Regulation of Fuels and Fuel Additives: Renewable Fuel Standard Program

Summary and Analysis of Comments

Chapter 6
Costs

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

United States
Environmental Protection
Agency

EPA420-R-07-006
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6 COSTS

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What We Proposed:

The comments in this section correspond to Section VII of the preamble to the proposed rule, and are targeted at the projected costs of the program. A summary of the comments received, as well as our response to those comments, are located below.

6.1 Feedstock Costs

What Commenters Said:

The American Petroleum Institute (API) commented that EPA assumes only a 3.6% increase in corn prices between the 7.2 billion gallon use case and the 9.6 billion gallon use cases. Given the implied increase in demand for corn between these cases, API believes that it is likely that the corn price increase will be significantly above 3.6%. Also, corn futures for December 2006 delivery are $3.44 per bushel. API suggested that EPA recheck the production cost estimates and perform some sensitivity analysis using various corn price assumptions.

The commenter stated that it believes the corn ethanol, cellulosic ethanol, and soy-derived biodiesel production cost estimates (71 FR 55608) are of little value because of the volatility in prices on the feedstocks. The commenter stated that it believes that the underlying prices on the feedstocks, the assumed amount of feedstock needed to produce a gallon of ethanol or biodiesel, and the net operational costs are what should have been reported—this would allow for a clearer assessment of the total production costs under alternative prices on feedstock.

Letters:
American Petroleum Institute (API) OAR-2005-0161-0185

Our Response:

Our cost estimates are generally point estimates using the best available information. We then do sensitivities around these estimates. In the case of corn ethanol production, we have updated the RIA to include changes in cost over a range of corn, dried distiller grain (DDGS), and natural gas prices.

The model we used to project agricultural commodity prices (FASOM; see Chapter 8 of the RIA for details) is a long run equilibrium model, so it does not reflect the futures market (typically six months or less). We believe these long run projections are more indicative of sustained prices ethanol producers will pay as the system matures. Like petroleum refiners, ethanol producers generally lock in feedstock contracts for long term production needs, then use spot or near term markets for unforeseen marginal needs.

Three issues remain at the center of estimating cellulosic costs. First, feedstock costs are the most obvious, since no one knows yet which feedstock will be the cheapest; most likely, a variety of feedstocks will be used in different parts of the country. Secondly, no one knows for sure how much ethanol can really be produced by any of the feedstocks in an operation any larger than a laboratory bench. There are a couple of pilot or demonstration-size units, but there are no reliable data. Thirdly, no one has constructed a full-sized, fully-operational cellulosic ethanol plant, so no one knows for sure what the capital or operating costs are going to be; besides which, the capital and operating costs for each different feedstock and/or process will quite likely be different.

6.2 Corn-ethanol Production and Costs

What Commenters Said:

API noted that for corn ethanol, EPA estimated the per gallon cost of ethanol to range from $1.20 per gallon in 2012 (2004 dollars) in the case of 7.2 billion gallons per year case and $1.26 per gallon in the case of the 9.6 billion gallon case. The commenter stated that, in regard to the statement made on page 134 (3rd paragraph) of the Draft Regulatory Impact Analysis (DRIA)[1], the corn ethanol production costs ($1.20 - $1.26 per gallon) seem low, typical estimates seem to be roughly $1.35 to $1.50 per gallon with corn at $2.25 per bushel (this is roughly the corn price used in EPA's analysis), even accounting for DDG sale credits. The commenter noted that EPA assumed only a 3.6% increase in corn prices between the 7.2 billion gallon use case and the 9.6 billion gallon use cases. Given the implied increase in demand for corn between these 2 cases, the commenter stated that it believes that it is likely that the corn price increase will be significantly above 3.6%. Also, corn futures for December 2006 delivery are $3.44 per bushel. The commenter suggested that EPA recheck the production cost estimates and perform some sensitivity analysis using various corn price assumptions. The commenter also noted that EPA assumed that ethanol prices remain constant despite substantial increases in production and consumption (DRIA, p.262). The commenter stated that it believes that a regression model of ethanol prices against gasoline prices (and perhaps other variables), would give a reliable price elasticity coefficient. The commenter further stated that use of this standard economic analysis would allow EPA to develop a yearly forecast of ethanol prices.

