

# **Implementation Issues for the Renewable Fuel Standard - Part I**

*Rising Corn Costs Limit Ethanol's  
Growth in the Gasoline Pool*

April 28, 2011

Energy Policy Research Foundation, Inc.

## Implementation Issues for the Renewable Fuel Standard - Part I

### *Rising Corn Costs Limit Ethanol's Growth in the Gasoline Pool*

#### Summary

The Federal government provides a range of subsidies, tax incentives, and regulatory mandates to promote the use of ethanol and other renewable fuels into the national gasoline pool.<sup>1</sup> Until recently, ethanol use was limited by law to a maximum of 10% of the gasoline pool, or as a specialty fuel at high levels of concentration (a 70-85% blend called E85) for use only in "flex-fuel" vehicles.

Under the Renewable Fuel Standard (RFS), volumetric requirements for ethanol increase annually regardless of the growth in gasoline use. For 2011 the RFS requires the gasoline pool to reach nearly 10% of the national pool. Ten percent has historically been viewed as the limit for safe use in conventional vehicles. So called "obligated parties," such as refiners and importers, can only market additional volumes through greater sales of E85, but E85 has met considerable consumer resistance because of its high cost at the pump and because it provides fewer miles per gallon than gasoline. E85 also requires large investments in new pumps and tanks at retail outlets. In response to concerns over the market limitations of E85, the EPA has authorized the use of a new fuel, with 15% ethanol (E15), for model year (MY) 2001 and newer cars, with certain exceptions. These initiatives to increase the blending volumes for gasoline have been sought as a means to create additional market access for the mandated volumes of ethanol as the 10% volumetric level, or "blendwall" is reached.

One of the major obstacles to rapid increases of corn ethanol into the gasoline pool is the rising cost of ethanol's principal feedstock, corn. Domestically produced ethanol should have provided some modest constraint on the rising cost of gasoline as turmoil in the Middle East and North Africa has sent crude oil prices well above \$100 per barrel (bbl). Instead, ethanol has seen its feedstock costs more than double over the past 10 months, an increase considerably greater than the rise in crude prices over the same period.

---

<sup>1</sup> The federal program promotes several categories of renewable fuels, not just ethanol. The Energy Independence and Security Act of 2007 ("EISA") proposed four renewable fuel mandates, instead of the single mandate as was the case under earlier legislation. Under EISA 2007, the Renewable Fuel Standard (RFS) program was expanded as follows:

- \* RFS program includes diesel, in addition to gasoline;
- \* The volume of renewable fuel required to be blended into transportation fuel increased from 9 billion gallons in 2008 to 36 billion gallons by 2022;
- \* It established new categories of renewable fuel, and set separate volume requirements for each one, among other requirements. See EPRINC report, *A Primer on Requirements for the Use of Renewable Fuels in the U.S. Transportation Sector, July 2009*. <http://www.eprinc.org/pdf/rfsprimer.pdf>

U.S. policy requiring ever larger volumes of ethanol blended into the gasoline pool is now running into two distinct and important cost realities, both of which are likely to contribute to price increases in gasoline above the rising acquisition cost for crude now faced by domestic refineries.<sup>2</sup> The first is the rapidly rising cost of corn. Disappointing U.S. corn yields, loss of wheat crops worldwide, and increasing domestic and international demand for corn has pushed prices from \$3.50/bushel to over \$7.50/bushel since the summer of 2010, driving up ethanol prices to levels well above the cost of gasoline when adjusted on a GGE (gallon of gasoline equivalent) energy basis.<sup>3</sup> Expanding access will not solve the cost problem because it cannot provide a cost competitive alternative to E10.

The second problem is the volumetric mandate on the use of ethanol in the U.S. gasoline pool which will soon cross the threshold of 10% by volume. The RFS requires the placement of greater volumes of ethanol into the gasoline pool every year. When the RFS program was implemented in EISA (Energy Independence and Security Act) 2007 it was believed that corn ethanol would be cheaper than gasoline and that U.S. gasoline consumption would continually rise, therefore avoiding a blendwall problem. However, neither assumption has proven correct. The transportation fuels sector is now left with a program that mandates the blending of a fuel regardless of cost, demand, infrastructure, or value.

The RFS mandate not only increases prices at the pump as it requires blending larger volumes of a relatively expensive fuel, but it also creates market distortions and regulatory uncertainty throughout the transportation fuels supply chain. For example, E15 is not appropriate for heavy duty vehicles or vehicles built before 2000, nor is it appropriate for boats and small engines such as lawnmowers and chainsaws. It will require special retail blender pumps and tanks costing approximately \$120,000 each and yet to be determined labeling to avoid misfueling.<sup>4</sup> The auto industry remains concerned over E15's safety in vehicle engines, and the new blend level creates the potential for misfueling – all of which raises the liability to any refiner that produces E15. Most vehicles are warranted only for E10 fuel and it is unclear who holds the liability for any damage which might be caused by E15. It is illegal to sell blends above E10 to non flex-fuel MY 2000 or older vehicles. These concerns are likely to limit E15's

