed waste materials, which fits in perfectly with the government's recently-announced sustainable development strategy.

As we all know, petroleum is becoming scarcer and more expensive while the geopolitical situation is making security of supply less certain. The Quebec transportation sector, which relies almost exclusively on hydrocarbons, thus has a particular interest in diversifying its fuel sources.

Biodiesel represents a unique opportunity to establish Quebec's leadership in developing a "green" fuel for the transportation sector while reducing its dependence on petroleum products.

In developing an energy strategy, Quebec must play a central role in the provision of biogenous energy sources by, among other things, creating economic and political conditions that encourage the sustainable production of renewable resource-based fuels like biodiesel.

1.0

1.0 Background

The Kyoto Protocol commits the world's 38 most industrialized countries to reducing greenhouse gas emissions to 5.2 percent below 1990 levels by 2008-2012. In the context of this agreement, Canada resolved to reduce its greenhouse gas emissions to six percent below 1990 levels by 2012.

Quebec, a longtime supporter of the Protocol, implemented a number of measures in 1992 to stabilize and reduce its greenhouse gas emissions, which are considered the main cause of climate change. The Quebec government appears serious about assuming its responsibilities and showing leadership in this area.

Recent public reaction to a proposed thermal power plant in the Beauharnois region showed that Quebecers from all walks of life (i.e. investors, environmental groups, average citizens, the media, etc.) are making environmental protection a top concern. They have said "yes to developing new energy sources... but no if it means an increase in greenhouse gas emissions". Following government studies and pressure from environmentalists and the general public, the project was cancelled. In Quebec the message is clear: more than ever before, energy policy must take into account its environmental impacts.

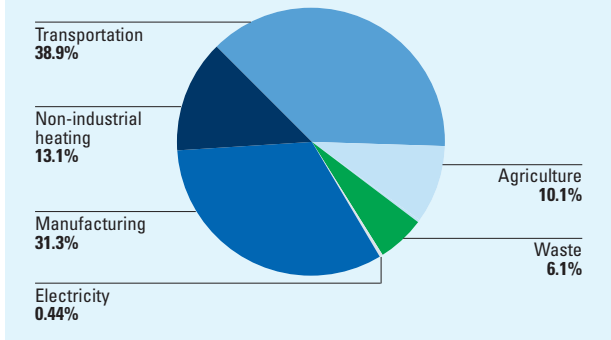
1.1 The Quebec situation and the importance of the transportation sector

Given the critical role that hydroelectricity plays in our economy, Quebec, like British Columbia, stands out from most provinces because of its low rate of human-generated carbon dioxide emissions. In comparison, Quebec emits half as much CO₂ per capita (roughly 12 tonnes) than the country as a whole (roughly 23.6 tonnes). Quebec thus accounts for only 12.5% of Canada's total greenhouse gas emissions. From 1990 to 2000, Quebec's total emissions went up by just 2.3% compared to 19.6% for Canada as a whole.

Though Quebec has a head start on the rest of Canada, it cannot rest on its laurels. The Quebec ministère des Ressources naturelles, de la Faune et des Parcs estimates that 2011 emissions will exceed 1990 levels by 19 percent if nothing more is done. Much remains to be done if Quebec is to meet its commitments and continue to show leadership in Canada and abroad.

Graph 1

Quebec's 2001 greenhouse gas emissions, by sector¹



To achieve this, the CQB recommends that Quebec focus future efforts on the sector with the highest greenhouse gas emissions, i.e. transportation (38.9 percent). In ten years, this sector has seen a 14.5 percent rise in emissions – the equivalent of 4.3 million tonnes of CO₂, rising from 29.3 to 33.6 million tonnes – and has been the primary cause of Quebec's rise in emissions during this period. This increase is due mainly to road transport, with an upsurge² in the number of light and heavy trucks on the province's roads. These vehicles have nearly doubled Quebec's rate of fossil fuel consumption since 1990. In Quebec alone, the sector's petrodiesel consumption has risen to 3.57 billion litres. This increase is worrisome because recent studies³ have shown that exhaust from diesel engines contains 20 percent more suspended particulate matter than exhaust from gasoline engines. The studies have also highlighted the negative effects of diesel emissions on human health.

The problem is serious but, fortunately, there are alternatives. It is especially important to promote the use of fuels in this sector that emit fewer greenhouse gases, such as biodiesel.

Biodiesel is a reliable, non-toxic, biodegradable and renewable fuel that can be used as additive or even an alternative to conventional petrodiesel. It therefore offers a practical, effective, and readily achievable solution to the problem of pollution and greenhouse gas emissions in the transportation sector. Its use is on the rise worldwide, especially in land and sea transport and the public transportation sector.

1. Ministère de l'environnement du Québec and Environment Canada.
2. The number of light trucks nearly doubled from 1990 to 2000, rising from 600,000 to nearly 1,100,000. In the same period, the number of heavy trucks multiplied by 2.5, rising from 100,000 to 250,000.
3. Report of the U.S. Environmental Protection Agency (EPA), 2002.

2.0 Biodiesel

Biodiesel is a methyl ester obtained through a chemical reaction with a light alcohol and animal or vegetable fats. It can be used at a 100 percent (B100) concentration, but can also be blended with petrodiesel in various proportions, the most common of which are two percent (B2), five percent (B5) and 20 percent (B20).

Biodiesel is easy to use because, unlike other alternative fuels, when used at B2 to B20 concentrations in existing vehicles, it requires no changes to the diesel engine or the fuel delivery and distribution system.

Its properties and merits are indisputable:

- Pure biodiesel is a lean **solvent**. It cleans and maintains the vehicle's fuel tank, fuel lines and injection system.
- Even at low concentrations, its **lubricity** is much higher than that of petrodiesel. This reduces engine wear and prolongs its lifespan, making biodiesel an attractive additive for future petrodiesels with very low sulphur content (which will change from 500 to less than 15 ppm under the new Canadian standard that comes into effect in 2006).
- Its **Cetane Number** (saturated hydrocarbon – the equivalent of the octane number for gasoline) is much higher, which means combustion occurs more easily and, accordingly, there are fewer emissions. The cetane number of pure biodiesel varies between 52 and 62 (for animal-based biodiesel), as opposed to 42 for regular petrodiesel. A higher cetane number also means better ignition quality.
- Biodiesel blends are **thermally stable**; they do not significantly change, even when exposed to temperatures above 70 °C.
- Even though biodiesel's **cloud point** is higher than that of petrodiesel, it is still safe and efficient at cold temperatures when blended in the right proportions (B2, B5, and even B20) and when certain simple conditions of use are followed.
- Lastly, it is equally **effective** and reduces a number of emissions in both electronic and mechanical injection engines.
- Because it contains more oxygen (11 percent), biodiesel, even in low proportions, **improves** combustion for the fuel with which it is blended. This **increases the efficiency** of the catalytic converter and **significantly reduces emissions**.

