# Analysis of the Potential Use of Biofuels toward the Renewable Fuel Standard in 2014

*Prepared for the Renewable Fuels Association*
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## Key Findings

- It is possible for all statutory components and allocations within the Renewable Fuel Standard to be met in 2014, after adjustments have been made for a waiver of a large majority of the Cellulosic Biofuel Standard.
  - For this to occur, the EPA would need to move expeditiously to issue a final rulemaking reflecting Total Advanced Biofuel and Total Renewable Fuel Standards that are higher than the agency proposed in November, so that obligated parties can adjust their procurement and operations accordingly.
- Total U.S. consumption of ethanol can expand by approximately 4% in 2014 if the right mix of policy/regulatory and economic signals is in place.
  - E85 accounts for most of the potential for expanded consumption.
  - The increase could be even larger if E85 is priced at a sustained discount to gasoline (on an energy-equivalent basis), as the consumer response could be stronger than implied by historical data, since discounts have been transitory in the past.
- Prices of Renewable Identification Numbers would need to rise above recent levels to facilitate expansion of ethanol consumption and effective compliance with the Renewable Fuel Standard, but the associated prices would be considerably below the peaks reached in 2013.

## Background and Objectives

The Renewable Fuel Standard was established in the Energy Policy Act of 2005. Two years later, the Energy Independence and Security Act of 2007 (EISA) expanded the previous biofuel usage targets dramatically and allocated the expanded standard (now known as RFS2) among specific categories of biofuels. There are four standards within RFS2, which specify the volumes of biomass-based diesel (mainly biodiesel) and cellulosic biofuels that must be used, along with requirements for the total consumption of advanced biofuels (defined as having 50% lower greenhouse gas emissions) and renewable fuels as a whole. The standards are nested, in that the usage of fuels under the Cellulosic Biofuel and Biomass-based Diesel Standards counts toward the Total Advanced Biofuel Standard, and the usage of fuels under the Total Advanced Biofuel Standard counts toward the Total Renewable Fuel Standard.

Importantly, there is no specific standard for corn-based ethanol; rather, it is eligible to be used toward the Total Renewable Fuel Standard but not the Total Advanced Biofuel Standard. Similarly, the difference between the Total Advanced Biofuel Standard and the sum of the Cellulosic Biofuel and Biomass-based Diesel Standards is effectively an allocation to “undifferentiated” advanced biofuels (i.e., the form of the advanced biofuels is not specified).

EISA provided for waivers to the RFS2 requirements under specific conditions. In recent years, the Cellulosic Biofuel standard has been largely waived, due to a lack of commercially available volume. However, in November 2013, the EPA proposed substantial cuts to the volumes associated with all RFS2 standards except for the Biomass-based Diesel Standard – for the first time reducing requirements other than the Cellulosic Biofuel Standard.

Informa Economics, Inc. (Informa) was retained by the Renewable Fuels Association (RFA) to analyze the ability of the U.S. fuel supply chain/market to utilize greater volumes of ethanol than reflected in the EPA proposal, and then to formulate a conclusion as to whether the 2014 standards – specifically the 14.4-billion-gallon allocation for which corn-based ethanol is eligible – could be met in a manner consistent with EISA. This report contains Informa's findings.

## Mechanisms and Constraints to Meeting RFS2

Longstanding EPA regulations limited the ethanol content of gasoline to 10% of fuel sold for use in non-flex-fuel vehicles, a blend referred to as E10. Flex-fuel vehicles (FFVs) are the only automobiles in which high-level blends – typically E85 – could be used. The main reason for the EPA's consideration of a reduction in the RFS2 standards is that the U.S. fuel supply reached an ethanol "blend wall" during parts of 2013, a point at which E10 blends are used in as much of the nation's gasoline supply as is practical.

In light of the E10 blend wall, there are three primary mechanisms that can be used toward meeting the Total Renewable Fuel Standard in 2014:

- The application of renewable identification numbers (RINs) carried over from 2013.
  - A RIN is a 38-digit code representing a specific volume of renewable fuel. RINs are generated by a producer or importer of renewable fuel, and once the fuel is blended, the separated RINs can be used for compliance purposes, held in inventory for future compliance, or traded.
- The use of ethanol blends above E10, most notably E85 but also E15 and mid-level blends (MLBs).
- The use of biomass-based diesel and other non-ethanol advanced biofuels in excess of the applicable standards, with the excess RINs used for compliance with the Total Renewable Fuel Standard.