---

<sup>2</sup> As the mandate grows, obligated parties will face rising costs and consumer resistance to the higher ethanol blends, but the volumes must still be marketed. Two outcomes are possible, In those cases where refiners can fully pass through rising costs for blends above E10, these costs will be passed on to the remainder of the product slate (diesel, jet fuel, E10, etc). In those cases, where refiners cannot pass through the rising costs of production, the refining industry will adjust by losing capacity to foreign imports. A middle ground is the most likely outcome, i.e., some price increases and some loss of capacity. A discussion of how refiners and prices will adjust to the higher cost structure in a post blendwall environment is discussed in the forthcoming EPRINC report

***Implementation Issues for the Renewable Fuel Standard Part II.***

<sup>3</sup> A large volume of U.S. corn production was hedged, i.e., ethanol producers had taken out contracts to "lock-in" corn prices at much lower levels than current production. These hedges will eventually come off and all ethanol producers will face higher feedstock costs. Also, the price of ethanol in the market is set by the marginal producer, i.e., the producer that has not hedged his production.

<sup>4</sup> See ***Gas Stations Get Aid to Sell More Ethanol***, Bill Tomson, *Wall Street Journal*, April 9, 2011.

[http://online.wsj.com/article/SB10001424052748704503104576251023724394758.html?mod=googlenews\\_wsj](http://online.wsj.com/article/SB10001424052748704503104576251023724394758.html?mod=googlenews_wsj)

introduction on a national level. In addition, production costs for E85 and E15 are not likely to be cost competitive with E10.

In a market free of volumetric mandates, costs would be the prime determinant in evaluating the appropriate mix of ethanol and gasoline sold at the pump. EPRINC's analysis shows that the volumetric ethanol mandate for the gasoline pool is bringing a more costly product to the market. Gasoline RBOB futures have recently traded (May 2011 contracts) at \$3.40/gallon and fuel ethanol futures prices (May 2011) at \$2.60/gallon. But when ethanol prices are converted to a gasoline energy equivalent basis, the true price of ethanol is \$3.90/gallon.<sup>5</sup> Ethanol, when adjusted for BTU and MPG equivalence, consistently sells above the price of gasoline at retail outlets.<sup>6</sup>

The Congressional debate over the deficit has highlighted concerns over the cost of ethanol subsidies, now estimated at nearly \$6 billion per year. The true cost is much higher. Absent volumetric mandates and blending tax credits, the U.S. would consume approximately 400,000 bbls/day (barrels per day) of ethanol, half the amount of ethanol consumed today. Ethanol is highly valuable as an oxygenate, particularly since the previously used oxygenate, MTBE, was phased out of use.<sup>7</sup> At current prices the natural market for ethanol is 3%-5% of the gasoline pool (see figure 5), but it could be larger under alternative pricing environments. At best, RFS is responsible only for the incremental blending of 400,000 – 500,000 bbls/d of the 800,000 bbls/d of ethanol consumed in the U.S. today. Therefore true cost of the blender's credit is closer to \$0.90/gallon rather than the nominal credit of \$0.45/gallon.

The Federal government estimates that programs which reduce petroleum imports are worth approximately \$14 per barrel. Using estimates routinely used by EPA, the \$14 per barrel benefit for import reduction yields \$2.7 billion in "import savings" benefits for 2011. These benefits must be compared to the direct and indirect costs of the program. The blender's credit alone costs the federal government over \$6 billion in lost revenue. In addition to these costs are the cost of grants, loan guarantees, loss of efficiencies in refinery and retail operations, and any impact the ethanol subsidies may have on corn prices. These additional requirements further expand the costs of the program, but even without including these additional costs of RFS, the loss of tax payer revenue alone far exceeds the benefits from the program by nearly 3 to 1.

It is not surprising that volatility in the oil market is also present in the corn market. Corn is a globally traded commodity and China, the world's second largest corn producer, has recently become a net importer of U.S. corn for the first time in many years, slowly leaving behind a policy of grain self-sufficiency. Both the ethanol market and the gasoline market cannot be isolated from global market

---

<sup>5</sup> Ethanol contains 76,000 BTUs (British Thermal Units) and Gasoline contains on average 113,000 BTU. See EPA data: <http://www.epa.gov/oms/rfgecon.htm>.

<sup>6</sup> See **AAA's Daily Fuel Gauge Report**.

<http://fuelgaugereport.aaa.com/?redirectto=http://fuelgaugereport.opisnet.com/index.asp>

<sup>7</sup> MTBE was used as a gasoline blending component like ethanol until the mid-2000's when it was phased out nationwide due to environmental concerns.

