farmdoc DAILY

Department of Agricultural and Consumer Economics, University of Illinois Urbana-Champaign

The Ethanol Blend Wall, Biodiesel Production Capacity, and the RFS…Something Has to Give

Scott Irwin and Darrel Good

Department of Agricultural and Consumer Economics
University of Illinois

February 13, 2013

***farmdoc daily* (3):27**

Recommended citation format: Irwin, S. and D. Good. "The Ethanol Blend Wall, Biodiesel Production Capacity, and the RFS…Something Has to Give." *farmdoc daily* (3):27, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, February 13, 2013.

Permalink: http://farmdocdaily.illinois.edu/2013/02/ethanol-blend-wall-biodiesel-rfs.html

We have had a number of posts in in the last year addressing issues associated with U.S. biofuels policy. In particular, we noted in the post found here that the new era of higher crop prices that began in late 2006 could be extended well into the future as a result of the Renewable Fuels Standard (RFS) for advanced biofuels which in all likelihood could only be met with a rapid expansion in biodiesel production. That analysis is revisited here based on additional information, including the mandated RFS volumes of biofuels for 2013 recently released by the U.S. Environmental Protection Agency (EPA). Our focus is on the increasing difficulty of meeting the RFS for both renewable biofuel (domestically produced ethanol) and advanced biofuels in the next 12 to 18 months. This issue is quickly coming to the forefront as the total mandate for biofuels continues to increase sharply–from 16.55 billion gallons this year to 20.5 billion gallons in 2015. Most importantly, the mandates could exceed the capacity to produce and/or blend biofuels by a substantial amount as soon as mid-2014.

We start with the advanced RFS and a potential scenario for meeting those requirements for the next three years (Table 1). The advanced RFS is for 2.75 billion gallons this year, 3.75 billion gallons next year, and 5.5 billion gallons in 2015. The advanced component of the RFS can be met with cellulosic ethanol, biodiesel, imported Brazilian sugar cane-based ethanol, or using accumulated credits (in the form of RINs) generated from previous discretionary blending (several other pathways have been approved but these are not expected to be large contributors to meeting the RFS over the next three years). Our expectation is that cellulosic ethanol will be available in very minimal quantities in the next three years. EPA, for example, has reduced the RFS for cellulosic ethanol in 2013 from one billion gallons to 11 million gallons (14 million gallons of ethanol equivalence). We assume a cellulosic RFS mandate of essentially zero for the three-year period. The RFS for 2013 requires a minimum of 1.28 billion gallons of biodiesel blending. A minimum of one billion gallons is required in each of the next two years, but we assume the current minimum of 1.28 billion will be extended for 2014 and 2015. Each gallon of biodiesel receives 1.5 gallons of credit for meeting the RFS so that production of 1.28 billion gallons counts as 1.92 billion gallons. The difference between the total RFS and 1.92 billion then has to be met with undifferentiated advanced biofuels, in the form of either additional biodiesel or Brazilian ethanol, or by using accumulated credits (in the form of RINs) generated from previous discretionary blending.

Table 1. Advanced RFS for 2013 and Assumed for 2014-2015--Billion Gallons

Calendar Year	Total	Cellulosic	Biodiesel	Undifferentiated Biodiesel	Undifferentiated Brazilian Ethanol
2013	2.75	0	1.28	0.00	0.50
2014	3.75	0	1.28	0.89	0.50
2015	5.50	0	1.28	2.05	0.50

Notes: Each gallon of biodiesel receives 1.5 gallons of credit toward meeting RFS mandates. Undifferentiated biodiesel in 2013 is assumed to be zero due to the use of 220 million gallons of D4 biodiesel RINS credits.

An important question is the mix of biofuels that will be used to meet the undifferentiated portion of the RFS. Based on our earlier analysis, the re-instatement of the biodiesel tax credit of $1.00 per gallon makes biodiesel economically more attractive than Brazilian ethanol for meeting the advanced RFS. It could be argued that unless price relationships or tax policy changes, the U.S. will import minimal amounts of Brazilian ethanol over the next three years. Here, we assume annual imports near the 2012 level of 500 million gallons. An analysis of alternative import levels is very straightforward. The remaining undifferentiated RFS is assumed to be met with biodiesel, remembering that each gallon receives 1.5 gallons of RFS credits, or with the current stock of biodiesel (D4) RINs. We assume that the current stock of D4 RINs is completely depleted to meet 330 million gallons (in ethanol equivalents) of the RFS in 2013. Under these assumptions, domestic biodiesel production needed to meet the advanced RFS increases from 1.28 billion gallons this year to 2.17 billion gallons in 2014 and 3.33 billion gallons in 2015.