Gary-Williams Energy Corporation (GWEC) commented that, according to the ethanol industry, corn production and plants to make ethanol are expected to increase significantly in the Corn Belt over the next decade. The commenter noted that around 97% of the country's current corn-based ethanol plant capacity is in Petroleum Administration District for Defense (PADD) 2 (where the commenter's refinery is located and markets most of its gasoline). The commenter also noted that about 88% of ethanol plants now under construction and 85% of probable new plants will be in PADD 2. The commenter stated that it has been suggested that large refining companies may decide to meet their RFS blending obligations at plants near ethanol production

[1] Page 134, 3rd paragraph: "We have estimated an average corn ethanol production cost of $1.20 per gallon in 2012 (2004 dollars) in the case of 7.5 billion gallons per year and $1.26 per gallon in the case of 9.9 billion gallons per year. For cellulosic ethanol, we estimate it will cost approximately $1.65 in 2012 (2004 dollars) to produce a gallon of ethanol using corn stover as a cellulosic feedstock."

sources – which the commenter believes will decrease the transportation costs and result in an imbalance in the distribution of ethanol, with a concentration in the corn-belt area and lower volumes on the coasts. The commenter stated that in PADD 2, gasoline volume will soon grow by at least 10% if regional refineries elect to blend as much ethanol as possible. As more flex vehicles come into use and retail distribution systems are put in place, the commenter stated that it believes that gasoline volume will increase further – demand is not expected to keep pace and prices will drop below national averages. As a result, the commenter believes that the Corn Belt will enjoy lower gasoline prices than the rest of the country; and further, the benefits provided by ethanol will be concentrated in that area.

A private citizen commented that it believes that the proposal's lack of data on operational costs is a major omission. The commenter suggested that EPA delineate the net operational costs, and also publish the item-by-item net operational costs. The commenter further stated that the proposal has assembled a large amount of information on the subject and will be valuable background for further discussions and evaluations.

Letters:
American Petroleum Institute (API) OAR-2005-0161-0185
Gary-Williams Energy Corporation (GWEC) OAR-2005-0161-0207
Private CitizenOAR-2005-0161-0158, -0159

Our Response:

Please see responses to comments in the previous section on general feedstock costs.

First, we intentionally did not assess the costs of the RFS program based on ethanol prices because the price of ethanol likely does not represent its production cost, particularly because ethanol use is subsidized at 51 cents per each gallon of ethanol and it is priced based on volume relative to gasoline, not energy content. Since our intent is to estimate the real cost to society of the RFS, using ethanol's production cost is more appropriate than its price. For the proposed rule we did estimate different ethanol production costs based on different ethanol demand volumes under the RFS and EIA cases. We estimated ethanol production costs for the proposed rule to be $1.20 per gallon for the RFS case, and $1.26 per gallon for the EIA case. For the final rule cost analysis, we are estimating the ethanol production cost to be $1.26 per gallon for the RFS case and $1.32 for the EIA case. The increases in ethanol production costs assume higher corn and differing DDG prices.

We believe there are multiple factors that will influence where ethanol is most heavily used, and in turn, its impact on gasoline demand and price. It is reasonable that a large volume of ethanol will be blended into gasoline in PADD 2, since distribution costs will be very low and there are mandates or tax incentives in a number of these states. This may result in lower gasoline demand in PADD 2, though this effect should not be surprising, since the purpose of the Renewable Fuels Standard is to decrease our use of and dependence on petroleum (most of which is from imported oil). We believe there will also be economic motivation to use large quantities of ethanol wherever gasoline is relatively expensive or where ethanol has value as a high octane, low-toxicity blendstock. For example, our refinery cost model shows a higher

preference for using ethanol in California and Federal Reformulated Gasoline (RFG) areas over blending all of the gasoline in the Midwest with 10 percent ethanol. However, it is important to point out that the increase in ethanol blended into gasoline will be phased in over time, so the increased ethanol will offset the increased demand for gasoline as opposed to reducing output from refineries.

In the table below are more details from the U.S Department of Agriculture (USDA) corn ethanol production cost model.

Cost details for 81 MMgal/yr corn ethanol plant based on USDA model.

