Supporting Biofuels:
A Case Study on the Law of Unintended Consequences?[1]

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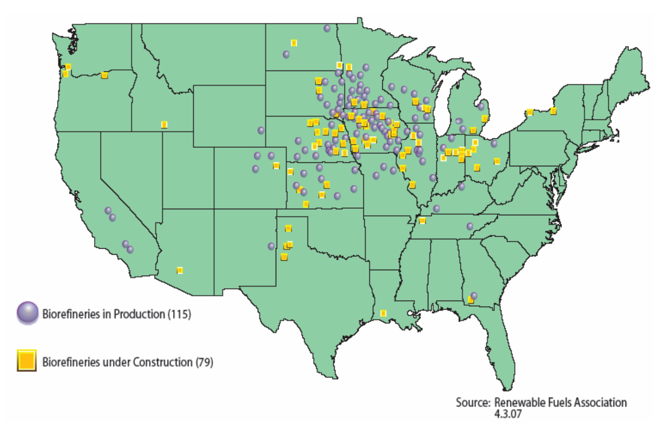
Abstract

Biofuels have been gaining new prevalence in recent years. There are primarily three reasons for this new popularity: 1- search for substitutes to oil that is becoming more expensive and geopolitically riskier; 2- desire to lower emissions; and 3- supporting the agricultural sector, especially in the developing countries. These are the same reasons that led to previous rush to biofuels in the 1970s. Except for Brazil, biofuels failed to reach significant market share: 3-4% in the US, 4-7% in China, India and EU. Nevertheless, many countries are putting policies and mandates into place to raise the share of biofuels. However, these fuels cannot compete with today's expensive gasoline without the subsidies. Ethanol from corn yields about seven times less energy content than ethanol from sugar cane per unit of energy used in its production. Cellullosic ethanol can be twice more efficient than sugar cane based ethanol but technology remains experimental and expensive. An increasing number of studies indicate negative externalities: biofuel production may be emitting more pollutants than gasoline production when the whole life cycle from crop production is taken into account; increasing crop production may not be sustainable due to increased need for water and pesticide use; smog-related health problems can worsen in urban areas if E85 used extensively. During the recent excitement, price of corn increased from $2.25 per bushel in summer 2006 to $4.25 in February 2007. Corn prices have risen in the past but many industry followers now believe that ethanol pressure will keep them high for an extended period this time around. Substituting corn for other commodities such as soy is also causing an increase in the price of these commodities. In developing countries, food versus fuel trade-off is even more critical. It appears that none of the three reasons are well founded. This study compiles most recent evidence on infrastructure, technology, cost, environmental impact, substitution effect, and trade considerations for biofuels, with a particular focus on corn-ethanol, to shed some light on the complex cost-benefit accounting of supporting biofuels.

1. Introduction

The Energy Policy Act (EPAct) of 2005 calls for biofuels production to reach 7.5 billion gallons a year by 2012. At the current rate of construction of biorefineries, this target will likely be reached sooner. Including President Bush, some have been proposed much more aggressive targets, such as increasing the share of biofuels within the fuel portfolio to 20 percent by 2020. Currently, there are 124



[1] This working draft incorporates research by the authors that has been disseminated before in Turkey, India and the U.S. in various media. The research was partially funded by API. Opinions expressed in this paper are those of the authors.
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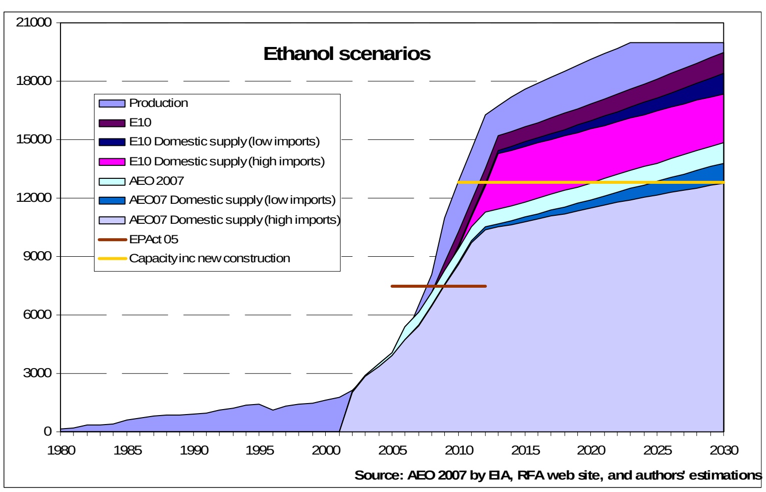
biorefineries in the US; 76 more are under construction and 7 are being expanded.[3] These refineries convert corn (as well as some other crops) into ethanol. The ethanol industry, including corn farmers, has received federal support since the 1970s (e.g., farm subsidies, tax and non-tax incentives, and import tariff). Today, ethanol accounts for about 3-4 percent of total gasoline consumption in the U.S., reflecting an increase from about one percent in 2000. This recent increase is primarily due to recent policies of replacing MTBE (methyl tertiary butyl ether) with ethanol in more than 20 states. Such blended gasoline contains 6-10 percent ethanol in volume. Most ethanol is used for such blending. A small amount of ethanol (about 0.3 percent of total) is used as E85 (fuel with 85 percent ethanol content) in flex-fuel vehicles that are capable to handle E85. According to the Annual Energy Outlook 2007 by the Energy Information Administration (EIA), the share of E85 will remain below two percent in 2030. There are several reasons for the market for E85 to remain limited, which will be addressed later.

