777 North Capitol St., Ste. 805
Washington, DC 20002

WEB: GrowthEnergy.org
EMAIL: info@growthenergy.org
TWITTER: @GrowthEnergy

PHONE: 202.545.4000
FAX: 202.545.4001

growth energy™
America's Ethanol Supporters

ETHANOL POLICY BRIEF

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Introduction

President Obama has laid out a significant agenda to grow the economy and expand the use of renewable energy, while reducing dependence on foreign oil and addressing the serious challenge of climate change. Expanding on policies laid out on the 2008 campaign trail, the Obama Administration announced the creation of the Biofuels Interagency Working Group in May 2009 and subsequently a roadmap to meet Congress' 2022 goal of 36 billion gallons of biofuel production.

The following briefing paper is designed to give an overview of the role ethanol plays in achieving these goals, including current ethanol policies and the critical issues facing the industry today. First, the paper will discuss information about ethanol and numerous benefits of investment in ethanol. From job creation to eliminating 16.5 million tons of greenhouse gas emissions (GHG) and the need to import over 364 million barrels of oil annually, ethanol's positive impact on the United States (U.S.) is undeniable. Next, key policy issues facing the industry will be examined. Critical regulatory, financial and infrastructure policies must addressed if the full potential of ethanol is to be realized. Lastly, this paper will set the record straight regarding several key myths about ethanol that have received significant media attention, including environmental impacts, impact on food prices and energy benefits.

The Benefits of Investing in Ethanol

Investing in ethanol offers tremendous benefits to help grow the U.S. economy and those of developing nations, reduce dependence on foreign oil and green our environment. The investments made in ethanol today will help bring about a new, more affordable, cleaner and more secure energy future for the nation.

Economic Benefits

Clean, affordable domestically-produced ethanol enhances America's economic prosperity and competitiveness through job growth, lessened dependence on foreign oil and increased GDP and tax revenues. In 2009 alone, the ethanol industry created and supported more than 400,000 new jobs across the country that cannot be exported or outsourced.[1] In addition, ethanol production contributed $53.3 billion to the nation's GDP and generated $8.4 billion in federal tax revenues, resulting in a surplus of $3.4 billion for the Federal Treasury.[2] Ethanol production also plays a critical role in revitalizing America's rural areas — some of the hardest hit by the economic downturn — creating high-paying jobs and stimulating economic growth.

Beyond its contribution today, the ethanol industry has only just begun to realize its full potential to grow the U.S. economy. Increasing ethanol production to meet the Renewable Fuel Standard (RFS) target of 36 billion gallons of renewable fuels by 2022 will provide the following economic impacts:

- The $631 billion of expenditures to build and produce 35 billion gallons of ethanol will add nearly $1,230 billion (2000$) to real GDP by 2022.[3]
- Real household income will increase an average of $24.6 billion (2000$) per year between 2009 and 2022.[4]
- As many as 1.18 million jobs will be supported in all sectors of the economy by the expanding ethanol industry.[5]
- Federal tax revenue will increase $222.6 billion (2000$) between 2009 and 2022 while State and local tax revenues will increase $167.2 billion (2000$). Ethanol will account for nearly 30 percent of motor fuel use by 2022.[6]

Further, America's increasing dependence on imported oil leaves the economy vulnerable

to supply disruptions and price volatility. Energy price spikes have a devastating effect on consumers and the economy as a whole. In addition, the cost of importing oil results in hundreds of billions of American dollars being sent overseas rather than invested at home. Ethanol will displace the equivalent of 10.97 billion barrels of crude between 2009 and 2022 with an aggregate value of $1.441 billion.[7]

Addressing the Challenge of Global Climate Change: Reducing Greenhouse Gases by 16 Million Tons Per Year

Today's ethanol offers a sustainable solution to powering our country while addressing the serious challenge of global climate change. Ethanol results in fewer GHG emissions than gasoline, is fully biodegradable and meets stringent tailpipe emission standards.[8] In 2009, the production and use of 10.6 billion gallons of ethanol in the U.S. reduced CO2-equivalent GHG emissions by approximately 16.5 million tons in 2009, the equivalent of removing more than 2.7 million cars from America's roadways.[9] According to a study published in the Yale Journal of Industry Ecology, ethanol produced from corn can reduce GHG emissions by as much as 59 percent relative to gasoline.[10] Continued innovation in the ethanol industry can further reduce emissions by as much as 67 percent.[11] The commercialization of advanced biofuels such as cellulosic ethanol promises to reduce GHG by 86 percent relative to gasoline.[12] By realizing the Renewable Fuel Standard (RFS) goal of 36 billion gallons of biofuel production by 2022, as made law by the Energy Independence and Security Act of 2007, we will reduce greenhouse gas emissions by 138 million metric tons — the equivalent of taking about 27 million vehicles off the road.[13]