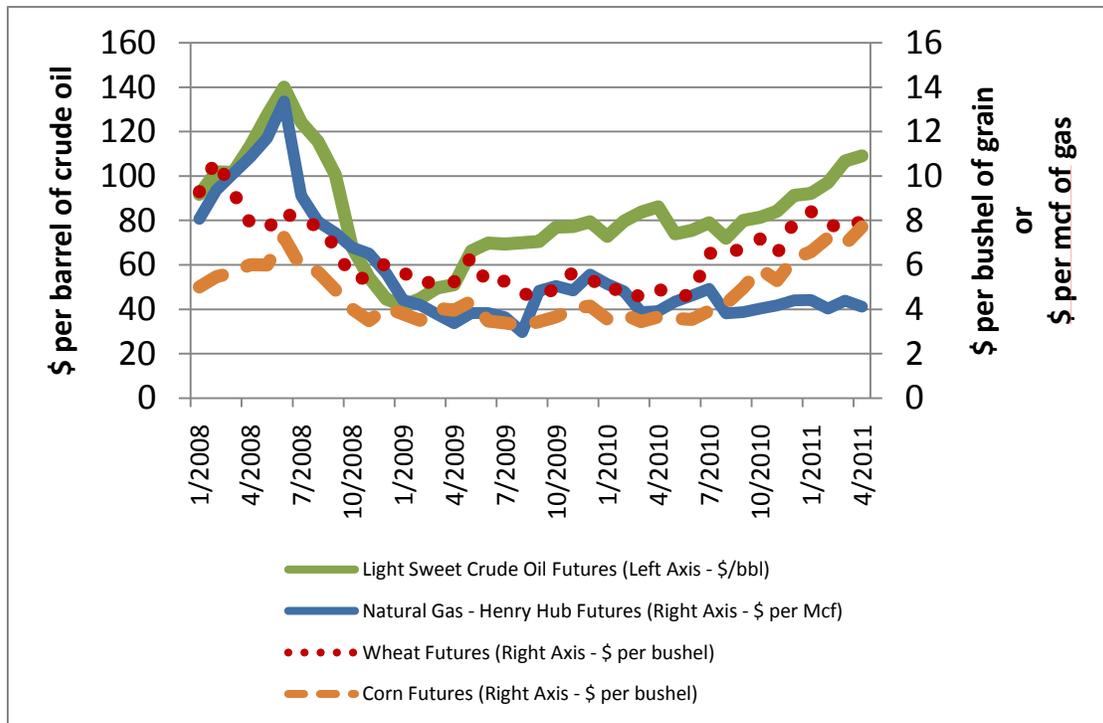
forces. As long as both of these commodities are locked into a regulatory environment that strictly prohibits adjustments to changes in market conditions, opportunities to temper the costs of market volatility through adjustments in the domestic fuel mix will remain limited, with corresponding and unnecessary cost increases for transportation fuels.

### Volatility in Commodity Markets: Corn and Oil

In its May 11, 2010 monthly *World Agricultural Supply and Demand Estimates* report, the U.S. Department of Agriculture (USDA) projected a 2010/2011 marketing year corn harvest of 13.4 billion bushels, an increase of 260 million bushels from 2009/2010, and record corn supplies of 15.1 billion bushels. Prices for the 2010/2011 marketing year, which ends in August 2011, were projected at \$3.50 - \$3.70 per bushel, within the expected final 2009/2010 range.

Corn and most other grains are internationally traded commodities. Russian wheat fires in 2010 set off an ongoing 100% plus rally in corn prices. Front month corn futures prices have nearly doubled from \$3.50/bushel to their current price around \$7.50/bushel in April 2011. From mid-2010 until April 2011 oil has risen at about half the rate of corn even though the turmoil in the Middle East has moved WTI above \$110/bbl.

**Figure 1. Corn, Wheat, Oil and Natural Gas Futures Prices**



Source: CME data

The corn rally has been supported by several fundamental supply and demand factors. The wheat fires in Russia reduced the potential world supply of grains and the market reacted in part by purchasing corn, sending prices higher. In September, the USDA reduced its corn yield forecast by 2.5 bushels/acre from 165 to 162.5 bushels, or 1.5 percent. Projected yields for 2010/2011 have been further reduced to 152.8 bushels per acre as of the February 9, 2011 report. This represents an 8% drop from 165 bushels/acre. Yet the September 2010 report still predicted a record crop of 13.2 billion bushels in 2010/2011 due to larger corn plantings. However, in its February 2011 report USDA reduced its crop estimate to 12.4 billion bushels – a 6% reduction.

U.S. and global demand have also supported corn prices. In the U.S., corn use for ethanol is set to increase to 4.95 billion bushels (USDA forecast from February 2011), 40% of the projected corn crop, up from an estimated 4.6 billion bushels in 2009/2010. This increase is largely accounted for by the mandated increase in ethanol blending called for in the RFS – from 12 billion gallons in 2010 to 12.7 billion gallons in 2011. In 2008/2009, the U.S. used 3.7 billion bushels of corn for ethanol (in 2008 nine billion gallons of ethanol were required per the RFS). Total domestic corn use for all sectors is expected to increase by a half billion bushels in 2010/2011. The corn stock-to-use ratio, a measure of corn inventories against demand, is projected by USDA to be at its lowest end-year level since 1995/1996 (approximately 5% of expected annual corn use). Total end-year 2011 stocks are not expected to exceed 675 million bushels, less than half of the previous year's estimated level.

