CHOICES
The magazine of food, farm, and resource issues
4th Quarter 2013 • 28(4)

A publication of the Agricultural & Applied Economics Association

AAEA Agricultural & Applied Economics Association

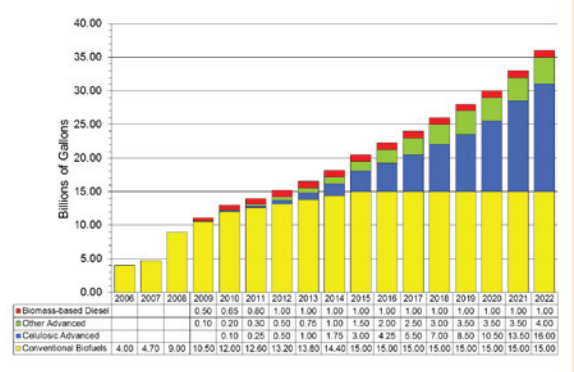
The Renewable Fuel Standard – Where Do We Go From Here?

Wallace E. Tyner

JEL Classifications: Q2, Q13, Q16
Keywords: Biofuels, Ethanol, Renewable Fuel Identification Numbers, Renewable Fuel Standards

The U.S. biofuels industry has been created with the support of government incentives. The first incentive was the National Energy Conservation Policy Act of 1978, which provided a subsidy on blended ethanol equivalent to $0.40/gallon (U.S. Congress, 1978). The subsidy continued in one form or another through 2011. In the U.S., as in other countries around the world, subsidies began to be replaced with mandates primarily because the cost of mandates did not appear on government budgets (Tyner, 2008a; and Tyner, 2008b). The first U.S. biofuels mandate appeared in 2005 legislation (U.S. Congress, 2005), but that Renewable Fuel Standard (RFS) was never really binding. It was soon replaced with the current RFS through the Energy Independence and Security Act (EISA) of 2007 (U.S. Congress, 2007), which is now the main operative biofuels policy.

Figure 1: Renewable Fuel Standard



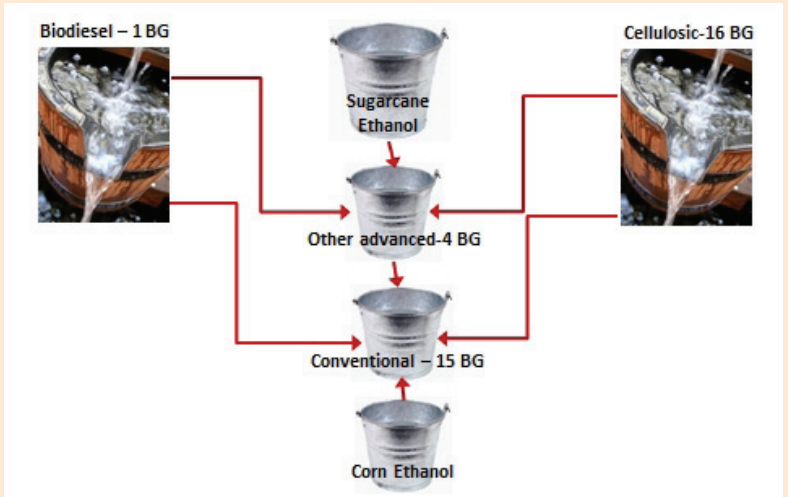
In its proposal for 2014 RFS requirements, the Environmental Protection Agency (EPA) significantly reduced the proposed levels from those contained in the original legislation. EPA cited the lack of progress in commercializing cellulosic biofuels and the ethanol blend wall as significant barriers causing it to depart from the original numbers. After reviewing some of the history of the RFS, its objectives, and how it operates, this article reviews the Environmental Protection Agency's (EPA) implementation and its significantly different proposal for 2014. The article concludes with a discussion of alternatives for moving forward and the consequences of different options.