In October 2010, the EPA approved a waiver for the use of E15 in marketing year 2007 and newer light-duty motor vehicles, and in January 2011 the EPA expanded the waiver to cover marketing year 2001 and newer light-duty vehicles. In July 2012, E15 was offered for sale for the first time at a station in Lawrence, Kansas. As of January 2014, there are 70 stations offering E15, according to the RFA. The expansion of E15 has been hindered by several issues:

- A number of states have laws and/or regulations that prevent the introduction of E15 into commerce.
  - As of this writing, there are 15 states where no laws or regulations prevent the sale of E15: Arkansas, Kansas, Illinois, Indiana, Iowa, Michigan, Minnesota, Nebraska, North Carolina, North Dakota, Ohio, Pennsylvania, South Dakota, Texas and Wisconsin.
  - There are also rulemaking efforts in at least four other states that could clear the way for the sale of E15 in 2014.
  - On the other hand, at least five states limit the ethanol content of gasoline to 10%, including two of the largest gasoline-consuming states, California and New York, as well as Arizona, Nevada and Oregon.
- The EPA did not grant a 1-pound Reid vapor pressure (RVP) waiver for E15 sold from May to September similar to the one that exists for E10, necessitating the use of a lower-RVP blendstock for E15 than for E10 in the summertime.
- The EPA requires that for a retail fuel station to offer E15, it must have compatible storage (e.g., underground storage tanks) and dispensing equipment and prominently display a sticker notifying customers about the fuel.
- There is concern by fuel manufacturers and retailers regarding lawsuits that could be brought by automobile owners who allege negative experiences from using E15.
- For vehicles manufactured since 2001, owner's manuals often specify that only blends up to 10% ethanol are to be used, and there is concern that the use of E15 could cause manufacturers' warranties to be voided.

Given these constraints, the volumes of ethanol that can be accounted for by E15 sales are likely to be limited in 2014. Informa estimates that the potential is in the range of 5-10 million gallons in 2014, although the announcement on January 15 that convenience store operator MAPCO Express will begin offering E15 and has a goal of expanding the program to 100 stores could be additive to this estimate, depending on the pace of the roll-out. (Murphy USA also recently began offering E15 at an Arkansas location and might be planning further expansion.) Instead, greater E85 usage will have to be relied upon to overcome the 10% blend wall in the near term.

## Responsiveness of E85 Sales to RIN Prices

In 2013, prices of conventional ethanol RINs (also referred to as D6 RINs) rose to levels that were multiples of any that had been experienced previously, spiking to nearly $1.50 during the summer. This occurred after market participants began to realize in early 2013 that ethanol usage could fall short of the level needed to meet RFS2, partially as a result of the 2012 drought that reduced the size of the corn crop. D6 RIN prices receded from record levels in late summer, and then they plummeted in the fall as it was reported and then confirmed that the EPA was going to propose significant reductions in the RFS volumes required for 2014.

The experience in 2013 was instructive as to the ability of higher D6 RIN prices to enhance the competitiveness of E85 at retail. Informa analyzed the relationship

between the E85 price discount to gasoline (E10) and monthly E85 station sales, as well as the relationship between the E85 price discount and RIN prices. Data from a number of sources was utilized, including the Minnesota Dept. of Commerce, which reports monthly E85 sales and price data from roughly 170 E85 stations across Minnesota; the Iowa Dept. of Revenue; and data collected from a large operator of E85 stations across the Midwest and individual station data from three other fuel marketers, which was provided to Informa under non-disclosure agreements[1].

## Brief Background on E85 Economics

The energy content of E85 is roughly 75% of gasoline, implying that a 23% E85 price discount is required to achieve cost parity (since E85 contains some gasoline along with ethanol). Consumers using E85 will need to re-fill more often than those using E10, the standard gasoline blend sold at retail. However, it is likely that a price discount greater than 23% is required to incentivize greater E85 usage. There is an inconvenience factor involved in more frequent fill-ups, and given the relatively limited number of E85 stations relative to the number of FFVs, owners of FFVs will generally need to travel greater distances to fill-up using E85.

Historically, cost parity between ethanol and gasoline has not been achieved on a sustained basis (Exhibit 1). After evaluating potential E85 usage given the current FFV fleet and fueling infrastructure relative to historical E85 usage, it can be concluded that economics have generally been the key limiting factor to historical E85 usage and have limited the build-out of E85 stations. For E85 usage to expand significantly, some combination of low ethanol prices relative to gasoline and elevated RIN prices is needed. One way to accomplish this is for the EPA to set biofuel requirements such that blending levels above E10 are required, which will cause RIN prices to rise to levels necessary to incentivize infrastructure build-out and make E85 economical at retail.

## Relationship between E85 Sales and the E85 Price Discount

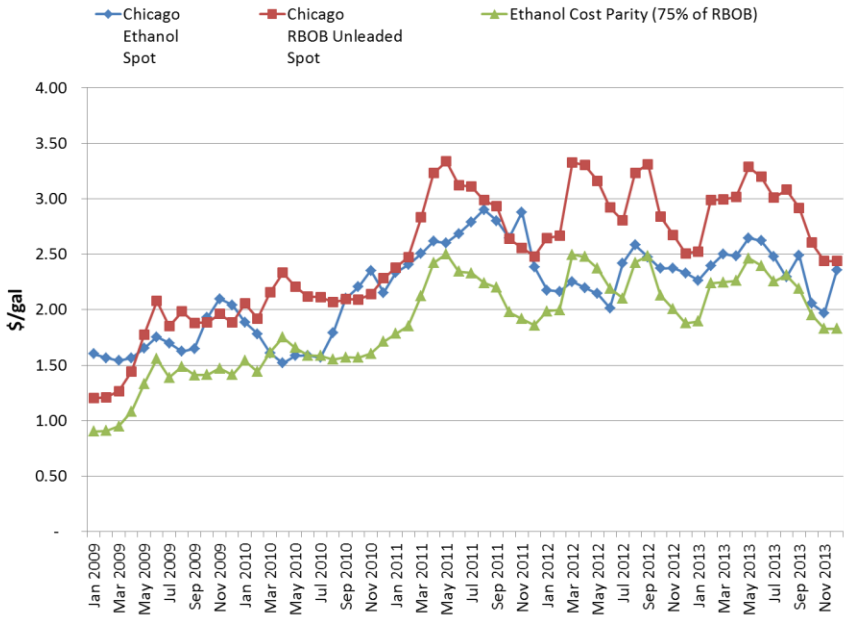
The following highlights key conclusions related to the relationship between E85 sales and the E85 price discount to gasoline (on an energy-equivalent basis).