2.1 A proven track record

Biodiesel is a fuel with a proven track record. Over the years it has been studied and tested at numerous concentrations, with different engine types, in a variety of conditions and over more than 40 million kilometers. In the United States and many European countries, biodiesel is rapidly becoming the alternative fuel of choice. It is estimated that in the year 2000 its worldwide production reached 900,000 tonnes (1 billion litres), and that its use has been steadily and significantly rising.

Europe

In Europe, half of all fuel used for transportation is petrodiesel. The size of the market and the high price of fuel have led European countries to choose alternative fuels, which makes the European Union (EU) the largest biodiesel producing and using region in the world.

In 2003 the EU countries' biodiesel production reached 1.4 million tonnes (1.6 billion litres), a 35 percent increase over its 2002 production.

The following information indicates the importance of biodiesel within the EU:

- In 2003, the EU issued a directive requiring that the transportation industry use two percent biofuel by 2005 and 5.75 percent by 2010.
- In Germany and Austria, more than 1,700 service stations offer biodiesel.
- A number of car makers, including Mercedes Benz and VW, have approved the use of biodiesel blends for their engines.
- Most French refineries add two to five percent vegetable oil methyl esters (VOMEs) or biodiesel to their petrodiesel.⁴
- Most French bus transit systems use a blend of biodiesel (Diester®) and petrodiesel.

United States

In response to the Clear Air Act of 1990, the United States implemented a series of measures to improve air quality and significantly reduce atmospheric pollutants. Some American states have adopted a variety of measures, including a new regulation requiring significant reductions in greenhouse gas emissions and the sulphur content of petrodiesel. The 2002 Farm Bill⁵ also promotes the use of biofuel.

4. Biofuels in Europe.
http://www.ifp.fr/IFP/fr/fichiers/cinfo/IFP-Panorama04_12-BiocarburantVF.pdf

5. Farm Security and Rural Investment Act.

In October 2004 the biodiesel market received a boost when President Bush signed an act granting it tax incentives. A study by the U.S. Department of Agriculture (USDA) predicts that the demand for biodiesel, which was estimated at 30 million gallons (113.5 million litres) in 2004, will reach at least 124 million gallons (469.3 million litres) by the end of 2006, as a result of this initiative alone.

The following information indicates the importance of biodiesel within the United States:

- Over the last three years, 40 American states have passed legislation in support of biodiesel. For example, since 2002 Minnesota has required that all petrodiesel sold on its territory until 2006 contain two percent biodiesel. After this date, the ratio must increase to five percent.
- In 2004 alone, 38 states introduced no fewer than 103 decrees, tax exemptions or other biodiesel-related incentives.
- The National Park Service uses biodiesel to reduce emissions into the environment.
- Biodiesel is used by the U.S. Postal Service, the Departments of Defence, Energy and Agriculture, and a number of companies that operate vehicle fleets for school transportation, public transit, recycling, and "green" public services.

Canada

Biodiesel use in Canada began to rise when Ontario and British Columbia stopped taxing it.⁶ Under Canada's National Action Program on Climate Change, the federal government set a production target of 500 million litres a year by 2010. It is already commercially produced in Nova Scotia, Quebec and Saskatchewan. In Nova Scotia, the Ocean Nutrition corporation produces more than five million litres of biodiesel a year. In Quebec, Rothsay⁷ produces the same amount and expects to increase its capacity to 35 million litres in 2005 and 70 million litres in 2006.

Since 2001, a number of biodiesel pilot projects have been conducted in various provinces, especially in the public transportation and public utility sectors. Quebec led the way in 2002 with its **BIOBUS** project (see below), and other initiatives soon followed. Transit buses in Brampton, Ontario have been using B20 biodiesel since October 2003, and Toronto Hydro's hundred or so diesel vehicles have been using it since July 2002.

Elsewhere

The biodiesel market is rapidly growing in other regions as well, especially Asia, Australia and Brazil.

2.2 Biodiesel in Quebec – the **BIOBUS** and **BioMer** projects

In Quebec, the use of biodiesel is increasing. For example, Rothsay-Laurenc's 35-vehicle fleet has successfully used it since 2001. Two major pilot projects have also helped promote its use in the Province.

The **BIOBUS** Project, the first of its kind in North America, was conducted with financial help from the governments of Quebec and Canada and the Société de transport de Montréal (STM). From March 2002 to March 2003, 155 buses from the STM's Centre de transport Frontenac were fuelled with 550,000 litres of pure biodiesel (in B5 and B20 concentrations).

This project clearly and irrefutably proved that in real operating conditions, biodiesel is efficient and economically viable even in cold regions like Montreal where winter temperatures can reach -30 °C.

Following the **BIOBUS** Project, the **BioMer** Project successfully set out to measure the effects of using pure biodiesel (B100) in cruisers of various types and sizes. From June to October 2004, twelve boats belonging to four cruise companies from the Old Port of Montreal and the Lachine Canal were fuelled with biodiesel.

The **BioMer** Project went beyond simply measuring emissions. It also highlighted the effects of biodiesel use on cruiser engine performance and the marine environment by conducting an impact assessment of its environmental effects (i.e. emission reductions) and its biodegradability and toxicity. The project's findings will be published in winter 2005.

These two projects have attracted a great deal of interest from potential users in Quebec (i.e. for public, road, rail, marine, industrial, forestry, commercial and personal transportation) who are giving serious thought to using it, not only for its performance but as a way to contribute to national efforts to lower greenhouse gas emissions.

6. The Greater Vancouver Area is preparing to solicit an initial bid call for the purchase of 650,000 litres of biodiesel.