The EISA RFS

EISA was comprehensive legislation with the biofuels RFS being only a part of it. EISA established a progressively growing mandate for renewable fuels. The main biofuels objectives in EISA were to reduce dependency on foreign oil, reduce greenhouse gas (GHG) emissions, and to enhance rural incomes. Figure 1 shows the evolution of the RFS levels through 2022 for each of the categories of biofuel. The overall level of required biofuels in 2022 is 36 billion gallons (BG) ethanol equivalent. However, with the nesting structure, it is possible to meet the different components of the RFS in many ways.

Even though there are four categories of biofuels, EISA has a nesting structure that makes it somewhat difficult to understand. The general flow of the nesting structure is shown in Figure 2 and each of the four categories of the RFS components are described below.

Figure 2: Nested RFS Structure



- Biomass based diesel—the original maximum mandate for biodiesel was 1 BG, but EPA has now increased that level to 1.28 BG for 2013. In terms of meeting the biodiesel category mandate, the requirement must be met in physical gallons (unlike the other categories); but when counted towards the advanced and total mandates, it is converted to ethanol equivalent, which makes the 1.28 BG biodiesel equal to 1.92 BG ethanol equivalent. The biodiesel category must reduce greenhouse gas (GHG) emissions by at least 50%, compared with the fossil fuel option as defined by the legislation and EPA. It can be transportation fuel, transportation fuel additive, heating oil, or jet fuel. It can be ester-based diesel (e.g., from soybean oil), or non-ester renewable diesel (e.g., from cellulosic feedstocks). Biodiesel (as defined here) is required for the biodiesel part of the RFS. However, biodiesel can also be used to meet the other advanced category or the conventional biofuel category (e.g., corn ethanol).
- Cellulosic advanced biofuel—only biofuels produced from cellulosic feedstocks such as corn stover, miscanthus, switchgrass, forest residues, or short rotation woody crops can count in this category. Cellulosic biofuels must be shown to reduce GHG emissions by 60%. By 2022, 16 BG of cellulosic biofuels are required. Since that is ethanol equivalent, if the biofuel were bio-gasoline, the volume would be 10.67 BG. While no other type of biofuel can meet this category, cellulosic biofuels could, in principle, meet the entire 36 BG ethanol equivalent RFS, if at least 1.28 BG were renewable diesel. However, progress in developing the cellulosic biofuel industry has been slow, and EPA has been forced to waive most of the RFS each year because only tiny amounts of the product have been produced. For example, in 2013, the RFS calls for 1 BG of cellulosic biofuels, but that has been reduced to 14 million gallons—the amount EPA expected to be available in 2013 (U.S. EPA, 2013d). So far, each year that EPA has reduced the cellulosic mandate to near zero, it has not reduced the overall renewable fuel mandate. For 2013, even though the cellulosic category has been reduced from 1 BG to 14 million gallons, the overall mandate remains at 16.55 BG. Thus, the shortfall in cellulosic biofuels must be made up by extra biodiesel or non-cellulosic advanced biofuels (including sugarcane ethanol).

  One other important point in the cellulosic category is that in any year that EPA waives any part of the cellulosic RFS, blenders have an option to buy their way out of blending instead of actually blending (U.S. Congress, 2007; and Tyner, 2010). To buy out of blending, obligated parties must purchase a credit from EPA plus purchase an advance biofuels RIN. The price for the credit in 2013 is $0.42/gal., and the November 20, 2013, price of an advanced biofuel Renewable Fuel Identification Numbers (RIN) was $0.21/gal. Thus, the total cost of buying out of the RFS obligation would be $0.63/gal. Converting that to gasoline equivalent, assuming it would be valued on an energy basis, would make it $0.95/gal. As of November 20, 2013, wholesale gasoline was $2.66/gal., so the maximum one would pay for cellulosic biofuel is $3.61/gal. gasoline equivalent. At present, there is no cellulosic biofuel available for that price. The consequence of this "off ramp" is that the cellulosic part of the RFS may not really be a binding mandate.
- Other advanced—this category can be a wide range of biofuels that reduce GHG emissions at least 50%. Sugarcane ethanol that meets the GHG reduction standards qualifies. Biodiesel qualifies. Cellulosic biofuels can be used. Recently, EPA approved sorghum ethanol produced under certain conditions. Corn ethanol cannot be used for this category.
- Conventional biofuels—this category is the only one that permits corn-based ethanol. It requires a