- There is a notable relationship between E85 sales and the E85 price discount, as illustrated in Exhibit 2 depicting Minnesota E85 sales and price discount data.
  - While the relationship depicted in Exhibit 2 implies a linear relationship between the E85 price discount and monthly E85 sales per station, it is entirely possible that as the E85 price moves below cost parity (~23% price discount) on a sustained basis, there will be an even stronger demand response to further discounts. That is, consumption should increase more rapidly than historical data would indicate when E85 prices are sustained at levels below cost parity to gasoline, since discounts have been transitory in the past. However, due to the lack of historical data for periods when the E85 price discount reaches levels

[1] Data for the large retailer was provided via the RFA, which indicated it had not altered or edited the data. This data was broken into two subsets: an 11 station data set representing an urban area and a 39 station data set representing stations across several Midwest states.

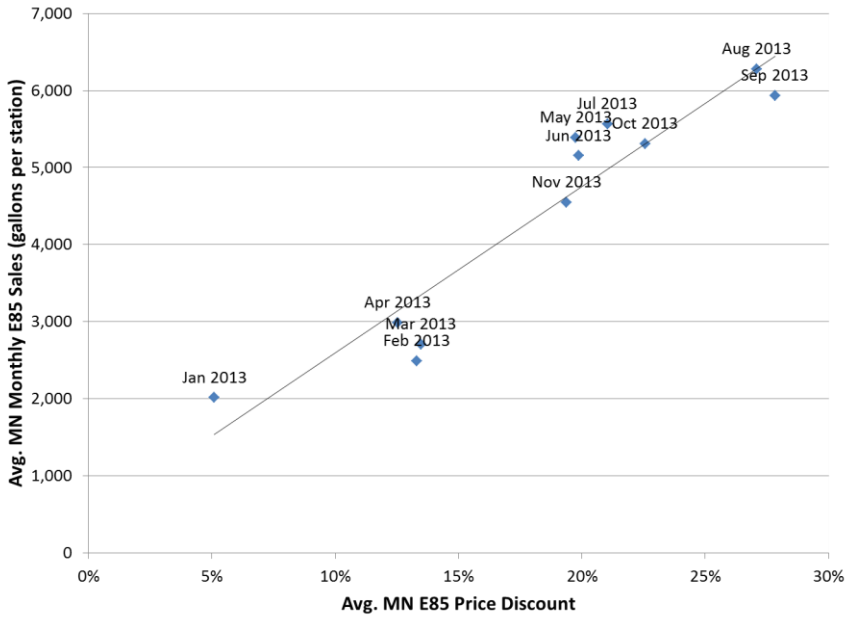
notably above 23% on a sustained basis, Informa has chosen to use the 2013 data as the best, substantiated indication of this relationship, and thus views this to be conservative when evaluating discounts beyond cost parity.

**Exhibit 1: Historical E85 Economics**




Source: OPIS

**Exhibit 2: Minnesota Monthly E85 Station Sales vs. E85 Price Discount**




Source: Minnesota Department of Commerce (E85 Sales), Informa Economics (Analysis)

- E85 stations located in urban areas sell greater volumes of E85 because of the higher overall fuel demand and a greater number of FFVs within a reasonable distance.
  - Based on Informa's analysis, average monthly E85 sales in rural areas were approximately 5,500 gallons per station in 2013, whereas sales were upwards of 13,000 gallons per station in more urban areas.
  - Roughly 20% of E85 stations are located in urban areas and 80% in rural areas, though this reflects a relatively narrow definition of urban.

- The impact of a change in the price discount is also greater in urban areas than in rural areas. The greater concentration of FFVs near urban E85 stations means a larger potential demand response and a lower price discount required to incentivize FFV owners to drive to their nearest E85 station (rather than filling-up at a station that is perhaps closer and more convenient), as this distance is generally less than in rural areas.
  - Based on Informa's analysis, for every 10% increase in the E85 price discount, monthly E85 sales increase by about 2,400 gallons per station in rural areas and upwards of 5,500 gallons per station in urban areas[2].

**Relationship between the E85 Price Discount and RIN Prices**

The following highlights key conclusions related to the relationship between the E85 price discount and D6 RIN prices.