The U.S. is not the only country demanding more grain. In early February 2011 the U.N. issued an alert on China's wheat supply. China has experienced its worst drought in 60 years; its major wheat producing region, Shandong province, is facing its worst drought in 200 years. As a result, China is increasing grain prices at home, but is also importing more grains. This includes not only wheat but also corn. China, the world's second largest corn producer, is for the first time since 1995 a net importer of corn. In 2008/2009 China was a net exporter, according to USDA data, and grain self-sufficiency has been a national security priority in China. The U.S. grain council has estimated that China will import 3 million tons of corn during the 2010/2011 marketing year.<sup>8</sup>

Ethanol futures for May 2011 have traded at \$2.60 per gallon, about 80 cents below RBOB gasoline, while corn has traded at above and around \$7.60/bushel. A bushel of corn produces 2.8 gallons of ethanol plus \$0.35/gallon of DDG (distillers' dried grain, a byproduct of the ethanol production process used in cattle feed), implying a corn crush of practically zero when DDG is excluded and a crush of \$0.35 with DDG.<sup>9</sup> This suggests poor profitability, if any, for ethanol producers at current prices. DDG provides the only income to offset weak ethanol prices, which are barely recouping the cost of corn, but

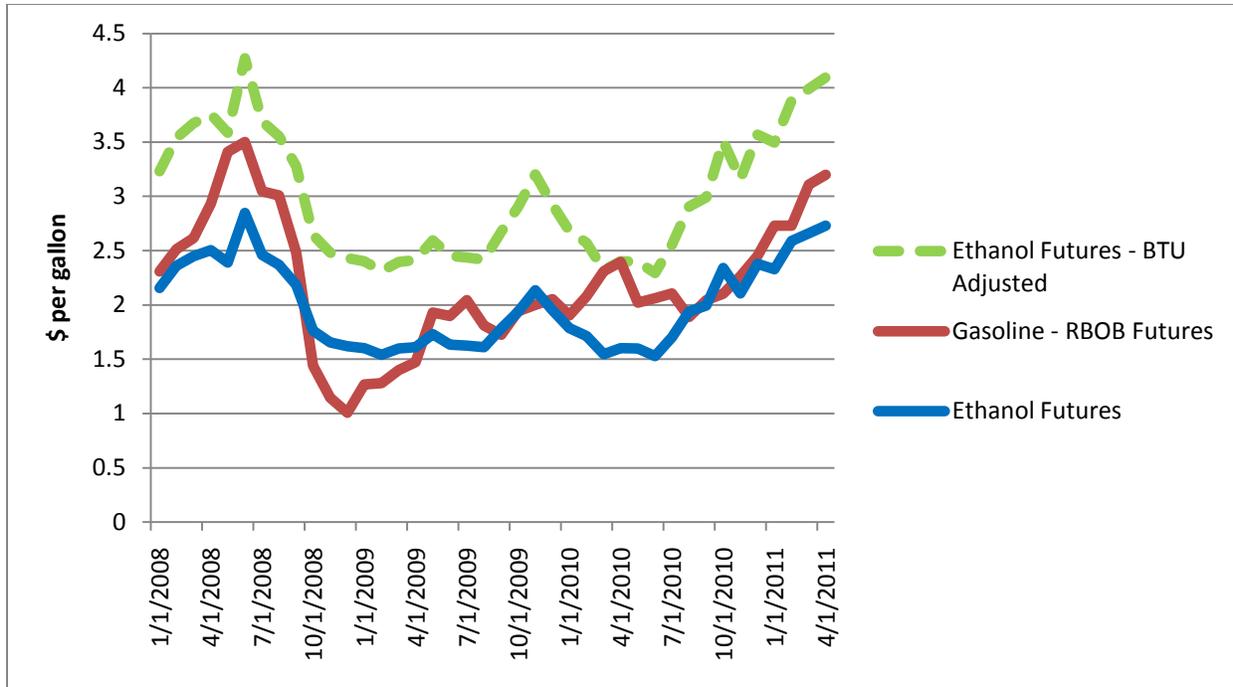
---

<sup>8</sup> **China May Import More Corn As Reserves Fall**, Tom Polansek, *Wall Street Journal*, April 5, 2011. <http://online.wsj.com/article/SB10001424052748703806304576244884052055672.html>

<sup>9</sup> The corn crush is a way of comparing the value of ethanol to the feedstock from which it is derived (similar to a gasoline crack spread). It is the difference between the cost of corn and the value of ethanol: the price of finished ethanol minus the price of corn (price of corn/2.8).

not enough to recoup operating, capital, and transportation costs. Ethanol producers have recently remained profitable because many purchased their corn on contract months ago when prices were lower and have hedged against rising prices. Over time futures contracts and hedging will provide diminishing returns should corn prices remain high.

