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Environmental Concerns of Gasohol

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Summary

Gasohol production and use has the potential for causing adverse environmental impacts. These impacts include air and water pollution, health and safety effects, and socio-economic issues. There are some potential unknown consequences and the specific effects will vary by the type of plant and location. Overall, there are no apparent significant environmental impacts that cannot be provided for in the orderly planning and development of gasohol production.

Introduction

While most of the interest and publications about gasohol relate to the various production options and investment incentives, there has been a fair amount of investigation into the environmental concerns. Generally, the environmental issue that is of most apparent national significance is soil erosion and nutritional loss due to 1) harvesting of plant material that would normally remain in the soil, or 2) expansion to poor quality soils to increase production. However, there are some unknown effects that will need to be evaluated.

In the last ten years there have been major changes in the way environmental issues are considered. Prior to 1970, there was a general ignoring of the environmental effects and costs of any particular activity, and most of the last ten years activity has been spent determining how best to evaluate environmental effects and how to consider them at the appropriate time and in the acceptable amount. In recent years, however, the environmental concern and impact processes have been largely integrated into the normal planning and development functions of industry and government. By using the process of anticipating potential adverse impacts of an activity, corrections can be made at early stages of development; thus, the effects can be minimized or eliminated with only minor inconveniences and costs compared to being forced to make corrections at a later date.

Gasohol production is intertwined with the need for developing domestic energy production, for switching from fossil fuels to renewable energy sources, in considering the international security and balance of payments issues, and in providing domestic economic development. While there are differing attitudes on how effective gasohol can address any of these factors, it is clear that its use will increase. If enviornmental concerns are not fully understood and accounted for, it will cause unnecessary delays and costs in gasohol production and use.

A brief listing of some of the environmental effects are provided below; specific considerations will vary by type of producting plant, type of feedstock, current cropping practices, and geographical location.

Air

Air pollution effects can be divided into three categories: 1) field impacts of feedstock production, 2) fermentation and distillation, and 3) end-product use. Under field conditions there may be increased dust due to less crop residue on the soil surface, and possible odors and dust from disposal of any spent fermentation materials on land. During the fermentation and distillation cycle there can be odor, leakage of vapors, dust from feedstock storage, hydrocarbon emissions from final product storage, and air emissions from boiler fuel. Drying of stillage may cause additional air emissions. Use of gasohol in internal combustion engines has shown to slightly decrease the carbon monoxide and increase emissions of nitrogen oxide and evaporation of hydrocarbons. Ethanol is clearly an octane booster, but the effect of gasohol on fuel mileage is difficult to conclude at this time.

Depending on the source of the feedstock, gasohol will have one positive effect on air pollution, that of not increasing carbon dioxide levels (although carbon dioxide is produced in the fermentation cycle). Since organic material produces carbon dioxide during decay in the field, the burning or fermentation of any of this material only shifts the same release to another location. Since the major source of carbon dioxide increase is fossil fuel combustion, the use of any biomass as a fuel will decrease the problem (increased carbon dioxide causes increased global surface temperatures).

Water

Potential water quality problems may occur if leach from production waste is allowed to enter waterways or reach water tables. There may be times when certain batches cannot be used for further intended uses and must be disposed of either on land or in water. This will create the normal biological oxygen demand (BOD) of organic matter and may affect salinity and trace elements depending on source of feedstock. Because of the large amount of water used in processing, the water itself may be at high BOD, but in some cases could be recycled or used for fertilizer. Additional water quality problems could occur with blow-down from condensors or scrubbers (for air emissions control).

Solid Waste

Some solid waste will be generated in material that cannot be used for its intended purpose (e.g. bad batches), but the primary solid waste will probably be any residual from boiler fuels such as ash.