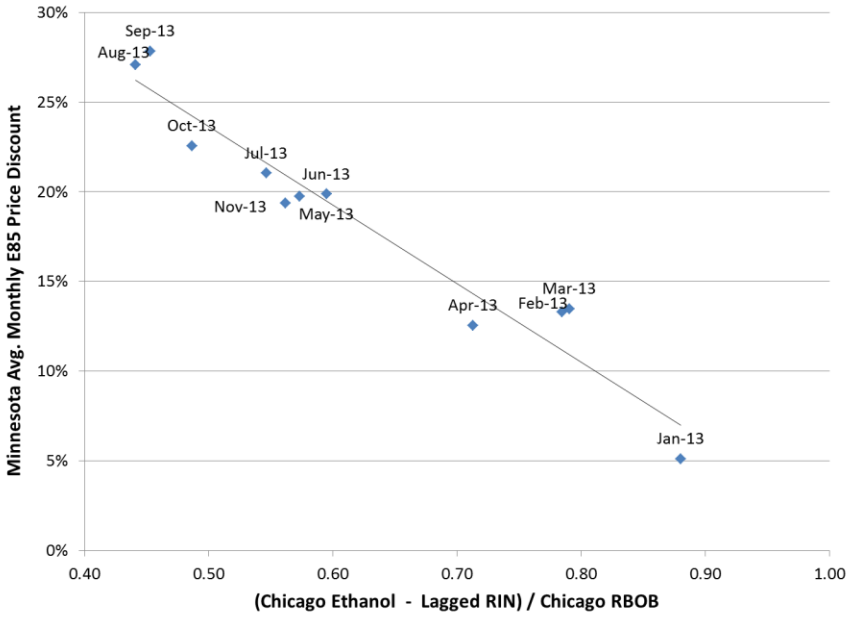
- Higher RIN prices represent a revenue stream for blenders who sell RINs to obligated parties. This in turn makes it economical to price E85 at a discount, incentivizing greater E85 usage. The E85 price discount is driven by the price of gasoline (RBOB), the price of ethanol, and the RIN price. Exhibit 3 shows that the ratio of ethanol prices minus lagged RIN prices over RBOB is correlated to the E85 price discount. This ratio represents a rough approximation of the lowest ethanol-to-RBOB price relationship a blender could offer without facing negative gross margins on purchased ethanol (this does not necessarily imply that the ethanol price will be reduced by the full RIN value as it is used in E85). Given how purchasing contracts work and the general lack of transparency in the open market for RINs, it takes time for the RIN price to impact the E85 price discount, and is thus reflected in Exhibit 3 by lagging the RIN price. This relationship was generally supported by individual station data obtained from Informa under non-disclosure agreements.

- Based on this analysis, Informa concludes that a $0.10 change in the RIN price results in a 2% change in the E85 price discount.

[2] The "rural" relationship is based on the Minnesota Department of Commerce data representing approximately 170 E85 stations and the 39 station data provided by the RFA. The high end of the "urban" relationship is based on the 11 station data representing urban retailers provided by the RFA. This data was generally supported by other individual station data obtained from Informa under non-disclosure agreements.

- This relationship is used later in this report in determining potential E85 sales in 2014.

**Exhibit 3: Minnesota Monthly E85 Price Discounts vs. Ethanol, RBOB and RIN Prices**




Source: Minnesota Department of Commerce

## Infrastructure for Distribution of Ethanol Blends above E10

The potential for sales of blends containing more than 10% ethanol is dependent not only upon economics but also on infrastructure. As noted previously, there are currently a moderate number of stations offering E85 and a small number offering E15. The realities of expanding infrastructure are discussed in this section.

### E15 Infrastructure Considerations

In the long term, a key advantage E15 holds over E85 is that it can be used in the large majority of vehicles that are not FFVs. However, as noted, there are a handful of constraints to offering E15, including the requirement that equipment at a retail station be compatible with the blend.

For stations that do not already have compatible infrastructure, investments in new equipment have to be weighed against potential returns. Industry structure is an obstacle to obligated parties dictating that E15 be made available on a widespread basis at stations, as the low margins associated with gasoline sales led several oil companies to sell their downstream operations in recent years. It is estimated that over 90% of service stations in the U.S. are owned by independent businessmen, and the

owners of 58% of total stores own only a single service station.[3] Therefore, for owners of stations without E15-compatible equipment, the decision to retrofit their stations or install new equipment depends on access to capital and their assessment of the return on investment, which includes factors such as:

- Cost of conversion:
  - Does an underground storage tank (UST) and/or dispensing equipment need to be replaced or retrofitted?
  - What would the associated capital expenditure be?
  - How long will process take, and how disruptive would it be?
  - Does the station have the space to install the new equipment?
  - Are there federal or state government programs that will offset part of the cost?
  - Does the owner have access to capital to cover the remainder of the cost?
- E15 sales volume:
  - Will sales be additive or replace a portion of existing sales?
- Impact on profits:
  - If sales are expected to increase, how much will aggregate profits increase?
  - If E15 will replace another product offering, will the margin per gallon be higher?
    - For stations that are part of a company that can blend E85 and thereby separate RINs that can be offered for sale, what is the associated incremental revenue?
- Product differentiation:
  - How will customers view E15?