7. <http://www.rothsay.ca/>

2.3 Biodiesel production in Quebec

Much of the biodiesel used in other countries (i.e. Europe and the United States) is produced from commercially grown soya or rapeseed oil, while in Quebec it has so far been produced mainly from agri-food industry waste like recycled cooking oils and animal fats. For example, the pure biodiesel used in the **BIOBUS** project consisted of 24 percent vegetable oils, 28 percent animal fats, and 48 percent cooking oils. The biodiesel in the **BioMer** project was made from 100 percent cooking oil.

In its Ville Sainte-Catherine rendering plant, Rothsay has been producing biodiesel since 2001 via a process that uses recycled fats like cooking oils and animal fats that it salvages from businesses (i.e. restaurants, slaughterhouses, etc.). Its current production capacity is about five million litres of biodiesel per year. In June 2004, Rothsay announced it would spend \$14 million, including \$7.5 million of new money, to increase its capacity to 35 million litres per year and perhaps eventually double this.

A partner and biodiesel provider for the **BIOBUS** and **BioMer** projects, Rothsay believes the reclamation of food industry waste represents a unique opportunity for Quebec to climb to the top ranks of the world's large biodiesel producers and, eventually, exporters. The reuse of animal fats, especially slaughterhouse waste, has become all the more important for this Maple Leaf Foods subsidiary because, given the stir caused by bovine spongiform encephalopathy, commonly known as mad cow disease, these materials are being abandoned by companies that used to buy them.

Table 1

Available raw materials in Quebec that can produce biodiesel

	Tonnes	Millions of litres
Animal fats	190,000	206.3
Cooking oils	60,000	65.2
Vegetable oils (soya)	40,000	43.4
TOTAL	290,000	314.9

Quebec has large amounts of raw material (i.e. 290,000 tonnes or 314.9 million litres) with which to make biodiesel. In 2001, Quebec produced 190,000 tonnes or 206.3 million litres of animal fat (i.e. fats and oils from slaughterhouses or livestock producers) and 60,000 tonnes or 65.2 million litres of recycled oils (i.e. cooking grease from the restaurant industry). With regard to vegetable oils, some 40,000 tonnes or 43.4 million litres of soya oil could be made available for biodiesel production if the soya available for mass export were transformed into oil. The increasing demand for biodiesel could thus provide significant opportunities for the agricultural sector by adding value to certain oilseed crops like soya.⁸ The production of vegetable oil for biodiesel would help stimulate the rural economy by creating new sources of revenue and jobs, and this would in turn generate widespread benefits.

Table 2

Soya production in Quebec (2004)

Annual production	roughly 500,000 tonnes
Destined for:	
• Livestock feed	80,000 tonnes
• Oil production	190,000 tonnes
Processed in Quebec (oilseed crushing)	30,000 tonnes
Exported for human consumption (may be used to make biodiesel)	200,000 tonnes
Used to make oil	20%
Amount of soya oil available for biodiesel production	roughly 40,000 tonnes (43.4 million litres)

The CQB is convinced that Quebec has enough raw materials to meet its rising demand for biodiesel in the short and medium term.

8. Of the annual crops cultivated in Quebec, soya and canola are the most integrated into the direct seeding system. Direct seeding is recognized as one of the best agricultural soil conservation practices.

2.4 The price of biodiesel

Like most renewable fuels, biodiesel is being hurt by the high cost of raw materials, which makes it less competitive than fossil fuels. As we have seen, biodiesel can be produced from three different sources: vegetable oils, animal fats, and recycled cooking oils.

Table 3

Price of raw materials for biodiesel production (2004)

	Price variation per tonne	Average per tonne	Excess cost of biodiesel before tax
Animal fats	\$400 < \$500	\$450	20 cents/litre
Cooking oils	\$400 < \$500	\$450	20 cents/litre
Vegetable oils	\$450 < \$1,080	\$765	49 cents/litre

Biodiesel made from vegetable oils is currently the most expensive to produce, leading to an additional cost of 49 cents/litre over the price of petrodiesel. However, the price goes to 20 cents/litre when the biodiesel is made from animal fats⁹ and recycled cooking oils. The additional cost seems to depend largely on the price of crude oil and variations in the price of petroleum products.

Table 4 shows that in the case of pure biodiesel made from cooking oils or animal fats, the additional cost can be largely offset by appropriate tax incentives.

Table 4

Fuel price structure

		Biodiesel (B100) ¹			
		Petrodiesel ²	Without tax exemption	Without excise tax	Without the two taxes
Price of fuel	17 Dec. '04	\$0.501	\$0.701	\$0.701	\$0.701
Excise tax	\$0.040	\$0.040	\$0.040	–	–
Fuel tax	\$0.162	\$0.162	\$0.162	\$0.162	–
Subtotal		\$0.703	\$0.903	\$0.863	\$0.701
GST	7.0%	\$0.049	\$0.063	\$0.060	\$0.049
QST	7.5%	\$0.056	\$0.072	\$0.069	\$0.056
Retail price		\$0.809	\$1.039	\$0.993	\$0.806
Additional costs			\$0.230	\$0.184	(\$0.002)

1. Made from cooking oils or animal fats only.

2. Based on the rack price (OBG Montreal) of seasonal petrodiesel with low sulphur content.

Whatever biodiesel blend is used (B2, B5 or B20), its price becomes competitive with petrodiesel when a full tax exemption is applied (Table 5).

Table 5

Impact of tax exemption on biodiesel's retail price

		Biodiesel (B100) ¹			
		Pétrodiesel	B2	B5	B20
Without tax exemption		\$0.807	\$0.812	\$0.819	\$0.853
Without excise tax		\$0.807	\$0.811	\$0.817	\$0.844
Without the two taxes		\$0.807	\$0.807	\$0.807	\$0.807

1. Made from cooking oils or animal fats only.

2.5 Norms and standards

Whether pure or blended, biodiesel must respect established quality standards to ensure the safe and optimal performance of engines in which it is used.

In the absence of a Canadian standard for pure biodiesel (B100), Canada uses the ASTM D6751 standard developed by the American Society of Testing and Materials. However, a Canadian standard for B1 to B5 blends will soon come into effect while another for B6 to B20 blends is expected at the end of 2005.¹⁰

In 2002, the European committee for standardization on methyl esters developed the EN 14214 standard for biodiesel. Stricter than North American standards, it tightens the rules governing biodiesel production and quality control (while taking into account, among other things, the nature of raw materials) and redefines standards with regard to oxidation problems.

