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Evaluation Report Summary / April 2009

Biofuel Policies and Programs

Traditional biofuels continue to serve a useful purpose, but the state needs to rethink its subsidy programs and increase its planning for advanced biofuels like cellulosic ethanol.

Major Findings:

- Corn-based ethanol and soy biodiesel help reduce the consumption of petroleum and other fossil fuels, but their overall ability to reduce dependence on fossil fuels is constrained by land resources and other considerations.
- The environmental impacts of corn-based ethanol and soy biodiesel are unclear in some respects and more complicated than is often acknowledged by both supporters and detractors of these biofuels.
- The environmental impacts of corn-based ethanol and soy biodiesel are relatively modest at the production levels that are achievable nationwide without a large increase in the land devoted to their production.
- Cellulosic ethanol appears capable of greater energy savings and better environmental impacts than corn-based ethanol, but it is just beginning to be produced at pilot and demonstration facilities. Algae-based biodiesel is believed to have promise, but it is still in the research and development stage.
- The state's subsidy programs are not generally designed to maximize the energy and environmental benefits of biofuels, although some corn ethanol producers in the state have implemented technology that significantly reduces fossil fuel use and greenhouse gas emissions.
- The producer payment program, while very helpful in stimulating corn-based ethanol production in the 1980s and 1990s, has continued to provide subsidies even when producers made large profits.
- Although the financial condition of the ethanol industry has deteriorated during the last year, maintaining the producer payment program may have little effect on future ethanol production.

Recommendations:

- The Legislature should consider ending the producer payment program for corn-based ethanol and redirecting the funds to programs designed to further reduce fossil fuel energy use and greenhouse gas emissions.
- The Department of Employment and Economic Development should not use the JOBZ program for biofuel plants unless they need subsidies and offer significant energy and environmental benefits.
- The Environmental Quality Board (EQB) and its member agencies should examine what land could be used to grow biomass for cellulosic ethanol production and how the biomass could be grown and harvested with minimal environmental impact.

The full report is available at www.auditor.leg.state.mn.us/ped/2009/biofuels.htm

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Report Summary

Traditional biofuels reduce the consumption of petroleum and other fossil fuels, but are limited in their overall ability to replace petroleum-based fuels.

Minnesota has been a leader in requiring the use of ethanol in gasoline and biodiesel in diesel fuels. The state currently requires nearly all gasoline sold in the state to contain 10 percent ethanol and nearly all diesel fuel for motor vehicles to include 2 percent biodiesel. State law calls for the ethanol blend percentage to increase to 20 percent in 2013 provided the Environmental Protection Agency (EPA) approves its use in motor vehicles. The state's biodiesel blend rate is scheduled to increase to 5 percent in May 2009, with subsequent increases for warm weather months in 2012 and 2015.

The federal government has long subsidized the use of ethanol and approved a tax credit for blending of biodiesel in 2004. The state's main program for subsidizing ethanol producers has been a producer payment program, which began in 1987. In addition, the state's Job Opportunity Building Zones (JOBZ) program has provided tax breaks for more recently built ethanol plants and several biodiesel facilities.

Corn-based ethanol and soy biodiesel reduce fossil fuel energy consumption, but the fossil fuel energy savings are limited due to land constraints and other considerations.

In general, corn-based ethanol and soy biodiesel provide more energy than the fossil fuel energy used to produce them. For each gallon of pure corn-based ethanol (E100), the fossil fuel savings—including petroleum, natural gas, and coal—are the equivalent of the energy content in 0.26 to 0.37 gallons of gasoline. A gallon of pure soy biodiesel (B100) has fossil fuel savings equal to the energy content in 0.83 gallons of diesel fuel. If only petroleum savings are considered, a gallon of E100 saves about 0.69 gallons of gasoline, while a gallon of B100 replaces 0.96 gallons of diesel fuel.

The overall petroleum savings from corn-based ethanol and soy biodiesel are limited, however, by land and other constraints. About 31 percent of the corn crop and 7 percent of the soybean crop harvested in the United States in 2008 is expected to be used for biofuels. These usage levels have raised concerns about the impact of biofuels on world food supplies and prices. Yet, we estimate that only 5.2 percent of gasoline use and 0.6 percent of diesel use would be replaced by these biofuels in 2009.

Future growth in crop and biofuel yields will probably allow corn ethanol and soy biodiesel to replace a greater percentage of gasoline and diesel fuel use. By 2020, only a slight increase in the land used to make corn-based ethanol in 2008 would be needed to power all motor vehicles in the nation with E10. But that level of biofuel consumption would replace only 7 percent of gasoline use. Nationwide B2 usage is not achievable using soybeans alone without a major increase in acreage used for soy biodiesel. To achieve nationwide use of E20 and B5 by 2020 would require about two-thirds of all of the land planted with corn in 2008 and slightly more than half of all the land planted with soybeans. While Minnesota could achieve these higher levels of biofuel consumption using traditional biofuels, their achievement at the national level depends on developing more advanced biofuels like cellulosic ethanol and algae-based biodiesel.

Certain environmental impacts of corn-based ethanol and soy biodiesel are unclear, particularly their impact on greenhouse gas emissions.

A number of studies have concluded that corn-based ethanol and soy biodiesel reduce greenhouse gas emissions. An Argonne National Laboratory analysis found that the average reduction in greenhouse gas

emissions was 19 percent for E100, which is about 2 percent for E10, compared with gasoline. The average reduction for Minnesota is probably somewhat higher due to its reliance on petroleum from Canadian oil sands and the implementation of fossil fuel saving technology by three ethanol plants. Studies of pure biodiesel estimate greenhouse gas reductions between 41 and 94 percent compared with diesel fuel. For B2 blends, the reduction is between 1 and 2 percent.

