

ETHANOL PRICING ISSUES FOR 2008

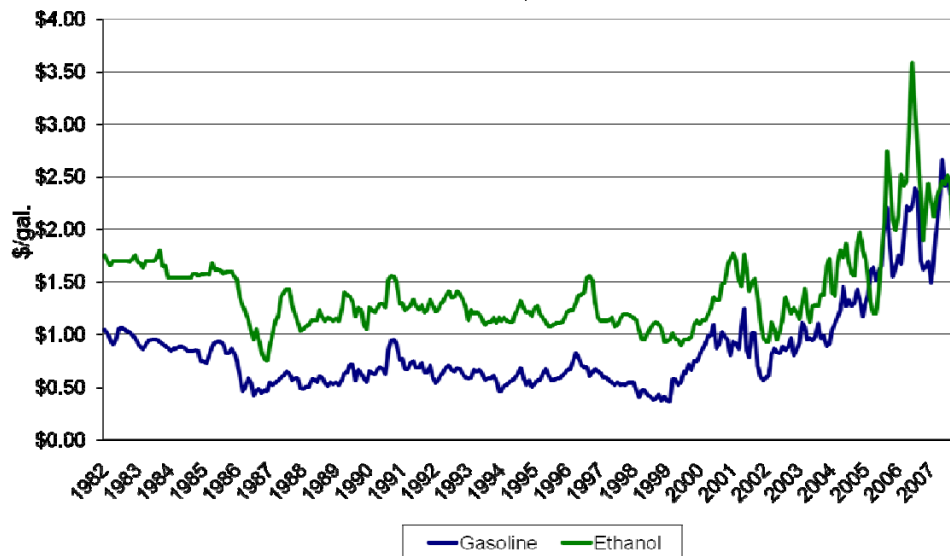
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Recent actions on the new Energy Bill have created long term optimism for ethanol. But what can be expected for ethanol pricing and profitability for 2008? No one knows for sure, of course, but the reason for this note is to highlight some of the issues key to determining what might happen with ethanol pricing in 2008. Again, while long run prospects for ethanol look good, ethanol pricing could experience some instability and pressure for lower prices in 2008.

Over a long history, ethanol prices have tracked pretty well gasoline prices (Figure 1). Since 1982, ethanol typically was priced higher than gasoline because ethanol had value not only directly as a fuel, but also as an additive providing octane and oxygen to the gasoline-ethanol blend and because of subsidies. Since 2005, not only has the average spread fallen, but also the range of spreads over the course of a year is much greater, reflecting more volatile prices for gasoline and ethanol. (For example, the high spread reached \$1.36 per gallon in June 2006, but fell to a negative \$0.45 in October 2007. The recent volatility in ethanol prices is likely to continue into 2008, suggesting that players in the market need to be attentive to market conditions. At least three factors merit special consideration: 1) infrastructure constraints, 2) size of the E10 and E85 markets, and 3) size of the market potential compared with the capacity expansion. The interplay among these factors all point to downward pressure on ethanol prices for 2008.

Figure 1

Historic Ethanol and Gasoline Prices Omaha, NE



Source: (Nebraska Energy Office, 2007)

Infrastructure constraints

In the fourth quarter of 2007, both gasoline and ethanol markets departed from their historic patterns. Normally, gasoline prices follow crude oil prices pretty closely. After the peak summer driving season is over, both crude oil and gasoline prices typically drop in the fall with the declining demand for petroleum products. However, this year for geopolitical reasons and increasing world demand, rather than decline, crude oil continued its escalation to near \$100/bbl. In the U.S. market, however, insufficient demand could not support higher gasoline prices. Thus, the main impact of the much higher crude oil prices was declining refining margins. It is likely that normal refining margins will return by spring or summer of 2008, as demand for petroleum products increases again.

On top of lower than normal fourth quarter gasoline prices, ethanol prices have been even lower in comparison with those gasoline prices. Ethanol prices have been depressed mainly because of infrastructure issues. Essentially, ethanol production capacity has grown faster than the capacity of existing infrastructure to move the product to market. Most of the ethanol (over 90%) is produced in the Midwest, while the markets mirror the population centers across the rest of the country.

