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Revising Ethanol Blend Limits: A Discussion of Key Issues and Implications for Corn Prices

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Executive Summary

In response to the financial difficulties facing the nation's ethanol producers, the Environmental Protection Agency (EPA) is considering raising the ethanol blend limit (i.e., the allowable ethanol content in a gallon of conventional gasoline) from the current 10%. USDA has expressed strong support for raising the limit to between 12% and 13% in short order, and industry groups propose raising the limit to 15%. To date, discussion of the effects of a possible change to ethanol blend limits have focused mainly on technical feasibility of burning higher ethanol blends in unmodified engines (consistent with the responsibilities of EPA with respect to this issue). So far, potential market impacts of this change have been ignored. This paper evaluates the impact of an increased ethanol blend limit on corn use and price in the short run: specifically, over the next two corn marketing years. The implications of such corn use shifts are of critical importance to the nation's livestock and dairy industries and, by extension, to consumers of these end products.

Data and procedures from EPA's calculation of RFS mandate requirements is used to estimate the impact on corn use for ethanol production that would result from a change in the blend limit. An existing model of corn supply and demand (Anderson and Coble) is adapted to evaluate the potential impact of this change in corn use on equilibrium price and quantity in the corn market.

Results suggest that the market impacts of increasing the ethanol blend limit to even the 12.5% level are potentially economically significant, raising corn prices by over 15% and resulting in substantial reductions in feed use and corn exports. These results represent an upper bound on possible market effects of a change in the blend limit. Actual effects would depend on whether or not refiners would blend up to the higher allowable limit. This, in turn, depends primarily on the relative prices of ethanol and petroleum. Given the uncertainties in these markets, it would make sense to approach any change to current bioenergy policy, including changes to blend limits, with considerable caution due to the possibility of severe adverse unintended consequences for other agricultural market participants and, by extension, consumers.

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Introduction

The decline in gasoline prices since mid-2008 has helped to create a difficult situation for the nation's ethanol producers. In 2006, ethanol production capacity expanded rapidly, spurred in part by a major upward revision in ethanol use mandates included in the Energy Policy Act of 2005. With fuel prices soaring to record levels in 2007 and 2008, ethanol production was a profitable enterprise. However, fuel price declines since mid-2008 have dramatically eroded profit margins in the ethanol industry. The problem has been compounded by the excess ethanol production capacity developed over the past two years.

Secretary of Agriculture, Tom Vilsack, has recently proposed providing support to the ethanol industry by raising the ethanol blend limit, which currently stands at 10%. According to Vilsack, an increase in this limit to somewhere in the 12% to 13% range is within the discretion of the US Environmental Protection Agency (EPA) and could be accomplished quickly, with no need for further legislative authorization or review (US Department of Agriculture Office of Communications, 2009). Vilsack's comments expressed further interest in eventually pushing the blend limit to 15% (E15), a position currently being advocated by Growth Energy, an ethanol industry group (www.growthenergy.org) that has formally requested a waiver of the current blend (Growth Energy, 2009). To make their case, they cite evidence that existing vehicle engines could easily handle *up to 20%* ethanol blends, thus implying no short-run technical constraints to this change either.

USDA, along with ethanol producers, appears to be pursuing an increase in the ethanol blend limit as a means of providing financial relief to the ethanol industry with little consideration of how such an increase might affect participants in related markets. For example, a study released by Growth Energy to support increasing the blend limit to 15% focused exclusively on the positive direct and indirect economic impacts resulting from a six billion gallon per year (bgy) increase in ethanol production (e.g., job creation resulting from one-time construction activities and annual plant operation activities) (Hodur, Leistritz, and Senechal; 2009). This study gave no consideration of the impact that such an increase in ethanol production (which represents a 57% increase over the 2009 RFS mandate of 10.5 bgy of conventional ethanol) may have on related markets. As recent history demonstrates, changes in bioenergy policy have the potential to create major disruptions in agricultural markets. To say the least, it would be prudent to evaluate the potential impacts of any bioenergy policy changes on related markets before such changes are implemented. The purpose of this paper is to evaluate the impact of an increased ethanol blend limit on corn use in the short run: specifically, over the next two corn marketing years. The implications of such corn use shifts are of critical importance to the nation's livestock and dairy industries and, by extension, to consumers of these end products.