Sustainable ethanol production remains a top priority of the ethanol industry. Agricultural and technical innovations are constantly increasing crop yields, reducing the intensity of pesticide and fertilizer use, improving water productivity, and promoting conservation tillage that reduces erosion and sequesters carbon. Precision agriculture techniques are utilized and farm machinery is integrated so only the amount of input necessary is applied. Since 2001, ethanol plants have decreased energy use by 21.8 percent and reduced their use of water by 26.6 percent, despite a 6.4 percent increase in yield.[14] In addition, while corn ethanol production increased more than 50-fold between 1980 and 2008, the number of farmed acres remained nearly unchanged, due to steadily increasing corn yields per acre.[15]

Reducing Dependence on Imported Oil

In 2008, the U.S. imported nearly 60 percent of the petroleum it consumed.[16] As the U.S. confronts the current energy and climate crisis, ethanol offers a renewable, domestic energy alternative to meet our nation's growing energy needs today and reduces our dependence on oil from volatile and unfriendly regions. The domestic production of nearly 10.6 billion gallons of ethanol in 2009 eliminated the need to import at least 364 million barrels of oil to manufacture gasoline, keeping $21.3 billion in the U.S. economy instead of sending it overseas.[17]

The commercialization of cellulosic ethanol offers even greater potential to further U.S. energy independence. According to a recent Sandia National Laboratory and General Motors report, The 90 Billion Gallon Biofuel Deployment Study, biofuels could replace nearly a third of current U.S. gasoline use by the year 2030.[18]

U.S. dependence on foreign oil also has a staggering impact on the domestic economy. Beyond the cost paid at the pump, there are additional costs that can be attributed to every barrel of oil. According to a study commissioned by the U.S. Department of Energy, price spikes, oil shocks, supply disruptions and loss of wealth have cost the U.S. more than $7 trillion over the last 30 years.[19]

The Center for Forensic Economic Studies has estimated this "import premium" at an additional $24 per barrel of imported oil.[20] The economic loss to the U.S. when dollars are spent overseas, known as the "import multiplier," also places a significant strain on the U.S. economy. The Center for Forensic Economic Studies further estimates that for every dollar spent on foreign crude oil, an additional $1.55 is removed from the U.S. economy.[21] Additionally, the cost of securing our access to Middle East oil — deploying U.S. forces in the

Persian Gulf, patrolling its water and supplying military assistance to Middle East countries – is estimated at $50 billion per year.[22]

By increasing the production of domestic, renewable fuels, we will not only enhance U.S. national security but dramatically reduce the transfer of wealth that occurs today. In 2009, the use of domestic ethanol enabled us to keep $32 billion in the U.S. economy rather than enriching friend and foe alike abroad.[23] Further, achieving the goal of the RFS is estimated to decrease oil imports by $41.5 billion, and to result in additional energy security benefits of $2.6 billion.[24]

Global Development

The development of a sustainable, global ethanol market will help the economies of developing nations, lifting communities and families out of poverty and hunger. By making corn and other grains a commodity that can sustain the world's growing population, we will encourage investment in developing agriculture and help the economies of developing nations and create better lives at home. Utilizing abundant idle farming land in combination with agricultural innovation to increase crop yields, countries around the world can benefit from both food and fuel production in a sustainable manner. For some countries, growing crops for biofuels means they will be diversifying their farms, which makes their farmers less risk averse because the prices of ethanol are tied to the fuel market, rather than the food market. In addition, in some cases farmers are able to grow energy crops on land that is not otherwise suitable for food production.

For some African countries, imports of oil and oil derivatives account for up to 80 percent of their foreign exchange expenditure.[25] As countries develop, they can advance to use crop residuals, like leaves and stalks for cellulosic ethanol. By learning many of the agricultural innovations that the U.S. and Brazil use today for ethanol production, other countries can grow their own crops for ethanol, helping them to become more energy independent and even become energy exporters – growing their economy.

Biofuels Policy

Today's ethanol offers a sustainable solution to powering our country while addressing the serious challenge of global climate change. If the full potential of ethanol is to be realized, it is important that vital regulatory, infrastructure, financial and trade issues are addressed in the near term.