We should point out that Rothsay's Quebec plant is already able to meet North American and European standards.

2.6 Biodiesel distribution

One of biodiesel's assets is that it can be blended without having to change existing infrastructures or develop a special distribution network.

For organizations with storage facilities, direct delivery of the chosen blend (B5 or B20) is the simplest method. This is especially true for public transit companies. However, any organization with a fleet of vehicles, a limited scope of activity, and storage facilities can be easily supplied this way.

However, the accessibility of biodiesel is not limited to this mode of distribution. Because of the financial and environmental risks associated with potential spills and contamination, a growing number of public and private organizations no longer use their old underground storage tanks. They have therefore been turning to existing distribution networks, i.e. service stations. **The CQB feels it is vital that biodiesel be made available to the many users of these networks.** However, a great deal needs to be done to convince oil companies and fuel distribution firms to offer biodiesel, in conjunction with existing incentives, to generate user interest and thereby create a balance between supply and demand.

9. The price of animal fats, traditionally higher than recycled cooking oils, has fallen as a result of the mad cow crisis.

10. Canadian General Standards Board.

3.0

3.0 Positive Effects

3.1 On the economy

The **BIOBUS** project demonstrates the enormous economic potential of biodiesel: i.e. a strategic investment that helps reduce greenhouse gases and other pollutants. It proves that behind every new initiative to reduce emissions is a wealth of business opportunities.

Various groups, like the Federation of Quebec Producers of Cash Crops (agri-food industry), certain CCTTs (College centres for technology transfer), a number of businesses (like the Rothsay corporation), and the big users (municipalities and public, industrial and commercial transport companies) share the same desire to reduce greenhouse gas emissions. Users in particular spend a great deal of money each year to improve their vehicles' performance while employing all possible means to reduce emissions.

All these groups feel biodiesel is a winning solution – environmentally, economically, and socially – for all Quebecers. National and international environmental analyses have clearly shown its potential for business development and job creation.

One example is the Rothsay corporation, Canada's first biodiesel producer. It has been in Quebec since 1964 and directly employs 58 people in the province. It recently announced the expansion of its Ville Sainte-Catherine plant. The expansion is expected to create more than 16 new jobs in addition to its existing direct and indirect jobs, not counting those created by the expansion of the plant or those related to the product's distribution.

Since biodiesel can be made from oilseed crops or recycled waste materials, we can assume that every locally-produced litre of biodiesel helps lower crude oil imports, develop the local economy, and create jobs for Quebecers.

Increasing our use of biodiesel is a good idea because it would diversify our sources of supply, even if it does not completely replace petroleum.

3.2 On technology and research and development

Since 2000, Rothsay has been refining its biodiesel production process. A Quebec-based expertise has emerged in the use of biodiesel in northern climates, an area where the province has demonstrated real leadership. Benefiting from this expertise, a number of College centres for technology transfer (CCTTs) have devoted considerable attention to biodiesel. Applied research has been conducted on, among other things, means of biodiesel production and its use in cold weather.

Among these centres, **Oleotek**¹¹ has played an active role in developing Canadian biodiesel standards by sitting on the Canadian General Standards Board (CGSB) and helping implement suitable quality assurance tools. It has also developed small-scale biodiesel production procedures for smaller municipalities, and is conducting biodiesel oxidation research on behalf of Natural Resources Canada and the Rothsay corporation.

The **Institut du transport avancé du Québec (ITAQ)**¹² has a keen interest in energy efficient transportation technologies that use renewable energy sources. It is taking part in a number of studies to assess biodiesel as an alternative fuel. In its search for technical answers to the problem of biodiesel use in northern climates, ITAQ is studying, among other things, the development of thermal management systems for this fuel.

A partner of the **BioMer** project, **Maritime Innovation**¹³ recently conducted biodiesel impact analyses on the performance of marine diesel engines. It also plans to conduct, as early as next summer, a pilot project on biodiesel use in the generator of a merchant navy container ship.¹⁴

Cintech agroalimentaire¹⁵ is closely watching the biodiesel issue for opportunities to reclaim certain biomass materials like pig manure. These materials could eventually produce a biogas that is compatible with biofuels like biodiesel and ethanol, or be used in the production of high cetane components.

11. CCTT in oleochemistry, associated with the Cégep de Thetford. <http://dev.cegep-ra.qc.ca/services/entreprises/oleotek.php>

12. CCTT associated with the Cégep de Saint-Jérôme. <http://www.cstj.qc.ca/itaq/>

13. CCTT associated with the Cégep de Rimouski. <http://www.innovationmaritime.ca/>

14. The generators used by docked container ships are known to be a major source of pollution.

15. CCTT associated with the Cégep de Saint-Hyacinthe. <http://www.cintech-aa.qc.ca/>

This research and expertise opens up promising avenues which could have a significant short or medium term impact on the product's cost, its use in cold weather, and its environment and energy balance while promoting the emergence of innovative new technologies.

The CQB believes the development of biodiesel in Quebec will generate new revenue and jobs in all the sectors that provide technical support to this industry.

3.3 On the environment

Conversion of waste material

Biodiesel is a renewable and readily usable energy source for the transportation sector. It can be made with local and renewable resources, either from agricultural products or agri-food industry by-products (i.e. slaughterhouse waste, cooking oils, non-food-grade virgin oils, agricultural surpluses) which would otherwise be released into the environment where they could leak methane, a powerful greenhouse gas.

Biodiesel's life cycle analysis (LCA) shows that, unlike petrodiesel, the amount of energy required to produce this renewable fuel is less than the amount it releases during combustion. It is the same when biodiesel is made from harvested oilseed plants, a process for which the LCA must consider the energy needed to make fertilizers, cultivate plants and extract vegetable oils. In the case of biodiesel made from recycled materials, the "energy released/energy required" ratio is even more profitable because the material is used a second time.¹⁶

Quebec has expertise in the recycling of cooking oils and animal fats for biodiesel production. It is therefore entirely possible to produce 100 percent of our biodiesel from existing waste materials.

Specialized crops, a generally positive environmental record

Biodiesel made from vegetable oils is sometimes criticized for its agricultural origins. People say its production leads to a cycle of pollution (agricultural land, pesticides, transportation, etc.) which limits the benefits associated with its use. However, recent studies tend to qualify this claim. For example, in Quebec biodiesel could be produced from soya, which has a generally positive environmental record.

