SUSTAINABILITY at The National Academies

MEETING RECAP

WHAT ABOUT THE BLEND WALL?

National Academies
Science and Technology for Sustainability Program

Meeting at: The Institute on the Environment
University of Minnesota
April 8, 2010

This meeting recap was prepared by National Academies staff as an informal record of issues discussed during a dissemination meeting for the report "Expanding Biofuel Production and the Transition to Advanced Biofuels, Lessons for the Upper Midwest for Sustainability: Summary of a Workshop." It has not been reviewed and should not be cited or quoted, as the views expressed do not necessarily reflect the views of the National Academies or members of the Workshop's Steering Committee.

The National Academies' Science and Technology for Sustainability (STS) Program hosted an informal working meeting on April 8, 2010 to discuss emerging issues associated with the production and use of higher level ethanol blends—beyond E-10[1]. The meeting was held in conjunction with the publication of the summary of a June 2009 workshop examining the environmental, economic and social impacts of expanding biofuel production in the Upper Midwest.[2] An issue raised at the June workshop now receiving increased attention is the possibility that the U.S. Environmental Protection Agency (EPA) will allow higher ethanol blend levels in gasoline.

In March 2009, Growth Energy, on behalf of 52 ethanol producers, petitioned the EPA to grant a waiver—raising the blend level in order to increase the market for ethanol. The working meeting identified a number of the potential constraints and consequences associated with such a change. The meeting engaged representatives from industry, the policy community, government regulators, and researchers in an informal dialogue designed to better understand potential issues and identify needed actions and research to minimize any unintended, adverse consequences and ensure sustainability going forward.

Robert Wisner, Iowa State University, set the stage for the meeting by describing the provisions of the 2007 Energy Independence and Security Act (EISA), outlining the concept of a blend wall and explaining the waiver request and describing the economics of the biofuel industry. He explained that the 2007 act mandates substantial increases in ethanol fuel blending with use levels of 12 billion gallons for corn based ethanol and 100 million gallons of cellulosic ethanol in 2010, increasing to levels of 15 billion gallons and 16 billion respectively in 2022. Because cellulosic fuels have been slow to develop, EPA has sharply decreased this year's cellulose ethanol mandate to 6.5 million gallons and these mandates are not expected to meet EISA targets in the next few years. However, corn based ethanol fuel production is expected to meet or exceed target levels. All ethanol fuel producers are constrained by the size of the existing market for ethanol fuel, which is limited, in part, by government regulations restricting the percent of ethanol allowed to be blended into regular gasoline and the small number of E-85, flex fuel vehicles in use as well as very limited E-85 retail facilities.

[1] Ten percent ethanol blended with gasoline
[2] Expanding Biofuel Production and the Transition to Advanced Biofuels, Lessons for Sustainability from the Upper Midwest, Summary of a Workshop. NRC 2010 http://www.nap.edu/catalog.php?record_id=12806

Current engine technology has a fuel mileage disadvantage for E-85 of about 25 percent, which means large-scale development of that market would require lower ethanol prices relative to gasoline than E-10 or E-15 markets, where consumers are less likely to notice the mileage disadvantage. Ethanol price pressure from policy emphasis on a large-scale E-85 market could discourage cellulosic ethanol investors.

Wisner explained that currently the blend level for non-flex fuel vehicles is set at E-10, which means that 10 percent ethanol can be blended with gasoline. Currently blends up to E-85 can be used in flex fuel vehicles. However, the extent to which E-10 is part of the gasoline supply varies substantially across the country. If all gasoline currently consumed in the U.S. included 10 percent ethanol, the maximum size of the market would be about 14 billion gallons. However, consumption by flex fuel vehicles is low—since the flex fuel vehicle fleet comprises less than 5% percent of the vehicles currently on the road and will not likely absorb new supplies.

Wisner added that by increasing the blend level to15 percent, the size of the market, theoretically, could increase by about 50 percent to around 20-21 billion gallons annually. However, most see this prospect as unlikely given the other constraints which limit effective demand. In addition, the full market impact is likely to occur slowly. The potential "waiver" simply allows higher fuel blends. It is not a mandate or requirement, and thus distributors and consumers are free to choose a higher blend level or not.

While much of the attention is currently focused on the Growth Energy petition requesting approval for the use of 15 percent blends, projected ethanol production capacity increases are likely to exceed demand, and it is likely that approval for even higher level blends—E-20 or E-30—may be requested in the future. At a state level, Minnesota has implemented a mandate which requires that gasoline be blended with 20 percent ethanol in 2013. Actual implementation of the mandate, however, requires waivers from EPA. Few other states have created mandates for ethanol. In Iowa, the largest ethanol producing state, recent proposals to introduce legislation requiring a 10 percent ethanol blend failed.

