

Renewable Fuels

Submission to the Standing Committee on Natural Resources

Jesse Row, P.Eng.

June 2006



Sustainable Energy Solutions

About Pembina

The Pembina Institute creates sustainable energy solutions through research, education, consulting and advocacy. It promotes environmental, social and economic sustainability in the public interest by developing practical solutions for communities, individuals, governments and businesses. The Pembina Institute provides policy research leadership and education on climate change, energy issues, green economics, energy efficiency and conservation, renewable energy and environmental governance. More information about the Pembina Institute is available at <http://www.pembina.org> or by contacting info@pembina.org.

Experience with Renewable Fuels

The Pembina Institute has completed several major research papers on ethanol and biodiesel, and has been involved in discussions with companies, governments and other environmental non-governmental organizations (ENGOs) on renewable fuels policies.

Pembina's most recent research into biofuels includes two separate projects for major integrated energy companies on the topics of: 1) the state-of-the-art in lignocellulose ethanol production technologies, and 2) opportunities and challenges with introducing biodiesel at the retail pumps¹.

The Pembina Institute has also been involved in consultations with the Council of Energy Ministers Working Group on Renewable Fuels, as well as discussions with members of the ethanol, biodiesel and petroleum industries regarding the broader introduction of renewable fuels into the Canadian marketplace.

Pembina is also a part of the Canadian Renewable Energy Alliance (CanREA), an alliance of Canadian civil society organizations from the non-profit or voluntary sector that hold a common interest in promoting a global transition to energy conservation and efficiency, and use of low-impact renewable energy. Within CanREA, Pembina is working closely with other members on formulating a common perspective on the advancement of renewable fuels within Canada.

Outline

The Pembina Institute's submission to the Parliamentary Standing Committee on Natural Resources will cover the following areas:

1. Federal Environmental Policy: Context
2. Maximizing Environmental Benefits
 - Cellulose Ethanol
 - Biodiesel
 - Sustainable Agriculture
 - Co-product Markets
3. Competition with Food
4. Future Opportunities

Federal Environmental Policy: Context

Impact on National Greenhouse Gas Emissions

To put the 5% renewable fuels standard into context, it's important to understand the magnitude of the emission reductions that are expected to occur as a result of the policy. To do this, one must consider the following factors:

- On-road vehicles (gasoline and diesel) account for about 19% of national greenhouse gas (GHG) emissions. If you add-in the upstream GHG emissions from fuel production and transportation, on-road vehicles are then responsible for 27% of national GHG emissions (a 40% increase above just the tailpipe GHG emissions).
- It is expected that starch ethanol (produced from corn and grain) will account for the majority of the 5% standard.
- Natural Resources Canada estimates that starch ethanol is expected to reduce life-cycle GHG emissions by 40%, on average.

Taking all of these factors into account means that if 5% of fuel in Canada today is replaced with starch ethanol, **the total reduction in national GHG emissions will be about 0.5%**. (I.e., 5% of GHG emissions caused by on-road vehicles, which accounts for 27% of national GHG emissions, will be reduced by 40%.) When we consider the fact that GHG emissions in Canada have risen by about 30% since 1990, the impact of a 5% national renewable fuels standard on national GHG emissions is expected to be small.

Another important piece of context is the fact that at least 3 provinces (Ontario, Manitoba and Saskatchewan) have established or are in the process of establishing renewable fuel standards. This means that approximately 45% of the population are already expected to be converting to at least 5% renewable fuels. Therefore, **federal action in this area could be said to be responsible for reducing national GHG emissions by less than 0.3%**.

It is clear that a national strategy to reduce GHG emissions needs to address more than just renewable fuels. It needs to achieve significant reductions in emissions in all major sectors including emissions from industry, buildings and vehicles.

Impact on Air Quality

In reviewing research related to impacts of renewable fuels on air quality, such as levels of smog, there is no clear agreement among the studies. At the very least, most researchers agree that these fuels will not make air quality worse than it already is, but **the degree of improvement in air quality is uncertain at this point**.

Maximizing Environmental Benefits

The following section summarizes several methods of maximizing the environmental benefits that can be achieved with a national renewable fuels standard.

First, it is important to note that the greenhouse gas benefit of ethanol varies significantly depending on the material used to produce the fuel. Conventional ethanol is made from grain and corn, but it is also possible to produce ethanol from lignocellulose or plant fibres, such as cereal straw, corn stover, hay, switchgrass and wood. Life-cycle analyses of these different production methods published by Natural Resources Canada show that, in general, the **net greenhouse gas emissions from lignocellulose ethanol are three times lower than those from wheat and corn ethanol**ⁱⁱ. Our own research, completed for one of Canada's largest energy companies, confirms this calculation. Clearly, the production and use of lignocellulose ethanol needs to be increased in order to maximize the greenhouse gas benefits of ethanol fuel.

It is also important to note that **the mass of available lignocellulose feedstock is currently more than five times greater than the available mass of starch-based feedstock**ⁱⁱⁱ. In fact, given current production volumes and market demands, **there is not enough wheat and corn available in Canada** to supply 3 billion litres of ethanol (approximately 5% of all the gasoline and diesel expected to be sold in Canada in 2010^{iv}). Therefore, Canada has three primary options to meet a 5% renewable fuel standard: 1) develop domestic production of lignocellulose ethanol, 2) increase the availability of grain and corn, or 3) import renewable fuels from other countries.

Fortunately, **Canadian companies are world leaders in lignocellulose ethanol technology**. It is an Ottawa-based company, Iogen, that has pioneered lignocellulose ethanol technology. Iogen is now poised to begin the development of large-scale plants. With the right leadership from the federal government, the world's first commercial-scale lignocellulose ethanol plant could be built here in Canada. Looking forward, there is boundless opportunity to export this clean technology (and Canadian expertise) around the world.