In Europe and elsewhere in the world, there are ambitious policies to increase the share of biofuels in the transportation sector. The European Union mandate is 10 percent by 2020 although the target is 20 percent. India is pursuing a biofuels industry based on jatropha and other crops; Nigeria and other countries in Africa are looking into cassava as feedstock for ethanol. Especially in developing countries, it did not take long for food concerns to be raised in reaction to biofuels debate. We will address the food versus fuel trade-off later in this paper.

2. Evolution of demand and supply conditions for ethanol

With increasing production, ethanol will become a commodity subject to boom-bust cycles like other commodities. As such, ethanol will be subjected to risk of overbuilding. Although oil and gas upstream industry is best known for the boom-bust cycles, excess supply analogies also include: LNG regasification plants that were built in the 1970s but remained idle for almost three decades; gas-fired combined cycle plants that were built in the 1990s but used much less than their desired capacity factor; and small refineries that were built in the 1970s under misconceived federal support programs. The prime non-energy examples of over-expansion can be found in the real estate industry (e.g., empty office space in downtown areas that lead to the collapse of rents from time to time).

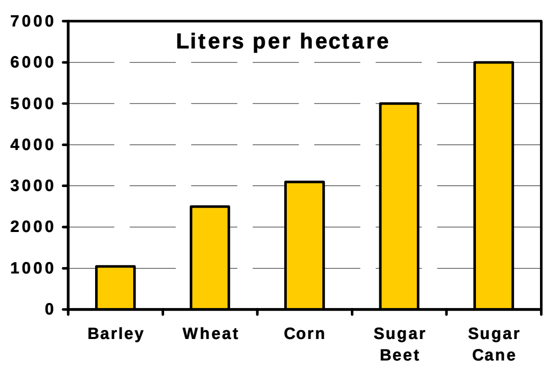


Existing 124 biorefineries have 6.5 billion gallons a year (bgy). When the new expansion is finalized by 2009-2010, the capacity will be more than doubled to 12.9 bgy. It is, however, doubtful that the market will expand that

[3] As of August 1 according to the Renewable Fuels Association (http://www.ethanolrfa.org/industry/locations/). The map is also from the RFA web site but it reflects the count as of April 3.

quickly (see chart above).[4] Beyond 2010, we assume that production will continue to rise for few more years at a fast pace under the current policies to support the ethanol industry and the excitement this environment causes among the investors. Afterwards, we assume slower expansion until the industry reaches 20 bgy capacity; there is a natural limit to corn-based ethanol industry's potential due to cropland constraints. The chart also reflects the forecast deduced from the Annual Energy Outlook 2007 by the EIA. According to AEO 2007, the share of ethanol will reach 7.5 percent of the gasoline pool by 2012 and increase to only 7.6 percent by 2030, reflecting mainly oxygenate needs of the fuels industry. Currently, a minimum of two percent by weight oxygen is required. MTBE has half as much oxygen content by weight as ethanol, so twice as much volume of MTBE is needed to meet this requirement. Generally, this translates to about 11.2 percent by volume of MTBE and 5.8 percent by volume ethanol.[5] E85 demand in 2030 is estimated as 257 million gallons by the EIA. Nevertheless, we also consider a scenario for rapid transition to E10 for the whole gasoline pool (by 2013, all gasoline will contain 10 percent ethanol).

Despite the import tariff, in recent years, ethanol imports increased from 45 mgy in 2002 to 653 mgy in 2006. The Central American Free Trade Agreement (CAFTA) allows for ethanol imports from Central American and Caribbean countries that are part of CAFTA. These countries accounted for all imports in 2002 and 220 mgy in 2006; Brazil accounted for the rest. There was at least one bill in Congress in 2006 to remove the import tariff. President Bush visited both Brazil and Central American countries to establish ethanol partnerships in March 2007.



