

**Ethanol's Role in Mitigating the
Adverse Impact of Rising Energy Costs on
U.S. Economic Growth**

**John M. Urbanchuk
Executive Vice President
AUS Consultants**

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The importance of ethanol as an alternative fuel to the nation's economy has never been greater, and its value promises to grow even larger. Oil prices are again playing havoc with the American economy. The U.S. economy is facing the most significant period of sluggish growth in more than a decade and rising oil prices are a major contributor to the current economic slowdown. Most major economic indicators have posted declines for at least three consecutive months; sales of autos and both new and existing houses are weakening; layoffs are mounting across a broad range of industries; corporate profit reports continue to disappoint the market; and many economic analysts are trimming their forecasts of real growth for 2001.

High oil prices increase the cost of doing business for virtually all firms and drain additional money from consumers' pocketbooks. The failure of the United States to develop a comprehensive energy policy has led to falling domestic production of petroleum and natural gas; near record levels of capacity utilization in refining; and increased dependency on imported oil, which has, in turn, placed American consumers more at risk to the arbitrary decisions of the world's oil exporters.

The price of oil in the world market is largely influenced by the actions of the OPEC Cartel. OPEC, whose members produce more than 42 percent of the world's crude oil, significantly influences the supply and price of crude oil on world markets by cooperating with one another to agree on production targets. In this way, the cartel essentially acts as a single supplier of oil to the world marketplace. In short, OPEC production decisions are paid for by the world's oil consumers. Consequently, increases in crude oil prices can be viewed as a "tax" imposed by foreign oil producers on American consumers. Ethanol is a renewable fuel source that can be produced from a

wide range of feedstocks including grains such as corn, wheat, barley, sorghum, agricultural wastes and cellulose. Increased use of domestically produced ethanol will reduce the amount of oil we need to import and will reduce the amount of "tax" that American consumers are forced to pay. Relying on ethanol for an increasing share of our transportation fuel requirements means that every acre of land that produces biomass used to make ethanol becomes an oil patch that never runs dry. For example, last year Iowa produced 1.7 billion bushels of corn on 12 million acres. If all of this corn were used to produce ethanol, it would make 4.5 billion gallons or the equivalent of 190 million barrels of crude oil. This represents a 21-day supply of crude oil for the United States.

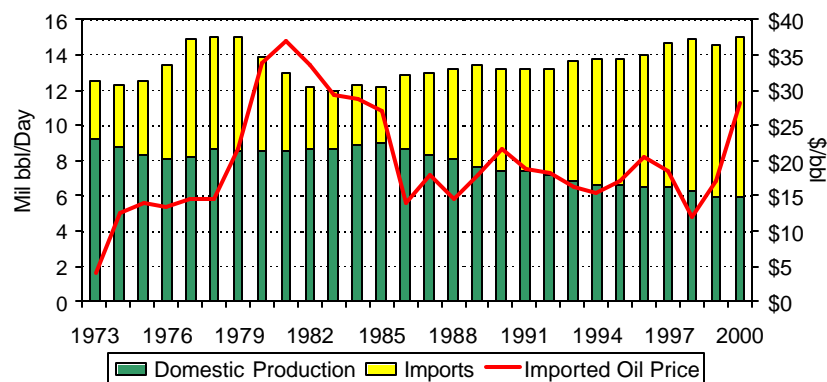
A quadrupling of ethanol use over the next fifteen years would save American consumers \$57.5 billion (1996 dollars). This is equivalent to a "tax refund" of nearly \$540 for each household in the United States. The combination of investment in plant and equipment to produce additional ethanol and stimulus provided by the consumer savings provided by replacing expensive imported oil with domestically produced ethanol will add \$685 billion to real GDP by 2015, increase household income by nearly \$186 billion over the next fifteen years, and generate more than 156,000 new jobs throughout the entire economy by 2015. By way of comparison, this is about six percent of the total number of non-farm jobs created in the U.S. economy during all of 2000.

America is More Dependent Than Ever on Imported Oil

It is a sad commentary on U.S. energy policy that dependence on foreign oil has grown significantly over the past 30 years. At the time of the first energy crisis caused by the Arab oil embargo in 1973, imports accounted for 26.1 percent of crude oil consumption in the United States. By the second oil crisis in 1980, U.S. dependency on imported oil totaled 39 percent. Last year the United States relied on imports for 59 percent of crude oil requirements, and the U.S. Department of Energy's Energy Information Agency (EIA) currently projects America's dependence on imported oil to grow from 59 percent in 2000 to 69.4 percent by 2010. EIA expects domestic oil production to fall another 7 percent to about 5.4 million barrels per day by 2015. Over this same period net oil imports are projected to reach 11.5 million barrels per day, almost 30 percent higher than current import levels.