Rail is the logical mode to move to distant markets, but at least three infrastructure constraints are still being faced. First, the U.S. gasoline blending industry has historically received fuel by pipeline or water. For example, in 2002, only 81 of 760 fuel blenders in the U.S. had the capability to receive rail shipments (Table 1). Moreover, only ten sites can receive a unit train shipment of ethanol. Second, car shortages are easing as the rail tanker fleet expands from 41,000 to 77,000 cars. Third, capacity to blend the ethanol at destination market terminals also has been insufficient. There is now some evidence that in some locations (e.g., Florida), additional blending capacity can be added fairly quickly. However, it will likely take a longer time frame to upgrade rail receiving capacity. It remains to be seen how both these infrastructure issues will play out with the ethanol capacity increase expected in 2008.

Table 1. Rail Receiving Capability of Fuel Blenders, 2002

PADD	Total Blenders	Rail Receiving Capability	Percent of Blenders with Rail Receiving Capability
1	251	20	8.0%
2	275	24	8.7%
3	131	17	13.0%
4	15	4	26.7%
5	88	16	18.2%
US	760	81	10.7%

Source: (Reynolds, 2002)

Size of U.S. E10 and E85 markets for ethanol

Under current legislation and rules, the U.S. ethanol market consists of two parts: 1) the market for ethanol blends up to 10% - known as E10; and 2) the market for E85, a blend of 85% ethanol and 15% gasoline. The upper limit on the E10 market is 10% of national gasoline consumption, which is about 140 billion gallons per year (BGY). Table 2 provides the potential for the E10 market by Petroleum Administration for Defense District (PADD) (see Figure 2). In 2005, 3.0% of U.S. gasoline was blended with ethanol (Table 2). While state level data are not available for 2006 or 2007, the national blend rate has since climbed to 4.4% (Table 3).

Table 2, 2005 Gasoline and Ethanol Consumption, by PADD

PADD	States	2005 Gasoline Consumption (000 bbls)	2005 Ethanol Consumption (000 bbls)	% Gasoline Blended with Ethanol
IA – New England	MA, NH, ME, VT, RI, CT	155,779	4,306	2.8%
IB – Central Atlantic	NY, PA, MD, NJ, DE, DC	435,778	10,367	2.4%
IC – Lower Atlantic	FL, GA, NC, VA, SC, WV	597,420	5,845	1.0%
IIA – Midwest	TN, MI, OH, IN, KY, IL	561,167	26,840	5.0%
IIB – Upper Plains	WI, ND, SD, MN	140,465	10,662	8.2%
IIC – Lower Plains	MO, OK, KS, IA, NE	200,655	7,775	4.0%
III – Gulf Coast	LA, AL, MS, AR, TX, NM	481,987	3,381	0.7%
IV – Rocky Mountain	CO, UT, ID, MT, WY	106,582	2,518	2.4%
V – West Coast	CA, AZ, WA, OR, NV, HI AK	586,275	24,942	4.4%
US Total		3,266,108	96,636	3.0%

SOURCE: (Energy Information Administration - US DOE, 2007d)

From Table 2, it is clear that the maximum potential for E10 if all gasoline in the country would be about 14 billion gallons. Blending rates on the East Coast have more than doubled since 2005 to 7.3%, while the blend rate climbed to 8.0% in the Midwest PADD (Table 3). On the West Coast, the overall blend rate has remained around 5.0%. Gasoline and ethanol consumption in the Rocky Mountain district is quite low, so the major area using little ethanol is the Gulf States. Only around 1.0% of the gasoline was blended in 2007, although that is up from none in 2005. There may be several reasons for the low level of ethanol usage in that region, but certainly one is the warm temperatures in summer. Ethanol is more volatile than gasoline, and in a blend it produces more evaporative emissions during the warm summer months in warm climates. Because of this problem, it is likely that little ethanol will be used in the Gulf States district during summer. Thus, the Gulf should be viewed at best as an E5 market rather than an E10 market.