Countries like Brazil, which has been producing ethanol from sugar cane since the 1970s, have natural advantages that help them produce ethanol at lowest cost in the world. It takes seven times less energy to produce an equal amount of ethanol from sugar cane than from corn. It also takes half as much sugar cane cropland as corn cropland to produce same amount of ethanol (see chart above).[6] Natural conditions such as soil quality and rainfall render sugar cane production in Brazil lowest cost in the world, further reducing the cost of ethanol production. Consumers in the U.S. would benefit from these cheaper imports if tariffs are reduced, or better yet, removed.

It seems reasonable and desirable to expect an increasing role for imports in the ethanol market. Accordingly we pursue a couple of import scenarios. Relative to the rate of increase experienced in last 4-5 years, both scenarios are conservative:

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[4] These data are taken from http://www.ethanolrfa.org/industry/locations/ and http://www.ethanolrfa.org/industry/statistics/.

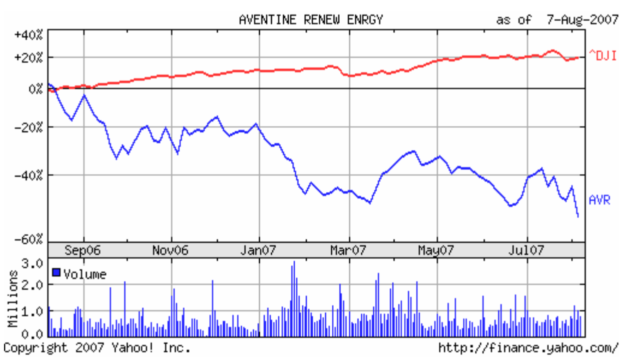
[5] These percentages will vary slightly depending on the specific gravity of the base gasoline blend. For details, see the Issues section of the Annual Energy Outlook 2007 by the EIA.

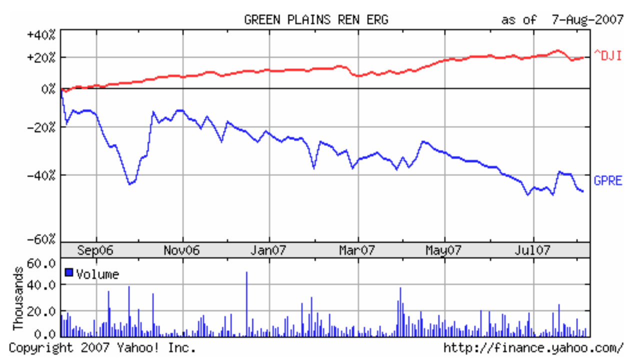
[6] Reproduced from WorldWatch, 2006. *Biofuels for Transportation: Global Potential and Implications for Sustainable Agriculture and Energy in the 21st Century.*

the low growth scenario assumes an annual growth rate of two percent and the high growth rate scenario assumes five percent. Based on the data represented in the chart, we offer some observations:

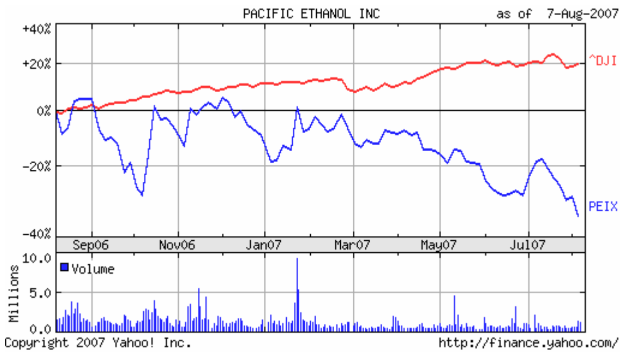
- Capacity of 12.5 billion gallons per year is significantly larger than the EPAct 2005 target of 7.5 billion gallons;
- If all currently existing and under construction capacity becomes available by 2010,
  - there will be excess supply of 3.1 billion gallons according to AEO 2007 forecast (AEO projects a demand of 12.5 billion gallons only in 2018-19);
  - with imports, capacity overhang will last until 2023 (low imports) or 2028 (high imports);
  - even with the E10 scenario, there will be at least two years of excess capacity;
- If more projects are added to the current list, ethanol prices are likely to collapse and many investors will suffer even with the E10 scenario without imports.

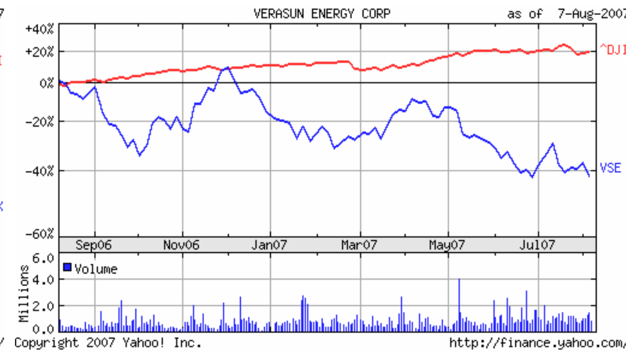
The financial markets seem to share these concerns about a coming glut in ethanol production capacity.[7] These concerns can also be seen in the stock price performance for publicly traded companies. Except for big corporations such as ADM, Cargill and Monsanto, which have a wide portfolio of products, stock prices of ethanol companies such as VeraSun Energy Corp, Green Plains Renewable Energy, Pacific Ethanol and Aventine Renewable Energy Holdings have performed significantly below market and lost up to 50 percent of their value relative to early to mid 2006 (see charts below). Other ethanol companies have performed similarly or worse over the last year (e.g., Xethanol Corporation, Andersons Inc.).