Renewable Fuel Standards Requirements and Ethanol Blend Limits

The blending of ethanol with gasoline is currently influenced by two somewhat contradictory requirements, both of which are embodied in the Clean Air Act and both of which are administered by the EPA. First, the Renewable Fuels Standard establishes the minimum percentage of renewable fuels that must be blended nationally into conventional gasoline for sale to final consumers. In practice, the EPA implements the RFS by establishing a national blending requirement as a percentage of total expected use. Thus, based on a renewable fuels mandate of

11.1 billion gallons for 2009 (of which 0.6 billion gallons is mandated to be non-conventional ethanol), the EPA established a national blending requirement of 10.21%. Note that the RFS refers to the percentage of *aggregate* fuel production that must come from renewable sources (for all practical purposes, this means corn-based ethanol and, to a far lesser extent, biodiesel). Second, there is in place an ethanol blend limit that establishes the *maximum* percentage of ethanol that can be blended into a given gallon of conventional gasoline. Blends of more than 10% ethanol cannot be considered conventional gasoline. Higher blends, E85 for example, are available, but only for use in flex-fuel vehicles. The proposal currently supported by USDA calls for allowing higher blends (potentially up to 15%) to be sold as conventional gasoline for use in all motor vehicles.

To understand why the ethanol industry perceives an increase in the blend limit to be necessary, it is instructive to consider the recent history of RFS mandates. In order to establish the RFS blending requirement, EPA must first estimate total quantity of fuel demand expected for the upcoming year and then convert the congressionally-mandated renewable fuel volumes into a percentage of that total quantity. A schedule of annual mandated renewable fuel volumes was first established in the Energy Policy Act of 2002. This schedule was revised upward with the Energy Policy Act of 2005 and again with the Energy Independence and Security Act of 2007 (EISA). The renewable fuel mandate schedule from each of these pieces of legislation is presented in Table 1. Note that the advanced bio-fuel mandate beginning in 2009 was intended to be filled with biomass-based fuels such as cellulosic ethanol. Because cellulosic fuels are not currently commercially available, EPA notes that this requirement, for now, will basically have to be met with biodiesel.

EPA's procedure for developing a renewable fuels blending requirement from the annual volume mandate is summarized in the following equation (US Environmental Protection Agency, 2009):

1) $$RFS_i = 100 \times \frac{RFV_i}{(G_i + GS_i) - (R_i + RS_i) - GE_i},$$ [2]

Where RFS_i is the renewable fuels blending requirement for year i expressed as a percent of total fuel use; RFV_i is the annual volume of renewable fuels required for year i, in gallons, as defined in the EISA; G_i is projected gasoline use (48 contiguous states) in year i, in gallons; GS_i is projected gasoline use in non-contiguous states and territories opting into the RFS program in year i, in gallons[3]; R_i is the expected amount of renewable fuel blended into gasoline projected to be consumed in the 48 contiguous states in year i, in gallons; RS_i is the expected amount of renewable fuel blended into gasoline projected to be consumed in non-contiguous states and territories opting into the RFS program in year i, in gallons; GE_i is projected gasoline production by exempt small refineries in year i, in gallons.

The EPA reports this calculation for the 2009 standard as

[2] EPA's formula includes an adjustment to the renewable fuels volume (*RFV_i*) for cellulosic ethanol; however, that adjustment is not required until 2013. Over the time frame considered here, the RFS calculation is implemented as shown in Equations 1 and 2.

[3] Non-contiguous states and territories are not automatically included in the RFS program; however, they may opt into the program. For 2009, Hawaii has opted into the program.

2) $$RFS_{2009} = \frac{11.1}{138.47 - 11.03 - 18.73} = 10.21\%,$$

The numerator in equation 2 is the mandated volume of renewable fuels (in billions of gallons) from the EISA, and the denominator includes, from left to right, projected gasoline use in all states except Alaska, projected renewable fuel use in all states except Alaska, and gasoline production by small refineries exempt from participation in RFS programs.

