The MTBE Crisis and the Future of Renewable Fuels

Testimony by Dr. David Morris
Vice President, Institute for Local Self-Reliance
1313 Fifth Street SE
Minneapolis, Minnesota 55414
dmorris@ilsr.org
612 379 3815

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I thank the members of this Committee for giving me the opportunity to testify on this important issue. My name is David Morris. I am Vice President of the 26 year old Institute for Local Self-Reliance, a non profit policy research organization based in Washington, D.C. and Minneapolis.

ILSR's mission is to strengthen local economies. Fifteen years ago I coined the term, the "carbohydrate economy", to describe an industrial economy whose materials foundation consisted largely of plant matter, and whose processing and manufacturing enterprises were significantly owned by the cultivators of that plant matter. The carbohydrate economy maximizes environmental benefits while also maximizing economic benefits to the communities that cultivate and process the raw materials.

ILSR's web site, www.carbohydreeconomy.org contains what we believe is the world's largest data base of companies involved in converting plant matter into fuels and industrial products. Over the years we have published dozens of technical and policy reports, including, *The Carbohydrate Economy: Making Chemicals and Industrial Materials from Plant Matter; Ethanol Policy and Development; A New Industry Emerges: Making Construction Products from Cellulosic Materials.* ILSR also publishes the quarterly magazine, *The Carbohydrate Economy.*

This hearing is about the future, but we cannot know where we want to go if we don't know where we have gone. Therefore, I'd like to take a couple of minutes to briefly review the history of gasoline additives.

By the end of World War I, ethanol production had reached 50 million gallons. When the car industry introduced higher compression engines, ethanol was very much in the running to become the anti-knock additive of choice. Ethanol was the superior candidate, but oil companies were uninterested in giving up 10 percent of the gas tank to farmers. Thus they chose lead, an additive that required only a few ounces per gallon. At the time leaded gasoline was introduced there was such a controversy about its potential public health effects that the federal government took the gasoline off the market for a year while the U.S. Surgeon General oversaw an analysis that astonishingly and shamefully gave leaded gasoline a clean bill of health. By the late 1930s 70 percent of all gasoline was leaded.

In the 1970s the federal government tried to reduce air pollution by requiring that new cars come equipped with catalytic converters. Then we discovered that lead in gasoline harmed the catalytic converters. Moreover, compelling evidence had been gathered to identify leaded gasoline as the cause of serious health problems. The federal government responded by phasing out leaded gasoline.

Ethanol was again available as an octane enhancer, but oil companies again preferred fossil fuels over living fuels. They raised octane levels by dramatically increasing the light aromatic fraction of their gasoline. By the late 1980s as much as 40 percent of gasoline consisted of chemicals like benzene, toluene and xylene.

The Clean Air Act of 1990 forced oil companies to reduce benzene levels. It also required them to add oxygen to gasoline in many parts of the country. Once again ethanol was the perfect solution. Once again oil companies opted for a fossil fuel derived additive: MTBE.

And now MTBE has shown up in ground water and lakes from California to Maine. The outrage has led California to phase out MTBE over the next three years and to a federal recommendation to phase out MTBE nationwide. That is why we are meeting today, to discuss alternatives.

As we do so we should learn from our mistakes. California is aggressively trying to persuade the federal government to abolish the oxygenate requirement altogether even though its own California Energy Commission has concluded that this would be the most costly and potentially the most disruptive option. Such a crude oil-only policy would make us dependent on the oil industry's once again reformulating its gasoline. The history of lead, aromatics and MTBE does not instill confidence that they can come up with a reformulation that doesn't create more problems than it solves.

The MTBE catastrophe is a classic result of partial cost accounting. Government agencies evaluated the additive from only one perspective: its impact on air quality. They ignored its impact on water quality. In seeking alternatives, the federal government would be well-served to adopt a full cost accounting approach.

It is time for a full cost accounting approach to transportation fuels. When we do so, ethanol is clearly the superior candidate.

Environmental Issues

The perfect transportation fuel has yet to be identified. Methanol is corrosive and toxic. MTBE, which represents two thirds of the oxygenate market, is, as we have seen, polluting the ground water. Electric vehicles presently rely on a half ton of lead acid batteries, a potential environmental problem and they increase the generation of electricity which, depending on the fuel used to generate the electricity, can cause environmental problems as well.

Ethanol has its shortcomings as well, but when we compare it to alternatives, it stacks up very well indeed. And as an aside, one of the most attractive of all transportation fuels, hydrogen, can be and I suspect will be extracted from plant matter in the long run.