	Natural Gas cents/gal	Coal cents/gal
MATERIAL INPUTS		
Corn Feedstock	87.19	87.19
Caustic	0.46	0.46
Alpha-Amylase	1.19	1.19
Gluco-Amylase	1.73	1.73
Gasoline	10.67	10.67
Sulfuric Acid	0.17	0.17
Lime	0.08	0.08
Makeup Water	0.06	0.06
Urea	0.33	0.33
Yeast	0.37	0.37
Corn Feed Hauling	7.67	7.67
Water	0.69	0.69
Electricity	3.50	4.02
Natural Gas	19.38	0.00
Coal	0.00	6.91
Subtotal	**133.47**	**121.53**
CO-PRODUCTS		
DDGS	-26.67	-26.67
Carbon Dioxide	0.00	0.00
Subtotal	**-26.67**	**-26.67**
TOTAL VARIABLE COSTS	***106.80***	***94.86***
LABOR		
Plant Operators' Salaries	1.31	1.56
Maintenance Salaries	1.18	1.72
Supervision & Administration	1.00	1.31
Employee Benefits	1.04	1.37
Subtotal	**4.53**	**5.96**
OTHER COSTS		
Operating Supplies	0.89	1.29
Maintenance Supplies	1.18	1.72
Insurance & Local Taxes	0.94	1.37
Captial Depreciation	11.81	17.16
Subtotal	**14.82**	**21.53**
TOTAL FIXED COSTS	***19.35***	***27.49***
TOTAL PRODUCTION COST	***126.14***	***122.35***

6.3 Cellulosic Ethanol Production

What Commenters Said:

API commented that personnel at the U.S. Department of Energy (DOE) indicate $2.26 per gallon as an estimate of cellulosic ethanol production costs, in contrast to EPA's cost estimate of $1.65 per gallon.

Letters:
American Petroleum Institute (API) OAR-2005-0161-0185

Our Response:

In that we do not have a reference, other than "DOE personnel," for the $2.26 cost to which API referred [p.15], it is not possible for us to compare the DOE estimate with ours. Several different processes, some of which use different feedstocks, have been proposed for producing cellulosic ethanol. While several of these processes show promise, as of the date of this rule, none has been shown to be 'the best' overall. The choice of feedstock, process, and plant location has been shown to have large impacts on the estimated cost of cellulosic ethanol. Regardless, currently an estimate for producing cellulosic ethanol would necessarily be based on assumptions, for the most part. Since there are no publicly available, "real-world" capital and production costs (including those for gathering, transporting, storing, and feeding the various feedstocks), we decided to use a study prepared by the National Renewable Energy Laboratory, an organization working under contract with DOE, using corn stover as a feedstock. Given the time constraints for finishing this rule, we believe this would provide a reasonable estimate, especially in view of the dearth of real-world data.

6.4 Biodiesel Production

What Commenters Said:

API noted that the proposal estimated production costs of soy-derived biodiesel of $2.06 per gallon in 2004 and $1.89 per gallon in 2012. The commenter noted that current soy costs are roughly $2.00 per gallon, and thus questioned how soy-derived biodiesel production costs could be $2.06. The commenter stated that it believes that a better estimate would be $2.50 per gallon for soy-derived biodiesel. The commenter also stated that, for biodiesel, the cost range is between $1.89 and $2.11 if produced using soybean oil and less if using yellow grease or other relatively low cost or no-cost feedstock.

Letters:
American Petroleum Institute (API) OAR-2005-0161-0185

Our Response:

We based our biodiesel production costs based on oil feedstock prices as forecasted by USDA in 2012 under the RFS mandate and with EIA biodiesel fuel projections. As such, the feedstock prices used are those that are projected to occur in 2012. Additionally, from our biodiesel cost presentation, it is possible for the reader to calculate biodiesel production cost with higher feedstock costs, than those used in our analysis. This can be accomplished, as we provide separate estimates of the effects that feedstock prices and operating cost have on the total production cost of biodiesel. This provides a mechanism to estimate biodiesel production costs with a wide variety of biodiesel feedstock oil prices, in addition to those reflecting current market conditions.