The impact of pollutant and greenhouse gas reduction on air quality

Though the amount of CO₂ released during the combustion of petrodiesel and biodiesel is roughly the same, it is preferable to use the latter for the following reason: Biodiesel is derived from biomass (animal or plant) produced according to a four-year life cycle, while petrodiesel is a fossil fuel that releases into the atmosphere carbon which was extracted from it hundreds of millions of years ago. Each litre of pure biodiesel (B100), used as an alternative to a litre of petrodiesel, therefore leads to a greenhouse gas reduction of 2.33 kg of CO₂ (according to the results of the **BIOBUS** Project) which results from the combustion of non-renewable fossil energy.

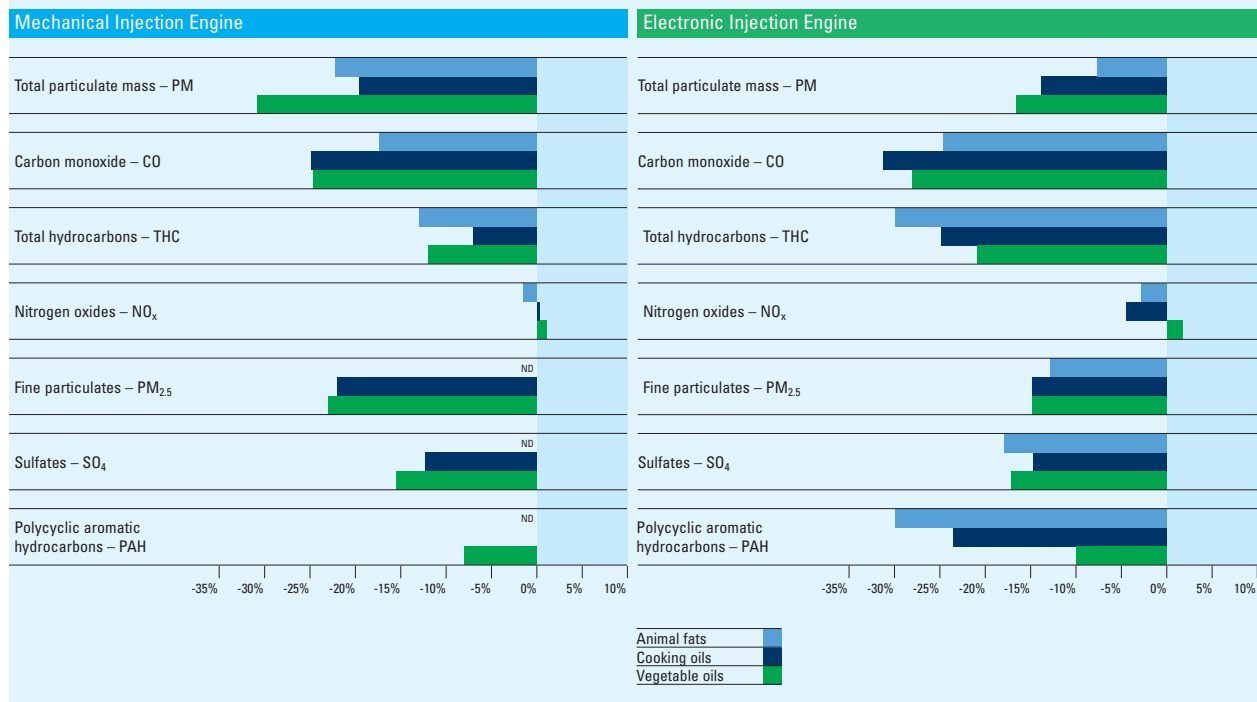
In the context of sustainable transportation, a principle to which all levels of government are committed, the environmental impact is major because these 252 million litres would make a real contribution toward eliminating some 588,000 tonnes of CO₂ (see Table 6, p. 13), or the equivalent of nearly 117,600 light vehicles travelling an average of 20,000 km per year on Quebec's roads. At the very least, biodiesel would significantly offset the rise in pollution associated with the ever growing number of motor vehicles.

The activities conducted during the **BIOBUS** Project showed that biodiesel reduces a number of emissions, even more so when used in electronic injection engines than in mechanical injection engines. As a guideline, the attached graph shows the impact of B20 concentration biodiesel on emission reductions for Cummins four-stroke mechanical and electronic injection bus engines. It compares the varying B20 emissions to those of the standard petrodiesel used by the STM.

16. *Biodiesel in British Columbia. Feasibility Study Report*, May 2004, p. 31.

Graph 2

Emission changes with B20 compared to the reference petrodiesel used by the STM (BIOBUS Project)



Toxicity and biodegradability

In general, biodiesel is as biodegradable as sugar and ten times less toxic than salt.

Environmentally, pure biodiesel (B100) has the advantage of being fully biodegradable and relatively non-toxic. When petrodiesel is blended with biodiesel, its biodegradability is three times the normal rate of petrodiesel.¹⁷ Blending petrodiesel with biodiesel speeds up petrodiesel’s rate of biodegradation. Because of its higher biodegradability, accidental spills of biodiesel are less dangerous. Its low toxicity and its biodegradability make it ideal for use wherever the environment is fragile. For example, all boats and vehicles belonging to Channel Islands National Park near Los Angeles (United States) have used biodiesel since 2000.

Biodiesel is also noted for its non-toxic, biodegradable solvent properties, since it is used to clean coastlines polluted by accidental oil spills. In 2000 it was successfully used to clean French and Spanish coastlines polluted by oil from the Erika.

3.4 On health

According to the World Health Organization (WHO), current climate changes are having serious effects on human health and giving rise to significant health care costs. This is due to, among other things, the increasing frequency and severity of smog episodes (ozone and particulate matter) and heat waves. The most recent data show a direct correlation between high levels of air pollution and increased absenteeism at school and work, hospitalizations, and even deaths. The same occurs during heat waves, which are increasingly frequent and inevitably lead to deaths in larger cities.

One study¹⁸ has shown that 16,000 deaths per year in Canada are caused by air pollution, which accounts for eight percent of all non-accidental deaths in the country. Moreover, 80 percent of air pollution-related cancer risks are directly linked to the inhalation of petrodiesel emissions.¹⁹

17. Canadian Renewable Fuels Association Web site <http://www.greenfuels.org/>
18. « Taking Our Breath Away », David Suzuki Foundation, 1998.