Presently ethanol is made from sugar and starch from a variety of feedstocks(sugar cane, barley, wheat, corn, potatoes, whey, brewery wastes). Corn represents the raw material for over 90 percent of U.S. ethanol. Some environmentalists worry that we should not devote any land to feeding our cars when a growing world population goes hungry. But this is not a stark either-or choice. When ethanol is produced from corn starch the amount of feed protein produced per acre is not reduced. Indeed, the value of that protein is enhanced by concentrating it. Making ethanol does reduce the amount of starch but there is no apparent looming worldwide shortage of starch.

Moreover, most industry analysts believe that starch is only a transitional feedstock for making ethanol. Starch has a high value and if it is used for industrial purposes it may find more attractive markets as a biochemical rather than as a biofuel, as butanol and polylactic acid and other higher priced commodity and specialty chemicals.

Many believe that cellulose in the form of corn stalks, municipal solid waste, prairie grasses, etc. will become the raw material for future ethanol production. Cellulosic crops require relatively small amounts of inputs, have a very attractive overall environmental impact and can be grown in sufficient abundance to provide 10-20 billion gallons of ethanol a year. Several companies are seriously pursuing cellulose-to-ethanol production facilities.

Some in the environmental community worry about the net energy ratio of ethanol. Corn is the feedstock of choice for making ethanol and corn is a relatively energy intensive and fertilizer intensive crop. However, the

energy intensity of corn has dropped by over 35 percent since 1980.[1] And the energy intensive of ethanol manufacturing plants has dropped by 80 percent since 1980.

ILSR was the first to undertake an in-depth, case-study based investigation of the energy used to make ethanol. The initial report, *How Much Energy Does It Take to Make a Gallon of Ethanol?* was issued in 1993 and updated that report in 1995. When we looked at the operating efficiencies of the best ethanol plants and the best corn growing state, a good indicator of the energy efficiency to be expected from future ethanol production, the energy output to input ratio was more than 2 to 1.[2]

ILSR also compared the greenhouse gas impact of gasoline with MTBE, with that of gasoline with ethanol. Our draft report concluded that when MTBE is used in gasoline, greenhouse gas emissions could increase by up to 8 percent or decline by up to 4 percent. When ethanol is the additive greenhouse gas emissions reductions range from 10 to 40 percent.[3]

With regard to ground level air quality impact, ethanol contains by far the highest amount of oxygen of any alternative. A 10 percent blend can reduce carbon monoxide emissions by some 20 percent. Carbon monoxide is a harmful pollutant in its own right and one of the precursors of ozone formation,.

The only real controversy regarding ethanol and air quality appears to be around the question of ozone formation. There are some in the environmental community who think the addition of ethanol increases ozone formation, although when we examine even the most pessimistic of these studies we find that the projected increase is very small.

We should keep in mind, however, that ozone is not directly emitted but rather is formed by the interaction of a number of chemicals. Back in 1990 the Clean Air Act required that regulators assume a direct correlation between the quantity of hydrocarbons in the air and the amount of ozone formed. Today the government relies on a more complex analysis. That analysis takes into account not only the quantity of emissions but their reactivity. Ethanol, a less reactive chemical, replaces more reactive elements of gasoline. The reduction in reactivity offsets the increase in mass hydrocarbon emissions.

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[1] AREI/Production Inputs. Economic Research Service. USDA. Washington, D.C. 1996.

[2] Irshad Ahmed, David Lorenz, David Morris, *How Much Energy Does It Take to Make a Gallon of Ethanol?* ILSR. Minneapolis, MN. August 1995. A later study by the USDA echoed ILSR's findings. See Hosein Shapouri, James A. Duffield and Michael S. Graboski, *Energy Balance of Corn Ethanol Revisited*. USDA, Office of Energy. 1995.

[3] Irshad Ahmed and David Morris, *Ethanol, MTBE and Greenhouse Gas Emissions*. Draft. ILSR. Minneapolis, MN. June 1994.

And as noted above, ethanol produces the greatest reduction in carbon monoxide emissions, one of the elements of ozone formation.

