RENEWABLE FUELS ASSOCIATION

ISSUE BRIEF

Summary of RFS2 Final Rule

The U.S. Environmental Protection Agency (EPA) released its final rule for the expanded Renewable Fuels Standard (RFS2) on February 3, 2010. Based on additional internal analysis, public comments from stakeholders, and comments from peer reviewers, the EPA made numerous modifications to the proposed regulation. Most of the changes are minor in nature and the general complexion of the rule remains unchanged (e.g., indirect land use change, renewable biomass requirements, and other controversial elements remain largely intact), but several modifications have notable implications for the ethanol industry.[1]

Many of the more noteworthy changes made by the EPA are discussed below.

I. Lifecycle Greenhouse Gas (GHG) Analysis

Corn Ethanol

As a result of several enhancements to the EPA's lifecycle analysis, the GHG performance of newly constructed "average" corn ethanol plants has improved considerably and all new (i.e., non-grandfathered) corn ethanol is now considered compliant with the Energy Independence and Security Act of 2007 (EISA) requirement that conventional biofuels reduce GHG emissions by at least 20% relative to baseline gasoline. Many of the changes made by the EPA were recommended by the Renewable Fuels Association (RFA) and other stakeholders in written comments and meetings.

In a change from the proposed rule, the EPA did not base its GHG threshold determination on existing corn ethanol production pathways since "production from existing plants is grandfathered for the purposes of compliance…." The EPA assumes all newly built corn ethanol plants will utilize dry mill technology and will not use coal as a feedstock for stationary combustion. Thus, the lifecycle analysis of corn ethanol examines only the new corn ethanol that would be subjected to the 20% GHG reduction threshold.

The EPA found that "…corn ethanol produced at…new plants (and existing plants with expanded capacity employing the same technology) will exceed the 20% GHG performance threshold." The analysis showed GHG reductions for dry mill corn ethanol ranging from -7% to -32%, with the midpoint of the range being -21%. This compares to the EPA's results in the proposed rule of a +5% GHG increase to an -18% reduction for typical dry mill corn ethanol (using the same 30-year

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[1] ***Clarification:*** *During the conference call on February 3rd announcing the release of the final rule, EPA Administrator Lisa Jackson misspoke on the subject of the EPA's updated GHG modeling. Corn starch ethanol only qualifies as a "conventional" biofuel -- not an advanced biofuel -- under the rule.*

timeframe and 0% discount). The GHG reduction for corn ethanol outlined in the final rule would have been even more pronounced had EPA maintained certain elements of its earlier lifecycle analyses (e.g., 100-year accounting timeframe, Intergovernmental Panel on Climate Change (IPCC) fertilizer emissions factors). The major reasons for the improved GHG performance of corn ethanol are described below.

- *Impact of price on yield improvements*: The FAPRI model now includes an elasticity factor for yields to respond to changes in prices over time both in the U.S. and internationally. However, the factor (0.07) is significantly lower than anticipated and, therefore, has less of a positive impact than expected.

- *Distillers grains*: The EPA now assumes that 1 lb. of distillers grains will replace 1.196 pounds of total corn and soybean meal for various beef cattle and dairy cows in 2015. The higher displacement ratio is phased in gradually from 2007 to 2015. For swine and poultry, the displacement ratio remains at 1:1 throughout the life of the RFS, but the EPA now assumes more soybean meal is displaced than in previous analyses, which has the effect of reducing necessary soybean acres.

- *New Brazil module*: The FAPRI model was updated to include additional agricultural detail in Brazil. The FAPRI model now includes an integrated Brazil module that provides additional detail on agricultural land use in Brazil for six geographic regions.

- *Satellite data*: The EPA greatly expanded the satellite data that was used to determine the types and locations of indirect land use changes. The satellite data used for the final rule also spanned a longer timeframe than the data used for the proposal.

- *Available land types*: Idle cropland and forest was added to the FASOM analysis for the United States agriculture sector, which apparently reduced the amount of land converted internationally.

- *Foregone sequestration*: The new analysis includes "more conservative foregone forest sequestration estimates that account for natural gains and losses over time."