**Figure 2. Gasoline and Ethanol Futures Prices (Front Month)**

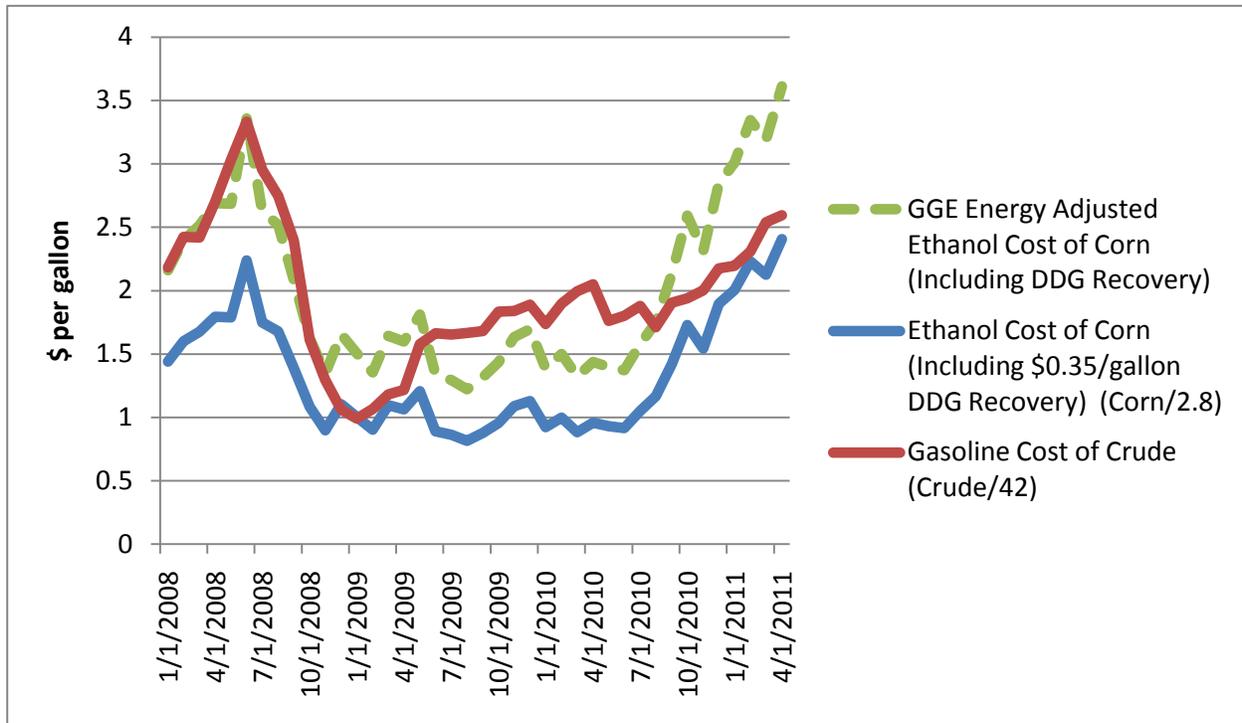


Source: CME data

In an environment of high gasoline prices, high corn prices will make it difficult to market large quantities of E15 which has been viewed as a bridge to higher ethanol blends, such as E85. As figure 3 below shows, the cost of the corn that goes into a gallon of ethanol costs 40% more than the amount of crude oil needed to produce a gallon of gasoline when adjusted both for the lower BTU value of ethanol and ethanol’s DDG recovery \$.35/gallon.<sup>10</sup>

<sup>10</sup> Assumes a basic crack, i.e. 1 gallon of crude == 1 gallon of gasoline.

**Figure 3. Ethanol and Gasoline Feedstock Costs (Per gallon prices of corn, corn BTU adjusted, and oil)**



Source: CME data, EPRINC calculations

### **The Renewable Fuel Standard and the Gasoline Market**

The Renewable Fuel Standard (RFS) requires the blending of 12.95 billion gallons of renewable fuel (excludes biodiesel) in 2011 and 14.2 billion gallons in 2012. Of these volumes, 12.7 billion may come from “Conventional Biofuel”, essentially corn ethanol, in 2011 and count towards RFS obligations and in 2012 13.2 billion gallons of corn ethanol will count towards the obligation. EPA has issued a waiver reducing the mandated volumes of cellulosic ethanol by 97% for 2011 as cellulosic ethanol has yet to be produced commercially. It is likely that only corn ethanol will be blended into gasoline in 2011. Blends have been legally limited to 10% by volume (E10) in regular gasoline. Alternatively, ethanol can be blended at 70%-85% concentrations (E85), but this blend can be consumed only by specially designed flex fuel vehicles (FFVs) and is only available at 2,350 retail fuel stations across the country (out of over 110,000 stations, according to the USDA).