Note that the 2009 RFS blending requirement calls for the volume of renewable fuels use to total 10.21% of total gasoline consumption. This may at first seem to conflict with the 10% ethanol blend limit. It is important to reiterate the distinction between the RFS requirement and the ethanol blend limit. The RFS requirement is based on the aggregate volume of gasoline sold whereas the blend limit refers to the maximum ethanol content of any given gallon of gasoline which can be considered conventional. The RFS requirement could still be met without blending more than 10% ethanol per gallon if a sufficient volume of higher blends (E85, for instance) is also being produced. However, the market for E85 and similar blends is much smaller than the market for conventional gasoline, and logistical issues on such blends remain a challenge. More importantly, in the short run, E85 demand is limited by the relatively low price of conventional gasoline. The lower energy content of E85 compared to conventional gasoline fairly directly translates into reduced average fuel economy (Roberts, 2008). Thus, in order to compete with conventional gasoline, E85 must sell at a discount. In the current market environment, retailers have little opportunity to do that profitably.

Moving forward, with gasoline demand expected to decline in 2009 and grow only about 1% in 2010 (US Department of Energy, 2009), higher RFS mandates prescribed by the EISA will translate into an increasing RFS blending requirement. At some point, blenders may in fact see real tension between the RFS requirement and the ethanol blending limit. Raising the blending limit now would forestall that possibility, ensuring that ethanol producers maintain access to the conventional gasoline market with essentially the full volume specified in the RFS mandate. From an ethanol producer's standpoint, this would surely be desirable; and this situation at least circumstantially explains the strong interest on the part of producers in raising blend limits as soon as possible.

Of course, raising ethanol blend limits does not necessarily ensure that refiners will increase blends up to the limit. The preceding discussion suggests that an increase in the cap could make it easier for refiners to meet RFS requirements by basically allowing them to satisfy the requirements with blends qualifying as conventional gasoline. Whether refiners would actually choose to blend beyond the RFS minimum up to higher blend limits would depend on the relative prices of gasoline and ethanol. If refiners did, in fact, blend up to a 15% limit, this would alleviate the current problem of overcapacity in the ethanol industry. Hodur, Leistritz, and Senechal summarize ethanol production capacity as follows: 10.3 billion gallons per year (bgy) in production, 1.9 bgy idled, 1.5 bgy under construction, and 0.6 bgy in planned expansion. By their estimates, then, total potential capacity amounts to 14.3 bgy – well in excess of 10% of total fuel consumption for 2009 based on EPA's estimate of consumption from equation 2 (i.e., 119.74 bgy or 138.47 bgy of expected use minus the 18.73 bgy from exempt small refiners).

Evaluating the Impact of a Change in the Ethanol Blend Limit

To date, discussion of the effects of a possible change to ethanol blend limits have focused on technical feasibility of burning higher ethanol blends in unmodified engines (e.g., Growth Energy and US Department of Agriculture Office of Communications) or on the potential macroeconomic impacts of increased ethanol production (e.g., Hodur, Leistritz, and Senechal). This discussion so far has ignored the potentially significant impacts of increased ethanol production on other agricultural industries.

Through 2007 and much of 2008, the effects of ethanol policy on other users was a topic of considerable interest. At that time, high petroleum prices were providing a strong incentive for refiners to blend ethanol (then a relatively low-priced fuel) at as high a rate as possible. For now, the price advantage that ethanol once enjoyed is gone. Feed users and export customers still appear to be forfeiting a larger part of the corn market to ethanol users due to RFS mandate requirements[4]; but the incentive to blend beyond RFS limits, as would clearly be allowed by an increase in the blend limit, is not there right now.

The real concern for corn users that compete with ethanol is that, with a higher blend limit in place, a change in the relative prices in petroleum and ethanol could result in a surge in ethanol blending that would have significant effects on corn use and price. As Abbot, Hurt, and Tyner (2008) note, increased corn use for ethanol production implies that other users are being priced out of the market. For livestock producers, who have already experienced a dramatic rise in production costs over the past two years, a further increase in ethanol production represents a potentially serious challenge.

The possible effects of an increase in ethanol blend limits can be evaluated by adapting the model developed by Anderson and Coble. The general form of that model is as follows:

(3) $Q_{df} = \alpha_f + \beta_f P_d + \Gamma_f X_f$,
(4) $Q_{dx} = \alpha_x + \beta_x P_d + \Gamma_x X_x$,
(5) $Q_{de} = \alpha_e + \beta_e P_d + \Gamma_e X_e$,
(6) $Q_s = \alpha_s + \beta_s P_s + \Gamma_s X_s$.