Intermediate Blends: Providing a Market for Cellulosic Biofuels

Today's vehicles are designed to run on gasoline blended with small amounts of ethanol. More than 70 percent of the gas Americans use in vehicles today contains ethanol.[26] Most vehicles use a blend of 10 percent ethanol and 90 percent gasoline. Currently, the U.S. Environmental Protection Agency (EPA) caps the amount of ethanol that can be blended into gasoline at 10 percent, commonly referred to as "E10". The 10 percent cap is an arbitrary number that dates back to 1978 when the EPA granted a waiver for the use of this fuel blend as substantially similar to gasoline.

Unfortunately, ethanol producers have reached full market penetration due to this regulatory cap commonly referred to as the "blend wall," producing more ethanol than can be used under current restrictions. This prevents compliance with the RFS mandated by law in the Energy Independence and Security Act of 2007 and threatens to block research and development into cellulosic and future generations of biofuels.

While higher blends like E85 (85 percent ethanol, 15 percent gasoline) play a role in our renewable fuel supply, limited numbers of flex-fuel vehicles and lack of necessary infrastructure will continue to limit its impact in the near-term. In order for intermediate blends to be used in all cars on the road today, a waiver must be issued by the EPA or granted by Congress.

Adoption of higher, intermediate blends of ethanol in gasoline will enable the industry to "scale" the blend wall and provide numerous benefits to the U.S., including reducing our nation's dependence on foreign oil, creating green jobs, growing the economy, and helping to improve the environment.

Based on 2007 U.S. gasoline consumption, increasing the blend level from E10 to E15 will avoid the importation of another seven billion gallons of gasoline.[27] By moving to E15, we can create more than 136,000 new jobs and inject $24.4 billion into the U.S. economy.[28] Intermediate blends are also better for the environment because ethanol offers substantial reductions in greenhouse gas emissions. Currently, E10 reduces greenhouse gas emissions by 59 percent compared to conventional gasoline.[29]

On March 6 2009, Growth Energy and a group of 54 ethanol producers submitted a waiver to the EPA to increase the limit of ethanol that can be blended in gasoline from ten percent to up to 15 percent. A significant and sound body of scientific evidence has already been established that overwhelmingly supports a fuel blend of 15 percent of ethanol without vehicle modifications. In fact, the Growth Energy Green Jobs Waiver had more third-party science, from independent and state and federal studies, than any of the previous 11 waivers approved by the EPA.

Multiple studies by government agencies and academic institutions, conducted on more than 100 vehicles, 85 engine types and 33 fuel dispensing units all point to the same thing: a 15 percent fuel blend has no adverse impact on an automobile engine's performance, maintenance or emissions. These studies include a year-long drivability test and over 5,500 hours of materials compatibility testing.

A study by the State of Minnesota, in cooperation with academic and industry groups, compared the effects of E0, E10 and E20 on several fuel system components (19 metals, eight elastomers and eight plastics) and conclusively found no significant differences between E10 and E20 use. The study also determined that a 20 percent ethanol blended fuel (E20) proved effective at both powering the vehicles successfully and was also non-distinguishable in performance.[30] In addition, a University of North Dakota study found that all four vehicles tested operated well on blends beyond 10 percent ethanol. Three of the four vehicles tested also obtained greater fuel economy at higher blends of ethanol than when running on unleaded gasoline.[31] Further, intermediate blends can utilize existing fuel infrastructure. The State of Minnesota concluded that the effects of E20 do not present problems for current automotive or fuel dispensing equipment.[32]

Multiple peer-reviewed studies have found that higher blends of ethanol do not increase vehicle emissions. A study prepared by Oak Ridge National Laboratory for DOE, Effects of Intermediate Ethanol Blends on Legacy Vehicles and Small Non-Road Engines, Report 1, concluded that when E15 and E20 are compared to traditional gasoline, there are no significant changes in vehicle tailpipe emissions, vehicle driveability, or small non-road engine emissions as ethanol content increased.[33] An updated release of the study in February 2009 further confirmed these findings. Additionally, a report by the Energy & Environmental Research Center and Minnesota Center for Automotive Research found that exhaust emissions levels for all vehicles at all levels of ethanol blend were within the applicable Clean Air Act standards.[34] In fact, the American Lung Association of the Upper Midwest has designated ethanol as a "Clean Air Choice" due to its prevention of lifecycle CO2 and other pollutants.[35]

Failure to act on removing the blend wall could be disastrous for the rural economy. Already, the insecurity around the blend wall and oversupply of ethanol has resulted in the foreclosure of several ethanol plants in states like Kansas and Idaho. This economic ripple could turn into a tidal wave consuming ethanol producers and farmers across the country along with small businesses near ethanol plants if the blend wall is not dealt with immediately. Today, multiple small and commercial-scale cellulosic biorefineries are in various planning and production stages. In order to hasten the development of commercially viable cellulosic ethanol, a product market is necessary to encourage investment in these technologies. Failure to utilize existing ethanol supplies will cause investments in cellulosic ethanol to dry up and America will lose its

competitive advantage on this new technology.