Figure 2. PADD Geographic Areas



Table 3. Calculated Ethanol Blend Rate by PADD, 2005, 2006 & 2007

PADD	Refinery & Blender Production			Ethanol Production			Blend Rate		
	05	06	07	05	06	07	05	06	07
	Million bbls						Percent		
East Coast	460.9	555.7	584.6	14.3	34.5	40.0	3.2	6.6	7.3
Midwest	629.3	624.7	617.5	38.7	40.1	45.8	6.6	6.9	8.0
Gulf Coast	1,286.8	1,218.0	1,210.5	0.5	9.9	12.9	0.0	0.8	1.1
Rocky Mountain West	105.5	104.4	107.7	1.5	1.5	2.5	1.4	1.5	2.4
West Coast	553.4	549.9	533.4	26.6	27.8	26.4	5.0	5.3	5.2
US Total	3,035.9	3,052.8	3,053.7	81.5	113.8	127.6	2.8	3.9	4.4

SOURCE: (Energy Information Administration - US DOE, 2007d).

For E85, the potential size is huge. However, at present only around 6,000,000 flex-fuel vehicles can burn E85 (Alternative Fuels and Advanced Vehicles Data Center, 2007). Of these, roughly 600,000 fleet vehicles consumed 37 million gallons of E85 in 2005 (Table 4). In addition, few stations sell E85. As of December 2007, only 1,530 gasoline stations sold E85 (Table 4). Thus, for 2008, the realizable potential for E85 is very small.

The experience of Minnesota is instructive in gaining a perspective on the limited demand for E85. Minnesota has 315 E85 stations, or 20% of the US total (Tables 4 and 5). The blend rate in Minnesota by law is 10%, requiring 266 million gallons of ethanol.

The ethanol usage rate in 2007 was 11.6%, suggesting that the 1.6% of the ethanol was blended as E85. The average station with E85 pumps in Minnesota handled around 32,000 gallons of ethanol. Nationwide, this would only total roughly 50 million gallons, or half the capacity of one of the new larger plants. Thus, in the short run, E85 is not a solution to the burgeoning supplies of ethanol. The Energy Information Administration of the US-DOE estimates that a station would need to charge 2 to 7 cents per gallon more for E85 to recoup the investment upgrade cost of installing E85 equipment, assuming a 15 year useful life, and 160,000 gallons of E85 per year (Energy Information Administration - US DOE, 2007b).

Table 4. Stations and Alternative Fuel Vehicles (AFV), by PADD,

PADD	Fuel Stations	Fuel Stations with E85	Percent Stations with E85	Number of Alternative Fuel Vehicles	AFV E85 consumption (M gal)
IA – New England	7,407	2	0.0%	20,051	1,083
IB – Central Atlantic	17,880	32	0.2%	73,658	4,847
IC – Lower Atlantic	33,828	97	0.3%	83,962	7,721
IIA –Midwest	25,015	374	1.5%	62,151	5,861
IIB – Upper Plains	9,785	481	4.9%	20,790	2,480
IIC – Lower Plains	14,512	195	1.3%	35,817	2,592
III – Gulf Coast	34,419	48	0.1%	122,499	4,386
IV – Rocky Mountain	5,749	59	1.0%	23,457	2,077
V – West Coast	82,776	242	0.3%	147,382	6,719
US Total	231,371	1,530	0.7%	589,767	37,766

Source: (Energy Information Administration - US DOE, 2007a)

Table 5. Ethanol Gallons per Station in Minnesota, 2007

Ethanol for:	Gallons of Ethanol	No. of Stations	Gallons/Station
E10	266,044,800	3,656	72,769
E85	10,063,200	315	31,947
Total Ethanol	276,108,000	3,656	75,522

How much less than the theoretical maximum market of 14 billion gallons of E10 is the realistic market for 2008? It is impossible to have firm numbers, but our best estimate is that the absolute maximum potential for 2008 is no more than 12 billion gallons for both E10 and E85. In the next section, we compare this maximum market size with the production capacity expected to come on line in 2008.