reduction in GHG emissions of at least 20%. However, ethanol plants that were in operation or under construction as of December 2007 are grandfathered and need not meet the GHG reduction requirement. The RFS level is 13.8 BG in 2013 and reaches 15 BG in 2015 and remains at that level. In addition to corn ethanol, any of the other biofuel categories also can be used to meet the conventional biofuels category. In fact, technically, there is no mandate for corn ethanol. For example, for 2013, there is an overall mandate of 16.55 BG, of which 2.75 BG must be some form of advanced biofuel (1.0 BG cellulosic, 0.75 BG other advanced, and 1.0 BG biodiesel from Figure 1). The difference between the overall mandate of 16.55 BG and the sum of the advanced biofuels, 2.75 BG, is the amount that can be filled with corn ethanol which would then total 13.8 BG.

The RFS is enforced by creating blending obligations for each type of biofuel. The blending obligations are based on market share for the type of fuel and generally apply to refiners and gasoline or diesel importers. For example, if you are a refiner, and you have 10% of the gasoline market for 2013 with a 13.8 BG total obligation for corn ethanol, you would be required to blend 1.38 BG. To satisfy this blending obligation, you would need to supply to the EPA at the end of the year certificates demonstrating that you have blended 1.38 BG of corn ethanol. These certificates are called RINs. Each category of biofuels has a separate RIN, and there are blending obligations for each category and each obligated party. RINs can be bought and sold in an open market. Most RINs are actually turned in to EPA at the end of the year by the party that blended the fuel. Thus, for most renewable fuel, the RINs are just the mechanism for demonstrating compliance with the blending obligation. RINs are traded by those who expect to blend more than or less than their blending obligation. In general, if the RIN price is near zero, that is an indication that the RFS is not really binding. A higher RIN price suggests that the RFS is driving behavior in the market place. Historically, corn ethanol RINs were usually near zero, but biodiesel and other advanced biofuels were much higher. Now, corn ethanol RINs are priced near biodiesel and other advanced RINs because all three can be used to meet the corn ethanol blending obligation.

One other characteristic of the RINs market that bears mentioning is that RINs for up to 20% of the blending obligation can be carried forward to the next year and used later. In practice what this means is that any carried-forward RINs are used in the subsequent year, and RINs for that year replace the RINs that were used to be carried-forward to the next year. In other words, even though the regulations state that the RINs must be used in the next year, in fact they can be continuously rolled forward.

The Blend Wall

The blend wall refers to a physical limit on blending of ethanol. It is derived from the U.S. practice of blending gasoline with 10% ethanol. 2013 U.S. consumption of gasoline-type fuel is about 133 BG per year. With ethanol being blended at 10%, the maximum ethanol that can be blended is 13.3 BG. There is a small amount of ethanol blended as E85, and a tiny amount blended as E15, but they are really too small to matter for present purposes. As mentioned earlier, the RFS blending requirement for corn ethanol in 2013 is 13.8 BG, and it grows to 15 BG by 2015. Thus, the physical limit on blending is less than the RFS, which makes the blend wall a real constraint. With the projected growth in the RFS over the next two years, it may be impossible to meet the RFS requirements because of the blend wall. The RIN markets in 2013 have reflected the blend wall reality, with considerably higher RIN prices.

RFS Implementation by EPA

As indicated above, in its 2010 implementation of the RFS, the EPA opted for an ethanol equivalent interpretation of the RFS values in the legislation (U.S. EPA, 2010a; and U.S. EPA, 2010b). The importance of this ruling is that it puts all biofuels on a level playing field. For example, drop-in bio-gasoline is expected to have 1.5 times the energy of ethanol, so each gallon of bio-gasoline would carry 1.5 RINs. Therefore, all biofuels produced are credited for their energy content instead of for the physical number of gallons produced.