The conclusion by a growing number of atmospheric scientists is that ethanol, at worst, generates no more ozone than does MTBE. At least one study of the Minneapolis area concluded that a 10 percent ethanol blend reduces ozone formation by about 10 percent.[4]

Any environmental evaluation of ethanol blends should consider the impact on air toxics. This is an issue that has only recently been receiving attention. Ethanol displaces up to 10 percent of the gasoline and the elements of the gasoline it displaces are carcinogenic substances like benzene, toluene and xylene. When toluene and xylene are burned they add to tailpipe benzene emissions. According to one analysis, a splash blend of 10 percent ethanol reduces benzene exhaust by 25 percent and reduces the overall toxicity of the gasoline, based on the California Air Resources Board potency weighting, by 30 percent.[5]

Finally, we should note that the evaporative emissions of ethanol itself are not a problem. Indeed, ethanol's evaporative emission rate is about half that required of gasoline under the Clean Air Act. Add a few ounces of ethanol to a gallon of gasoline and the gasoline's emissions of volatile organic compounds rises by about 15 percent or 1 pound increase in Reid Vapor Pressure(RVP). Add 10 percent ethanol and the volatility increase stays at 15 percent. But if ethanol rises to about 25 percent of the gasoline's content, the RVP goes back down to where it was before ethanol was added. And if ethanol becomes the primary fuel, something that is happening as E85 cars begin to take the road, the volatility drops dramatically below that of gasoline-only cars.

We should not visit the sins of gasoline on the head of ethanol.

Economic Issues

Ethanol is an attractive environmental fuel. More attractive still is its potential for economic development in both rural and urban communities.

An increased demand for ethanol increases the price of corn, albeit modestly. An increased number of ethanol plants increases the price of corn to nearby farmers significantly, largely because of avoided transportation costs. But the maximum benefit to American farmers occurs when the farmers themselves own the plant.

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[4] Gary Whitten, unpublished report to the Minnesota Pollution Control Agency. Systems Application International, Inc. San Rafael, CA. Data reported by Renewable Fuels Association. Washington, D.C.1996.

[5] Whitten, Op. Cit.

Many observers note the dominant role that ADM plays in ethanol production. It is true that ADM remains the largest ethanol producer by far, but the fastest growing sector of the ethanol industry consists of locally owned, small and medium scaled biorefineries. Indeed, ARCO's market share of the U.S. MTBE market in 1998 was only slightly less than ADM's share of the U.S. ethanol market.

Most American states produce no petroleum. Even Texas is a net oil importer. The U.S. imports a majority of our oil. The Energy Information Administration predicts that this could soar to 75 percent in the next 10-15 years.

Today there are about 20 cooperatively owned ethanol cooperatives nationwide. In my home state of Minnesota about 11 of the state's 15 ethanol plants are owned by more than 8,000 farmers. Ethanol constitutes 10 percent of all gasoline fuel sold in Minnesota, and farmer owned biorefineries produce over 90 percent of that total.

Ethanol has the additional benefit, pointed out by many, that it displaces imported oil. It also displaces increasingly imported MTBE. Today one third of MTBE is imported. In 1996, according to the Energy Information Administration, 1.4 billion gallons of MTBE were imported, up from 400 million gallons in 1993. More than 70 percent of MTBE comes from OPEC countries.

Finally, we should realize that ethanol is the entry point to an even greater materials revolution: the substitution of biochemicals for petrochemicals. The process for making ethanol can be and is evolving into processes for making higher value commodity and specialty chemicals like butanol and polylactic acid and levulinic acid and glycerine. The incentives offered to the ethanol industry have not only built a viable transportation fuels industry but has built the foundation for the revival of biochemicals. The country that gains the leadership in these technologies will find an eager market among billions of people who live in countries that have an abundance of plant matter but lack the hard currency to import expensive petrochemicals.

Comparing tax incentives

Let me turn finally to the question of tax incentives, a contentious point among many.

The revolution in our transportation fuel sector has brought many new and old fuels into the marketplace: electricity, propane, natural gas, ethanol, methanol.

The government provides incentives for all these cleaner burning fuels. Some incentives, like the one for ethanol, are given to the fuel itself. Others, like those offered electric vehicles or compressed natural gas vehicles, are given for the conversion of the vehicle or for the construction of fueling facilities.

I believe one could make a strong argument that among alternative fuels, ethanol receives one of the smallest tax incentives.

Electric vehicles receive a federal tax credit of 10 percent of the value of the car. In California, EV-1 manufactured by GM and the Solectra electric vehicle sell for about $32,000. Thus the value of the federal tax credit is $3200. Some states provide substantial additional tax benefits and some electric utilities offer EV owners lower electric rates.

The EV federal tax credit is much higher than the ethanol tax incentive. Ethanol's tax incentives come to about $30 per vehicle-year.[6] The EV federal tax credit comes to about $3200, which if invested in treasury bills would generate about $200 per year while maintaining the principal.