Estimated 2008 ethanol production capacity

Keeping track of industry capacity has been a challenge given the explosive growth. Ethanol industry capacity numbers are reported by at least four entities (Table

6). The lists of plants are maintained by researchers in CARD at Iowa State University, as well as two trade associations, the Renewable Fuels Association and the American Coalition for Ethanol, and the e-magazine, *Ethanol Producer*. There is general agreement among the four sources that industry capacity in November 2007 is around 7 BGY at 135 plants. These numbers include 15 to 20 plants that process a feedstock other than corn, such as cheese whey or brewery waste. Typically, these other plants are very small compared to corn ethanol plants. However, there is expected to be a tremendous surge of new capacity coming on line in the first half of 2008, although estimates vary among the four sources (Table 6). Many plants that were started in 2006 when ethanol prices peaked (Figure 1) will complete construction in 2008. Estimated production capacity for July 2008 is nearly 12 billion gallons, and by the end of 2008 capacity is expected to reach over 13 billion gallons.

Table 6. Ethanol Capacity and Expansion, December 2007

Reporting Association	Web Address	Current Capacity		Expansion	
		Number of Plants	Capacity (MGY)	Number of Plants	Capacity (MGY)
CARD	www.card.iastate.edu/research/bio	142	7,222	90	7,069
Renewable Fuels Assn	www.ethanolrfa.org/industry/locations	131	7,023	82	6,452
Ethanol Producer	ethanolproducer.com/plant-list.jsp	138	7,166	54	4,167
American Coalition for Ethanol	www.ethanol.org/index.php?id=37	135	7,005	75	5,503

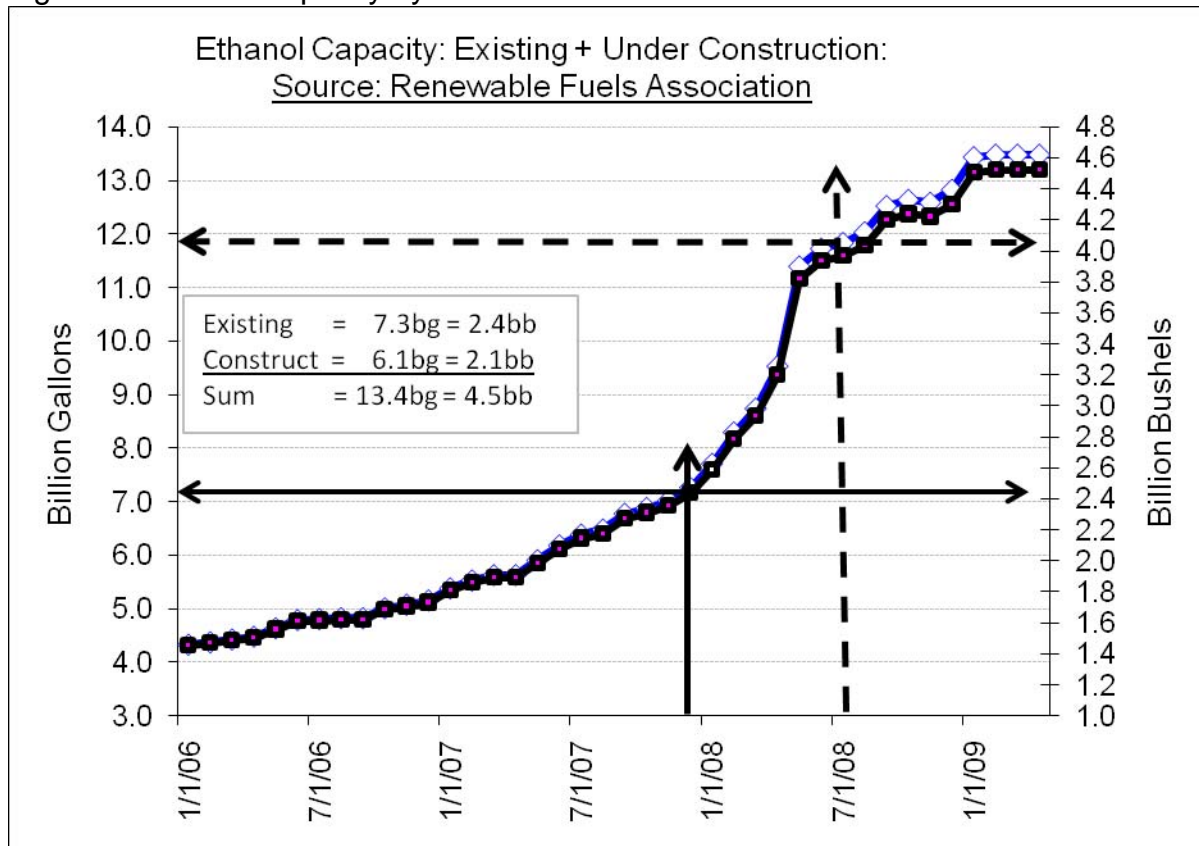
As shown in Table 6, a host of new plants and a tremendous surge of new capacity will be coming on line in the first half of 2008 (Figure 3). Thus the industry is on the verge of its most rapid growth phase yet, with potential capacity increasing from 7.3 billion gallons in December 2007 to 11.8 billion by July 2008. The rate of new capacity coming on line is expected to slow in the second-half of the year, and much of the expansion for the industry will be in-place by the end of 2008 when capacity is expected to be about 13.5 billion gallons.