19. *Les changements climatiques: enjeux majeurs de santé publique des Québécois* by Dr. Louis Drouin, regional contact person, Unité de santé au travail et environnementale, Direction de la santé publique de Montréal-Centre; and contact person for the scientific panel “Pollution atmosphérique et santé publique” of the Institut national de santé publique du Québec.

Petrodiesel's pollutants include particulate matter, nitrogen oxide, carbon monoxide and a long list of toxic chemicals that increase the risk of cancer, respiratory problems and chronic health problems like asthma. More than 40 petrodiesel emission components are considered air pollutants and toxic contaminants. Most vulnerable to this vile cocktail are children, the elderly, and people with chronic illnesses.

Air pollutants are now known to have direct health effects. Atlanta (United States) adopted strict regulations governing the use of cars during the 1996 Summer Olympic Games. A 24-hour public transit system helped minimize greenhouse gas emissions during this 17-day period. This led to significant and almost immediately noticeable reductions in air pollution. One study²⁰ showed that emergency room visits and hospital admissions for asthma went down by 11 to 40 percent. Ozone levels went down by nearly 30 percent, and asthma attacks among children decreased dramatically. The number of children admitted to hospital went down by 19 percent.²¹

This example showed that when concrete steps are taken to improve air quality, public health improves. According to economists, the health benefits of improved air quality would save Canada roughly \$8 billion over 20 years. The authors of a study conducted for the Canadian Council of Ministers of the Environment estimate that reducing vehicle-related pollutants and particulate matter could lead to Canada-wide health care savings of roughly 11 to 30 billion dollars over a 24-year period.

It is clear that a major reduction of atmospheric pollutants and particulate matter would lead to significant and sustainable health benefits for Quebecers while easing pressure on the health care system. Whatever its concentration and origin, it has been proven that biodiesel significantly reduces pollution and greenhouse gas emissions. For example, a B5 blend lowers the production of ozone (which is responsible for smog) by at least 25 percent, while B20 lowers it by roughly 30 percent.²²

It is important that the current generation enjoy good health and that the health of future generations not be destroyed by the effects of air pollution and climate change. **The CQB believes that using biodiesel reduces the effects of fossil fuel consumption on public health.**

20. Timothy Begany, "Study: Fewer Cars Equal Fewer Asthma Exacerbations", *Pulmonary Reviews.com*, Vol. 6, No. 5, May 2001.

http://www.pulmonaryreviews.com/may01/pr_may01_fewer.html

21. David Suzuki, *Climate Change and Health*.

<http://www.cwhn.ca/resources/kyoto/suzuki.html>

22. **BIOBUS** Project.

4.0 The Future of Biodiesel

4.1 Potential market

The potential market for biodiesel²³ is significant. In Quebec alone, petrodiesel consumption in the transportation sector has reached 3.57 billion litres. This could mean 252 million litres of biodiesel when the proper blends are calculated.

Table 6

Potential biodiesel market

(based on 2001 consumption figures)

	Petrodiesel Biodiesel ¹	Taxable ²	Biodiesel blend	Biodiesel Biodiesel
Road transport	1,860 million	16.2 cents	B5	93.0 million
Public transport	90 million	10.8 cents ³	B20	18.0 million
Rail transport	252.3 million	3.0 cents	B20	50.5 million
Commercial transport	656 million	16.2 cents	B5	32.8 million
Marine transport	146 million	0 cents	B20	29.3 million
Off-road applications ⁴	570 million	0 cents	B5	28.5 million
Potential biodiesel market				252.0 million

1. In litres

2. Application of fuel tax

3. After refund of one-third of tax

4. Agricultural and manufacturing sectors

Sources: L'énergie au Québec – Édition 2003, MRNFP, 2004

Forecast: Conseil québécois du biodiésel (CQB)

Thanks to the Rothsay corporation, Quebec is well able to meet its current and future biodiesel needs. However, the government must take a clear position on the issue and announce incentives before Rothsay halts the expansion of its Quebec plant. **Without incentives to make the price of biodiesel more competitive, the CQB believes Rothsay will soon sell its production outside the province to where such measures exist. Given the growing demand for biodiesel, it would be unfortunate if, a few years down the road, Quebec had to import renewable fuel that it already produced in sufficient quantity and quality on its own territory.**

4.2 Public transit

The **BIOBUS** Project heralded a greener vision of public transportation in Quebec, and today serves as a model for public transit companies and their users.

The project has clearly shown that biodiesel is efficient and economically viable in real operating conditions, even in Quebec's northern climate.

The experiment reveals a promising future for biodiesel in Quebec's public transportation sector. If we replaced the petrodiesel used by all buses in Quebec (2,850 buses) with B20 for one year (i.e. 90 million litres), we would eliminate 42,000 tonnes of CO₂ emissions from a non-renewable energy source, i.e. the equivalent of 8,400 cars circulating on our roads.

Table 7

Impact of B20 use by Quebec's urban transit authorities on the reduction of annual CO₂ emissions

Bus fleet	2,850 buses ¹
Total distance travelled	195.3 million km
Total fuel consumption	90 million litres
Biodiesel consumption	18 million litres
Expected CO ₂ reduction (B20)	42,000 tonnes
Equivalent number of cars travelling 20,000 km per year	8,400 cars

1. The STM alone represents 50 percent of Quebec's urban bus fleet.

The findings of the **BIOBUS** project showed that biodiesel cuts down on air pollutants and greenhouse gases while helping reduce urban smog.²⁴ They also showed that biodiesel cuts these emissions more effectively in electronic injection engines than mechanical injection engines. Given the market trend toward vehicles with electronic injection engines, we can assume that biodiesel use would have a significant impact on the urban environment.

In light of the preceding, it is not surprising that the STM and the Réseau de transport de la capitale (RTC) say they would like to convert all their buses to biodiesel once the Quebec government has established suitable incentives.

Toronto and Halifax have taken the lead. The transit commissions of both cities recently announced they would convert their buses to biodiesel, despite the fact that Halifax enjoys no government incentives.

The Quebec government has often shown a genuine desire to reduce urban air pollutants and greenhouse gas emissions.