America's consumption of oil remains at near record levels and domestic production continues to decline. Falling domestic production means that the shortfall must be made up by imports of foreign oil. This situation is illustrated in Figure 1. Crude oil demand for refining into motor gasoline and other petroleum products reached nearly 15.1 million gallons per day in 2000. This was the highest level of demand since the late 1970's. Domestic production of crude oil in 2000 averaged 5.9 million barrels per day, 34 percent lower than in 1985. The difference between demand and domestic production is made up by imports. Imports of crude oil averaged nearly 9 million barrels per day during 2000; almost triple the level of imports in 1985.

Figure 1
U.S. Crude Oil Supply, Demand, and Price

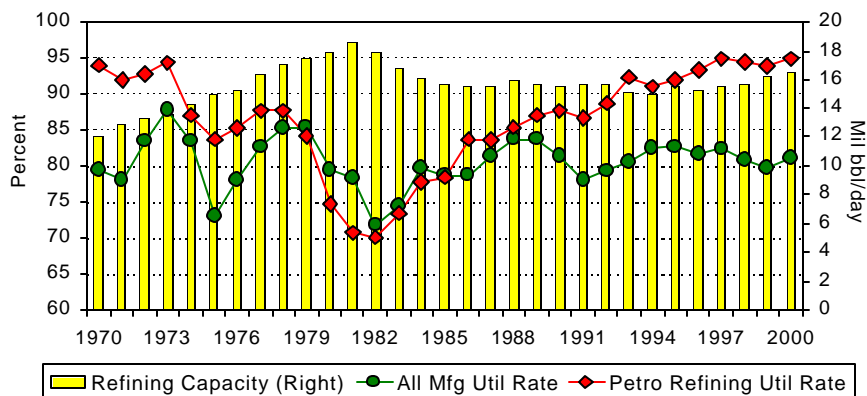


Source: U.S. Energy Information Administration Petroleum Supply Annual

Constrained output by the Organization of Petroleum Exporting Countries (OPEC) producers resulted in a sharp run-up in world oil prices over the past two years culminating in the highest level of oil prices since the 1990-91 Gulf War. OPEC, whose members produce more than 42 percent of the world's crude oil, significantly influences the supply and price of crude oil on world markets by cooperating with one another to agree on production targets. In this way, the cartel essentially acts as a single supplier of oil to the world marketplace. This supply situation has been aggravated by restricted capacity of the domestic refining industry to turn crude oil into gasoline and other petroleum products. As shown in Figure 2, capacity in the petroleum refining industry

has increased over the past several years. However, the utilization rate of this capacity is at the highest levels in 30 years. According to estimates published by the Federal Reserve Board, the petroleum refining industry is operating at almost 95 percent of capacity. By comparison, the capacity utilization rate for the entire manufacturing sector is about 80 percent. This has two implications. First, there is little or no slack in capacity so that a minor mechanical problem or catastrophe such as a fire that shuts a refinery down would quickly reduce production of refined products. Second, very high operating rates wear out machinery and equipment faster, leading to longer run problems. These factors have increased the prices American consumers pay for gasoline and other petroleum products, and combined with political turmoil in the Middle East, have again focused attention on America's dependence for energy from an increasingly unstable region of the world.

Figure 2
U.S. Petroleum Refining Capacity and Utilization Rate



Source: DOE/EIA; Federal Reserve Board

High Oil Prices are Affecting the American Economy

Economic growth in America is slowing precipitously and oil prices are part of the reason for the slowdown. High oil prices affect both the demand and supply side of the economy. First, higher prices for imported oil act like a tax increase on consumers. Since the United States imports about one third of the petroleum it consumes from OPEC, a sharp increase in the price of imported oil precipitated by restricted supply has the same impact as tax on income levied by OPEC on American consumers. That is,