The aggregate effect of these improvements (and others) was to reduce *by half* the emissions from international land use changes (from 60.4 g/MJ to 30.3 g/MJ) that are included by the EPA in the corn ethanol lifecycle. A full comparison of lifecycle emissions by phase as presented in the proposed rule versus the final rule is shown in the attached table.

While the EPA made several positive improvements to its lifecycle GHG analyses, a number of key changes resulted in ethanol's GHG reductions being less significant than would have otherwise been the case. The major factors that negatively affected the ethanol GHG lifecycle are discussed below.

- *Timeframe for Accounting of Emissions*: For its final rule analysis, the EPA used a 30-year timeframe to account for lifecycle GHG emissions, versus the 100-year (2% discount) timeframe used for the proposed rule. This change likely had the greatest impact on the final GHG reduction results for corn ethanol and other biofuels. If the EPA had maintained its 100-year timeframe (and 2% discount rate) for the final rule analysis, the corn ethanol GHG reduction would have been approximately 35% instead of 21%. The EPA provides very little scientific rationale in the final rule for employing a 30-year timeframe rather than 100 years. The decision appears largely arbitrary. The EPA suggests the shorter timeframe was adopted because: 1.) it is more consistent with the average lifespan of a biofuel production facility; 2.) future emissions are less certain; and 3.) significant GHG reductions are needed in the near term to avoid catastrophic climate changes. All three of these arguments are suspect and each is definitely debatable. Further, the average lifespan of a biofuel plant is irrelevant in determining emissions from land use change—*what is important is the ongoing use of the land.*

- *Fertilizer Assumptions and Modeling*: The EPA made several revisions to its assumptions on emissions from fertilizer production and use. These modifications resulted in significant increases in emissions from the domestic and international agriculture phases of the GHG lifecycle. For domestic crop production, the EPA used new fertilizer production factors that had the effect of increasing emissions. The EPA also integrated the results of new modeling on N2O emissions from fertilizer use. For international agriculture emissions, the EPA updated its estimates of international fertilizer use. This resulted in slightly higher international agriculture emissions. It appears the EPA used N2O emissions estimates from DAYCENT modeling runs that were completed after the proposed rule was published. Thus, the new modeling results have not been made available to the public for review and comment. Because N2O emissions are highly uncertain, this is significant problem.

Though the EPA made several changes to its lifecycle analysis that either increased or decreased GHG emissions from specific production phases, several key elements of the analysis remained unchanged.

- *Crop Yields*: While the EPA considered a "high yield" case (230 bu/acre for corn by 2022) for sensitivity analysis, it continued to rely on a very conservative yield trajectory (183 bu/acre by 2022) for its main analysis and determination of ethanol lifecycle GHG emissions. Notably, the "high yield" sensitivity case had very little effect on overall GHG reductions. Using a 2022 yield of 230 bu/acre resulted in a median corn ethanol GHG reduction of -23% versus the -21% reduction associated with a 2022 yield of 183 bu/acre. The reasons for this are somewhat unclear.

- *Baseline Gasoline*: The EPA received many comments encouraging the agency to consider indirect emissions related to production and use of baseline gasoline. The RFA also suggested that the EPA should use marginal sources of gasoline as the baseline for comparison to ethanol, since the new gallon of ethanol can be assumed to replace the marginal ("new") gallon of gasoline, which comes from increasingly high carbon sources. The EPA opted not to consider indirect emissions for gasoline; the agency also failed to revise the baseline for a marginal vs. marginal comparison.

Cellulosic Ethanol

Although the final results are very similar to those presented in the proposal, the EPA refined its lifecycle analysis for cellulosic ethanol. All modeled cellulosic biofuel pathways far exceed the 60% GHG reduction requirement in EISA. As it did in the proposal, the agency examined two cellulosic feedstock types: corn stover and switchgrass. Switchgrass-derived ethanol was determined to reduce GHG emissions by 110% (biochemical) and 72% (thermo-chemical). Indirect land use change emissions for switchgrass are about half of the indirect land use change (ILUC) emissions for corn ethanol. Corn stover ethanol results in reductions of 130% (biochemical) and 93% (thermo-chemical).