The other important implementation decision by EPA has to do with handling of the cellulosic waiver. Every year to date, all or part of the cellulosic mandate had to be waived because the cellulosic biofuels were not available. However, EPA has not reduced the biofuels total requirement or the advanced requirement even though it waived the cellulosic part. For 2013, that meant that the total RFS remained at 16.55 BG. Given the nesting structure, that meant that other advanced (primarily sugarcane ethanol) and biodiesel had to fill the void left by cellulosic biofuels. If there was not enough of these biofuels in 2013, carry-forward RINs would have to be used for part of the mandate. The situation gets worse in 2014 if the prior implementation approach had continued. The mandated volumes would exceed physical supply plus carry-forward RINs.

EPA Proposal for 2014

EPA has now recognized that it cannot continue to maintain its current implementation approach. In its final 2013 ruling, EPA signaled that it would change course in 2014 (U.S.

EPA, 2013a; and U.S. EPA, 2013b). On November 15, 2013, EPA issued its proposed 2014 RFS levels (U.S. EPA, 2013c; and U.S. EPA, 2013e). Table 1 contains the original 2014 RFS, the EPA 2014 proposal, and another option to be discussed below. The EPA proposal reduces the total RFS by 2.94 BG, and it reduces the category permitting corn ethanol by 1.39 BG. In fact, the corn ethanol level is even below the blend wall. Therefore, it provides no incentive for expansion of the corn ethanol market or to use all the current installed capacity. EPA has abandoned its previous policy of holding the total constant when it waives most of the cellulosic category. In the EPA 2014 proposal, they explicitly recognize the blend wall, but reduce the corn ethanol category even below that. The ethanol industry claims the EPA does not have statutory authority to reduce the total more than it reduces the advanced categories.

Alternatives for the Future

The lack of progress in developing cellulosic technology combined with the blend wall have changed the renewable fuels landscape. The oil industry and others are actively calling for complete repeal of the RFS. In this section we examine some of the consequences of possible options.

The first option would be to eliminate the RFS completely. Eliminating the RFS would kill the biodiesel and cellulosic biofuels industries immediately because these categories have a low likelihood of being economic without the mandate. Sugarcane ethanol imports also likely would be eliminated or substantially reduced. In the near term, corn ethanol likely would retain a market up to the blend wall as it is currently less expensive than gasoline and provides added octane and oxygen. Over the longer term, it is possible the petroleum industry would develop other octane enhancers to use in lieu of ethanol. To the extent that happened, corn prices could fall substantially.

The second option would be simply to reduce the overall total whenever part of the advanced category was waived. This option would go a long way towards having a viable RFS. It would lower the overall and advanced mandates by the amount of the cellulose waiver. It would require some increased biodiesel production, but these volumes probably would be manageable without substantial distortion of vegetable oil markets. However, it would not solve the blend wall problem long term.

The third option would be to waive the overall total when cellulose is waived and to accommodate the blend wall. This is the approach EPA took in its proposal for 2014. This option deals with both the cellulosic biofuel and the blend wall problems, but it is difficult to determine exactly where the blend wall is or will be given dynamic market adjustments and RIN pricing. For example, in November 2013, the wholesale ethanol price has been about $0.85/gal. lower than wholesale gasoline. That price gap and RIN values could provide a strong economic incentive to produce and sell more E85 (Babcock and Pouliot, 2013). However, if the EPA-proposed ethanol level were maintained, there would be no incentive to produce and sell more E85.

Now we come to a final alternative. Before exploring this option, we must clearly state that any proposed numbers for the 2014 RFS are somewhat subjective and depend on interpretation of many of the factors described in this article. Clearly, Congress intended the RFS to encourage growth of the biofuels industry. Governments only create mandates when the market outcome is not deemed acceptable. However, the market reality has changed since the passage of the RFS in 2007. Then gasoline consumption was 142 BG and was expected to grow. Thus, the blend wall would not have been a problem, but consumption dropped to 133 BG by 2013. In 2007, it was believed that cellulosic biofuels would become economical and be commercially produced by now. That has just begun to happen.