[7] For example, see http://www.boston.com/business/markets/articles/2006/08/03/is_ethanol_stalling_out/ and http://money.cnn.com/2006/01/30/markets/biofuel/index.htm.





2.1 Adequacy of distribution and marketing infrastructure

The expansion of ethanol market is structurally restricted by the demand for additives in the gasoline pool. Further growth of the market would require wider distribution and direct use of ethanol as a fuel (such as E85). But that market appears very limited, contributing to concerns about excess supply of ethanol.

Only about five million flex-fuel vehicles are currently on the road. Consumer interest on these vehicles and on ethanol in general remains limited, partly because consumers lack information about flexfuel cars, ethanol fuel qualities and distribution locations. E85 is sold in limited number of gas stations (about 0.7 percent of total). Different fueling islands are usually required. Tests may also show that different storage tanks and pumps may be necessary because ethanol is more corrosive. In October 2006, Underwriters Laboratories Inc. suspended authorization to use UL Markings (Listing or Recognition) on components for fuel dispensing devices that specifically reference compatibility with alcohol blended fuels that contain greater than 15 percent alcohol (i.e. ethanol, methanol or other alcohols).[8] UL is currently testing equipment and certification requirement for such fuels.

Ethanol is primarily transported on rail cars, tanker trucks, and barges to fuel terminals for blending with gasoline, and to gas stations via tanker trucks. Ethanol tends to separate and is corrosive; pipeline transportation is avoided.[9] The number of ethanol carloads in railways tripled between 2001 and 2006, and another 30 percent increase is expected in 2007.[10] These increases will likely put pressure on the carrying capacity of this infrastructure. It will be take time to invest in new capacity; in the meantime, cost of transportation and distribution will rise.

Similarly, increased supply of byproducts such as distiller's grain and CO_2 cannot be as easily distributed to markets as in the past. Local markets for these byproducts can become saturated, which will then put pressure on longer distance transportation infrastructure for these products. Eventually, these bottlenecks can be relieved with new construction or substitution but the transition will have its costs.

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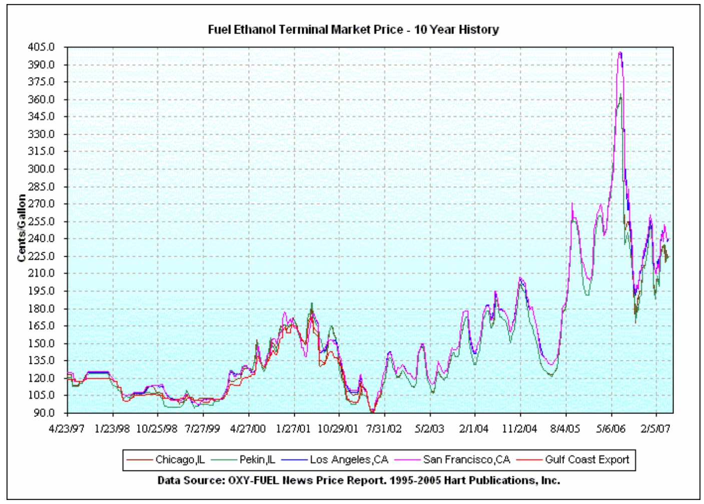
[8] http://www.ul.com/gasandoil/ethanol.html
[9] "Pipeline Considerations for Ethanol," a report from the Agricultural Marketing Resource Center at Kansas State University, concludes that ethanol will not be transported routinely over long distances via pipelines (www.agmrc.org/NR/rdonlyres/4EE0E81C-C607-4C3F-BBCF-B75B7395C881/0/ksupipelineethl.pdf).
[10] See *The Wall Street Journal* article, Can Ethanol Get a Ticket to Ride?, Feb. 1, 2007.