Equations 3 through 5 express functions corn demand for feed, export, and ethanol, respectively. Equation 6 is the corn supply relationship. Assuming a double-log functional form, the coefficients (β's) on corn price (P_d) in these equations represent own-price elasticities. X_i represents a matrix of demand shifters (eg., income, prices of wheat or grain sorghum, etc.) or supply shifters (e.g., fuel/fertilizer prices, price of soybeans, etc.). The following equilibrium conditions permit a solution of the model for equilibrium prices and quantities:

(7) $Q_s = Q_{df} + Q_{dx} + Q_{de}$, and
(8) $P_d = P_s$.

To implement this model in an investigation of ethanol blend limits, own price elasticity of supply, β_s, is assumed to be 0.469 as estimated by Marsh (2007). Own price elasticities of

[4] For 2008/09, USDA projects lower use by both the feed and export sectors but higher use by the ethanol sector compared to 2007/08, despite basically no change in market prices (USDA Office of the Chief Economist).

demand for feed and exports, β_f and β_x, are assumed to be -0.2978 and -0.2644, respectively, as estimated by Park and Fortenberry (2007). In the current application of this model, demand for ethanol is assumed to be perfectly inelastic (i.e., $\beta_e = 0$)[5]. Intercepts for all equations are set at levels yielding a level of corn use and price corresponding to current 2008/09 marketing year estimates from the March *World Agricultural Supply and Demand Estimates* report: 5.3 billion bushels (bbu) for feed use, 1.7 bbu for export, 3.7 bbu for ethanol production, and $4.10 per bushel marketing year average price (US Department of Agriculture Office of the Chief Economist, 2009).

EPA's RFS requirement calculation from equations 1 and 2 can be used to define a reasonable shock to corn demand from the ethanol sector due to a change in blend requirements. Specifically, the desired blend requirement is substituted on the left-hand side of equation 1 for RFS_i. Using EPA numbers from the denominator of equation 2, the equation is then solved for the ethanol volume (RFV_i in equation 1) corresponding to the specified blend percentage. Using a corn:ethanol conversion rate of 2.75 bushels per gallon (Hart and Babcock, 2007), this volume can then be converted into the necessary quantity of corn. A shock that shifts corn demand from the ethanol sector to that level is then applied to the corn supply/demand model, and the model is solved for the new equilibrium. Note here the assumption that corn demand from the ethanol sector would remain perfectly inelastic after the change in the blend limit. This implies that refiners blend all the way up to the new blend limit. This is a very strong assumption. How much ethanol refiners blend will be influences by a number of factors including relative prices of crude oil and ethanol and RFS mandate requirements. Based on these facts, results presented here should be considered upper bounds on the potential impact of a change in the blend limit. Note, however, that this assumption is consistent with the analysis of Hodur, Leistritz, and Senechal presented to EPA in support of the blend limit waiver.

To begin, we consider the effect of a change in the blend limit from the current 10% to 12.5% -- consistent with what Secretary of Agriculture Vilsack has stated that he would like to see quickly implemented by EPA (USDA Office of Communications). Based on the procedure outlined in equation 1 and the EPA gasoline production/use figures in equation 2, blending to 12.5% would require 13.63 billion gallons of ethanol and, by extension, 4.958 bbu of corn. To explore impacts in the current and the upcoming marketing year, we assume that this increase in blending would begin in May. Thus, corn use for ethanol production is shifted to 4.115 bbu in the current marketing year (i.e., 0.67 x 3.7 bbu + 0.33 x 4.958 bbu) and to 4.958 bbu in 2009/10. These represent at 11% and 34% increase in corn devoted to ethanol production, respectively.

Further analysis is performed on a 15% blend limit, the proposal currently before EPA. In that case, corn use to meet the full blend limit amounts to 4.442 bbu in the current marketing year (a 20% increase over current corn use by the ethanol sector) and 5.949 bbu for 2009/10 (a 61% increase).