In response to the Growth Energy Green Jobs Waiver, the EPA has taken a positive step towards higher blends of clean, green, and homegrown ethanol. In December 2009, the EPA released a letter to Growth Energy stating that its engineering assessments indicate that the "robust fuel, engine and emissions control systems on newer vehicles (2001 and newer model years) will likely be able to accommodate higher ethanol blends, such as E15." The letter further indicates that should ongoing test results remain supportive, the agency would be in a position to approve the use of E15 for 2001 and newer vehicles in mid-2010.[36]

Flexible Fuel Vehicles

Today's vehicle fleet is designed to run on small amounts of ethanol blended into gasoline without modification. However, in order to run on both gasoline and higher blends of ethanol such as E85 (85 percent ethanol, 15 percent gasoline), vehicles must be manufactured "fuel flexible." Other than fueling capability and ethanol compatible components, flexible fuel vehicles (FFVs) are similar to their conventional gasoline counterparts. Their power, acceleration, payload, and cruise speed are comparable whether running on ethanol or gasoline.[37]

In addition to flex fuel technology used in vehicles on the road today, advanced engine technology has been developed by engineering firm Ricardo, in partnership with Growth Energy, which takes full advantage of ethanol's properties of high octane and latent heat of vaporization to deliver near-diesel levels of engine efficiency at substantially reduced cost. Ricardo's Ethanol Boost Direct Injection (EBDI) engine technology solves many of the shortcomings of current generation flex-fuel engines, which are typically only optimized for gasoline operation and do not make full use of the properties of ethanol. For example, a flex-fuel product derived from a standard gasoline engine might suffer a fuel economy penalty of about 30 percent when operating on higher ethanol blends such as E85. The Ricardo EBDI engine addresses this problem by being able to adapt its operation to offer fully optimized flex-fuel performance on any blend of fuel from standard pump gasoline to E85 fuel.[38]

In order to fully utilize the significant benefits of ethanol, an increased number of FFVs are needed in the nation's vehicle fleet. Legislation requiring U.S. automakers to produce a target percentage of new automobiles as flex fuel capable will guarantee that the nation's FFV fleet grows. The extra cost of manufacturing a flex-fuel vehicle is a modest $50 to $100 compared to the expected cost of roughly $3,000 to $12,000 for a 40-mile plug-in hybrid vehicle battery, making FFVs affordable for auto manufacturers and consumers alike.[39] Widespread adoption of FFVs will ensure maximum consumer fuel choice and mitigate the risk of energy supply disruptions from abroad.

Blender Pumps

While E10 blends are sold in gas stations across the country, specialized infrastructure is necessary to dispense higher blends such as E20, E30, E50 and E85. Today, there are more than 2,000 retail stations (out of more than 170,000 stations nationwide), offering E-85 across the country.[40] The expanded use of blender pumps will give consumers maximum fuel choice and flexibility. Blender pumps contain separate hoses for flex fuel blends and standard gasoline, and are clearly labled with instructions. By utilizing exisiting tanks and pipes, huge cost savings can be realized by retailers and the per-gallon mark-up passed along to consumers to pay for equipment is reduced. According to the American Coalition for Ethanol, the cost for a four-fueling position blender pump ranges from $60,000 to $100,000 compared to the cost of $60,000 for one E85 pump and $250,000 for four pumps.[41]

Blender's Tax Credit

The ethanol industry is an important source of new jobs and economic growth for the American economy at a time when it is needed most. Government investment in ethanol is important to encourage the growth of "green jobs" and ensure that the promise of advanced biofuel is realized. The Volumetric Ethanol Excise Tax Credit (VEETC), commonly referred to as the "blender's credit," was established in the 2004 Jobs Creation Act as a $0.51/gallon payment to

gasoline blenders for blending ethanol into the gasoline supply, creating an economic incentive to expand the use of ethanol, similar to the to the federal production tax credit for investors in wind and other renewable power plants of renewable electricity from sources like wind and solar energy. The 2008 Farm Bill reduced the credit to $.45/gallon and it is set to expire on December 31, 2010 unless action is taken by Congress. The blender's credit is needed to ensure market access for ethanol and spur the continued investment necessary to develop and deploy next generation biofuels. Ethanol competes with a heavily subsidized product in oil and depends on that competitor to get ethanol to the consumer. A recent study by the U.S. General Accounting Office found that, since 1968, the oil industry has received approximately $150 billion in tax incentives. By comparison, the ethanol industry has received a mere $11.2 billion, despite the fact that ethanol is an emerging technology.[42]