6.5 Distribution Costs

6.5.1 Ethanol Distribution Costs

6.5.1.1 Estimated Ethanol Transportation Costs

What Commenters Said:

API commented that it believes that the estimated ethanol transportation cost of 9.2 cents per gallon is low and should be adjusted. The commenter suggested that EPA check current ethanol shipping rates. The commenter also stated that, according to Jim Jordan and Associates, current regular railcar movements are roughly 17 to 22 cents per gallon from Chicago to Philadelphia, and 15 to 20 cents per gallon if shipped via unit train.

Letters:
American Petroleum Institute (API) OAR-2005-0161-0185

Our Response:

As suggested by the commenter, we compared current ethanol rail shipping cost to the estimated shipping costs in the proposal. The tank cars used to ship ethanol (or biodiesel) by rail are typically not provided by the rail carrier. Some ethanol shippers own their rail cars, but most are leased from a third party. Thus, there are two components to the cost of shipping ethanol by rail: 1) the ethanol freight tariff and associated fuel surcharge assessed by the rail carrier, and 2) cost of leasing the necessary rail tank cars.

We obtained information about current rail car lease rates from various industry sources on the condition that the sources are not identified. Based on this information, we are estimating a current $650 per month lease fee for a 30,000 gallon ethanol rail car, with a single shipment being completed each month by regular rail car movement (i.e., at single car rates), and 1.5 shipments being completed if shipment is made via unit train. We obtained current single car and unit train ethanol freight tariff rates and associated fuel surcharge information from CSX and BNSF rail companies at www.csx.com and www.bnsf.com. We derived current unit train and single car rail ethanol shipping costs by totaling the relevant rail car lease fees, rail tariffs, and fuel surcharges.

Our estimate of the current cost of shipping ethanol from Chicago to Philadelphia is 10 cents per gallon via unit train and 12 cents per gallon at single car rates.[2] The proposal estimated the hub terminal ethanol shipping cost to be 8.4 cents per gallon and the satellite terminal shipping cost to be 10.4 cents per gallon. Thus, current ethanol freight rates from Chicago to Philadelphia rail are approximately 1.6 cents greater than those estimated for Pennsylvania as a whole in the proposal.[3] The Jim Jordan and Associates report referenced by API is a proprietary report to which we do not have access. API did not respond to our solicitation for additional discussion regarding why the cost estimates they reported from shipping ethanol from Chicago to Philadelphia by rail are so much higher (5 to 10 cents per gallon) than the current rail shipping cost that we derived.

Evaluation of the current rail freight cost estimates shows that these are reasonably consistent with the ethanol shipping costs in the proposal. For example, current rail shipping costs from Chicago to Albany New York are 11 cents per gallon if conducted on a single car basis, and 13 cents per gallon if shipped via unit train. The proposal estimated an ethanol shipping cost to New York of 11.4 cents per gallon for hub terminals and 13.4 cents per gallon for satellite terminals. Current rail shipping costs from Southwest Iowa to central California are 20 cents per gallon if conducted on a single car basis, and 16 cents per gallon if shipped via unit train. The proposal estimated an ethanol shipping cost to California of 16.5 cents per gallon for hub terminals and 18.5 cents per gallon for satellite terminals.

We do not believe that the modest differences between current rail ethanol freight rates and the ethanol freight rates estimated in the proposal in themselves necessarily indicate that the estimated ethanol shipping costs in the proposed rule are too low. The ethanol distribution system is currently evolving and we believe there is considerable room for increased efficiencies and concomitant lower shipping costs than those today. The recent precipitous discontinuation of the use of methyl tertiary butyl ether (MTBE) and its replacement by ethanol necessitated the rapid development of an expanded ethanol distribution infrastructure. This rapid expansion may have resulted in temporary spikes in ethanol shipping costs that may explain the higher ethanol freight cost in the report referenced by API.

In conducting our review, however, we identified several areas where it was appropriate to make adjustments to our estimated ethanol freight costs.[4] Incorporating these adjustments, we arrived at an estimated national average ethanol freight cost of 11.3 cents per gallon under the Renewable Fuel Standard (RFS) case (6.67 billion gallons of ethanol per year in 2012) and 11.9 cents per gallon under the Energy Information Administration (EIA) case (9.6 billion gallons of ethanol per year in 2012). This compares to the 9.2 cent per gallon ethanol freight cost estimate for both the RFS and EIA cases in the proposal. We assumed that these freight costs do not include the cost of capital recovery for the distribution facility improvements necessary to handle the increased volume of ethanol under the RFS and EIA cases. Adding in the annualized capital

[2] There currently is no unit train ethanol service from Chicago to Philadelphia. We estimated the Chicago to Philadelphia unit train freight rate by comparing the difference between unit train and single car freight rates in locations where both services are currently available.