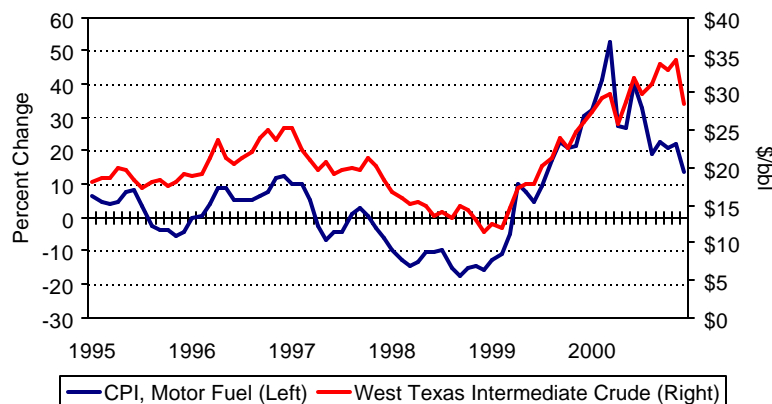
hikes in world oil prices resulting from OPEC production decisions directly translate into higher prices consumers are forced to pay for the petroleum products refined from imported oil, thereby redistributing income from American consumers to foreign oil producers. When the value of oil imports is expressed in terms of the price of consumption goods in the United States, this “tax” amounted to almost \$33 billion in 2000. Looked at another way, this is roughly equivalent to an across-the-board four percent increase in federal income taxes. The impact this has on slowing consumer demand depends on whether households view high oil prices as permanent or temporary. A temporary tax increase has a smaller and less adverse macroeconomic impact than a permanent increase since consumers adjust savings rather than consumption. How consumers actually view the increases in oil prices that have taken place over the past two years remains an open question. However, some indication of an answer may be found in the continuing monthly declines in consumer confidence and expectations about the future of the economy.

High oil prices also have significant inflation impacts. High oil prices increase costs for virtually all businesses. Increased operating and distribution costs resulting from high oil prices reduces profitability and puts pressure on corporate earnings. Eventually, these costs are passed along to consumers resulting in increases in inflation and reduced purchasing power. Weak corporate profits are considered a key element behind the recent declines in stock values and performance of the major stock market indices. The prospect of weak earnings has prompted many firms to announce layoffs as a way of controlling costs. This has contributed to the recent rise in the unemployment rate. The poor performance of the stock market has adversely affected shareholders’ wealth. This wealth effect also contributes to reduced consumer spending. The potential impacts of high oil prices on industry output likely are smaller now than they were two decades ago because increased efficiency and conservation has made oil less important now relative to the overall size of the economy, and technology has increased the potential growth rate of the economy. Nonetheless, high oil prices exert a negative impact on economic growth.

As shown in Figure 3, changes in the Consumer Price Index (CPI) for motor fuels closely track movements in world oil prices. After declining through most of 1997 and 1998, crude oil prices and the CPI posted significant gains. Spot oil prices peaked in November 2000 at their highest level since October 1990. Reflecting the increase in oil

prices, the CPI for Motor Fuels posted a year-over-year increase of 28.5 percent. Sharply higher oil and motor fuel prices helped push the CPI for All Items to an annual gain of 3.4 percent for all of 2000, the fastest rate of increase since 1991.

Figure 3
CPI for Motor Fuel and Spot Oil Prices



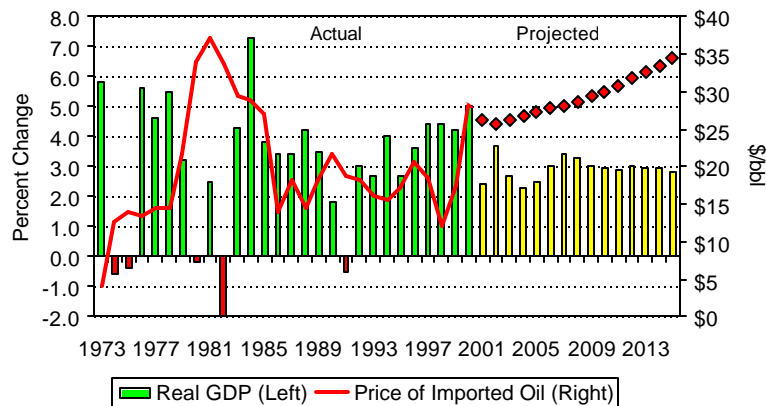
Source: Bureau of Labor Statistics; DOE/EIA Monthly Oil Review

Inflation is a tax that reduces consumers' real incomes. The more consumers have to pay to fill their gas tanks means less disposable income is available for spending on all other goods and services. When combined with the effects of higher fuel costs on business profitability, the sharp increase in oil prices has contributed to the deterioration in consumer confidence about the outlook for the economy. Consumer retrenchment typically results in lower spending and reduced consumption, which quickly translates to slower aggregate economic growth. Recent government statistics indicate that real GDP in the United States grew at an annual rate of 1.4 percent in the fourth quarter of 2000, the slowest growth in almost six years. While by no means the only cause, high oil prices have been a major contributor to this slowdown.