Further, government investment in ethanol results in significant contributions to the U.S. economy including federal and state tax revenue, increased GDP and reduced farm program and unemployment payments which more than offset initial government investment. In 2009, ethanol production generated $8.4 billion in federal tax revenues, resulting in a surplus of $3.4 billion for the Federal Treasury.[43] An Iowa State research team investigated farm subsidies, farm income, and ethanol mandates, incentives and tariffs. The researchers concluded that ethanol policies saved the U.S. government $2.65 billion in 2007 because farmer support payments, that would have been due under other legislation, would have been higher than the ethanol supports received by farmers.[44]

Tariff on Ethanol Imports

To prevent U.S. tax dollars from subsidizing foreign-produced ethanol there is a secondary duty in place on imported ethanol of 14.27 cents per liter or 54 cents per gallon. Because all ethanol, regardless of the country of origination, receives the benefit of the Volumetric Ethanol Excise Tax Credit (VEETC), the secondary duty was created to offset the value of this tax credit taken by the petroleum industry when ethanol is blended with gasoline. The ethanol tariff is important to encourage continued investment in the U.S. ethanol industry. Further, it would be irresponsible to offset our dependence on foreign oil by replacing it with dependence on yet another foreign source.

Next Generation Biofuels

Next generation biofuels, such as cellulosic ethanol, are liquid transportation fuels made from a wide variety of feedstocks including switchgrass, corn stover, citrus pulp, wood chips and even municipal waste. The geographic diversity of these feedstocks will enable cellulosic biofuels production throughout the U.S. While the commercialization of next generation biofuels offers tremendous promise in the near term, grain-based ethanol production is a vital foundation upon which scientists and producers have begun to build. As science moves from making ethanol from corn to producing it from corn cobs and other plant materials, ethanol will continue to be a sustainable and effective energy solution for the world.

Today, significant progress has been made in achieving wide-scale commercialization of cellulosic ethanol. Multiple pilot plants are in operation around the country with commercial-scale projects under construction.

Further, intensive research and development is rapidly advancing the state of cellulosic ethanol technology. A key challenge to commercialization that remains is the complex and costly conversion process necessary to convert cellulosic feedstocks to fuel. Further, cellulosic biorefineries are expected to be far more capital-intensive than grain-based plants. As with all emerging technologies, costs will come down as technology is scaled and efficiencies are improved over time. According to the latest estimates, cellulosic ethanol is expected to be cost-competitive with gasoline by late 2011.[45]

According to DOE, cellulosic ethanol has the potential to reduce greenhouse gas emissions by more than 86 percent relative to gasoline.[46] In addition, dedicated energy crops used in the production of advanced biofuels can be grown on marginal land not suited for traditional crops. The U.S. Departments of Energy and Agriculture's

Billion Ton Study found that 1.3 billion tons of U.S. biomass feedstock are potentially available for the production of biofuels – more than enough biomass to meet the new renewable fuel standard mandated by the Energy Independence and Security Act of 2007.[47] Further, a recent report by Sandia National Laboratory and General Motors found that biofuels could replace nearly a third of current U.S. gasoline use by the year 2030.[48]

Today, ethanol producers are investing heavily in next generation biorefineries. The federal government, in partnership with leading companies and academic institutions, has invested significantly in the research, development and deployment of next generation biofuels technologies. As with other alternative energy technologies, continued government investment is essential to commercializing cost-competitive advanced biofuels. Ultimately, the success of today's ethanol industry is essential to spurring continued investment and ensuring a cleaner, more secure, affordable energy future for the U.S.

The Biotechnology Industry Association study, U.S. Economic Impact of Advanced Biofuels Production, found that the advanced biofuels industry could create 29,000 direct new jobs and $5.5 billion in economic growth over the next three years, with the potential for job creation to reach 807,000 and economic growth to reach $148.7 billion by 2022.[49]

Setting the Record Straight

Despite ethanol's tremendous success in growing the U.S. economy, reducing dependence on foreign oil and greening the environment, misinformation exists about ethanol's impact on the environment, food prices and energy benefits. As a result of deceptive public relations campaigns and two controversial studies, these myths have garnered significant attention from the media, policy makers and the public at large. However, a wide body of scientific evidence affirms that ethanol is making positive contributions to ensuring a sustainable and secure energy future for the nation.