[3] In areas where rail is the predominate means of transportation, hub terminal rates are comparable to unit train rates and satellite terminal rates are comparable to single car rates.

[4] See Chapter 7.3 of the RIA for additional discussion of our estimation of ethanol freight costs.

costs, results in a total annual ethanol distribution cost of 12.7 cents per gallon under the RFS case and 13.1 cents per gallon under the EIA case. This compares to the 10.3 cent per gallon ethanol distribution cost estimate for both the RFS and EIA cases in the proposal.

6.5.1.2 Blending and Distribution

What Commenters Said:

Harms Oil commented that it is common in South Dakota for there to be a limitation in the number of entities offering ethanol at a terminal. The commenter noted that there are generally 25 different sellers of gasoline and only 5-10 suppliers of ethanol. The commenter further noted that, as a result of this practice, some blenders have made investments in off-site bulk blending facilities. The commenter stated that it believes that the market has thus shown a need for blending at places other than the pipeline terminal, even when there is renewable product available at the terminal. The commenter stated that it believes that off-site, bulk plant blending of ethanol is less efficient and more costly than pipeline terminal blending. Further, the commenter noted that the only way the renewable product will be sold in a competitive environment, is if the renewable product is offered at a lower price than the product in the terminal. The commenter stated that it believes that retention of the opportunity to offer blended product in the marketplace will foster more competition, and in our opinion, lower the price of the blended product to the consumer.

Letters:
Harms Oil OAR-2005-0161-0220

Our Response:

We designed the final rule to not interfere with current practices of distributing and blending ethanol. Parties who blended ethanol with gasoline downstream of the terminal will continue to be able to do so. Compared to a 3.9 billion gallon per year ethanol use reference case, we estimated 243 additional terminals would install ethanol blending systems to meet the requirement under the RFS for 6.7 billion gallons per year of ethanol use by 2012. Under the 9.6 billion gallon per year ethanol use case projected by the Energy Information Administration (EIA) for 2012, we estimated that 515 additional terminals would install ethanol blending systems. Thus, we expect that the number of terminals that offer ethanol (and ethanol blended gasoline) will increase significantly as the volume of ethanol used increases over time.

6.5.2 Biodiesel Distribution Costs

What Commenters Said:

API commented that it believes that EPA's assertion that the estimated freight costs for ethanol of 9.2 cents per gallon adequately reflects the freight costs for biodiesel is speculation

with no basis in fact. However, the commenter did not provide any specific suggestions regarding how the estimates of biodiesel distribution costs should be amended.

Letters:
American Petroleum Institute (API) OAR-2005-0161-0185

Our Response:

We sought additional information regarding the freight costs for biodiesel. This information indicates that freight costs for biodiesel are typically 30 percent higher than those for ethanol which translates into an estimate of 15.5 cents per gallon for biodiesel freight costs. This estimate is based on our review of publicly available biodiesel and ethanol freight rates from CSX and BNSF rail at www.csx.com and www.bnsf.com, on information regarding the lease rates for biodiesel versus ethanol freight cars considering the smaller size of biodiesel tank cars[5], and on discussions with biodiesel distributors. Including the cost of capital recovery for the necessary distribution facility changes, we estimate the cost of distributing biodiesel to be 21.5 cents per gallon.

6.6 Blending Costs and Impacts on Gasoline Costs

What Commenters Said:

The New York State Department of Environmental Conservation commented that it believes that better use of standard economic analytical techniques could significantly improve the economic analysis of this and future rulemakings. The commenter stated that it believes that EPA's treatment of labor costs as part of fixed plant costs (DRIA p.236) is an unorthodox methodology. The commenter noted that labor costs normally vary with production volume, thus it believes that they should be classified as variable costs in future economic analyses. The commenter also noted that API stated that a regression model of gasoline price against crude oil prices (and other appropriate variables) could provide more reliable estimates of the sensitivity of gasoline prices to crude oil price changes than the price ratios used by EPA in the sensitivity analysis conducted to compare $70 per barrel crude oil to $47 per barrel crude oil.