The relationship between growth in real GDP and oil prices is illustrated in Figure 4. The recessions of 1973-74, 1980, 1982, and 1991 were precipitated by sharp increases in oil prices. The 63 percent increase in oil prices during 2000 was the sharpest annual increase in two decades. The increase has been muted in part by structural changes in the economy that have made oil less important relative to the overall economy than was the case in 1980. Consequently many economic forecasters

do not expect the sharp increases in oil prices to precipitate a recession in 2001. High oil prices will, however, contribute to slower growth both in the near term as well as the long term. Assumptions regarding the price of imported oil and the pattern of expected growth in real GDP are displayed in Figure 4.

Figure 4
U.S. Economic Growth and Oil Prices



Sources: History - Bureau of Economic Analysis and DOE/EIA.
Projections - Macroeconomic Advisers, LLC. January 2001 Long-Term Outlook

Increased Use of Ethanol Will Mitigate the Adverse Impact of High Oil Prices

Every additional gallon of ethanol produced and consumed displaces crude oil and reduces the amount of oil America needs to import. This, in turn, reduces the amount of tax levied on American consumers by foreign oil producers, and puts more money back into the pockets of American consumers.

Ethanol is a renewable fuel source that can be produced from a wide range of feedstocks including grains such as corn, wheat, barley, sorghum, agricultural wastes and cellulose. Ethanol is primarily produced by fermentation of sugars found in grains and other biomass. Corn is the primary grain feedstock for U.S. ethanol production, with nearly 55 percent of the corn used in ethanol processed in dry milling plants and the remaining 45 percent in wet mill facilities. Typically ethanol is blended with gasoline in a ratio of 10 percent ethanol to 90 percent gasoline. Ethanol-blended fuels currently account for more than 15 percent of U.S. motor fuel sales.

According to the U.S. Department of Energy, the U.S. ethanol industry produced a record 1.63 billion gallons of ethanol in 2000. This is the equivalent of 68.5 million barrels of crude oil. As shown in Figure 5, ethanol production in the United States has increased significantly over the past three decades while domestic production of crude oil has declined.

Moreover, ethanol production is expected to continue its rapid growth as a result of regulatory and marketplace developments increasing the demand for fuel ethanol. A study prepared for the Governors' Ethanol Coalition in 2000 concluded that the ethanol industry has the resources and ability to double in size by 2004 and triple by 2010 without disruption in supply or increasing consumer costs.

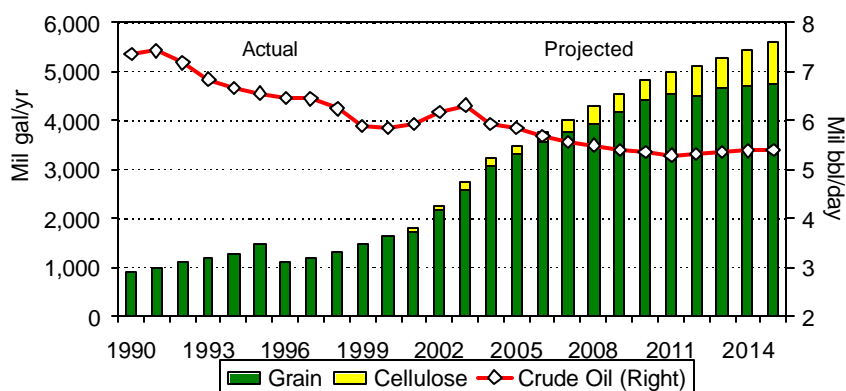
Ethanol is widely marketed across the United States as a high quality octane enhancer and oxygenate capable of reducing air pollution and improving automobile performance. In spark ignition engines, ethanol emits significantly less carbon monoxide and air toxic pollution than gasoline therefore reducing the amount of harmful emissions released into the atmosphere. Gasoline is oxygenated because the oxygen makes gasoline burn cleaner thereby reducing ozone forming compounds and carbon monoxide. The Clean Air Act Amendments of 1990 mandates increased oxygen content for gasoline to meet ozone and CO standards. The most widely used oxygenate has been MTBE (methyl tertiary butyl ether), which is derived from natural gas. However, MTBE is being phased out because it is proving to be a contaminant in much of the nation's water supply.