Food vs. Fuel

In early 2008, commodity prices reached record highs and ethanol was targeted as the primary cause for soaring food prices globally. As a result of a highly successful public relations campaign by the Grocery Manufacturers Association to blame ethanol for higher food prices, the true forces behind the rise were ignored.[50]

Today, despite the fact that corn prices have dropped by 50 percent since their peak in June 2008 and oil prices have tumbled, food prices remain high, proving what government and academic experts have known all along – ethanol was not to blame for the dramatic rise in food prices.

In realty, biofuels production accounted for only a minimal percentage of the overall increase in global food prices. While global food prices increased 45 percent from April 2007 to April 2008, increased production of corn-based biofuels accounted for an estimated 3 percent of the overall increase, according to the U.S. Department of Agriculture.[51] Study after study has shown that ethanol had minimal impact on food prices. According to University of Nebraska-Lincoln Economist Richard Perrin, today's ethanol production is responsible for about one percent of the increases in U.S. food prices.[52] A study from the Agricultural and Food Policy Center at Texas A&M found, "The underlying force driving changes in the agricultural industry, along with the economy as a whole, is overall higher energy costs, evidenced by $100 per barrel oil."[53]

So what really caused the dramatic rise in commodity and global food prices in 2008? The increases were principally caused by other factors, the greatest of which were the high cost of oil and market speculation. Other factors that contributed to rising global food prices include:

- Increased demand for meat as the populations of emerging economies shift their diets to include more animal proteins
- Higher oil and gas prices leading to increased fertilizer, harvesting and transportation costs
- Two years of bad weather and drought leading to poor harvests in some parts of the world
- Reduced global food supply and increased demand for U.S. agricultural exports
- Hedge funds and index funds purchase of grain and oilseed futures, particularly speculative activity
- Reduction in global agricultural research and development slowing pace of crop yield growth

Moreover, these factors generally relate to commodity prices, which represent only 20 cents of every dollar spent in the U.S. on food. The remaining 80 cents is driven by labor, packaging, advertising and other costs, which have little to do with corn-based ethanol.[54] Further, given that foods using corn as an ingredient make up less than a third of retail food spending, overall retail food prices would rise less than 1 percentage point per year above the normal rate of food price inflation when corn prices increase by 50 percent.[55]

No less a source than Don Mulligan, General Mills' chief financial officer, recently admitted to the low input cost of grain, while at the same time General Mills posted a 50 percent hike in 2009 third quarter profits. "We have a very wide portfolio of input costs," Mulligan explained. "Grains, for example, which I think people would associate as being a large percentage, is 5 to 10 percent of our input (costs)..."[56]Consistent increases in crop yields and record harvests prove that America's farmers will continue to produce enough corn to meet demand for ethanol and domestic demand for corn as food and feed, as well as corn for export — and have ample stock of corn leftover for storage. According to the USDA, 2009 end-of-year corn stocks totaled over 1.6 billion bushels, despite record ethanol production and steady export levels.[57] In January 2010, the USDA crop report estimated that American farmers are expected to produce a record 13.2 billion bushels of corn, the largest U.S. corn crop in history, without adding a single additional acre of land into agriculture production.[58] The USDA report further indicates that U.S. grain yield is estimated to reach a record level for 2009, at 165.2 bushels per acre, up 2.3 bushels from the November forecast and 4.9 bushels above the previous record of 160.3 bushels per acre set in 2004.[59]

Land Use

Sustainable ethanol production remains a top priority of the ethanol industry. Agricultural and technical innovations are constantly increasing crop yields, reducing the intensity of pesticide and fertilizer use, improving water productivity, and promoting conservation tillage that reduces erosion and sequesters carbon. Between 1970 and 2009, corn yield increased by nearly 95 percent, as the result of an increase in corn productivity through better seed variety, better farming practices, and other agricultural measures.[60] Further, while corn ethanol production increased more than 50-fold between 1980 and 2008, the number of farmed acres remained nearly unchanged, due to steadily increasing corn yields per acre.[61]

Despite these record crop yields and ethanol's continued gains in emissions reductions, some are proposing that ethanol's life-cycle greenhouse gas emissions be expanded to include emissions that are not directly caused by ethanol production. This is based on the controversial theory of indirect land use change (ILUC), which claims that the use of crops for ethanol production causes deforestation in other parts of the world, releasing stored carbon. GHG emissions are universally measured through a process called life-cycle analysis (LCA) whereby emissions can be tested and verified. In the case of ethanol, LCA takes into account the land used to grow the feedstocks for fuel. However, ILUC theory would assign the emissions from land use changes in other parts of the world to the indirect cause (biofuels) rather than the direct cause (deforestation, etc.).