2.2 Price competitiveness

Because E85 has lower heat content than gasoline, it needs to have a lower price per gallon to provide the right economic incentive (same amount of service – miles traveled per energy unit) to consumers. According to Iowa Renewable Fuels Association, ethanol should be sold at about 20-30 cents per gallon cheaper than gasoline. Oil prices have also been volatile going under $60 numerous times over the last couple of years; gasoline price (NY Harbor) was down to $1.5 per gallon in October 2006 but it was up to $2 in April 2007. E85 would eventually have to compete with other alternatives as well. With efforts to increase fuel efficiency (e.g., new Bluetec engines of Daimler), increasing popularity of hybrids and possibly introduction of plug-in hybrids, developments in other alternative fuels (e.g., NGVs), the market potential for E85 is as uncertain as the overall fuels market. The chart depicts the increased volatility and level of the price of ethanol. Since ethanol is mostly used as an additive, the cost increase raises the price of gasoline, albeit marginally. But, in the long-run, the higher price of ethanol will undermine the competitiveness of E85 especially if price of oil remains stable or declines and/or if tax incentives and other support for ethanol is reduced.



3. Possible changes in current energy policies

Some of the incentives are scheduled to expire soon and others are under re-evaluation. For example, some tax incentives will expire by the end of 2008 (see Appendix 1 for tax incentives and Appendix 2 for non-tax incentives received by the biofuels industry) and the current tariff on imports may be reduced or eliminated (e.g., see May 2006 bill by Senators Feinstein, Kyl and Sununu[11]).

Despite the import tariff, in recent years, ethanol imports increased from 45 million gallons per year (mgy) in 2002 to 653 mgy in 2006 as discussed above. Under a larger biofuels mandate, the role of imports may increase even if tariff remains in place unchanged. Removal or reduction of the tariff could, however, lead to larger imports that would lower the cost of biofuels for U.S. customers.

The future of many of these policies is uncertain; there are different studies and opinions about pros and cons of biofuels and policies in support of biofuels. Biofuels are part of a wider range of alternative fuel and technology options for the transportation sector. Accordingly, there are various bills or proposals making the rounds in Washington, supporting one strategy or another. But, an increasing number of studies and news coverage point out negative externalities and impacts

[11] The bill, though not passed, is still discussed at Senator Feinstein's web site: http://feinstein.senate.gov/06releases/r-ethanol0508.htm.

associated with corn-based ethanol. This information may undermine the support for the industry. We address some of these externalities and impacts next.

4. Unintended consequences

As we have already touched on, the expansion of biofuels capacity around the world will have impacts on other sectors of the economy as well as the environment. We focus on several of these unintended consequences that have already received considerable academic and public attention:

1. impact on livestock and poultry industries,
2. impact on consumer food prices (food versus fuel debate), and
3. environmental impacts.

4.1 Impact on livestock and poultry industries

Between the summer of 2006 and February 2007, the price of corn increased from \$2.25 per bushel to \$4.25. Futures prices for corn are around \$3.80; expectations are between \$3 and \$5 for the next year.[12] To the extent, corn replaces soy production in cropland, the supply of soy will decline and its price will increase. Both corn and soy are important inputs for feed in livestock and poultry industries; the increasing cost of feed is raising the cost of doing business in these industries. Agricultural economist Professor Wally Tyner at Purdue University estimates that the cost of poultry has risen about 15 percent due to higher corn prices.[13]

In a recent study,[14] Global Insight concluded that under higher mandates for renewable fuels animal farmers will bear the cost relative to the baseline. Margins for the swine industry may decline by 50 percent under a 16-bgy mandate by 2016 or 90% under a 20-bgy mandate relative to the baseline of 7.5-bgy by 2012 (as prescribed by EPAct 2005). Margins for the cattle industry may decline five percent and 20 percent respectively under the two scenarios. The poultry industry will also see reduced margins, albeit relatively less than the swine and cattle industries.

Biorefining yields distiller's dried grain (DDG) or wet distiller's grain (WDG) as a by-product. These are good products for feed in livestock and poultry industries. Increased production of DDG and WDG will partially mitigate rising feed costs; but there will be costs associated with transitioning and developing new distribution infrastructure. If livestock and poultry farms are near the ethanol refineries, WDG is the cheapest option for them. But, there is a limited capacity of such conveniently located farms. Shipping the grain longer distances would require drying. Drying and longer distance shipping increase costs. The Global Insight study concludes that livestock margins will decrease most significantly in Texas, Oklahoma, Colorado, California and North Carolina, to where the grains would have to travel longer distances. Even biofuels producing states such as South Dakota, Nebraska, Kansas, Missouri, Wisconsin, Illinois and Indiana will see their livestock farmers having to live with declining margins.

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[12] For example, see the probability analysis of Professor Hilker, Department of Agricultural Economics, Michigan State University at http://www.msu.edu/user/hilker/crnfut.htm.

[13] Quoted in "Ethanol Demand Threatens Food Prices," an article by Britanny Sauser on February 13, 2007 issue of Technology published by MIT Review (http://www.technologyreview.com/Energy/18173/).