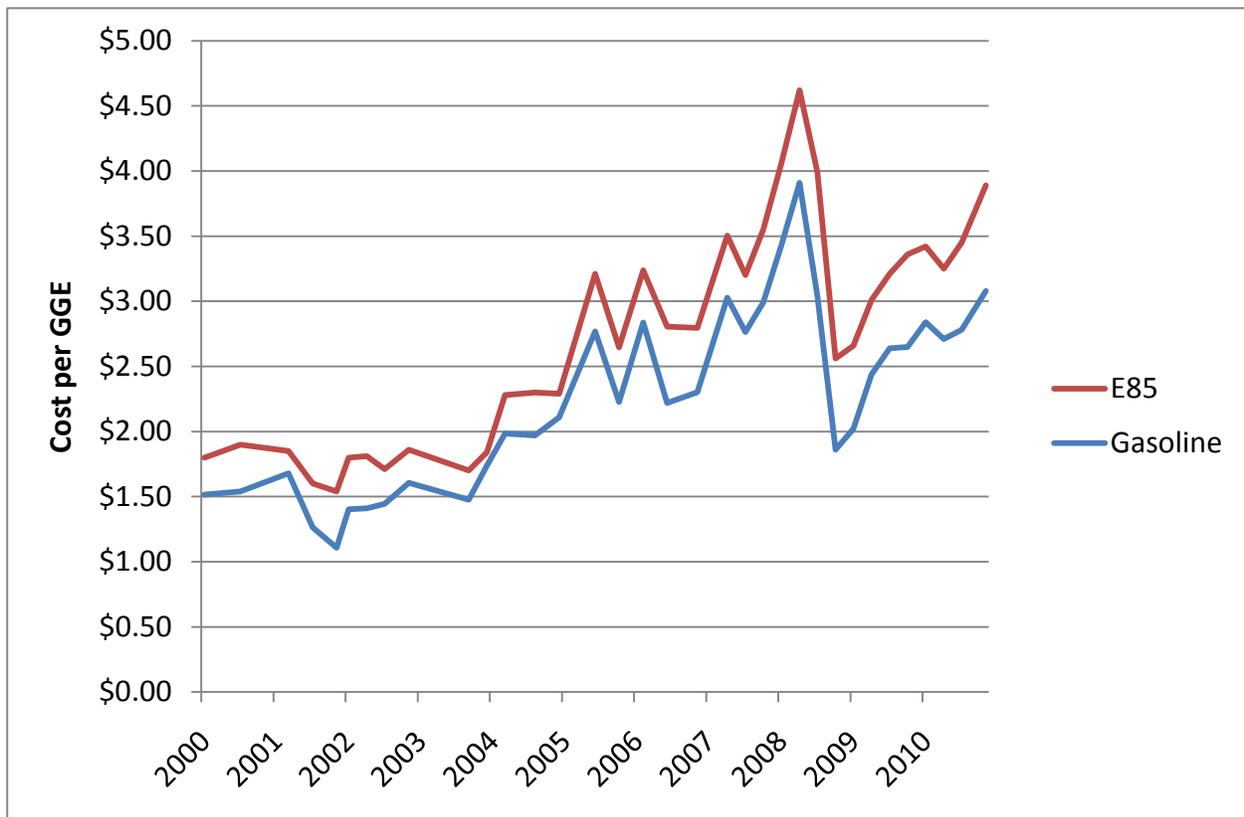
Several factors have limited growth in E85 sales. From 2004-2008 E85 accounted for less than 1% of U.S. gasoline demand.<sup>11</sup> Among the more important are the limited number of compatible vehicles and the small number of fueling stations. But perhaps the most significant factor in preventing E85 consumption is its high cost at the pump when compared to E10 gasoline. E85 has been more expensive at the pump

<sup>11</sup> See EIA data: [http://www.eia.gov/cneaf/alternate/page/atftables/attf\\_c1.html](http://www.eia.gov/cneaf/alternate/page/atftables/attf_c1.html)

on a GGE basis since 2000 according to DOE data shown in Figure 4 below. Because E85 has never been cost competitive with gasoline, the only practical means of selling ethanol (and meeting the mandate) is through ethanol sales in the traditional gasoline pool (E10).

Gasoline demand has remained flat at 9 million bbls/d since 2008 after reaching a peak of 9.3 million bbls/d in 2007. But ethanol consumption has doubled since 2007 and as a result the gasoline pool has nearly reached 10% ethanol saturation, leaving little remaining space within the existing pool to incorporate the legally mandated volumes of ethanol called for over the next several years. In response, EPA is allowing E15 blends for certain vehicles in hopes that it will provide an outlet for additional ethanol volumes. USDA has proposed using funds from the Rural Energy for America Program from the 2008 farm bill to provide loan guarantees and grants for the installation of E85 pumps and E15 blend pumps to help foster sales of the two fuels and mitigate the blendwall. The USDA believes access is the problem; figure 4 suggests price is the problem.

**Figure 4. U.S. Average Gasoline and E85 Retail Prices (BTU adjusted by DOE)**



Source: DOE Data

Ethanol blending is currently about 800,000 bbls/d and it is likely that the minimum 12.5 billion gallons of ethanol called for in 2011 by the RFS will be supplied. An average of 775,000 bbls/d was blended

through the first ten months of 2010, an annual rate of 11.8 billion gallons, well in excess of the required 11 billion gallons. Gasoline consumption has averaged 8.9 million bbls/d (million barrels per day) through the first six months of 2010 for an effective blend rate of 9 percent. Although this calculation is imperfect (caveats include limitations on ethanol distribution<sup>12</sup> and small refiner exemptions from RFS, availability of blending credits from the previous year, and an assumption that gasoline demand does not see significant growth) the blendwall will likely be reached sometime in or around 2012-2013, hence the interest in moving additional supplies through E15.

To meet the blend target for 2011 (12.6 billion gallons), a rate of 822,000 bbls/d of ethanol must be blended. Production breached 900,000 bbls/d in late 2010 and the U.S. is currently a net exporter of ethanol. Some ethanol exports are blended with gasoline so that the blender's credit can be claimed and the blended fuel then shipped abroad.<sup>13</sup> Absent the mandate and blender's credit, ethanol would still have a significant market which EPRINC estimates would be around 300,000-400,000 bbls/d – roughly the historical blend rate of MTBE (an oxygenate used instead of ethanol before it was phased out of use - see figure 4 below).