The theory of ILUC gained notoriety as a result of a paper by Tim Searchinger published in Science in February 2008. Searchinger, a

lawyer with no scientific training or credentials, claimed that ethanol production created more greenhouse gas emissions than gasoline due to "indirect land use changes." Even though Searchinger lacked scientific credibility and academics across the board criticized his methodology and findings as "highly speculative" and "seriously flawed," the media widely covered Searchinger's findings prompting government and non-governmental organizations to take a closer look at these theories.[62] Among the largest criticisms of Searchinger's study include a failure to adhere to internationally accepted methodology for LCA, a lack of accounting for the value of distillers dried grains and outdated information that resulted in poor assumptions.

ILUC is a flawed theory, dismissed by many in the academic life cycle analysis community because of its many ethical and intellectual weaknesses. Current theories of ILUC are based on worst-case scenarios that assume changes in land use always result in a large carbon debt. However, depending on what land is converted and how the land is managed during and after the change, it is possible for land use change to result in the emission of no additional carbon. Further, ILUC models do not take into account soil types, fertilizer practices, tillage, agricultural practices in different countries and other varying conditions.

Among the largest flaws of ILUC is that it assumes that biofuels production results in new land production in different parts of the world – a fact that is unknown at this point. According to LCA expert Dr. Michael Wang of DOE's Argonne National Laboratory, "There has also been no indication that U.S. corn ethanol production has so far caused indirect land use changes in other countries."[63] ILUC also fails to account for technological advancement in increasing corn crop yields and additional resources such as switch grass and corn stover used for next-generation cellulosic ethanol – feedstocks grown on existing agricultural lands or on marginal soils not suited for traditional agriculture – further reducing the need for new cropland. Leading voices in the environmental community have noted that using indirect land use measures is flawed for this very reason: "The marginal impact of land use changes here in the United States on land use in the rest of the world is extremely hard to predict with economic equilibriums and agricultural and trade policies all interacting in complex ways," according to Nathanael Greene of the Natural Resources Defense Council.[64]

By adopting ILUC, ethanol producers, as well as many other industries, would be held accountable for the actions of people and businesses on the other side of the world over which they have no control. Such policies jeopardize U.S. competitiveness in the global marketplace and punish businesses that have made sustainability a top priority.

Despite the lack of certainty surrounding ILUC, policy makers have proposed its inclusion in models developed to calculate the GHG emissions of ethanol.

On the federal level, the Energy Independence and Security Act of 2007 requires the EPA to coordinate with the U.S. Department of Energy, the U.S. Department of Agriculture, and stakeholders to design and implement a revised renewable fuel standard (RFS) aimed at reaching production of 36 billion gallons of biofuels by 2022. As part of this new RFS, the EPA is required to complete a lifecycle analysis of GHG emissions to establish those fuels that qualify for the different renewable fuel standards.

On February 3, 2010 the EPA released its final regulation on an expanded RFS which recognizes the value of domestic ethanol as a low-carbon fuel, reducing GHG emissions by at least 20 percent or higher than the gasoline it replaces. While Growth Energy believes that a more thorough examination of ILUC is needed before it can be included in GHG calculations, we are pleased that the EPA took significant steps to correct the original draft regulation that would have America remain dependent on dirty, imported oil.

On the state level, several states are looking to adopt a low carbon fuel standard (LCFS), aimed at reducing greenhouse gas emissions by limiting the carbon intensity of fuels. California is furthest along in adopting a LCFS. A number of Northeastern states are also looking at the idea, as is the Midwest.

In January 2007, Governor Arnold Schwarzenegger signed an Executive Order establishing the first statewide LCFS. The goal of the LCFS

is to lower the carbon intensity of California's transportation fuels by 10 percent by 2020. Governor Schwarzenegger charged the California Air Resources Board (ARB) with developing the regulations that would govern the LCFS. One of the most controversial aspects of the ARB's rulemaking has centered on the inclusion of ILUC models in calculating the carbon intensity of biofuels.