[14] *Winners and Losers of Increased Renewable Fuel Mandates: Agricultural Producers and U.S. Consumers*, Global Insight, June 2007. The charts from this study will be sourced as Global Insight, June 2007.

4.2 Impact on consumer food prices: food versus fuel debate

There is a global upward trend in food prices.[15] Food price inflation is expected to be greater than the general rate of inflation in the coming years. Food prices are usually volatile due to uncertainty associated with farming (rainfall, diseases, bottlenecks in the supply chain, etc.). As such, not all of the recent increase in prices can be attributed to rising corn prices, but reasons for the current higher level of prices are expected to persist. One of the most important of these reasons is the increasing demand for biofuels (dubbed as "the ethanol crisis" by the National Chicken Council[16]). Some academics share these views. For example, Professor Marshall Martin, Associate Director of Agricultural Research Programs at Purdue University, believes that the expected increase in corn-based ethanol production is the main driver for rising corn price.[17]

As discussed before, cost of livestock and poultry has also been rising. These increases will be reflected on consumer food prices as well. The price of farmland has been rising too;[18] these increasing costs will eventually impact the cost of agricultural production and raise the cost of all kinds of crops. Clearly, this will cause a chain reaction through livestock and poultry as well as other food production industries. The Global Insight study estimates an increase of 0.6 and 1.4 percent by 2016 above the baseline under the two scenarios (16-bgy and 20-bgy, respectively) for the overall food price inflation. Inflation expectations differ across various foodstuff items with largest increases expected in products derived from the livestock and poultry industries. Naturally, consumers will spend a bigger share of their disposable income for foodstuff. The increase in food expenditures in 2016 relative to the baseline are estimated at $12 billion for the 16-bgy scenario and at $26 billion for the 20-bgy by Global Insight (2007).

In India, wastelands (lands that are not appropriate for food crops but can be used for other crops) are used for jatropha production, which is converted to biodiesel. Already, about 22,000 acres are used for jatropha production and this is expected to rise to 100,000 acres. Many fear that if this trend continues and crop-based biofuels gain further prominence, lands that are traditionally used for production of food crops can also be converted to biofuel-dedicated crops such as jatropha or rapeseed. This threatens food supply security, which is a major concern for populous India. Already, wholesale food prices in India have been more than 10 percent higher in early 2007 as compared to same period in 2006. Previously, such food price inflation has been five to seven percent, driven by higher oil prices. In Nigeria and elsewhere in Africa, studies and pilot projects are under way to produce biofuels from cassava. Again, since cassava is a major part of daily diet in these countries, risking adequacy of food supplies or raising their prices is a major concern.[19]

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[15] For example, see *The Wall Street Journal* article, "Crop Prices Soar, Pushing up Cost of Food Globally," April 9, 2007.

[16] http://www.nationalchickencouncil.com/pressroom/pr_detail.cfm?id=62

[17] Quoted in "Ethanol Demand Threatens Food Prices," an article by Britanny Sauser on February 13, 2007 issue of Technology published by MIT Review (http://www.technologyreview.com/Energy/18173/).

[18] For example, see *New York Times* article, "Ethanol Is Feeding Hot Market for Farmland," in August 8, 2007 issue.

[19] For a more dire prediction, Runge and Senauer (May/June 2007).

4.3 Environmental impacts

A byproduct of biofuel (especially ethanol) production is CO_2, which has been marketed to food processors among others. As CO_2 emissions increase along with biofuel capacity, it is unlikely that the market for CO_2 will expand at the same rate. Industries that use CO_2, such as the food sector, are subject to their own market dynamics and there is no reason to expect their demand for CO_2 to increase at the same level of increase in CO_2 emissions from biorefineries. Non-marketed CO_2 emissions may be subject to regulation. Even in the U.S. some form of GHG (greenhouse gases) regulation with CO_2 emission reduction as one of the major goals will likely be implemented within the next few years. The cost of compliance with these regulations can be significant (buying permits in a cap-and-trade system or paying a carbon tax or investing in capture-storage technology). These regulatory costs can be significant across the whole value chain of ethanol production (from corn production to ethanol consumption).

Biofuels in general and ethanol in particular are claimed to offer emission reductions. Various studies have tested this hypothesis. The Energy and Resources Group (ERG) from the University of California Berkeley concluded that corn-based ethanol reduces overall GHG emissions by up to 13 percent, using the ERG Biofuel Analysis Meta-Model.[20] Argonne National Laboratory, using its GREET model, estimates these emission reductions in the range of 21 to 24 percent.[21] The Lifecycle Emissions Model (LEM) by the Institute of Transportation Studies at the University of California, Davis estimates a range from 30 percent reduction to 20 percent increase in greenhouse emissions.[22] David Pimentel from Cornell claims that biofuel production consumes more energy than it yields, implying that emissions will likely be higher as well.[23] Taken together, these studies show that lifecycle emissions from ethanol production are significant and may even be higher than those associated with current fuel usage.