So what do we do? Do we scrap the RFS and forget the cellulosic biofuel potential? By our estimate, drop-in cellulosic biofuels could be economical with long-term oil prices of around $110-$120 per barrel. We have made much progress, but we are not quite there yet.

Do we drastically reduce the RFS and stymie future biofuels growth as implied by the 2014 EPA proposal? Either is possible.

However, we think another in-between option should be considered, and that is shown in the last column in Table 1 (Tyner, 2013). It reduces the 2014 RFS by the amount of the 2014 cellulosic level of 1.75 BG. It reduces the category permitting corn ethanol by 0.5 BG recognizing the

Table 1: 2014 RFS Alternatives (billion gallons)

Category	Original 2014 RFS	New 2014 EPA Proposal	Alternative Option
Cellulosic	1.75	0.017	0.03
Biodiesel	1	1.28	1.5
Advanced	3.75	2.2	2.5
Other advanced	0.5	0.263	0.22
Corn ethanol	14.4	13.01	13.9
Total	18.15	15.21	16.4

blend wall but also recognizing the potential to pull more E85 into the market. It also increases biodiesel to 1.5 BG in recognition of the much higher level it has already achieved in the market. While there is no magic in these precise numbers, we believe they represent a possible viable option for the future that keeps renewable fuels growing as intended by Congress while at the same time recognizing market reality.

For More Information

Babcock, B. and Pouliot. S. (2013). Price it and they will buy: how E85 can break the blend wall. (August).CARD Policy Brief 13 PB-11. Iowa State University.

Tyner, W.E. (2013) The renewable fuel standard at a crossroads. (November 18). Available online: : http://www.pennenergy.com/index/blogs/energy-and-environmental-economics.html

Tyner, W.E. (2010) Cellulosic biofuels market uncertainties and government policy. Biofuels 1(3): p. 389-91.

Tyner, W.E. (2008a). The global impacts of US and EU biofuels policies, in Sugarcane ethanol: contributions to climate change mitigation and the environment, P. Auurbier and J. van de Vooren, editors. Wageningen Academic Publishers. p. 181-97.

Tyner, W.E. (2008b). The US ethanol and biofuels boom: its origins, current status, and future prospects. *BioScience* 58(7): p. 646-53.

U.S. Congress. (2007). Energy independence and security act of 2007. H.R. 6, 110 Congress, 1st session. Washington, D.C.

U.S. Congress. (2005). Energy policy act of 2005, Public Law 109-58. Washington, D.C.

U.S. Congress. (1978). National energy conservation policy act, Public Law 95-619, 95th Congress (1977-78), H.R.5037. Washington, D.C.

U.S. Environmental Protection Agency. (2013a). 40 CFR part 80, regulation of fuels and fuel additives: 2013 renewable fuel standards. (August 6). Washington, D.C.

U.S. Environmental Protection Agency. (2013b). EPA finalizes 2013 renewable fuel standards. (August 6). Washington, D.C.

U.S. Environmental Protection Agency. (2013c). EPA proposes 2014 renewable fuel standards, 2015 biomass-based diesel volume. (November). Washington, D.C. Available online: http://www.epa.gov/otaq/fuels/renewablefuels/documents/420f13048.pdf.

U.S. Environmental Protection Agency. (2013d). Regulation of fuels and fuel additives: 2013 renewable fuel standards. Federal Register 78(26). p. 9282-9308.

U.S. Environmental Protection Agency. (2013e). 2014 standards for the renewable fuel standard program. 40 CFR Part 80. (November). Washington, D.C. Available online: http://www.epa.gov/otaq/fuels/renewablefuels/documents/rfs-2014-standards-nprm-11-15-13.pdf

U.S. Environmental Protection Agency. (2010a). Part 80 - Regulation of fuels and fuel additives. Washington, D.C. p. 120 pp.

U.S. Environmental Protection Agency. (2010b). Subpart M - renewable fuel standard, Environmental Protection Agency, editor. p. 120.

Wallace E. Tyner (wtyner@purdue.edu), is the James and Lois Ackerman Professor in the Department of Agricultural Economics, Purdue University, West Lafayette, IN.