Growth Energy supports a Low Carbon Fuel Standard — as long as it is done right. And the Low Carbon Fuel Standard proposed by the state of California is not done right. It relies on a flawed, unproven and unscientific concept that would punish biofuels, despite the opportunity biofuels like ethanol provide as cleaner, greener fuels that are an alternative to dirty foreign oil. In fact, 27 leading scientists in this field wrote to the California Air Resources Board in June 2008 urging them to delay implementation of the ILUC penalty against biofuels in the Low Carbon Fuel Standard, citing the lack of science supporting its model.[65]

However, despite scientific evidence to the contrary, in April, CARB initially approved the LCFS regulation. CARB included provisions in the regulation that, if approved, would eliminate corn ethanol from the California market — even though corn ethanol is the only practical alternative to gasoline refined from petroleum oil for most consumers, and the only one that uses domestic resources.

In January 2010, Growth Energy and the Renewable Fuel Association jointly filed a legal challenge in U.S. District Court to California's flawed Low Carbon Fuel Standard. The federal litigation charges that the California Air Resources Board ignores the intent of Congress by barring domestic ethanol from the California fuel market.

Biofuels and Energy Use

Today, each gallon of ethanol produced delivers one third or more energy than is used to produce it and this positive energy balance is constantly increasing with new technologies.[66] According to USDA, ethanol produced from corn provides 67 percent more energy than is used during production compared to a net energy loss of 20 percent in the production of gasoline.[67] Over the last 20 years, the amount of energy needed to produce ethanol from corn has significantly decreased because of improved farming techniques, more efficient use of fertilizers and pesticides, higher-yielding crops, and more energy-efficient conversion technology.[68] Since 2001, ethanol plants have decreased energy use by 21.8 percent and reduced their use of water by 26.6 percent, despite a 6.4 percent increase in yield.[69]

In 2005, a study conducted by David Pimentel, an insect ecologist at Cornell, and Tad Patzek, a former oil company employee who is now director of the University of California Oil Consortium, received significant media attention for its claims of a negative energy balance for ethanol. However, the study has been thoroughly discredited by the scientific community and a growing body of government and academic research, including studies by the Departments of Agriculture and Energy, the Colorado School of Mines, Michigan State University and Agri-Food Canada. At the time of its release, Dr. Robert McCormick of DOE's National Renewable Energy Laboratory stated, "At least eight other peer-reviewed studies that have been conducted over the past 12 years find exactly the opposite, that biodiesel has a highly positive energy balance."[70] The most common criticism leveled is that the study relied on old data which resulted in an overestimation of energy use by not taking into account efficiency gains in agriculture, fertilizer production, ethanol production and in the transportation sector. In fact, more than 40 percent of the references listed in the 2005 report were from the 1980s and 1990s. In addition, scientists have criticized the study for failing to account for the value of co-products such as dried distillers grains and failing to meet internationally accepted standards for conducting life cycle studies.

The Gulf Dead Zone

The Dead Zone, also known as a hypoxia zone, is an annual phenomenon that lasts several months and usually peaks around late July. Discovered in the 1970s, it may have existed for a century. The "Dead Zone" is caused by nitrogen and phosphorus delivery to the Gulf of Mexico, but it is unfair to place the majority of the blame on ethanol. Nitrogen and phosphorus come from many sources other than crop fertilizer such

as animal manure, crop cultivation, municipal and domestic waste from sewage treatment plants and storm water runoff, and atmospheric deposition from power plants and vehicles.[71] According to a recent report by the U.S. Geological Survey, animal manure on pasture and range lands contributes nearly as much phosphorus as cultivated crops, 37 vs. 43 percent.[72]

Today, it is possible for farmers to grow corn in such a way that does not contribute to the "Dead Zone." According to Professor Don Scavia of the University of Michigan, the use of buffer strips between crops and the streams and precision farming could eliminate fertilizer contamination from corn farming. It is also possible to remove nitrogen and phosphorous from the water before it gets into the Gulf.[73] In addition, the latest advances in agriculture technology enable farmers to apply fertilizers with pinpoint accuracy which means fewer nutrients are lost to runoff and the impact to soil, water and air is minimized. Fertilizers per bushel of corn continue to decline. According to a 2007 study by Argonne National Laboratory, between 1970 and 2005, corn yield increased by 90 percent, while nitrogen fertilizer application increased by only 22 percent, phosphorus fertilizer application was reduced by 25 percent, and potash fertilizer application was reduced by six percent.[74]

Beyond the Gulf of Mexico, a recent report by the Chesapeake Bay Commission and the Pennsylvania Department of Agriculture found that ethanol and other biofuels produced from plants in the Chesapeake Bay watershed can prevent millions of pounds of runoff. The study, Chesapeake Biofuel Policies — Balancing Energy, Economy and Environment, found that production of biomass can reduce erosion, absorb excess fertilizer from idle farm fields and capture carbon dioxide as they grow.[75]

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