Table 2 shows the effect on the corn supply/use balance sheet from increase in ethanol blending. Current USDA projections for 2008/09 (reflecting no change in blend limits) are shown in this table as well to provide a point of reference. It should be pointed out that adjustments to the Food, Seed, and Industrial category of use in this table are completely ad hoc. Historically, that

[5] For the short-run analysis presented here, that is not as strong an assumption as it may sound. Anderson and Coble argue for a perfectly inelastic demand curve when RFS mandates are binding. Abbot, Hurt, and Tyner (2009) note that RFS mandates have, in fact, been binding since the fourth quarter of 2008.

category of use changes very little, fluctuating in about a 100 million bushel range over the past ten years. Downward revision of use in that category would occur at some level, however, in the event of increased corn use from the ethanol sector. The adjustments included here reflect that fact and are consistent with the limited information available for that sector.

These results suggest the potential for a major impact on those industries that compete with the ethanol sector for corn from even a 2.5% increase in the blend requirement. In the 12.5% blend scenario compared with the 2008/09 benchmark, feed use is found in this model to decline by about 5% by the end of 2009/10. For the 15% blend scenario, feed use is estimated to decline by almost 9% by the end of 2009/10. It should be pointed out that these adjustments would follow already sharp declines from 2007/08 feed use. Higher costs of production have led to ongoing contraction in the beef, pork, poultry, and dairy sectors. A higher ethanol blend limit could add to the incentive for herd/flock reductions by keeping upward pressure on feed prices and ultimately contributing to higher prices for meat, poultry, and dairy products at the retail level.

The impact of higher corn prices on meat production will be mitigated by the increased availability of by-product feeds (i.e., distiller's grains and related products); however, as recent history has demonstrated, the ability of by-product feeds to offset the effect of higher corn prices is limited for a number of reasons. First, distillery by-products are an imperfect substitute for corn, especially for pork and poultry producers, limiting the degree to which they can feasibly be incorporated into a ration. Second, feeding by-products results in additional costs related to storage, handling, and management (e.g., testing each load for nutrient content) that at least partially offset any favorable price difference. Third, so far by-product prices and corn prices remain closely correlated. [6] If corn prices move higher, the price of substitutes will move higher as well. This relationship may break down for wet distiller's products in certain local markets, but for dry distiller's products, which really have the potential to impact the market at the aggregate level, arbitrage will insure a fairly consistent, direct relationship with the price of corn. The bottom line is that by-product availability will create some slippage between corn prices and meat production, but the general result that higher corn prices will lead to higher costs of production and reduced supply in the meat sector will hold for the foreseeable future. Export use is estimated to decline by 4.5% and 7.8% in the 12.5% and 15.0% blend scenarios, respectively. Again, this would come on top of already-sharp declines from 2007/08 levels.

To provide another perspective on potential changes in corn use, figure 1 shows the various components of corn use as a percentage of the annual total. From this perspective, the reduction in corn use as a feed ingredient has already been dramatic. The move to a higher ethanol blend limit would potentially accelerate an ongoing trend toward the ethanol sector controlling a greater share of the corn market. The shift in feed use is not as dramatic as Figure 1 suggests. As has been widely discussed during the recent surge in ethanol production, distiller's grains (DG, wet and dried) are a major by-product of ethanol production and are useful as a feed source. Figure 2 shows corn for feed use combined with DG use. This figure assumes that DG production amounts to 1/3 the amount of corn used for ethanol production and that all of the DG produced would offset corn use for feed. Figure 2 illustrates the point that the total decline in feed use is not as dramatic as the decline in corn feeding suggests; however, this does change the fact that the replacement of corn with DGs implies significant and often difficult adjustments in

[6] The correlation of weekly dried distillers grains price and CBOT corn futures settlement price from January 2005 thru February 2009 was 95.0%

the livestock sector, mainly reflecting regional differences in by-product availability and differences in the ability of various livestock species to effectively utilize DG as a feedstuff (Lawrence, et al., 2008). Moreover, as just discussed, the availability of DGs offsets, to some degree, the lost quantity of corn, but the impact of higher corn prices is largely reflected in DG prices as well, meaning that the impact on cost of production is not so effectively mitigated.