Conditions for the EPA Waiver

Wisner explained that in order to approve the waiver under the Clean Air Act, EPA must determine that the higher level fuel blends will not cause or contribute to a failure of the following over the useful life of the vehicle—motor vehicles or their engines, any of a vehicle's emission control devices or systems, or non road engines and non road vehicles. Particular attention will focus on tailpipe emissions, evaporative emissions, compatibility of materials, and drivability. In December 2009, EPA announced that additional testing was needed, but based on the information it had collected to date, EPA would consider allowing E-15 blends for use in all vehicles manufactured since 2001. No date has yet been announced for a final EPA determination.

Bruce Jones of Minnesota State University described work being done at the university to evaluate the effects of higher fuel blends on both automobiles and small engines. While most of the focus has been on the use of ethanol blends in automobiles, MSU has also been testing the use of ethanol blends in non-road vehicles and small engines—chainsaws, outboard motors etc. The use of ethanol blends in some of these engines is more problematic because the engines are not equipped with electronic fuel control systems, and therefore the use of ethanol blends may result in unacceptable levels of emissions, materials incompatibility and general performance issues.

Issues for the Ethanol Industry, Going Forward

A substantial part of the meeting was devoted to discussions about some of the potential challenges and bottlenecks associated with meeting overall demand for ethanol including:

1. Limited market impact of a 15 percent waiver if it applies only to 2001 and newer model vehicles.
2. Regulations in some states, such as California, which would limit higher ethanol fuel blends due to projected volatile organic compound (VOC) emissions from higher ethanol blends.
3. Consumers' preferences for clear gasoline (E-0) or E-10 because of potential mileage reductions associated with higher ethanol blends.
4. Current auto manufacturers' warranties not valid for ethanol blends of more than 10 percent

Representatives from fuel refiners and distributers noted some of the supply chain risks, including the inherent difficulties in shipping higher blend products, generally by truck or rail, and the mismatch between sources of ethanol supplies and major gasoline markets. They also raised concerns about future liability and insurance issues.

Dick Mills, Holiday Stationstores, a major gasoline retailer in the Upper Midwest, described some of the problems likely to be faced by distributors if higher blend fuels are approved. In particular he noted that it will be costly and logistically difficult for stations to add or change tanks, pumps and dispensing equipment. If higher blends are allowed but only for newer vehicles or if there are state by state differences in blend mandates, stations may be forced to choose which blend to offer: E-10 or a higher ethanol blend. He noted that there were likely to be significant liability issues for station operators since most equipment is not designed for higher blends and not approved/certified by Underwriters Laboratory (UL)—a requirement for insurance coverage. While UL may certify new equipment for use with E-15 or beyond, this will not apply to legacy equipment, and the cost of replacing this equipment is likely to be significant.

Mills noted that car owners also face problems in that automobile warranties are not now valid at blends higher than 10 percent. It is not clear who would bear the liability for engine or other problems potentially caused by higher blends—the manufacturer, the car dealer, the customer or a government agency that mandates the use of higher fuel blends? In addition, customers may balk at using higher blended fuels if the mileage loss associated with ethanol is not reflected in lower fuel prices.

During a follow up discussion, some meeting participants expressed concern with the potential incompatibility/mismatch of current fuel transportation, storage, and distribution systems with higher ethanol blends and the associated environmental and safety consequences of this mismatch. Cost and liability issues were raised by several participants, as well. **Paul Nelson** of the Iowa Department of Natural Resources (DNR) talked about the state's efforts to assess the compatibility of materials used in storage tanks and the likelihood of corrosion problems in equipment used to store fuels with higher blend levels. The objective of Iowa's effort is to prevent the release of toxic substances and to protect service station owners and consumers. He noted issues associated with older/legacy equipment in which ethanol blends may degrade soft metals, corrode dispensers and lead to structural failure in fiberglass tanks etc. Iowa has no comprehensive inventory of this equipment and thus no way of knowing just how great the environmental risks. **Fran Kremer** of EPA noted that this was a nationwide problem with more than 600,000 tanks and 200,000 facilities nationwide but only limited information on the extent to which these facilities would be compatible with higher blend fuels. **Paul Nelson** suggested that recently installed newer equipment is probably compatible with blends up to E-15, but it is not clear if the equipment will be compatible with blends above E-15. However, many new dispensers currently are not UL listed for blends above E-10. Based on the work of the Iowa DNR, the state has issued formal guidance for service station owners/dealers, which now serves as a model for other states.