The environmental impacts of biofuels are unclear in a number of respects.

These studies have been criticized for a number of reasons. The greatest attention has been paid to land use impacts, since significant amounts of greenhouse gases may be emitted when non-cropland is converted to corn and soybean production. If biofuel production expands quickly and requires more land for corn and soybeans, emissions from land conversion could offset the reductions from biofuel use for many years. Indirect land use changes could occur in other countries if commodity price increases spurred by biofuel use cause land conversions elsewhere.

Biofuel expansion may have had a modest impact on land use in the United States. Since 2001, the amount of corn used for ethanol has expanded more than 400 percent and has consumed all of the increase in corn production even after accounting for the distillers grains that are a by-product of ethanol production. The acres used for corn and soybeans have grown 8 percent since 2001.

This issue has been controversial in part because the estimated land use impacts are based on projections, not actual land use changes, both in the United States and in other countries. The EPA is currently developing regulations that will determine whether, after considering land use impacts, various biofuels meet the greenhouse gas reductions required by federal law for advanced biofuels and corn ethanol produced at new plants.

Similarly, the impacts of corn and soybean production on water quality may depend on land use impacts. If biofuel expansion increases the number of acres planted with corn or soybeans, there will likely be an increase in the amount of fertilizers and pesticides that reach surface waters or groundwater supplies. But if biofuel expansion occurs without the need for additional land, there may be no marginal impact on water quality from crop production.

The impact of corn-based ethanol on various air pollutants is also subject to dispute. Total life-cycle emissions of five key air pollutants are higher for ethanol than gasoline, but urban emissions are lower. As a result, it has been generally believed that corn-based ethanol has a positive impact since overall air pollution levels are higher in urban areas. A recent study casts doubt on this conclusion at least for particulate matter. The study found greater overall health problems from particulate matter when ethanol is used instead of gasoline. The study used EPA models to measure the incidence of particulate matter and the health impacts.

Studies suggest that cellulosic ethanol will provide greater energy savings and better environmental results than corn-based ethanol, but some uncertainties remain.

Preliminary estimates indicate that, compared with corn-based ethanol, cellulosic ethanol would reduce overall fossil fuel consumption, provide greater reductions in greenhouse gas emissions, and require significantly less fertilizers and pesticides. Biomass for cellulosic ethanol would come from forest residues, corn cobs or other portions of the corn plant, and dedicated energy crops like switchgrass, prairie grasses, or willow and poplar trees. Furthermore, grasses and trees may be grown on marginal land that is not suitable for traditional crop production.

However, cellulosic ethanol is in the pilot project stage and is not yet being

Additional study is needed on the potential land use and environmental impacts of cellulosic ethanol.

produced commercially. There is considerable uncertainty about how cellulosic ethanol will be produced and whether it can be economically competitive even with the federal tax credit that began in 2009. Cellulosic ethanol can also have adverse impacts on greenhouse gas emissions if the biomass is produced on land previously used for traditional crop production. There are also concerns about whether growing biomass on marginal lands means that lands will be removed from the Conservation Reserve Program with adverse impacts on the environment and wildlife.

The state's subsidy programs for biofuels are not designed to maximize the energy and environmental benefits of biofuels.

The Legislature should consider ending the producer payment program and redirecting the funds to efforts designed to further reduce fossil fuel energy consumption and greenhouse gas emissions.

The producer payment program was instrumental in spurring the early growth of the state's ethanol industry. However, the program is not designed to maximize overall energy savings or reduce environmental impacts and may no longer have much impact on overall ethanol production. While several producers have implemented significant energy and environmental improvements to reduce natural gas or electricity costs, the state's producer payment program had little impact on those decisions. Ethanol plants constructed in recent years have received JOBZ tax breaks. However, some of these plants were built during very favorable economic conditions and may not have even needed subsidies.

Additional energy and environmental savings are possible in the future either by developing a cellulosic ethanol industry or through additional improvements to existing corn ethanol plants. However, the largest subsidy programs are not designed for these purposes. A small grant program administered by the Next Generation Energy Board has recently provided some funds for these and related purposes, but its funds are small compared with the other programs.

Furthermore, the producer payment program has paid $93 million over the last five years to companies that have earned profits of $619 million over this period. While financial conditions for ethanol producers have deteriorated in the past year, it is unlikely that maintaining these payments will influence production decisions. The subsidies are only a little more than 1 percent of sales.

Legislators should look carefully at this program in light of the current budget deficit and the state's goals of reducing energy consumption and greenhouse gas emissions. About $44 million is scheduled to be spent on the producer payment program from fiscal year 2010 through 2012.

The Next Generation Energy Board has funded a number of studies and demonstration projects that will increase knowledge about the potential for cellulosic ethanol. But more attention and funding is needed to achieve a better understanding of the potential sources and supplies of biomass for cellulosic ethanol production, as well as the potential land use and environmental impacts.

Summary of Agency Responses

In a letter dated April 9, 2009, Agriculture Commissioner Gene Hugoson wrote: "We commend your staff for their comprehensive review and thoughtful analyses of the complex energy, environmental and economic issues associated with biofuels production and use." However, he disagreed with the recommendation to terminate the producer payment program and emphasized the "profoundly positive impact" that Minnesota's ethanol program has had on the state's economy.

In a letter dated April 10, 2009, Natural Resources Commission Mark Holsten wrote: "The report recognizes the complexities surrounding biofuel production…." He also expressed support for the recommendation that the Environmental Quality Board study potential agricultural sources of biomass.