The stocks-to-use ratios in table 2 also illustrate the potentially large effects of changes in the ethanol blend limit on the corn market. In the first blend scenario, stocks-to-use in the corn market is projected to fall well below 10% -- a level at which prices have tended to become very volatile as market participants become concerned about being able to secure their needs in a very tight market. In the second scenario, stocks-to-use falls to an unrealistically low level, implying that the model used here is not capable of accurately reflecting the level of adjustment that would be required to deal with a 15% blend.

As noted earlier, this analysis shows the effect of quickly moving all the way to a higher blend limit. It is, of course, possible that ethanol blending would not change at all in response to a higher blend cap or that ethanol blending would settle at some intermediate level between the current level and the expanded cap. Similarly, the supply expectations presented in Table 2 are also not known with certainty. A production shortfall in the current production cycle would magnify the market impact of any change in the blend limit, whereas larger-than-expected production in the current cycle would mitigate those market impacts. The point here is that the actual outcome of a change in blend limits is probabilistic rather than deterministic. In that context, then, the baseline figures in Table 2 (i.e., current USDA 2008/09 projections reflecting no change in blending requirements) could be viewed as a lower bound on the market response to changes in the blend limit assuming “normal” production; and the values estimated for a change to 12.5% and 15% blending could be viewed as upper bounds on the market response.

The primary factor influencing actual blend levels will likely be the price of ethanol relative to the price of petroleum. Right now, that price relationship suggests little market impact from a change in blend limits since gasoline is now relatively inexpensive. From the perspective of other participants in the corn market besides ethanol producers, the worst case scenario would be a change in the blend requirement followed by a substantial increase in petroleum prices that would give refiners a strong incentive to blend up to the higher limit. In that event, the numbers in table 2 would likely become a reality. Given the historic volatility of petroleum prices, that outcome should not be entirely dismissed, though it is difficult to assign probabilities to the range of possible outcomes.

In the longer run, one would certainly see a supply response in the corn market to the use and price changes reflected in table 2. Between now and the end of the 2009/10 marketing year, however, the supply response would almost certainly be very small. Any price effects of a change in the blend limit occurring in the next few months would come too late to affect 2009 planting. There could be some relief from a positive supply response in the southern hemisphere. However, Argentina is the major corn producer in that region, and prospects for a significant change in the availability of exports from that country are uncertain to say the least.

Summary and Conclusions

Consumers around the globe have just recently endured the most dramatic episode of food price inflation in at least a generation. While the causes of this episode remain the subject of considerable debate, it is unrealistic to think that the bioenergy policies of developed counties did not play a role. Given this recent experience, it makes sense to carefully consider the potential agricultural and food market impacts of any further changes in these policies. The current narrow focus on the impact of blend limits on automobile performance is, without question, inadequate.

This work adapts an existing model of the corn market to evaluate the short-run effects of an increase in the ethanol blend limit to 12.5% or 15.0% on the various components of corn use (i.e., feed use, exports, ethanol production). The potential impacts of even the smaller increase in blend limits are quite substantial, with the potential to deal a further serious blow to the nation's livestock industries at a time when they are already struggling from an extended period of high costs of production and sluggish demand.

The current economic downturn has had the effect of relieving much of the pressure exerted on corn use and prices through 2007 and much of 2008. Still, though, the significance of ethanol use in the corn market continues to grow, even without factoring in the effect of a higher ethanol blend limit. The actual impact of a higher blend limit is uncertain, mainly due to the uncertainty associated with petroleum prices; but the possibility of major market impacts does exist and should not be ignored. Results of this study argue in favor of approaching any change to current bioenergy policy with considerable caution due to the possibility of severe adverse unintended consequences for other agricultural market participants and, by extension, consumers.

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Table 1. Renewable Fuel Mandates (billion gallons) since 2005

Year	2002 Act[a]	2005 Act[b]	2007 Act[c] *Conventional Ethanol*	*Advanced Bio-fuels*	*Total Mandate*
2004	2.3				
2005	2.6				
2006	2.9	4.0			
2007	3.2	4.7			
2008	3.5	5.4	9.0	0.0	9.0
2009	3.9	6.1	10.5	0.6	11.1
2010	4.3	6.8	12.0	0.95	12.95
2011	4.7	7.4	12.6	1.35	13.95
2012	5.0	7.5	13.2	2.0	15.2
2013			13.8	2.75	16.55
2014			14.4	3.75	18.15
2015			15.0	5.5	20.5