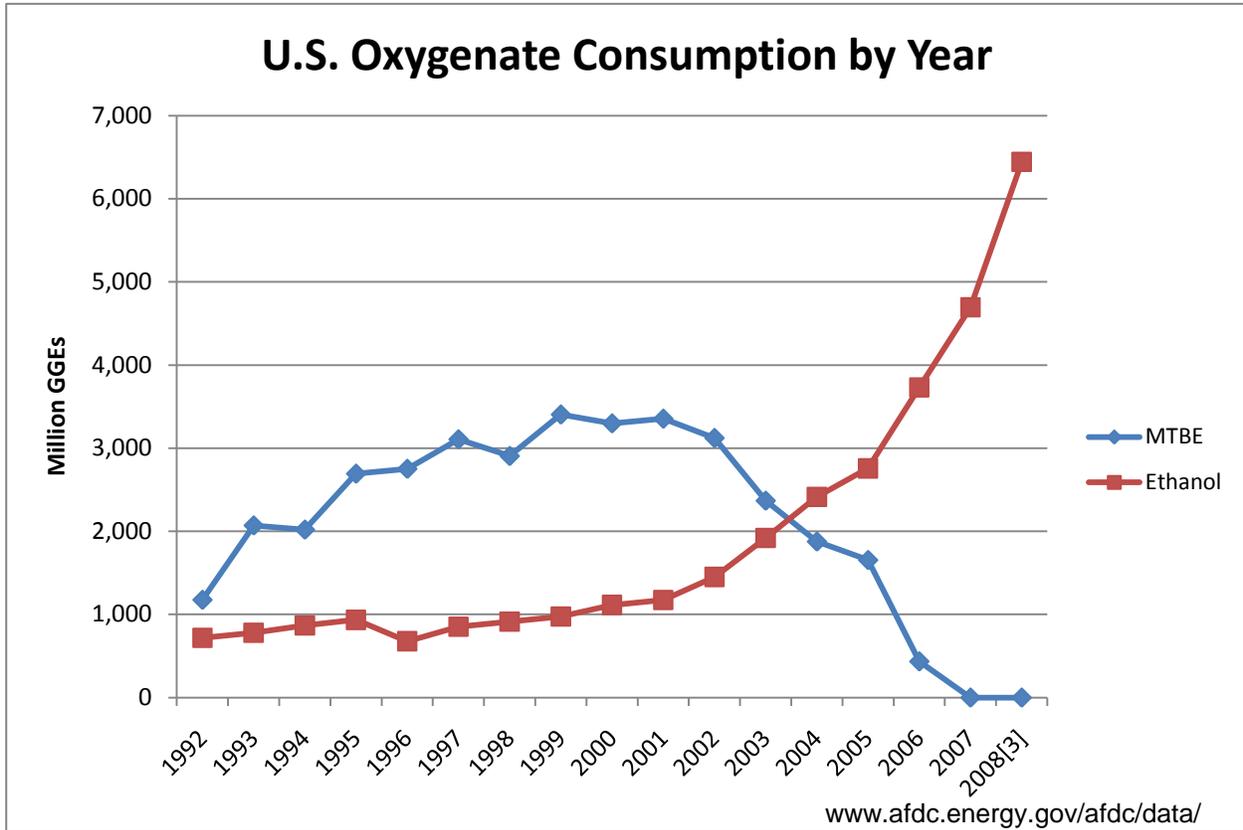
Even though the U.S. is subsidizing all ethanol production blended into the gasoline pool (800,000-900,000 bbls/d), subsidies and mandates have only increased blending by 400,000-500,000 bbls/d. This places the actual cost of the blender's credit at nearly \$0.90/incremental gallon. Approximately 50% of current ethanol use would have been blended even without the \$0.45/gallon blender's credit.

---

<sup>12</sup> Ethanol cannot be transported via petroleum pipelines due to physical characteristics which can make it corrosive to such pipelines.

<sup>13</sup> ***U.S. Produced Subsidized Ethanol Exports are at a Record, the FR Reports***, Alan Purkiss, *Bloomberg*, <http://www.bloomberg.com/news/2010-11-15/u-s-produced-subsidized-ethanol-exports-are-at-a-record-the-ft-reports.html>

Figure 5. MTBE and Ethanol Consumption 1992-2008



Source: DOE Data. Data is displayed as billion GGEs per year. 1 billion GGEs is equivalent to 1.5 billion gallons of ethanol, an annual rate of approximately 100,000 bbls/d of ethanol.

Facing pressure from the ethanol industry to expand the ethanol market and alleviate the blendwall problem, EPA issued a partial waiver on October 13, 2010 allowing E15 blends to be sold for use in MY 2007 and newer cars. A second waiver followed in January 2011 to include MY 2001 light vehicles and newer. It remains illegal to sell E15 to light vehicles prior to MY 2001.

Allowing E15 in the marketplace would theoretically postpone the blendwall for several years by enabling ethanol blends to increase in concentration by 50% (i.e. from 10% to 15%), thus enabling higher sales of ethanol volumes through the conventional gasoline market (i.e. the non-E85 market). However, E15 sales are likely to be constrained by economic, legal, and logistical issues.

## **Expanding Access to E15 and E85: The Bridge to Nowhere**

E10 has been the established legal limit largely because typical automotive gasoline engines (i.e. non-flex fuel engines) are only designed and warranted for fuels up to E10. E15 brings some unique regulatory and infrastructure risks to the market. Among the complications is the potential violation of the manufacturer's warranty if E15 causes a problem in a vehicle. Precisely where the liability lies, should there be a vehicle problem with E15, is unclear. In addition, E15 blends might not comply with state and Federal air and fuel quality standards. And a certified system for gasoline station pumps will have to be developed and certified to ensure that E15 is stored and dispensed safely and correctly. Procedures will also have to be developed to prevent misfueling. EPRINC doubts that an E15 blend will prove a suitable response to the blendwall problem. For a variety of reasons it is unclear whether or not E15 will even make it to the market in time to address the issue. EPA is being sued to overturn the E15 waiver. Challengers have raised concerns on both E15's safety and concern over rising corn prices. These legal challenges may keep E15 tied up in courts for a long time and Congress may pursue any number of legislative remedies.