The first question regarding the cost of conversion was addressed in a September 2013 letter from the Petroleum Equipment Institute (PEI) to the USDA.[4] In the letter, the PEI estimated the cost of E15 storage equipment installation under several scenarios, which differ in whether or not the UST and hanging hardware can be retrofitted or need to be replaced, as well as the number and type of dispensers that must be replaced. One thing to consider is that hanging hardware must be replaced every 3-5 years so this may be able to be replaced on schedule without any additional cost over regular repair and maintenance.

For an individual station, if neither a UST nor a dispenser needs to be replaced, the cost associated with offering E15 for sale can be as little as $1,000 (Exhibit 4). According to the PEI, if only retrofitting of dispensing equipment is necessary, this can be done for roughly $6,500 to $40,000, depending upon the number of dispensers involved. On the other hand, the most expensive scenarios involve stations that would have to replace USTs, since replacing a single UST can cost $115,000. If new dispensers must be installed along with a UST, the cost can go even higher.

[3] ICF International, Technical Analysis of the U.S. Retail Infrastructure for Ethanol Fuel Blends, April 2013.
[4] http://www.pei.org/portals/0/resources/documents/USDA-letter-e15.pdf

**Exhibit 4: Costs Associated with E15 Equipment Installation**

| Scenario | Scenario Description | | | | Cost Estimate | |
|---|---|---|---|---|---|---|
| | Replace UST? | # Dispensers Replaced | Type of Dispensers | Replace Hanging Hardware? | Average | Median |
| 1 | No | 0 | - | No | $1,167 | $1,000 |
| 1a | Yes | 0 | - | No | $112,968 | $115,000 |
| 2 | No | 2 | Retrofit | Yes | $8,385 | $7,600 |
| | No | 4 | Retrofit | Yes | $16,378 | $15,200 |
| | No | 6 | Retrofit | Yes | $25,264 | $22,800 |
| | No | 10 | Retrofit | Yes | $41,622 | $38,000 |
| 2b | No | 2 | Retrofit | No | $6,961 | $6,452 |
| | No | 4 | Retrofit | No | $13,812 | $13,000 |
| | No | 6 | Retrofit | No | $20,661 | $19,500 |
| | No | 10 | Retrofit | No | $34,240 | $32,500 |
| 2c | Yes | 2 | Retrofit | Yes | $121,222 | $126,170 |
| | Yes | 4 | Retrofit | Yes | $136,667 | $135,200 |
| | Yes | 6 | Retrofit | Yes | $149,607 | $152,800 |
| | Yes | 10 | Retrofit | Yes | $170,889 | $188,000 |
| 3 | No | 2 | New | Yes | $40,874 | $36,200 |
| | No | 4 | New | Yes | $81,334 | $72,000 |
| | No | 6 | New | Yes | $119,538 | $108,000 |
| | No | 10 | New | Yes | $201,380 | $187,380 |
| 3a | Yes | 2 | New | Yes | $156,667 | $166,000 |
| | Yes | 4 | New | Yes | $198,102 | $212,736 |
| | Yes | 6 | New | Yes | $239,444 | $241,696 |
| | Yes | 10 | New | Yes | $321,778 | $310,000 |
| 4 | No | 0 | New stand-alone | New | $31,775 | $30,000 |
| 4a | Yes | 0 | New stand-alone | New | $144,496 | $140,199 |

Source: Petroleum Equipment Institute

A hindrance in estimating how rapidly sales of E15 can expand is that, while the states that have legislative and/or regulatory constraints on E15 can be identified and the cost of retrofitting or installing new equipment can be estimated, there does not appear to have been survey done with a nationally representative sample to determine what percentage of stations have compatible equipment and, of the remainder, what changes are necessary.

## E85 Infrastructure Considerations

E85 offers the most promising pathway to a sizable expansion of ethanol consumption in the near term, due to a variety of factors. First, E85 uses the greatest amount of ethanol per gallon of fuel sold. Second, the existing infrastructure for E85 is also much

further along than E15 or other mid-level blends. Lastly, regulations and credits provide less uncertainty and potential incentives for investment in E85 retail sales.

Despite these advantages, E85 has specific challenges it must overcome in order to be the means for a significant expansion in ethanol consumption. First, as discussed above, the energy-equivalent price for E85 has historically been higher than E10. Second, there are currently only 3,263 stations providing E85[5] out of a total of 156,000.[6] Third, there were 14.6 million registered FFVs in the U.S. as of January 1, 2013, accounting for a relatively small percentage of light-duty vehicles (E85 is approved for use only in FFVs).[7] The first two constraints are the most important in the near term, as E85 is not frequently being used in many of the FFVs on the road.