Biodiesel is another renewable fuel with a very high potential to reduce greenhouse gas emissions. Again, data published by Natural Resources Canada indicates that biodiesel produced from canola reduces life-cycle greenhouse gas emission by 70% when compared with conventional diesel^v. If tallow or yellow grease is used as the feedstock, the greenhouse-gas reductions are greater than 85%^{vi}.

While the technical potential for lignocellulose ethanol and biodiesel to achieve greater reductions in greenhouse gas emissions is high, the reality is that these technologies are not as mature as the grain and corn ethanol industries. **Without targeted support for lignocellulose ethanol and biodiesel, they will be largely shut out of the marketplace**. This is a perspective shared by many industry and government stakeholders.

In order to leverage the investment that Canadians will be making into renewable fuels and provide maximum environmental returns, it is critical for the Government of Canada

to provide targeted support for lignocellulose ethanol and biodiesel. Here are some recommendations on how to provide such support, along with recommendations on how to improve the environmental performance of the whole renewable fuels sector:

- 1) Provide specific incentives to **encourage the production and use of lignocellulose ethanol and biodiesel**. The United States government already provides additional credits towards their Renewable Fuel Standard for these fuels.
- 2) Offer targeted support for the **development and commercialization of new renewable fuel technologies**. For example, when a company takes on the risk of building the first plant of its kind in the world, the Government of Canada could provide financial support for this type of innovation, which can leverage future economic and environmental benefits for the country.
- 3) **Promote sustainable agricultural practices through targeted incentives**. It has been shown that the environmental benefits of renewable fuels can vary widely depending on the agricultural practices used, even within Canada. For example, differences in farm energy use, fertilizer choice, land use changes, cultivation practices and transportation distances can vary life-cycle greenhouse gas emissions by more than 30%^{vii}.
- 4) **Market development assistance for renewable fuel co-products** should be provided. Many of the environmental benefits of renewable fuels come from the use of their co-products (e.g., if the co-products of ethanol production, such as animal feed and fertilizer, are not used to displace other products, the life-cycle GHG emissions from using ethanol can turn from a net decrease to a net increase when compared with conventional gasoline). A large percentage of the life-cycle greenhouse gas benefits of both ethanol and biodiesel occur when their co-products displace similar products produced by conventional means. If co-product markets do not expand, the overall environmental benefit of renewable fuels will be greatly diminished, and may even become negative in some cases.

It is our view that **these are foundational components** of a Canadian renewable fuels strategy. Adherence to these principles will allow the government to achieve the maximum environmental benefits for the resources spent.

Competition with Food

Making a choice between producing food or fuel from a particular piece of land goes beyond simple economics. Most people will tell you that currently, it is not a lack of food that keeps people around the world from going hungry, but there are many other reasons. This does not mean, however, that the question of producing fuel on cropland is not worth considering. In the future, when renewable fuels plays a bigger role on the national energy stage, it may very well create pressures on the food system.

Therefore, potential impacts on food availability warrant further attention. For example, **there are many opportunities to produce both food and fuel from the same piece of**

land (e.g., using the wheat or corn stalks to produce fuel, and using the grain or corn for food), but further commercialization is needed for these solutions to become competitive in the marketplace.

Future Opportunities

The future potential for renewable fuels to reduce greenhouse gases is quite significant. By using lignocellulose ethanol and biodiesel technologies, the impact on the climate for every litre of fuel is greatly reduced, but **we also need to increase the percentage of fuel that comes from low-emission sources**. This can easily be done in the next few years by increasing the renewable fuel standard to 10%. Beyond this, it will be important for Canada to provide support for the introduction of vehicles that have the option to run on 85% ethanol (E85). The more E85 compatible vehicles we have on the road, the easier it will be to begin distributing E85 in the community.

Closing

In closing, it is important to emphasize two specific points:

1. There are many opportunities to maximize the environmental benefits of a renewable fuels standard, but specific policies must be put in place to realize this potential.
2. A commitment to a renewable fuels strategy is a small component of the overall action plan Canada needs to protect our environment and substantially reduce greenhouse gas emissions.

The Pembina Institute is thankful for the opportunity to provide this submission to the Standing Committee on Natural Resources. We look forward to the upcoming discussion.

ⁱ Not publicly available.

ⁱⁱ Natural Resources Canada (1999). Alternative and Future Fuels and Energy Sources for Road Vehicles. Tables 4-9 and 4-13.

ⁱⁱⁱ When considering factors such as existing markets and the volumes of feedstocks that may ultimately be available for ethanol production, 2.0 billion litres may be produced annually from corn, wheat, and other starch crop feedstocks, while 11.5 billion litres may be produced from lignocellulosic feedstocks such as hay, wood residue, and forestry wastes. Source: Natural Resources Canada (2004). Economic, Financial, Social Analysis and Public Policies for Fuel Ethanol. Tables 5-19 and 5-27.

^{iv} The volume of gasoline and diesel expected to be sold in Canada in 2010 is 62.8 billion litres. This is a linear projection of the 2000-2004 net sales figures from Statistics Canada CANSIM Table 405-0002: Road motor vehicles, fuel sales, annual (Litres).

^v Natural Resources Canada (2005). Biodiesel GHG Emissions Using GHGenius- An Update. Table 5-1.

^{vi} Ibid.

^{vii} Natural Resources Canada (2005). Ethanol GHG Emissions Using GHGenius- An Update. Table 6-2.