If EPA successfully defends its court challenges, refiners and marketers will have to undertake investments to produce and distribute higher volumes of ethanol into the gasoline pool. However, it will not be cost competitive to produce E15 or E85, yet obligated parties will have a legal requirement to seek a solution for moving the higher volumes into the marketplace. Given that the average cost for new pumps and tanks to market E85 or E15 is approximately \$120,000, cost recovery for the capital investment and continued sales of an uncompetitive fuel will have to be recovered from the sale of other products, both at the retail level and at the refinery gate.

## **Costs and Benefits**

The RFS and related ethanol support (mandates, subsidies, and tariff protection) have resulted in some reduction in crude and gasoline imports. However, these reductions have come at a very high cost and substantially exceed any potential energy security benefits from reduced imports. EPRINC estimates that the full cost of the \$0.45/gallon ethanol subsidy is closer to \$0.90/gallon as the U.S. would consume ethanol at approximately half its current volume absent a mandate or blender's credit. By this metric the real cost of the blender's credit is \$37.80 for every barrel of incrementally blended ethanol over a subsidy and mandate free base case. Adjusted for energy content, the blenders' credit cost is \$56.70 per barrel of gasoline equivalent – a premium of \$1.35 for every gallon of gasoline offset by the RFS. Estimates by CBO (Congressional Budget Office) are in the same range.<sup>14</sup>

---

<sup>14</sup> According to estimates from the Congressional Budget Office (CBO), the costs to taxpayers of reducing consumption of petroleum fuels differ by biofuel. Such costs depend on the size of the tax credit for each fuel, the changes in federal revenues that result from the difference in the excise taxes collected on sales of gasoline and biofuels, and the amount of biofuels that would have been produced if the credits had not been available. The costs to taxpayers of using a biofuel to reduce gasoline consumption by one gallon are \$1.78 for ethanol made

Oak Ridge National Laboratory (ORNL) released a study in 2006 that estimated the cost to the U.S. economy of every barrel of imported oil.<sup>15</sup> ORNL found that the cost of imported oil to the U.S. economy is \$13.58/bbl (in 2004 \$) in addition to the market price. This cost includes both a monopsony component, which is the estimated effect that the U.S. has on world oil prices as the world's largest consumer of crude oil, and a cost for macroeconomic disruptions to the U.S. economy. ORNL's calculations do not include environmental or foreign policy costs. ORNL's study has been used by the National Highway Transportation Safety Administration (NHTSA) to provide justification for increasing corporate average fuel economy (CAFE) standards<sup>16</sup> and by the EPA to promote the National Renewable Fuel Standards Program (RFS2).<sup>17</sup>

In 2009 dollars, the incremental benefit of reducing oil imports by one barrel is worth \$14.70 using the conclusions from ORNL. As stated previously, EPRINC calculates that the entire RFS program is reducing petroleum imports by approximately 400,000 bbls/d. Based on ORNL study results and this estimate, the benefits of the RFS program in 2011 are not likely more than \$2.5 billion. These benefits must be compared to the direct and indirect costs of the program. The blender's credit alone costs the federal government over \$6 billion per year. In addition to these costs are the costs of grants, loan guarantees, loss of efficiencies in refinery and retail operations, and rising corn prices. These additional requirements further extend the costs of the program, but even without a precise calculation of these costs, the loss of tax payer revenue far exceeds the benefits from the program by nearly 3 to 1 under the most conservative assumptions.

---

from corn and \$3.00 for cellulosic ethanol. The cost of reducing an equivalent amount of diesel fuel (that is, a quantity having the same amount of energy as a gallon of gasoline) using biodiesel is \$2.55, based on the tax policy in place through 2009. See CBO report, ***Using Biofuel Tax Credits to Achieve Energy and Environmental Policy Goals***, July 2010. <http://www.cbo.gov/ftpdocs/114xx/doc11477/07-14-Biofuels.pdf>

<sup>15</sup> Oak Ridge National Laboratory, *Estimating the Energy Security Benefits of Reduced U.S. Oil Imports*. <http://www.epa.gov/OMS/renewablefuels/ornl-tm-2007-028.pdf>

<sup>16</sup>[http://www.nhtsa.dot.gov/portal/nhtsa\\_static\\_file\\_downloader.jsp?file=/staticfiles/DOT/NHTSA/Rulemaking/Rules/Associated%20Files/CAFE\\_Final\\_Rule\\_MY2011\\_FRIA.pdf](http://www.nhtsa.dot.gov/portal/nhtsa_static_file_downloader.jsp?file=/staticfiles/DOT/NHTSA/Rulemaking/Rules/Associated%20Files/CAFE_Final_Rule_MY2011_FRIA.pdf)

<sup>17</sup>For a discussion of EPA's calculations on the contribution and justification for subsidies for renewable fuels see; [www.epa.gov/otaq/renewablefuels/420f09023.htm](http://www.epa.gov/otaq/renewablefuels/420f09023.htm)