In deciding whether to install E85 equipment, a retail station owner goes through a process that is similar to the one described above for determining the return on investment. It is notable that costs associated with E85 installation may be eligible for the Alternative Fuel Infrastructure Tax Credit. While some ancillary issues associated with E15 (e.g., legal liability) might not apply, other factors such as offering E85 while operating under the brand of a major oil company can be a consideration. The total cost of adapting a station to offer E85 depends on whether a new tank, hanging hardware and/or dispensers must be installed, or retrofits must be done. To convert a station with a new tank and new or retrofitted dispensers, the total cost is estimated to be in the range of $50,000 to $150,000. If a new tank is not required, the range drops to $2,500-$105,000.

According to ICF International, a weighted average 75% of retail stations have at least one UST that is compatible with storing E85 (and thus could also store E15), and these stations on average have 2.3 USTs.[8] However, the proportion of tanks approved for E85 varies widely from state to state. For example, less than 10% of retail stations in Dallas and Houston are compatible with E85, while over 90% in Jacksonville and Miami are. This implies a cost per station of $43,370 to offer E85, based on the percentage of compatible USTs and estimates by Larry Gregory Consulting regarding hanging hardware and dispenser compatibility.[9] According to ICF, the approximate time for permitting of an E85 tank is 7-60 days, and the time for construction can be 1-90 days, depending on which equipment needs to be installed or retrofitted.

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[5] E85prices.com
[6] NACS, "Who Sells America's Fuel," 2013.
http://www.nacsonline.com/YourBusiness/FuelsReports/GasPrices_2013/Documents/CFR2013_WhoSellsAmericasFuel.pdf
[7] Hedges and Company via the Center for Agricultural and Rural Development.
http://www.card.iastate.edu/publications/dbs/pdffiles/13pb11.pdf
[8] ICF International, "Technical Analysis of the U.S. Retail Infrastructure for Ethanol Fuel Blends," April 2013.
[9] Larry Gregory Consulting, LLC, "A Comprehensive Analysis of Current Research on E15 Dispensing Component Compatibility," March 2012.
http://www.api.org/~/media/Files/Policy/Alternatives/E15-Infrastructure-Comprehensive-Analysis.pdf

## Ability to Meet RFS2 Levels Consistent with Statutory Requirements

### Assumptions Regarding the Levels at Which RFS2 Standards Would Be Set

While Congress specified levels of renewable fuel consumption in EISA, it also provided mechanisms to allow for flexibility in meeting the program. Two important mechanisms were the allowance for the credits to be used (i.e., RINs) and the granting of waiver authorities to the EPA.

Given that cellulosic biofuels were not produced commercially at the time EISA was passed, the EPA was granted authority to waive all or a portion of the Cellulosic Biofuel Standard if the agency does not expect cellulosic biofuel production to be sufficient in a particular year. In case such a waiver is granted, the EPA also was given discretion as to whether to reduce the Total Advanced Biofuel and Total Renewable Fuel Standards by up to the amount of the reduction in the Cellulosic Biofuel Standard.

EISA originally set the Cellulosic Biofuel Standard to ramp up quickly from 100 million gallons (ethanol equivalent) in 2010 to 1 billion gallons in 2013 and 1.75 billion gallons in 2014. However, the EPA has proposed reducing the 2014 obligation to 17 million gallons. As a result, it has become increasingly difficult to meet the Total Advanced Biofuel and Total Renewable Fuel Standards at levels originally targeted in EISA without a significant contribution from cellulosic biofuels.

Still, the question that was analyzed by Informa was whether RFS2 can be met in a manner that is consistent with EISA, in which the EPA maintains the standards and effective allocations to various categories of renewable fuels other than cellulosic biofuels. The portion of RFS2 for which corn-based ethanol is eligible (technically, the difference between the Total Renewable Fuel Standard and the Total Advanced Biofuel Standard) would be kept at 14.4 billion gallons for 2014, and the effective allocation to undifferentiated advanced biofuels would remain 500 million gallons.

In analyzing whether the 2014 standards and effective allocations can be met, it was assumed that the EPA in its final rulemaking:

- Retains the Biomass-based Diesel Standard at 1.28 billion gallons in 2014, which is not only equal to the 2013 standard but also consistent with the EPA's proposal; and
- Uses the discretionary authority granted to it by EISA to reduce the Total Advanced Biofuel and Total Renewable Fuel Standards, given its nearly complete waiver of the Cellulosic Biofuel Standard.
  - However, given the maintenance of the Biomass-based Diesel Standard at a volume higher than the 1-billion-gallon minimum set by EISA, it is not necessary for the EPA to reduce the other standards by the full amount of the cut in cellulosic biofuels.

Based on these parameters, in its final rulemaking the EPA would set the 2014 standards for RFS2 as follows (all expressed in ethanol-equivalent gallons except biomass-based diesel, which is actual gallons):

- Biomass-based Diesel: 1.28 billion gallons;
- Cellulosic Biofuels: 17 million gallons;
- Total Advanced Biofuels: 2.42 billion gallons; and
- Total Renewable Fuels: 16.82 billion gallons.