Health and Safety

Because of the increased volatility of gasohol, storage and operating conditions may be more sensitive, equipment temperatures may be dangerous if not insulated and protected, creosote buildup may occur in boiler stacks with more fuels, and noise levels may be significant. Non-explosion proof electric motors, metal grinding equipment, and flames may cause an explosion under some circumstances. Fermenting tanks may build up carbon dioxide and cause unconsciousness while viewing the process if care isn't taken. Some toxins that could occur in the natural feedstock may pass through into the mash to be fed as animal by-products and could constitute a health hazard (it is unlikely it would pass into the alcohol portion). Pesticide use may increase or decrease dpending on crop rotation patterns, changes in acceptable market quality of a crop, possible monoculture conditions over large land areas, and cleanliness needs of crop for fermentation (e.g. weeds).

Land Resources

The primary environmental impact on land appears to be soil erosion (by wind and water) and nutrient loss (by removal of vegetation). Additional impacts relate to changes in land use patterns with particular reference to prime agricultural land, and wildlife habitat changes due to different cropping practices. Establishment of additional acreage that is of inferior quality may further increase erosion, and harvesting of biomass in recreational areas may impact (either positively or negatively) aesthetics, timber production, and water runoff.

Socio-Economic

There has been considerable discussion on the use of productive farmland for energy use rather than food use. This is intensified by concerns that current grain surpluses (or other feedstocks) may not always be available and that the United States has historically been an export country for much of the world's undernourished people. Some examples include: 1) changes in fuel and food could affect political decisions in terms of world malnutrition, 2) the balance of payments may change from that which agriculture currently provides (currently a significant positive benefit), 3) potential impacts of other countries (particulary Brazil) of sending their gasohol production to the United States and thus having to import additional food, and 4) the competition between food and fuel may affect the reliability of long-term forecasts of each. The specific impacts will vary, depending upon which feedstock is used, whether the feedstock is considered as a by-product or as raw material, how the various feedstocks and by-products are integrated into other industries, which types of energy sources(e.g. solar, geothermal) can be used in gasohol production labor availability, and what the market will allow in terms of the flexibility of biomass for fuel vs. other uses for the raw material.

There are additional concerns relating to the cost of food and of agricultural labor in locations where biomass energy production presumably will compete with existing food production. It is generally assumed that energy demands would win over food demands (at current food production levels) and thus bid up the price of food, since the raw materials would be worth more when used for energy production. This will then raise additional questions relating to various subsidies and may cause development of a revised national policy on the issue. Since there are currently a number of incentives for gasohol production, any significant changes in subsidy may have a profound impact and should be considered before committing large amounts of resources to gasohol production over long periods of time.

Net Energy Use

Net energy is the amount of energy obtained from a process compared to the amount of energy used in that process. For example, the amount of energy derived from gasohol consists of burning that fuel in an internal combustion engine, where the energy involved in making the gasohol includes that used in distillation, fermentation, irrigation, hauling, drying, fertilizer, and indirectly, the energy used in making the tractor, or equipment, used in the process. There has been a great deal of discussion on net energy from gasohol with questions being raised that it takes more energy to make it than you get in using the product.

The answer depends on many assumptions and the specific plant design and end-of-product use. While it varies, generally, the net energy appears somewhat positive if the plant is of intermediate size, located close to the source of feedstock material and to the livestock operation for use of the stillage, and the crop or feedstock production does not require excessive amounts of energy (such as fertilizer and irrigation).

While the concern for net energy is important, also at issue is the use of imported fossil fuels. By substituting a non-petroleum based energy in the production of alcohol (such as waste heat, coal, geothermal, or solar) significant reductions can be made in petroleum use. In using renewable energy sources in alcohol production (such as solar), the net energy may still be about zero, but the limited petroleum source has been substituted by a plentiful and renewable one. Thus, it may be more appropriate to think of gasohol as an alternative to petroleum than as an additional source of energy.

Indirect Effects

Those raw materials required for producting gasohol will in themselves cause some environmental impact as they are produced. Examples include: 1) energy required for high intensity production, distillation and transport, 2) fertilizer production, 3) materials production, and 4) disposal and removal of old alcohol conversion plants. In addition, short-term inputs may appear favorable to gasohol production at the expense of such long-term factors as soil quality if plant residues are harvested rather than returned to the soil.

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