The experience of palm oil production in Indonesia demonstrates how a well-intended project can lead to higher emissions. The Dutch government supported a project to dry the swamp land in Indonesia and plant palm trees for production of plam oil, which was then used for power generation in the Netherlands. Recently, various analyses by Dutch institutions showed that the project emitted 33 tons of CO_2 for each ton of palm oil produced. In return, savings from switching from one ton of petroleum products to one ton of palm oil were only three tons of CO_2. Consequently, the Dutch government apologized to the Indonesians and promised to reduce palm oil consumption.[24]

Corn and other biofuel crop production needs to increase in order to supply the increasing number of biorefineries. The Global Insight study expects that, in the

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[20] Ethanol Can Contribute to Energy and Environmental Goals by Farrell et al., *Science*, Vol 311, 27 January 2006.
[21] http://www.transportation.anl.gov/software/GREET/ and the technical report titled *Fuel-Cycle Assessment of Selected Bioethanol Production Pathways in the United States* (http://www.transportation.anl.gov/pdfs/TA/377.pdf).
[22] For example, see *Lifecycle Analyses of Biofuels*, a draft report from May 2006 by Mark A. Delucchi (http://www.its.ucdavis.edu/publications/2006/UCD-ITS-RR-06-08.pdf). Also see previous publications by Delucchi and his colleagues at http://www.its.ucdavis.edu/people/faculty/delucchi/.
[23] For example, see http://www.news.cornell.edu/stories/July05/ethanol.toocostly.ssl.html. Professor Pimentel also claims that increased biofuels production contributes to dependence on oil and gas imports.
[24] See http://www.celsias.com/blog/2007/01/31/biofuel-nightmares-indonesian-palm-plantations/ for details and links.

U.S., environmentally sensitive land could be taken out of the Conservation Reserve Program and put into corn production in addition to land from other crops. The danger to forest lands, especially rain forests, in Brazil, Indonesia, Malaysia and parts of Africa has been deemed significant. Clear-cutting or burning are common practices for regular farming in some of these countries; a subsidized biofuels industry can create more incentives for such practices.

Increasing productivity of biofuels crops would likely require increasing use of fertilizers. For example, fertilizer consumption in the U.S. is expected to rise between six and nine percent relative to the baseline (Global Insight 2007). Nutrient loading (in particular from nitrogen) contributes to the hypoxia problem in the Gulf of Mexico (commonly known as the "dead zone"). The dead zone expanded from an average of 5,000 square miles between 1985 and 2006, to 6,682 square miles in 2006 and to an estimated 8,543 square miles in 2007, biggest ever.[25] The EPA is now considering adopting a significantly stricter approach for reducing nutrient loading than its current plan. If the agency follows through, this may raise costs to farmers and ethanol producers.

The increased demand for water by biofuel crop producers can push the already strained water resources to the limit. The Institute for Agriculture and Trade identified some of the potential challenges associated with water use by the ethanol industry.[26] Some of these problems can possibly be overcome if a market for water is developed so that water can be priced and the common pool problem can be avoided. This would also require clarifying rules about ownership of water resources. In the absence of such rational pricing of water use, depletion of water resources may become a serious problem, creating conflicts among alternative users of water and increasing operation costs for biorefineries as well as farmers.

The use of genetically modified seeds may address some of these problems by reducing the need for fertilizers, pesticides and water. But, many environmental groups resist increasing use of GM seeds. Europe has regulations in place against GM, which impacts even the ability of countries in Africa and elsewhere that may be exporting agricultural products to Europe.

5. Concluding Remarks

The support for biofuels is becoming a perfect example of the law of unintended consequences. Although different crops share similar problems, corn-based ethanol seems to present the worst case. At the societal level, the negative impacts of increasing the production of corn-based ethanol on food prices and supplies and on the environment far outweigh the expected economic benefits. The fuel remains relatively expensive and with limited market penetration despite all the federal support. Overall, there seems to be no justification for continuing to provide support to this industry with tax and non-tax incentives and protecting it from more efficient imports with tariffs. These funds could possibly be better spent on

[25] For research, see www.gulfhypoxia.net, the official site of the Louisiana Universities Marine Consortium (LUMCON). According to LUMCON scientist Eugene Turner, "The relatively high nitrate loading may be due to more intensive farming of more land, including crops used for biofuels." News reports covering this research include BBC (http://news.bbc.co.uk/2/hi/science/nature/6904249.stm), August 6, 2007 issue of the Time magazine, and CNN (http://www.cnn.com/2007/TECH/science/07/17/gulf.deadzone.ap/index.html).