Next, we consider the RFS for renewable biofuels (domestically produced ethanol) and the implications for U.S. ethanol production and corn demand (Table 2). It should be emphasized that quantities of ethanol included in Table 2 are in terms of 100 percent ethanol, whereas commonly reported ethanol production and trade data include small quantities (currently about two percent) of denaturant. Notice also that the volumes of ethanol imports in Table 2 are the same as the volumes of undifferentiated Brazilian ethanol in Table 1. This reflects the assumption that ethanol imports into the U.S. are driven entirely by the advanced RFS requirements. The (implied) RFS mandate for renewable biofuels is 13.8 billion gallons in 2013, 14.4 billion gallons, in 2014, and 15 billion gallons in 2015. The renewable mandate can be met by blending U.S. produced ethanol, blending advanced biofuels in excess of the advanced RFS, or using accumulated credits (in the form of RINs) generated from previous discretionary blending.

Table 2. U.S. Ethanol Balance Sheet and Implied Corn Consumption for 2013-2015---Billion Gallons except Corn

Calendar Year	Ethanol					Corn
	RFS	Consumption	Imports	Exports	Production	Consumption (bil. bu.)
2013	13.8	12.9	0.50	0.50	12.90	4.61
2014	14.4	13.1	0.50	0.50	13.10	4.68
2015	15.0	13.4	0.50	0.50	13.40	4.79

Note: Assumes zero stock change each year. All ethanol variables exclude denaturant volumes.

A central question is the maximum amount of ethanol that can be blended into the domestic motor gasoline supply each year, or the size of the so-called blend wall. For 2013, we estimate the blend wall at 12.9 billion gallons of pure ethanol (slightly smaller than our previous estimate). That is about the level of domestic consumption in each of the previous three years and reflects maximum penetration of the E10 market and about 100 million gallons of E85 consumption. The size of the blend wall in 2014 and 2015 depends on the magnitude of consumption of motor gasoline and the pace of expansion of E85 and E15 consumption. Here we assume that motor gasoline consumption is stagnant, consumption of E15 remains extremely low, and that annual E85 consumption increases by 200 million gallons in 2014 and another 300 million gallons in 2015. This magnitude of increase is in line with the current EPA estimate of E85 fuelling capacity. However, our recent analysis suggests that increases of that magnitude would require much lower ethanol prices relative to gasoline prices than those prevailing at the current time. Large corn crops in each of the next two years, resulting in lower ethanol prices, in combination with high gasoline prices might make E85 more economically viable, but given current infrastructure limitations our assumption regarding future increases in E85 consumption actually may be viewed as somewhat optimistic.

Based on the assumption of the size of the blend wall, and assuming equal amounts of U.S. ethanol exports and imports, domestic ethanol production would increase from 12.9 billion gallons in 2013 to 13.1 billion in 2014 and 13.4 billion gallons in 2015. Assuming production of 2.8 gallons of pure ethanol per bushel of corn, the use of corn for ethanol production would increase from 4.61 billion bushels in 2013 to

4.79 billion in 2015. So, corn consumed for domestic ethanol production will remain at a historically high but stable level. Future growth prospects under these assumptions look dim.

A key point is that annual production and consumption of domestic ethanol in Table 2 falls short of the RFS in each year. As mentioned earlier, that shortfall can be met either with existing stocks of ethanol (D6) RINs generated from previous discretionary blending of ethanol or from discretionary blending of advanced biofuels (D4 or D5 RINS) during the current year. The EPA estimates the stock of D6 RINs at the start of 2013 at about 2.6 billion gallons (Table 3). In the scenario presented here, consumption of domestically produced ethanol (production minus exports) would fall short of the RFS by 1.4 billion gallons in 2013, 1.8 billion gallons in 2014, and 2.1 billion gallons in 2015. If the shortfall was met with the existing stock of D6 RINs, those stocks would be exhausted sometime in 2014. Once the stock of RINs is depleted, the gap between the renewable RFS and actual blending would have to be met with discretionary blending of advanced biofuels. Here, we assume that renewable gaps of 600 million gallons in 2014 and 2.1 billion gallons in 2015 are met with discretionary production and blending of biodiesel (Table 4). Those gaps would be filled with 400 million gallons of biodiesel in 2014 and 1.4 billion gallons in 2015 since each gallon receives 1.5 gallons of credit toward the RFS.