Importantly, while the EPA can exercise its discretion in setting the Biomass-based Diesel, Total Advanced Biofuel and Total Renewable Fuel Standards as assumed above, the EPA had to invoke separate authority to initiate a waiver to cut the requirements more extensively as it proposed in November. In doing this, the EPA has had to initiate a rulemaking process parallel to the one for setting the annual RFS2 obligations. The EPA has based this additional waiver on a determination that there is an inadequate supply of biofuels, in terms of the volume that can be utilized through the fuel supply chain (due to the blend wall); however, questions have been raised as to whether this is an appropriate interpretation of "inadequate supply" as specified in EISA, which could well open up the process to lawsuits.

## RIN Inventories Available for Compliance with 2014 Standards

In determining whether the 2014 standards and effective allocations can be met, it also should be remembered that RINs carried over from the previous year (in this case 2013) can be used to meet up to 20% of each standard. Based on the supply and demand of biofuels in 2013, for which statistics are mostly complete as of this writing, it is estimated that:

- There were nearly 1.3 billion conventional biofuel (D6) RINs were carried over at the end of the year and are available for compliance with the 2014 Total Renewable Fuel Standard.
- An additional 390 million biomass-based diesel (D4) RINs were carried over and would be eligible for use toward that standard in 2014.
  - Given the industry's expectation that the Biomass-based Diesel Standard was going to be raised in 2014 and the fact that the blender's credit expired at the end of 2013, it is possible that as many as an additional 100 million D4 RINs are available to be applied to other standards in 2014.
- Due to moderate levels of ethanol imports and the EPA's decision to retain the 2013 Total Advanced Biofuel Standard at the statutory level, only minimal levels of other advanced biofuel (D5) RINs are likely to have been carried over.

## Biofuel Production and Consumption in 2014, and the Ability to Meet RFS2 Levels Consistent with Statutory Requirements

It is estimated that 13.7 billion gallons of ethanol could be consumed in the U.S. in 2014, given the potential expansion in E85 sales (discussed below), usage of a small

amount of E15 and other mid-level blends, and the expectation that overall gasoline sales in 2014 will be essentially the same as in 2013 (Exhibit 5). This compares with the 13.1 billion gallons assumed in EPA's proposal.

It is forecast that 475 million gallons of ethanol will be imported, which when combined with RINs generated for other advanced biofuels besides biomass-based diesel qualifying for D4 RINs will allow the effective allocation to undifferentiated advanced biofuels to be met (at the level implied by EISA). It is estimated that as much as 75% of the imported ethanol will be needed for compliance with California's Low Carbon Fuel Standard, as required reductions in the carbon intensity of transportation fuels are becoming stricter with each passing year.

**Exhibit 5: U.S. Ethanol Balance Sheet: RFS2 Compliance Scenario (Million Gallons)**

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | **2013** | **2014** |
|---|---|---|---|---|---|---|---|---|
| Beginning Inventories | 368 | 442 | 597 | 697 | 754 | 766 | 855 | 703 |
| Production | 6,521 | 9,309 | 10,938 | 13,298 | 13,929 | 13,218 | 13,296 | 13,952 |
| Imports | 441 | 556 | 198 | 18 | 196 | 548 | 400 | 475 |
| Total Supply | 7,330 | 10,308 | 11,733 | 14,012 | 14,878 | 14,532 | 14,550 | 15,130 |
| Domestic Usage | 6,738 | 9,552 | 10,923 | 12,855 | 12,919 | 13,004 | 13,222 | 13,710 |
| Exports | 150 | 158 | 113 | 403 | 1,193 | 674 | 625 | 650 |
| Total Disappearance | 6,888 | 9,710 | 11,036 | 13,259 | 14,112 | 13,678 | 13,847 | 14,360 |
| Ending Inventories | 442 | 597 | 697 | 754 | 766 | 855 | 703 | 770 |
| Ethanol Usage in Blends Above E10 | 56 | 64 | 73 | 93 | 141 | 160 | 180 | 380 |
| Renewable Fuel (D6) RIN Carryover, End of Year | | | | | | 2,041 | 1,284 | 0 |
| Total RIN Carryover (All Biofuels), End of Year | | | | | | 2,480 | 1,673 | 390 |
| Feedgrain Use @ USDA 2.7 Gal/Bu Assumption | 2,415 | 3,448 | 4,051 | 4,925 | 5,159 | 4,896 | 4,924 | 5,167 |

Sources: Dept. of Energy, U.S. International Trade Commission, Environmental Protection Agency (Historical Data); Informa Economics (Forecasts, as Shaded)
Note: Excludes cellulosic ethanol.

Still, the consumption of ethanol is not sufficient to permit the 14.4-billion-gallon difference between the Total Renewable Fuel Standard and the Total Advanced Biofuel Standard to be met by corn-based ethanol alone. Rather, given the expectation that the allocation to undifferentiated advanced biofuels will be met with few excess D5 RINs available, the burden of fulfilling the remainder of the Total Renewable Fuel Standard will fall on two sources: RINs carried over from 2013 and production of biodiesel and renewable diesel in 2014 beyond the Biomass-based Diesel Standard.