The CQB therefore recommends that the government encourage public transit companies, as soon as possible and through concrete incentives, to convert to biodiesel in the concentrations of their choice, up to a maximum of B20.

23. This position paper's evaluation focuses only on the transportation sector and does not explore the development potential of the residential, commercial and industrial heating sector, which consumes nearly 1.7 billion litres of petrodiesel annually.

24. See section 3.4 on health.

4.3 Incentives

As mentioned earlier, biodiesel is penalized by the high cost of raw materials, which makes it less competitive than petrodiesel. But given the desire to reduce petroleum consumption and greenhouse gas emissions, especially in the transportation sector, biodiesel's future remains promising.

In this context, certain countries have understood that offering incentives would make the price of these fuels more competitive and encourage more and more people to use them. Many studies have found that in most countries, the biodiesel market would never have developed without such incentives.

France led the way by introducing incentives in the early 1990s. Germany and Spain have since followed suit. The EU recently issued a number of directives to promote the production and use of biofuels in the transportation sector. The United States recently started doing the same.

The Government of Canada eliminated the excise tax (4 cents/litre) in November 2002. The Government of Ontario exempted biodiesel from the road tax (14.3 cents/litre) in June 2002. In November 2004, Ontario also decreed that gasoline sold in the province must contain an average of five percent ethanol by 2007. A similar measure in favour of biodiesel may be announced shortly. Since 1 July 2004, the Government of British Columbia has exempted biodiesel from the 15 to 21 cent road tax (where applicable) for B5 – B50 blends. In addition to ensuring user satisfaction, these measures pave the way for construction of plants in Ontario, British Columbia and elsewhere in Canada, and for the development of a new industry.

Here are some examples of tax incentives to encourage the use of biodiesel:

- Most EU countries offer tax incentives, ranging from 138 €/m³ in the United Kingdom (about 21 cents Canadian/litre) to 470 €/m³ in Germany (about 73 cents Canadian/litre).
- The European Parliament has adopted a regulation exempting biodiesel from 90 percent of applicable fuel taxes, which makes its price comparable to that of petrodiesel.
- In October 2004, President Bush signed an act granting a tax incentive of 1 cent U.S./gallon (0.26 cents Canadian/litre) for each percent of biodiesel in the blend, for biodiesel made from agricultural products like vegetable oils and animal fats.

It grants an incentive of 0.5 cents/gallon (0.13 cents Canadian/litre) for each percent of biodiesel made from recycled oils like cooking oil. In Canadian funds²⁵ this is roughly equal to 26.4 cents/litre for pure biodiesel (B100) made from agricultural products and 13.2 cents/litre for biodiesel made from recycled cooking oils. The incentive, whose goal is to secure the country's energy supply, reduce pollution and stimulate the economy, will come into effect in January 2005 for a two-year period.

The most popular option is the tax exemption, rather than a direct subsidy for producers or a tax refund for users.

A number of the aforementioned incentives have limits with respect to, among other things, implementation period, nature of the products or raw materials, quantity produced, etc. We may therefore conclude that incentives can be adapted to different contexts to encourage biodiesel use while respecting the constraints and objectives of each community.

Situation in Québec

Unlike other governments, the Quebec government offers no assistance or incentives to encourage biodiesel use. Paradoxically, the provincial fuel tax of 16.2 cents/litre applies to biodiesel, which is not the case for other renewable alternative fuels like natural gas, propane and ethanol.²⁶

However, there are many ways to promote the use of biodiesel:

A) Subsidy for biodiesel producers

Directly subsidizing biodiesel producers is an attractive option because it can reduce the price of biofuel by lowering its manufacturing costs. However, there is no indication that it would induce distributors to offer biodiesel to their clients or convince people to use it. **In the current context, the CQB feels it is preferable to adopt measures that target potential users.**

B) Tax refund for users

Upon the advice of the Rothsay corporation, the Quebec government considered offering a fuel tax refund (for pure biodiesel (B100) only) rather than simply eliminating the tax. This option was not implemented because it was deemed inapplicable for the main users it targeted: i.e. urban transit authorities.

25. Rate of exchange: \$1.00 U.S. = \$1.28 Can.

26. In the case of ethanol, the measure applies only if the Varennes plant becomes operational.

This option could not be adopted for two reasons: 1) urban transit authorities are required by law to buy their fuel from a single supplier. They cannot buy petrodiesel from one supplier and B100 biodiesel from another (and thereby obtain a tax refund); 2) furthermore, urban transit authorities are not authorized to make their own fuel blends.²⁷

Despite this, the **CQB believes the option should not be ruled out if we are to encourage urban transit authorities to use biodiesel. A biodiesel tax refund remains an attractive solution for the sector, provided it is not limited to B100 but applies to blends as well.**

C) Tax exemption for biodiesel

It would be reasonable for the Quebec government to follow the example of the other large provinces and grant biodiesel the same advantages it gives to other renewable or alternative fuels, which are exempted from fuel tax. Since most users are unwilling to pay more for a fuel, whatever its environmental benefits, a tax exemption can be used to boost demand.

Based on the example of British Columbia, the CQB believes the simplest way to promote biodiesel's large-scale, long-term market penetration is to grant it a tax exemption, as quickly as possible, to interest the greatest number of users in this renewable fuel.

D) Ordering by mandate that all fuel used for transportation activity contain a certain percentage of biodiesel

Another way to promote the use of biodiesel is to require oil companies to add five percent biodiesel to their products.

Ensuring by mandate the inclusion of one part biofuel within a reasonable time frame would have significant environmental benefits, especially on greenhouse gas emissions. It would create a stable market and, accordingly, require that Quebec's biodiesel production capacity be gradually increased. **The CQB believes enough biodiesel can be produced in the short and medium term to meet a requirement of this nature.**

In conclusion, all these tax incentives are important because they would encourage the development of biodiesel and make its price competitive with that of petrodiesel. However the **CQB believes a tax exemption is the simplest and most accessible option in the current context, and recommends that it be adopted as soon as possible. It also warns that without incentives, Quebec will have no biodiesel market.**

4.4 The impact of tax incentives

It is clear that the aforementioned options necessarily incur costs for the government such as lower tax revenues. However, this revenue loss must be viewed in perspective because, whatever happens, the production and use of biodiesel in Quebec will always be marginal in relation to petrodiesel. The effects of the tax holiday on government revenues will therefore be quite limited.