For natural gas conversions and fueling stations the federal government offers a tax deduction rather than a credit.[7] Several states offer additional conversion and fueling station incentives. The owner of a natural gas car would receive at least $200 for three years.[8]

One other federal fuel incentive that might be compared to ethanol is the the wind energy credit. This is a credit, payable to the producer, of 1.7 cents per kWh.[9] That represents 50-80 percent of the wholesale price of electricity.[10] The federal ethanol credit represents 80-85 percent of the wholesale price of gasoline.[11]

When we compare the ethanol tax incentives to those still provided for the oil industry we find a truly lopsided situation. A recent in-depth report by

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[6] Assuming 600 gallons of gasoline per vehicle-year(15,000 miles driven and 25 miles per gallon) and a federal tax incentive of 5.4 cents per gallon.

[7] Deductions range from $2,000 for cars and trucks weighing up to 10,000 pounds and up to $50,000 for trucks over 26,000 pounds and buses seating 20 or more passengers. Businesses installing fueling stations are allowed deductions up to $100,000.

[8] If we assume the cost of vehicle conversion is $2000, a three year writeoff and a 30 percent tax bracket. This excludes any tax benefits for the fueling apparatus.

[9] The wind energy credit increases with inflation, unlike the ethanol credit.

[10] The wholesale price of electricity ranges from 2-3 cents per kWh.

[11] The wholesale price of gasoline is about 65 cents per gallon. Since ethanol constitutes about10 percent of the gasoline, the federal tax incentive is 5.4 cents per gallon.

Professor Jenny Wahl found the incentives provided to the mature oil industry far surpass those given to the still embryonic ethanol industry.[12]

According to Dr. Wahl's conservative analysis, the tax incentives provided to the oil companies range from $3.3 to $10.9 billion a year. These are some five to 15 times greater than those given to the ethanol industry.[13]

We should not limit our inquiry into the oil industry's incentives simply to the tax code. Currently one quarter of the world's oil supply come from Persian Gulf countries. Two thirds of known oil reserves lie in the Gulf. The Pentagon spends $26-63 billion each year to protect access to Mideast oil. It seems reasonable to suggest that these costs should be borne by those who consume oil. If this were done, the cost to motorists would come to 19 cents a gallon.[14]

ILSR's report also estimated the environmental and health costs of gasoline. Our survey of the literature found a remarkable range of estimates, from $25.5 billion to $267 billion. This translates into 9.8 cents to $1.03 per gallon. We chose a very conservative estimate of 11.5 cents per gallon.

Our overall conclusion was that the oil industry receives incentives totaling over 32 cents per gallon of gasoline consumed. This compares to ethanol's incentives of about .6 cents per gallon of gasoline consumed.[15]

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[12] Jenny B. Wahl, *Oil Slickers: How Petroleum Benefits at the Taxpayer's Expense*. ILSR. Minneapolis, MN. August 1996. Dr. Wahl is Associate Professor of Economics at Saint Olaf College in Northfield, Minnesota. She has worked in the U.S. Treasury Department's Office of Tax Analysis and earned her PhD in Economics from the University of Chicago. The following analysis is taken from this report.

[13] The ethanol industry receives about $750 million in federal tax benefits per year. ILSR's report included only those tax incentives that the oil industry would receive over and above those that a traditional industry would receive. For example, the Congressional Research Service has found that the effective tax rate on oil and gas extraction income is 11 percent compared to the statutory rate of 35 percent. Other industries have effective tax rates much closer to the statutory rate.

[14] The cost would also be borne by those using heating oil and those who use petrochemicals. Currently the Pentagon is supported primarily from the general income tax. There are a number of tax shifting proposals being debated in Congress. Many Republicans support a shift from income to sales or value added taxes. Shifting the cost of the military, in part, from income taxes to oil taxes would be in keeping with this philosophy.

[15] The federal incentive is 54 cents for the ethanol itself and since ethanol is mixed as a 10 percent blend, the cost per gallon of gasoline comes to 5.4 cents. Our calculation assumes the cost of the federal excise tax incentive for ethanol is $750 million a year and total gasoline consumption of 120 billion gallons.

Conclusion

Three times before in history, environmental concerns led the federal government to reformulate its gasoline. Three times before the oil companies chose a 100 percent fossil fueled alternative that created more problems than it solved. Today, for the fourth time, the federal government is demanding changes in our transportation fuels. Let's not make the same mistake. This time we should make sure that a renewable fuel is the additive, and in the long run, the fuel, of choice.

Thank you.