Table 3. U.S. Renewable (D6) RINS Stock--Billion Gallons

Calendar Year	Beginning	Mandate - Production	Exports	Ending
2013	2.6	0.9	0.5	1.2
2014	1.2	1.3	0.5	-0.6
2015	0.0	1.6	0.5	-2.1

Table 4. U.S. Biodiesel Production for 2013-2015--Billion Gallons except Feedstock

Calendar Year	Mandate	Undifferentiated Biodiesel Gap	Renewable Gap	Total	Feedstock Requirement (bil. lbs.)
2013	1.28	0.00	0.00	1.28	9.6
2014	1.28	0.89	0.40	2.57	19.3
2015	1.28	2.05	1.40	4.73	35.5

As a result of the assumed blend wall for ethanol and modest imports of Brazilian ethanol, the production and blending of domestic biodiesel to meet the sum of the biodiesel mandate, the undifferentiated biofuels mandate, and the renewable biofuels gap increases from 1.28 billion gallons in 2013 to 2.57 billion gallons in 2014 and 4.73 billion gallons in 2015. It is somewhat counterintuitive, but these estimates of biodiesel requirements do not change if one alters the assumed level of Brazilian ethanol imports or cellulosic ethanol production. For example, larger Brazilian ethanol imports or cellulosic ethanol production reduce the need for biodiesel to meet the advanced RFS, but under a blend wall constraint this increases the RFS renewable mandate gap by exactly the same amount since the Brazilian ethanol imports or cellulosic ethanol displace domestic ethanol. This increased renewable gap would have to be filled by biodiesel production and the total amount of biodiesel is the same as before. This is an important illustration of how the blend wall and the RFS mandates can create “hidden” relationships between production levels for different types of biofuels.

Our analysis leads directly to the conclusion that full implementation of the RFS in 2013-2015 leads to an unprecedented boom in domestic biodiesel production. This is problematic for two reasons. First, we do not currently have the capacity to produce all the biodiesel required. The U.S. Energy Information Agency currently estimates capacity at 2.1 billion gallons annually. That estimate likely does not include idled capacity. The National Biodiesel Board estimates total production capacity at just over 3 billion gallons. Substantial capacity would need to be added in a very short period of time to meet the biodiesel requirements stemming from the current RFS and the expected ethanol blend wall. Second, the increase in biodiesel feedstock requirements would simply overwhelm feedstock markets. We project that feedstock requirements (vegetable oils, animal fats, recycled feeds) grow from 9.6 billion pounds in 2013 to 19.3 billion pounds in 2014 and 35.5 billion pounds in 2015. These requirements are huge relative to current feedstock supplies. For the 2010-11 marketing year, for example, the USDA estimated the total

domestic supply (including imports) of vegetable oils, lard, and edible tallow at 33.1 billion pounds, which is less than the feedstock requirements for biodiesel production in 2015. Meeting the implied feedstock requirements for biodiesel production would likely result in sharply higher feedstock prices and require a major shift in crop production to oilseed crops, not only in the U.S. but in other important production regions such as Brazil and Argentina. Higher feedstock prices, at least temporarily, could substantially alter the blending economics of biodiesel as well.

Conclusions

In short, something has to give with respect to implementing the RFS mandates between now and 2015. One source of "give" is a much more rapid expansion in the blend wall stemming from large increases in consumption of E85 and/or E15. Entirely eliminating the gap between the renewable mandate and domestic ethanol production (net of exports) would require about 2 billion gallons of ethanol in the form of additional E85 or E15 consumption by 2015. However, even this very large increase in ethanol consumption would not necessarily slow the projected biodiesel boom since the advanced RFS mandate increases so sharply. Even if the renewable gap is reduced to zero through increased E85 or E15 use, biodiesel production in 2015 would need to reach 3.33 billion gallons, which exceeds current biodiesel production capacity. Of course, the undifferentiated advanced mandate could be met by increased Brazilian ethanol imports instead of biodiesel, but this would require another 3 billion gallon increase in domestic E85 or E15 consumption. It seems unlikely that E85 consumption could increase from around 100 million gallons today to a total of 5 billion gallons in 2015. This far exceeds the current E85 fueling infrastructure (around 600 million gallons per year). As we have discussed in several previous posts (for example, here), we are also skeptical that E15 consumption could increase anywhere near the needed 5 billion gallons by 2015 due to a variety of limitations.

The second source of "give" is in the EPA rules for implementing the RFS. To date, the EPA has only chosen to write down the cellulosic component of the advanced mandate. The EPA has not elected to write down the total RFS mandate or the total advanced mandate even though the cellulosic component has been written down. This effectively means that the cellulosic mandate has been transferred to biodiesel and Brazilian ethanol imports. Reversing this policy and writing down the totals at the same time that cellulosic is written down would not entirely solve the near term problems of implementing the RFS but it would provide much needed breathing room for the markets. The EPA has the statutory authority to write the advanced mandate down to at least the existing biodiesel production capacity if not further. This may be the only realistic path for implementing the RFS in the next several years.