Implications of the estimated market size versus 2008 production capacity

Clearly, we have never been in this situation before. The depressed ethanol prices during parts of 2007 were largely due to infrastructure constraints, but also may foreshadow continued pricing pressure for ethanol in 2008. Infrastructure constraints are on their way to being resolved as rail capacity expands. In contrast, the situation we face in 2008 is that demand for ethanol will range from an EIA forecast of 9 billion gallons to perhaps 12 billion gallons at most. Meanwhile expansions in productive capacity will reach as much as 13 billion gallons. In other words, this is a market size – not an infrastructure or economics limit. Given the legal and physical barriers to going beyond E10 in the near term and the physical constraints to significantly increasing E85

in the one year time frame, we expect that the technical market size limit will be binding in 2008. If this is correct, what would it mean for the ethanol market?

Figure 3. Ethanol Capacity by Month



How much corn would all that capacity take? Figure 4 provides estimates of the bushels of corn required. This data are on a crop year basis which is an accounting period from September 1 to the following August 31. Data in the figure prior to the 07/08 marketing year are actual usage from USDA.

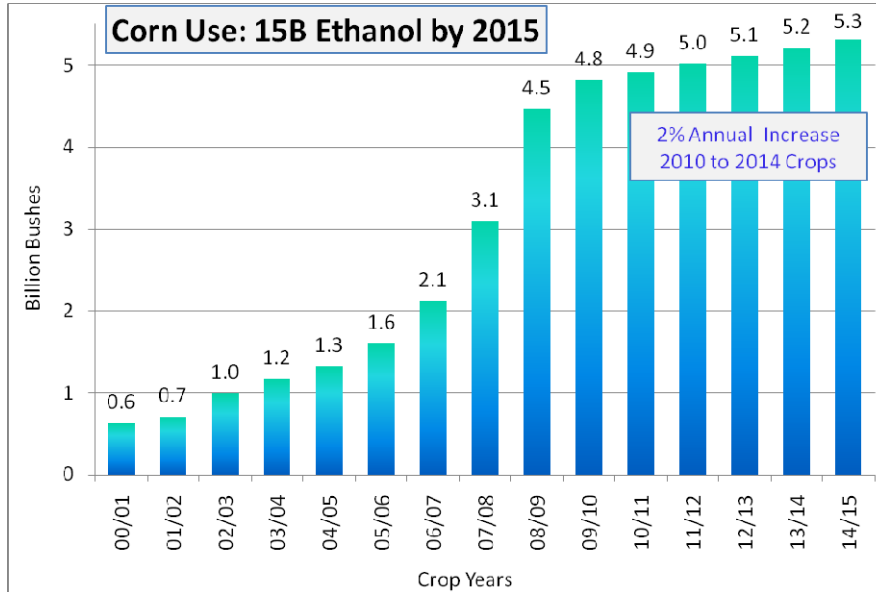
The 2007 crop (07/08 marketing year) will see an additional requirement of one billion bushels of corn for ethanol (from 2.1 to 3.1 billion bushels). Because the 2007 U.S. crop was a record in size, corn will largely be available for the expansion, but at very high prices. However, current estimates for the 2008 crop (08/09 marketing year) suggest there will be only about four billion bushels available for ethanol usage. If so, this would be about ½ billion bushels short of estimated needs for the industry to reach full capacity. This would constrain the industry to operate at about 89 percent of capacity and keep ethanol plant margins extremely thin or even negative at times.

