

The Economics of Biofuels

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1. Introduction

Biofuels have been the object of intensive research and development since the energy crisis of the 1970's. Recently, research has been done on the value of biofuels in reducing emissions of Greenhouse Gas (GHG) from agricultural production (i.e. from sources such as nitrous oxide from fertilizer, carbon dioxide from farm trucks and tractors and methane from livestock..) Reductions of GHG from crop production have generally been shown to be important in reducing total GHG emissions from biofuel production.

2. Biofuel and GHG

The paper will be divided into five sections:

1. A literature review which will incorporate a broad survey of the economic, scientific and technical studies to date;
2. A review of the methods by which energy can be produced from agricultural raw materials such as grain, crop residues, forages, wood from agro-forestry, and low-value vegetable oils. A systems approach will be used. All emissions of GHG in the productions of the inputs into biofuel production, the actual production emissions and savings in transportation will be investigated. It is important to verify and confirm that the total GHG emissions from the whole biofuels cycle are less than the total GHG emissions from the fossil fuel to be replaced.
3. An examination of present and planned production of agricultural based biofuels in Canada (mainly ethanol at present). This section will incorporate a brief analysis of:
 - The amounts of biofuels produced compared to Canadian agricultural needs;
 - The estimated economic value of biofuels (economic cost and benefit - see Section 3 below), including current government support programs;
 - Greenhouse gas emissions compared to some reference fossil fuels (gasoline, diesel, and natural gas);
 - Ethanol production at the Poundmaker complex in Lanigan, Saskatchewan (for use as a potential model). There may be a number of economic/environmental benefits from the development of biofuels to specific agricultural regions. Examples may also be drawn from the Commercial Alcohol large-scale ethanol plant at Chatham, Ont.;
 - What can be done to get the biofuels industry to take a lead in converting farm equipment to biofuel-based energy.

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4. A summary of the value of using biofuels in attaining Canada's GHG emissions reduction goals by 2008 - 2010. The focus here will be on agriculture's potential as opposed to an overview of ethanol's contribution within the whole Canadian economy.

5. If ethanol and other biofuels are considered as having a feasible and realistic potential on Canadian GHG emissions (source or sink), a review of possible policy issues (e.g. taxes vs. subsidies, institutions etc) will be provided.

3. The Cost of Biofuels

Without some economic value (i.e. a positive profit potential), the production of biofuels cannot be a viable proposition. To reduce the cost of biofuels, so that they are more competitive with fossil fuels, several approaches are currently being investigated.

3.1. Ethanol Bio-Refineries

Small ethanol plants are diversifying into higher value co-products, such as fiber and protein food products. These plants are more properly called bio-refineries rather than ethanol plants. In these bio-refineries grain is processed to yield relatively high value food products, with waste streams used to produce ethanol and animal feed. Economic analysis indicates that such an industry should be able to produce ethanol more cheaply than plants that produce only a relatively cheap feed byproduct. The second approach to reducing the cost of biofuels involves large-scale production of ethanol, methanol and hydrogen from lignocellulosic (grass hays, wood from fast growing poplar and willow) raw materials are being investigated. New technology to convert lignocellulosic materials and crop residues into ethanol shows promise of reducing the cost of ethanol to levels comparable to gasoline.

3.2 Methanol

Technology to produce methanol or hydrogen from agricultural raw materials is also being investigated. Considerable reductions in costs of biofuels to provide transportation services (cents per vehicle-km) can be achieved if they are used in fuel cells rather than internal combustion engines. This also reduces greenhouse gas emissions and emissions of air toxins and ozone precursors such as nitrogen oxides, carbon monoxide and volatile organic compounds.

Comparative costs and greenhouse gas emissions will be shown, comparing several biofuels with gasoline used in either internal combustion engines or fuel cells.

3.3 Biodiesel

Biodiesel is a term used to describe fuels and lubricants made by reacting vegetable oils or animal fats and greases with methanol to produce methyl esters of fatty acids. Such products are considerably more expensive than diesel fuel. Total potential supplies would only be enough to provide less than one percent of present diesel fuel requirements. Thus biodiesel is being investigated for niche markets where its superior environmental and technical performance, compared to diesel fuel, might allow it to compete.