It is estimated that as much as 1.60 billion gallons of biomass-based diesel could be produced in the U.S. in 2014, given processing capacity and feedstock availability. In an RFS2 compliance scenario, it is assumed that production reaches 90% of this maximum level, or 1.46 billion gallons, which consists of 1.27 billion gallons of biodiesel and 185 million gallons of renewable diesel qualifying for D4 RINs. The U.S. is forecast to import an additional 225 million gallons of biomass-based diesel qualifying for D4 RINs, though exports essentially offset this. Domestic usage of biomass-based diesel

reaches 1.44 billion gallons, exceeding the 1.28-billion-gallon Biomass-based Diesel Standard, and the number of excess RINs is even greater since 1.5 RINs are generated for a gallon of biodiesel and the number of RINs associated with a gallon of renewable diesel is typically even higher.

In all, 2.19 billion D4 RINs are generated (net of exports), of which 1.95 billion are needed for compliance with the Biomass-based Diesel Standard, and the remainder along with D4 RINs carried over from 2013 are available to be used for compliance with the Total Renewable Fuels Standard, though not all are needed. It is estimated that 390 million D4 RINs still would be carried over from 2014 (equal to the 20% cap for 2015 compliance with the Biomass-based Diesel Standard), though this assumes that the number of D5 advanced biofuel RINs and D6 conventional biofuel RINs are completely depleted. If it were instead assumed that some minimal level of RINs for these categories would be carried over (e.g., 100 million D5 RINs and 100 million D6 RINs), the inventory of D4 RINs would be only modestly lower since D4 RINs would be at their cap if all D5 and D6 RINs were exhausted. To provide the incentive for such levels of biomass-based diesel production, the market would have to offer a relatively high D4 RIN price.

Parallel to this analysis, Informa analyzed the volume of E85 that would be consumed under various conventional biofuel (D6) RIN price scenarios. Based on this analysis, it was determined that if the right regulatory signals were in place (i.e., in the final rulemaking, the 2014 RFS2 standards were set higher than the proposed levels) and RIN prices were approximately $0.75, this would be sufficient expand total E85 consumption to a little over 500 million gallons (equivalent to 370 million gallons of pure ethanol) by increasing the average monthly volume of E85 sold per station by 40% and incentivizing the addition of 530 new E85 stations.

The estimated additional per-station E85 sales volume is based on the analysis described earlier in this report regarding (1) the relationships between the E85 price discount and E85 station sales and (2) the impact of ethanol, gasoline and RIN prices on the E85 price discount. The 530 additional E85 stations is based on historical daily station increases in 2012 and 2013 (based on periodic data reported by E85prices.com) considering annual average RIN prices, as well as the increase in the average daily station estimates following the period of peak RIN prices in mid-July 2013. It also assumes that the new stations would be more evenly split between urban areas (near high concentrations of FFVs) and rural areas. This estimate of the increase in the number of stations is supported by a November 2013 Reuters article in which was noted that one company, Protec Fuels, had deals in the works to build or retrofit 450 stations before the EPA proposal was released and the deals were put on hold.[10]

As mentioned previously, it is possible that E85 consumption could be even larger if it is priced at a sustained discount to gasoline (on an energy-equivalent basis). It is

[10] Reuters, "Analysis: High-Ethanol Gas – Not Coming to a Pump Near You," November 27, 2013.

plausible that the consumer response to such a sustained discount could be stronger than implied by historical data, since discounts have been transitory in the past, and as a result E85 consumption could be appreciably higher than 500 million gallons.

It is worth noting that while this D6 RIN price necessary to accomplish this level of E85 consumption is higher than the price reported as of the writing of this report, it is only half of the peak price experienced in the summer of 2013. Additionally, given the need for multiple types of RINs to be used for compliance with the Total Biofuel Standard, that there would likely be convergence of the prices of different categories of RINs as happened in 2013, and the price of D4 biomass-based diesel RINs would be expected to rebound to roughly $0.85.

## Conclusions

Considering the potential for expansion in E85 consumption, moderate usage of E15 and other mid-level blends and the ability for the biodiesel industry to boost production, it is possible for RFS2 standards and effective allocations consistent with EISA to be met in 2014. (Again, this assumes a waiver of a large majority of the Cellulosic Biofuel Standard.) It should be noted that if the Total Advanced Biofuel and Total Renewable Fuel Standards were reduced by the entire amount that the Cellulosic Biofuel Standard is waived in 2014 (rather than being adjusted upward somewhat for the fact that the Biomass-based Diesel Standard is being set above the statutory minimum), this would further enhance the probability of compliance with all standards and allocations.

Given the potential for expansion in ethanol consumption and prospects for solid levels of exports based on cost-competitiveness brought on by a sizable corn crop and significantly lower feedstock prices, U.S. ethanol production would be forecast to reach 13.95 billion gallons in 2014. This is essentially identical to the record 13.93 billion gallons produced in 2011, when exports were by far at record levels. On the other hand, if the RFS2 standards are finalized in the same form as proposed by the EPA, U.S. ethanol production would total only 13.43 billion gallons – 500 million gallons less – due in large part to likelihood that deflated RIN prices would not be sufficient to incentivize much expansion of E85.