The Missouri Department of Natural Resources commented that, if RINs prove to be higher in cost/price as they are traded from one entity to another and the RIN value is higher than the equivalent value of the ethanol it replaces, the higher cost would obviously be borne by downstream consumers. The commenter stated that it was unclear if the modeling performed for EPA's cost estimates included an evaluation of the potential cost of RINs subject to the credit program. The commenter also noted that EPA did not account for any tax subsidy for renewable fuels and that these costs represent production costs of the fuel and not the market price (retail). The commenter stated that it believes that it is appropriate for EPA to consider using an inflationary index from base-line year 2004 to 2012 to include a "worse" and "best" case scenario to allow for a range in potential costs through the transition period. The commenter

[5] Ethanol freight cars have a capacity of 30,000 gallons, whereas biodiesel freight cars typically have a capacity of 25,500 gallons.

further stated that it believes that this would be very meaningful in determining the cost-to-retail price relationship and the potential economic impact on the transportation sector. The commenter also believes that this would provide insights to potential excise tax receipts for federal and state governments through 2012 as more renewable fuels are introduced into the nation's transportation fuel stream.

The Missouri Department of Natural Resources commented that it also believes that, while it is important to measure the economic impact of renewable fuels at the production or cost level, it is important to convey the retail price impact of a national renewable fuel policy. The commenter noted that U.S. consumers focus on the price of fuel at the pump, not the cost of product at the factory; thus to affect true market transformation, consumers must perceive renewable fuels not as the rule and not the exception. The commenter thus stated that it believes that EPA should make every effort to identify all related direct and indirect costs, including external costs, related to RFS transition and make its best effort to fully analyze and present this data or information in the final rule.

API commented that it believes EPA's estimates (DRIA, p.135, 2nd paragraph) of overall gasoline costs given the fuel changes assumed (both with and without the subsidy) are low given the underestimates of ethanol production costs, the underestimates of biodiesel production costs, and the underestimates of ethanol transportation costs.

Letters:
American Petroleum Institute (API) OAR-2005-0161-0185
Missouri Department of Natural Resources (MDNR) OAR-2005-0161-0217
New York State Department of Environmental Conservation (NYDEC) OAR-2005-0161-0169

Our Response:

One commenter stated that labor costs should be treated as a variable cost as opposed to a fixed cost. Labor costs may be treated as fixed or variable costs depending on how the laborers are employed by refiners. Regardless of how refiners treat their labor costs, as new refining units are installed, the labor would be expected to be fully utilized with that new refinery unit and the labor cost would be incurred. Thus, assigning the labor costs as fixed or variable costs is only an accounting issue. Also, labor costs are a very small part of the total costs so that even if they are not incurred because a refinery unit was to be shut down, their impact on the remaining cost is very small. For the final rule cost analysis, we used a linear programming refinery model to estimate the cost of the RFS. The linear programming refinery model treats labor as a variable cost.

The commenter said that for our crude oil price sensitivity analysis we conducted for the proposed rule, a more reliable estimate of gasoline price can be estimated with respect to higher crude oil price than that we estimated for the proposed rule. A more robust estimate of gasoline price with respect to crude price can be made, however, we simply wanted to make the point that higher crude oil prices would improve the economics of blending ethanol into gasoline based on a simple order-of-magnitude cost analysis.

One commenter stated that RINs may be higher in price than the equivalent value of ethanol, resulting in a higher cost to the consumer. We try as much as possible to estimate the impact on society based costs instead of prices because prices may estimate higher or lower impacts than production costs and may include transfer payments which are not real costs. In this case, because ethanol receives a subsidy, ethanol could be priced substantially below its production cost. Thus, even if RINs are valued higher than ethanol's market price, the RINs are likely to be valued lower than ethanol's production cost. To avoid these various distortions to the estimated societal cost of the program, we value ethanol based on its estimated production cost. We did provide the estimated impacts based on ethanol's subsidy applied to its production cost. This additional analysis helps to illustrate ethanol's impact on gasoline prices "at the pump." Overall, given that all scenarios project much larger ethanol use than required by the RFS, we do not foresee RINs adding any significant costs to the use of renewables.