[26] See http://www.agobservatory.org/library.cfm?refid=89449

research and development of alternative fuel or technology options with less negative externalities that could prove themselves in a market environment. In the long-run, the society will not benefit from fuels or technologies that are not commercially viable.

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Appendix 1 - Major Federal Biofuel Tax Incentives

Title	Code or Law	Fuel Type	Incentive	Qualifying Period	Limits
Volumetric Ethanol Excise Tax Credit (VEETC)	Public Law 108-357	ethanol of 190 proof or greater from biomass (e.g. corn grain, cellulosics)	$0.51 per pure gal of ethanol used or blended.	January 2005 – December 2010	Available to blenders/ retailers
Volumetric Excise Tax Credit for Biodiesel	EPACT 2005 §1344, Title XIII, Subtitle D	Agri-biodiesel (e.g. from soybeans or other oil seeds)	$1.00 per pure gal of agri-biodiesel used or blended	Expires December 31, 2008	Available to blenders/ retailers
Volumetric Excise Tax Credit for Biodiesel	EPACT 2005 §1344, Title XIII, Subtitle D	Waste-grease biodiesel	$0.50 per pure gal of waste-grease biodiesel used or blended	Expires December 31, 2008	Available to blenders/ retailers
Volumetric Excise Tax Credit for Biodiesel	EPACT 2005 §1344, Title XIII, Subtitle D	Renewable diesel – made from biomass by thermal deploymerization process	$1.00 per gal of diesel fuel used or blended	Expires December 31, 2008	Available to blenders/ retailers
Small Ethanol Producer Credit	EPACT 2005 §1347, Title XIII, Subtitle D	Ethanol from biomass (e.g. corn grain, cellulosics)	$0.10 per gallon ethanol or biodiesel produced up to 30 million gallons	Expires December 31, 2008	< 60 million gallon production capacity Cap at $1.5 million per yr per producer Can offset the alternative minimum tax
Small Biodiesel Producer Credit	EPACT 2005 §1345, Title XIII, Subtitle D	Agri-biodiesel	$0.10 per gallon ethanol or biodiesel produced up to 15 million gallons	Expires December 31, 2008	Same as above
Income Tax Credit for E85 and B20 Infrastructure	EPACT 2005 §1342, Title XIII, Subtitle D	Ethanol or biodiesel	Permits taxpayers to claim a 30 percent credit for cost of installing clean-fuel vehicle refueling property at business or residence	January 2006 – December 2007	$30,000 limit on tax credit
			standard U.S. import tariff on ethanol is a 2.5 percent + 54¢ per gallon		

Source: Renewable Fuels Association, http://www.ethanolrfa.org/policy/regulations/federal/standard/

Appendix 2 - Selected Non-Tax Federal Biofuel Incentives

Federal Action	Title	Goal	Notes and More information
EPACT 2005	Title II, §203 Renewable Fuels Standard (RFS)	4.0 billion gallons ethanol in 2006; 7.5 billion gallons of ethanol by 2012	brief summary of RFS provisions: http://www.ethanolrfa.org/policy/regulations/federal/standard/ summary of RFS and other biofuels incentives: http://www.ethanol.org/rfs.html EPA regulations relevant to RFS: http://www.epa.gov/oms/renewablefuels/
EPACT 2005	Title II, §941	Effective biomass R,D&D	Modifies the Biomass Research and Development Act of 2000. Broadens scope from industrial products to fuels and biobased products. Includes development and demonstration as relevant activities. It spells out research priorities and distribution of funds. 50 percent of the funds are to go to demonstration projects with 20 percent or greater cost-share.
EPACT 2005	Title II, §942 Production Incentive for Cellulosic Biofuels	Cost competitive cellulosic biomass by 2015	One gallon of cellulosic ethanol and ethanol produced in facilities using animal waste to displace fossil fuel use qualifies as 2.5 gallons towards satisfying the RFS
EPACT 2005	Title II, §943 Procurement of Biobased Products	Federal agencies to showcase biobased products	Expands Biobased Procurement Program to Federal government contractors, and establishes program of public education regarding federal use of biobased products
EPACT 2005	Title XV, §1511	Incentive for commercial cellulosic ethanol	Directs Department of Energy to provide loan guarantees for not more than 4 commercial demonstrations, to include one using cereal straw and one using MSW as feedstocks. Must have capacity of 30 million gallons or more.
Farm Security and Rural Investment Act of 2002	Commodity Credit Corporation Bioenergy Program	Increase ethanol production	The USDA Farm Service Agency has for several years encouraged new biofuel production capacity by making cash payments to bioethanol and biodiesel producers for new production. The program is scheduled to end in September 2006.

Source: Energy Policy Act of 2005 and the Farm Security and Rural Investment Act of 2002.

http://thomas.loc.gov/cgi-bin/thomas

http://www.ers.usda.gov/Features/FarmBill/