Since the 2008 crop now appears to be unable to meet the full demands of ethanol capacity, this means it will be the 2009 crop before corn production can expand sufficiently to meet the added demand. This implies continue high corn prices for both

the 2007 and 2008 crops. These prices are expected to be high enough to constrain the industry from reaching its 13.5 billion gallon potential until the 2009 crop.

If the corn ethanol industry then moves on to 15 billion gallons by 2015 as outlined in recent energy legislation, this can be achieved with about a two percent annual rate of growth in the crop from 2010 to 2014. This relationship is also shown in Figure 4.

Figure 4. Actual and Estimated Corn Use for Ethanol



One critical point is that the ethanol industry was able to source sufficient corn in its early expansion phase because the U.S. and world had excess capacity in corn and other crop production. However, the magnitude of the on-coming corn demand surge (along with increased crop demands for other biofuels) has eliminated all surplus crop production capacity. Now the ethanol industry must compete for corn inventories with extremely inelastic demands for food and other industrial uses, such as fructose or corn starch.

Summary and conclusions

The bottom line is that ethanol production capacity in 2008 will be growing faster than either logistical capacity to handle the product or the size of market given the blending limits that exist today. Longer term, more E85 or higher blending limits likely will be possible, but there appears to be little on the near term horizon that can alleviate the 2008 ethanol market problems. Essentially we see three possible impacts of this market constraint:

1. Ethanol price will have to be discounted given that production capacity will be larger than the capacity of the market to absorb the volume of ethanol produced.
2. Ethanol plant utilization will fall to keep actual production in line with the market constraint. Some inefficient plants could cease production entirely. It is uncertain what plants are at greatest risk. While newer plants enjoy economies of size advantages, they are saddled with much higher fixed costs. State level subsidy programs will influence the outcome, as well as proximity to end markets and the availability of corn in the local market.
3. It may be possible to export ethanol, especially if it is possible for blenders to blend ethanol with gasoline, collect the U.S. subsidy, and then export the product. This is happening today with biodiesel.

If a significant export market develops, that could effectively remove the market constraint. If not, then the impact will be some combination of reduced production and lower prices.

If oil prices remain high (in the \$90-\$100 range), we can expect to see considerably higher gasoline prices by summer of 2008. The higher gasoline prices will help support ethanol to some extent, but the technical size constraints on the ethanol market will still have a depressing effect on ethanol prices.

Another possible way to handle the problem of the market size limit, sometimes called a blending wall, would be to move from E10 to something slightly higher like E12.5 or E15. Such a change would be complicated. The Environmental Protection Agency would have to issue a waiver permitting the higher blending rate. Presumably, auto manufacturers also would have to agree to honor warranties under the higher blending percentages. However, if these obstacles could be overcome, the higher blending levels would effectively move out the blending wall for the near term.

The bottom line is that ethanol markets can be expected to be difficult for much of 2008. Longer term, these barriers will be overcome with the 2007 Energy Bill calling for 36 billion gallons of cellulosic ethanol, corn ethanol, and other renewable fuels by 2022. However, the near term obstacles could be significant.

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