Whether by legislation, litigation or consumer choice, most analysts agree that MTBE will soon be removed from gasoline. Ethanol is the primary available oxygenate to replace MTBE. The replacement of MTBE would stimulate production of nearly 3.5 billion gallons of ethanol annually by 2005. The nation's ethanol industry has the ability to meet this demand.

The projected growth path of ethanol production is shown in Figure 5. Currently most ethanol made in the United States is produced from grain, with corn the most widely used feedstock. In this regard, the current ethanol industry is creating a market opportunity for a

whole new generation of cellulose conversion technologies. These new technologies will open up greater opportunities for farmers to add value to their output. The U.S. Department of Energy currently projects that 15 percent of all ethanol will be produced from cellulose conversion by 2015. The projected relative share of grain-based and cellulose-based ethanol is shown in Figure 5.

Figure 5
U.S. Crude Oil and Ethanol Production



Source: DOE/EIA; USDA

Displacement of Imported Oil by Ethanol Will be a Significant Stimulus for the American Economy

A nearly four-fold increase in ethanol production over the next fifteen years will provide significant benefits to the American economy.

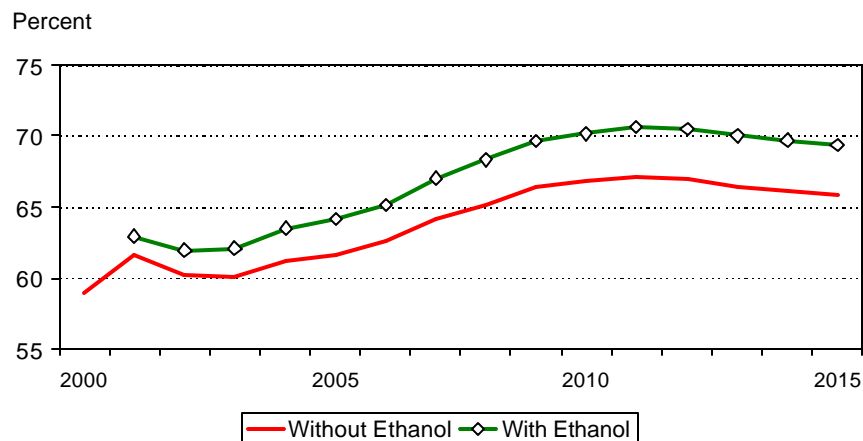
The ethanol industry will invest \$4.9 billion (1996 dollars) on structures, machinery and equipment, and supplies needed to build new ethanol plants and expand existing facilities. Additional investments in infrastructure will be made for pipelines, storage facilities and transportation infrastructure to handle the larger production of ethanol. This spending will stimulate aggregate demand, create new jobs, and generate additional household income. These impacts do not include the positive implications for agricultural output and farm income that will come from expanding a domestic market for grain and other agricultural products.

Perhaps the most significant benefit to the American economy will be the displacement of imported crude oil and reduction in the “tax” imposed on American

consumers by foreign oil producers. Every gallon of ethanol used in the nation's fuel supply reduces the amount of crude oil required to make gasoline and other petroleum products. As long as domestic oil production declines or remains flat, increases in demand for refined petroleum products means that more oil must be imported, thereby increasing America's dependency on foreign oil.

The production and use of 61.4 billion gallons of ethanol over the next decade and a half will displace nearly 2.6 billion barrels of imported oil. As a consequence, U.S. dependence on imported oil will be almost four percent lower than would be the case without ethanol. The impact of ethanol production on America's dependence on imported oil is shown in Figure 6. **(Note: The lines on Figure 6 are labeled backwards.)**

Figure 6
U.S. Crude Oil Import Dependency
(Percent of Refinery Inputs Supplied by Imported Oil)

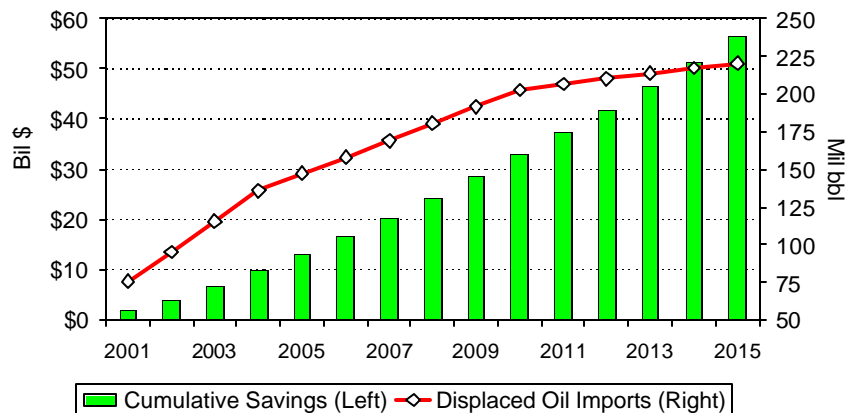


Source: DOE/EIA; USDA

Reduced Oil Imports Will Put Money Back Into Consumers' Pockets and Stimulate Economic Growth