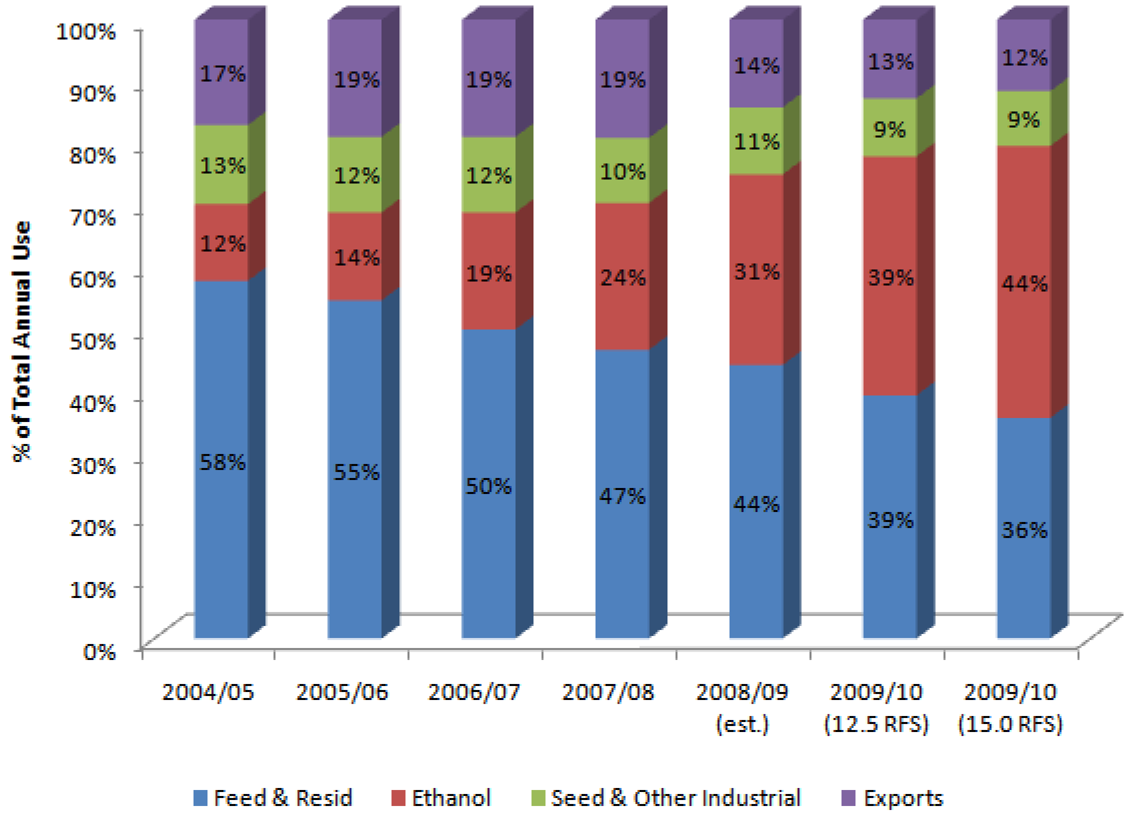
[a] Energy Policy Act of 2002
[b] Energy Policy Act of 2005
[c] Energy Independence and Security Act of 2007
Note: The Energy Independence and Security Act of 2007 includes mandates out to 2022; however, the conventional ethanol mandate remains at 15.0 billion gallons after 2015.

Table 2. Corn Supply/Use Balance Sheet Changes from 2008/09 to 2009/10 under Alternative Ethanol Blending Scenarios

	Baseline	*12.5% blending limit*		*15.0% blending limit*	
	2008/09	2008/09	2009/10	2008/09	2009/10
Planted Acres	86.0	86.0	86.0	86.0	86.0
Harvested Acres	78.6	78.6	78.8	78.6	78.8
Yield (harv. ac.)	153.9	153.9	156.9	153.9	156.9
Beginning Stocks	1,624	1,624	1,492	1,624	1,256
Production	12,101	12,101	12,364	12,101	12,364
Imports	15	15	15	15	15
Total Supply	13,740	13,740	13,871	13,740	13,635
Feed & Residual	5,300	5,209	5,032	5,138	4,838
Ethanol	3,700	4,115	4,958	4,442	5,949
Food, Seed, Ind.*	1,300	1,250	1,200	1,250	1,200
Exports	1,700	1,674	1,623	1,654	1,568
Total Use	12,000	12,248	12,813	12,484	13,555
Ending Stocks	1,740	1,492	1,058	1,256	80
Stocks:Use	14.5%	12.2%	8.3%	10.1%	0.6%
Avg. Price	$ 4.20	$ 4.35	$ 4.88	$ 4.55	$ 5.57