If developed to its full (or technical) potential, the Quebec market would represent about 252 million litres of biodiesel per year, i.e. 7.1 percent of the transportation sector's total petrodiesel consumption. This would be a tax holiday of \$23.8 million, which comes to \$41 per tonne of CO₂ reduction. We are not yet there.

Following a tax exemption, the CQB determines that the realistic potential for biodiesel use would be 35 million litres per year (see Table 8). Allowing for the normal rise in biodiesel supply and demand, it is realistic to expect the tax holiday to be roughly \$3.2 million for the first four or five years, or \$39 per tonne of CO₂ reduction – a politically acceptable investment for everyone. This measure could be temporarily maintained until the biodiesel market is mature enough to become more competitive by, among other things, lowering its production costs.

A decree would accelerate the biodiesel market's development by encouraging more production in Quebec or creating a need to import it.

²⁷. The status of blender is reserved for oil companies and importers.

Table 8

Impact of tax measures on the biodiesel market and the reduction of greenhouse gas emissions

Scenarios	Litres of biodiesel affected by the fuel tax exemption	Impact of tax holiday for Québec	Total reduction in CO ₂ emissions ¹	Cost per tonne of tax incentive	Equivalent number of cars travelling 20,000 km per year
	Millions of litres	Millions of \$	Tonnes	Dollars	Cars
Potential technical market	252.0	23.8	588,000	41	117,600
Decree for B2	71.5	8.5	166,800	\$51	33,400
Decree for B5	178.7	21.2	417,000	\$51	83,400
B20 for urban transportation	18.0	1.9 ²	42,000	\$46	8,400
Realistic market according to the CQB ³	35.0	3.2	81,700	\$39	16,300

1. Based on 2.33 kg per litre of biodiesel used (BIOBUS Project).

2. One-third of the fuel tax is refunded to urban transit companies.

3. Predicted distribution: one-third for road transport (taxable at 16.2 cents/litre), one-third for public transit (taxable at 10.8 cents/litre), and one-third for off-road applications (non-taxable or tax refund).

The economic value of the tax measures must also be measured in terms of increased energy self-sufficiency and the many environmental, economic, technological and health benefits that result from increased use of this biofuel. Table 8 outlines the effects of each of the proposed measures on taxation, the environment, and the quantity of biodiesel used.

Conclusion

In developing a new strategy to secure Quebec's energy future, the government must clearly state its position on the key issue of renewable energy if it wants to ensure a secure energy supply for Quebecers, meet the needs of sustainable development, and protect the environment.

Biodiesel's advantages have already been proven. There is no reason to delay its implementation in Quebec while initiatives to promote it are flourishing everywhere else.

It is clear that biodiesel's global market share is increasing and that it is, along with other green fuels and technologies (i.e. electric, hybrid or fuel cell vehicles), part of the energy landscape of tomorrow. Quebec must therefore waste no time in strategically positioning itself as a promoter, producer and user of biodiesel.

Given biodiesel's extraordinary development potential and environmental benefits, the CQB believes the Quebec government must quickly implement tax incentives to promote this biofuel and achieve its four main goals: to significantly reduce greenhouse gas emissions, to reclaim and convert agri-food industry waste, to reduce dependence on petroleum products, and to develop a "green" industry with high growth potential.

Recommendations

Considering that:

- Biodiesel would diversify Quebec's energy sources and ensure a secure energy supply;
- Biodiesel can play a significant role in fighting climate change and achieving Quebec's greenhouse gas reduction targets;
- Biodiesel is a readily available energy source for the transportation sector, which can be produced from local renewable resources;
- The development and use of biodiesel in Quebec would have a strategic impact on job creation, technological progress and the reduction of harmful emissions;
- The cost of fuel, a key profitability factor for the transportation sector, is subject to strong market pressures.

Accordingly, the Conseil québécois du biodiésel (CQB) recommends that the Quebec government:

- take immediate steps to promote the production and use of biodiesel in Quebec;
- to this end, immediately implement a differentiated tax incentive for biodiesel;
- make this incentive a tax exemption (elimination of applicable fuel tax on fuel oil);
- issue a decree requiring that oil companies incorporate five percent biodiesel into their products, while allowing a reasonable time frame for the industry;
- through concrete initiatives, encourage public transit companies to quickly switch to biodiesel in the concentrations of their choice, up to a maximum of B20;
- set an example by making biodiesel the fuel of choice for its own vehicle fleet.

For More Information

Web Sites

About BioDiesel.com (U.S.)

www.AboutBioDiesel.com

Biodiesel Association of Canada

www.biodiesel-canada.org/

Biodiesel in British Columbia: Feasibility Study Report (2004)

www.citygreen.ca/news_biodiesel-report.html

Canadian Renewable Fuels Association

www.greenfuels.org/bioindex.html

European Energy Commission – New and Renewable Energies

http://europa.eu.int/comm/energy/res/legislation/biofuels_en.htm

European Biodiesel Board

www.ebb-eu.org

BIOBUS Project

www.stm.info/info/biobus.htm

BioMer Project

www.biomer.ca

National Biodiesel Board (U.S.)

www.biodiesel.org

Natural Resources Canada – Biodiesel

<http://oee.nrcan.gc.ca/transportation/fuels/biodiesel/biodiesel.cfm?attr=8>

Wise Energy

www.wiseenergy.ca

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Canadian Biodiesel Initiative: Aligning Research Needs and Priorities with the Emerging Industry, Final Report, Kingston, BioCap Canada, 2004, 35 p.

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PAHL, Greg, *Biodiesel: Growing A New Energy Economy*, Chelsea Green Publishing Company, 2004, 224 p.

ROLLEFSON, Jim, FU, Gloria, CHAN, Albert, *Assessment of the Environmental Performance and Sustainability of Biodiesel in Canada*, Ottawa, National Research Council of Canada, November 2004, 190 p.

US Government, *21st Century Complete Guide to Biofuels and Bioenergy: Department of Energy Alternative Fuel Research, Agriculture Department Biofuel Research, Biomass, Biopower, Biodiesel, Ethanol, Methanol, Plant Material Products, Landfill Methane, Crop Residues* (CD-ROM), Progressive Management, 19,045 p.

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