American consumers will benefit directly from a de facto tax cut provided by lower real spending on oil and petroleum products. As indicated earlier, high oil prices act as a tax increase on consumers imposed by foreign oil producers. Higher prices for oil result in higher prices for gasoline and other petroleum-based products. When the oil used to produce these products is purchased from foreign suppliers, a good share of the additional money spent by consumers is exported. Displacing imported oil with domestically produced ethanol will put \$57.5 billion (1996 dollars) into the pockets of American consumers. This is equivalent to a “tax refund” of nearly \$540 for each household in the United States. The savings provided consumers by the increased production and use of domestically produced ethanol is displayed in Figure 7.

Figure 7
Consumer Savings Provided by Ethanol



Source: DOE/EIA; USDA

The economic stimulus provided by the “tax cut” will provide a boost to consumer spending that will result in increased demand for the full range of goods and services. The impact of this stimulus on household income was estimated by applying the direct earnings multiplier calculated by the U.S. Bureau of Economic Analysis (BEA) to the annual savings consumers will realize by displacing imported oil with ethanol. The GDP and job impacts were estimated by applying the BEA final demand multipliers for output and employment to the annual savings. The output, earnings, and employment impacts that will result from spending to increase ethanol production were added to these estimates. These estimates result from a combination of a series of snapshots of the economy rather than a dynamic flow analysis. This analysis also does not include the impacts that would be provided by increased demand for grain and other biomass crops used to produce ethanol. The impact of increased ethanol production will likely provide a significant boost to farm income. This will reduce the need for large-scale taxpayer-financed financial assistance to the farm economy.

A nearly four-fold increase in domestic ethanol production over the next fifteen years will provide the following benefits to the American economy:

- Consumers will realize direct savings of \$57.5 billion (1996 dollars) between 2001 and 2015. This stimulus will add an additional \$12.4 billion per year to household income for a total impact over the fifteen-year period of \$185.5 billion.
- The impact of increased consumer income on spending will further stimulate final demand. As a result, the displacement of 2.6 billion barrels of imported crude oil and spending to increase ethanol production will add \$685 billion to real GDP by 2015.
- New jobs will be created as a consequence of a higher rate of economic activity. The increase to final demand resulting from the additional domestic production and use of ethanol described above will support the creation of as many as 156,000 new jobs in all sectors of the economy by 2015. By way of comparison, this is about six percent of the total number of non-farm jobs created in the U.S. economy during all of 2000.

CONCLUSION

Ethanol is an American made product ideally suited to meet the demands of today's economic and environmental challenges. Increased use of domestically produced ethanol will reduce the amount of oil America needs to import and will reduce the amount of "tax" that American consumers are forced to pay for expensive foreign oil.

Ethanol's environmental benefits are well known and established. Ethanol is a clean source of octane and an environmentally safe and cost effective replacement for MTBE as an oxygenate in the nation's fuel supply, thereby preserving and enhancing the improvements in air quality achieved over the past decade.

Since most ethanol in the United States is made from grain or other agricultural products, increased production will stimulate demand for these crops, provide market support for prices, and enhance farm income thereby reducing the need for emergency government financial assistance to farmers. Today's ethanol industry is creating a market opportunity for a whole new generation of cellulose conversion technologies that will broaden the base of available feedstock.

Finally, producing and using ethanol can displace expensive imported oil thereby reducing America's dependency on imports from an increasingly unstable region of the world. Relying on ethanol for an increasing share of our transportation fuel requirements means that every acre of land that produces biomass used to make ethanol becomes an oil patch that never runs dry. Last year Iowa alone produced 1.7 billion bushels of corn on 12 million acres. If all of this corn were used to produce ethanol, it would make 4.5 billion gallons or the equivalent of 190 million barrels of crude oil. This represents a 21-day supply of crude oil for the United States.

AUS Consultants

155 Gaither Drive

Moorestown, NJ 08057

Telephone: (856) 234-9200

Fax: (856) 273-9710