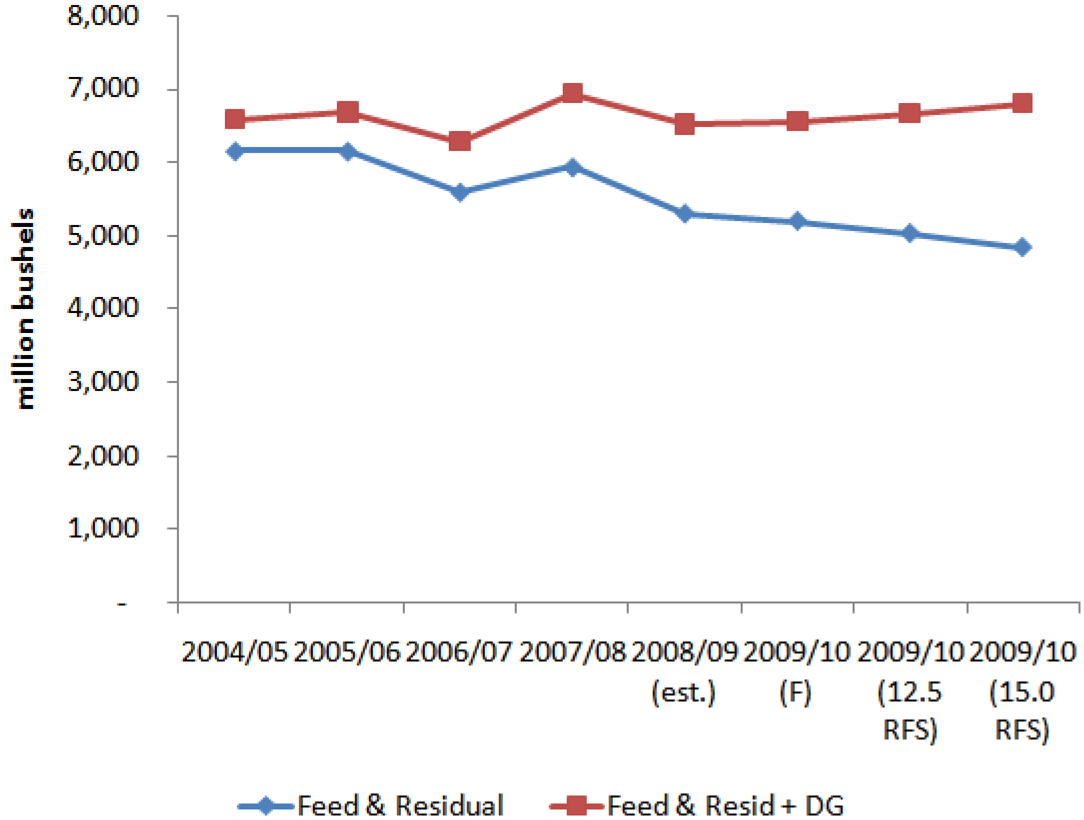
* Industrial uses other than ethanol production.

Note: 2008/09 baseline supply/use figures are taken from the March *World Agricultural Supply and Demand Estimates* report (USDA Office of the Chief Economist). 2009/10 acreage and yield figures taken from *Grains and Oilseeds Outlook for 2009* (USDA Agricultural Outlook Forum, 2009).



Note: 2008/09 (est.) values do not reflect any increase in the ethanol blend limit.

Figure 1. Corn use components as a percent of total use: 2004/05 through 2009/10 (forecast)



Note: Distiller's grains are assumed to equal 1/3 of the annual corn use for ethanol production.

Figure 2. Feed and Residual Corn Use with Distiller's Grains (wet and dry)