Mark Toso, of the Minnesota Pollution Control Agency, identified some of the risks associated with accidents, leaks and spills of ethanol blended fuels. He described several spills that had occurred in Minnesota, providing good scientific data on the risks associated with ethanol fuel blends and the need to develop new approaches to handling spills. In particular, he noted that ethanol blend spills are more problematic than traditional gasoline spills because they can alter soil structure, and generate large amounts of methane gas. Both **Mark Toso and Fran Kremer** of EPA's Office of Research and Development noted that ethanol extends petroleum plumes in ground water and the co-solvency results in higher BTEX[3] concentrations. Because the BTEX components are carcinogens, potential contamination is driving EPA's risk assessment efforts focused on the fate and transport of the plume. **Fran Kremer** added that one of the concerns was the possible contamination of water supply wells. In many parts of the US, aquifers are being over pumped, exacerbating the BTEX problem. During subsequent discussions, some participants suggested that the use of ethanol as a fuel additive had fewer risks than the MTBE[4] it replaced, but others suggested that the lesson from MTBE was that regulators needed to recognize the potential unintended consequences associated with ethanol and other fuel components and additives.

Jason Hill of the University of Minnesota and several other participants discussed additional environmental, health and greenhouse gas impacts associated with ethanol and other transportation fuels. Hill presented an analysis suggesting that improvement in corn feedstock production and conversion technology efficiencies could make greenhouse gas emissions and particulate matter emissions (PM 2.5) comparable to those of gasoline. More substantial improvements are also likely from cellulose-based fuels. Industry representatives at the meeting debated these conclusions and expressed concerns that some of the models were not representative of newer feedstock and fuel production efficiencies which reduced demands on land, energy and water. They also questioned the use of "unproven" calculations of indirect land use.

Fran Kremer suggested that additional research was needed to better understand the fate and transport of ethanol fuels, potential impacts on water supplies, improved tools to assess the full life cycle costs and benefits associated with all potential

[3] Common volatile organic compounds (VOCs) found in petroleum derivatives, benzene, toluene, ethylbenzene, and xylenes
[4] Methyl tertiary butyl ether, a chemical compound—historically used as a gasoline additive

energy sources, not just biobased fuels, and understanding the health consequences associated with fuel use by geographic location and socio-economic status.

Gary Herwick of Growth Energy and **Scott Austin** of POET Biorefinery provided data describing efficiency improvements in the ethanol industry and highlighted major reductions in energy (33 percent between 1997 and 2009) and water use (80 percent since 1987). Gary stated that corn yields have increased about 20 percent over the last 20 years and optimistically projected even greater yield increases over the next 20 years—allowing for major increases in production with minimal additional land requirements. Scott described some of Poet's efforts to make its refineries more efficient by using co-generation and wastes as fuel sources for refineries. He also described Poet's strategy for moving to integrate cellulosic ethanol production in its corn based ethanol refineries.

In the final sessions, discussions focused on the role of biofuels in the Midwest, the importance of expanding the market for biofuels and the need to fully assess and mitigate any inherent risks associated with higher ethanol blends. Several participants also suggested the need for a broader systems approach to meet future energy needs more sustainably. An integrated systems approach, they said, would recognize the importance of both technological solutions and behavioral changes such as promoting the increased use of public transportation, encouraging smart growth ideas and developing more energy efficiency vehicles. It would also encourage greater reliance on markets rather than the extensive set of taxes, subsidies and mandates that now exist.

In the concluding session, **Brendan Jordan** of the Great Plains Institute stressed the need for more consistent and open dialogue between the environmental community, government officials, energy producers and consumers. Too often discussions about energy and in particular the future of biofuels are dominated by stakeholders unwilling to enter into a constructive dialogue based on objective facts. A more open dialogue would help to provide a way move forward, that promotes industry growth while preserving critical natural systems and protecting public health.

Science and Technology for Sustainability (STS) Program

The National Academies' Science and Technology for Sustainability Program (STS) in the division of Policy and Global Affairs was established to encourage the use of science and technology to achieve long term sustainable development. The goal of the STS program is to contribute to sustainable improvements in human well-being by creating and strengthening the strategic connections between scientific research, technological development, and decision-making. The program concentrates on activities with the following attributes:

- Cross-cutting in nature, requiring expertise from multiple disciplines;
- Important both in the United States and internationally;
- Effectively addressed via cooperation among multiples sectors, including academia, government, industry, and non-governmental organizations (NGOs).