Brazilian Sugarcane Ethanol

One type of biofuel in particular—Brazilian sugarcane ethanol—benefited disproportionally from the EPA's revised lifecycle analysis. In the proposed rule released in May 2009, U.S. corn-based ethanol and Brazilian sugarcane ethanol were assumed to induce roughly the same magnitude of ILUC emissions.

Based on input from stakeholder comments and peer reviews, the EPA substantially revised its ILUC analysis for the final rule. As discussed earlier, the result of these revisions is that corn ethanol's international ILUC emissions were cut virtually in half to 30.3 g/MJ. Curiously, however, sugarcane ethanol's international ILUC emissions *dropped 93% to just 3.8 g/MJ*.

For the final rule, the EPA incorporated a Brazil module into the international FAPRI model framework and also considered more detailed satellite data. These changes allowed more detailed regional crop and pasture modeling. The new analysis also suggests a significant portion of corn acreage in Brazil will be switched to sugarcane and that very little pasture conversion would be needed to accommodate increased sugar production (in the final rule, U.S. corn ethanol is assumed to induce more net LUC in Brazil than Brazil sugarcane ethanol itself). The assumptions underlying many of these modifications seem highly debatable. While it is understandable that some of these changes would serve to reduce the ILUC emissions associated with sugarcane ethanol, it seems highly unlikely that the actual magnitude of the decrease would be of the scale indicated by the EPA's final rule. If similar improvements were made to the corn ethanol final rule ILUC analysis, why didn't we see a similar result?

The overall result of the EPA's modifications is that sugarcane ethanol is now assumed to reduce GHG emissions by an average of 61% compared to baseline gasoline. As such, sugarcane ethanol would surpass the 50% GHG reduction threshold for advanced biofuels and would actually meet the 60% standard for cellulosic ethanol. This is a significant change from the 26.5% GHG reduction from the proposed rule. By contrast, the final rule analysis suggests corn ethanol reduces GHG emissions by ~20% compared to gasoline. While this is a substantial improvement over the 5% increase in GHG emissions attributed to corn ethanol in the proposed rule, the improvement is not of the magnitude of the sugarcane analysis. The reasons for this disparity are very unclear.

Petition Process for Unique Pathways

In the final rule, the EPA discusses a system by which individual producers could petition the agency for a production pathway not analyzed, such as new and novel energy saving designs or co-product pathways. If the EPA approves these pathways, the producer can generate RINs, and will not need to update the regulations prior to the RINs being used. The EPA also anticipates including new feedstock and fuel pathways in periodic regulatory updates using the same petition process, but will use the annual rulemaking process to provide notice and public comment.

II. Renewable Biomass

The EPA finalized an "aggregate compliance" mechanism for determination of compliance with the renewable biomass requirement that biofuel feedstocks (crops and crop residues) must come from "existing cropland." The final rule also appears to have eliminated the requirements that qualifying feedstock must come from land that was "continuously actively managed." Under the final rule, the EPA will assume all crops and crop residues used for biofuels came from existing cropland as long as total cropland does not expand beyond a baseline level of 402 million acres (equivalent to 2007 total cropland). If the total acres in any one year are above 397 million acres, the EPA will investigate the increase. If the acres go above 402 million acres, reporting and recordkeeping requirements will be triggered. These requirements include providing evidence that the biomass came from land meeting the definition on December 19, 2007, or participation in a quality assurance program established by feedstock providers and producers. While still potentially burdensome, this option was the least onerous of the options discussed by the EPA in the proposal.

Consistent with the proposed rule, the EPA decided against including rangeland in the set of agricultural lands from which qualifying renewable biomass may be sourced. In comments, the RFA and others suggested rangeland should be considered for inclusion.

III. Tolerance Levels for Determining Grandfathered Ethanol Volumes

In the proposed rule, the EPA suggested it would allow a 10% tolerance on baseline volumes for which RINs can be generated by corn ethanol producers without complying with the 20% GHG reduction threshold. For the final rule, the EPA revised the tolerance level down to 5%. For example, if a 60 mgy ethanol plant completed debottlenecking that allowed it to now produce 63 mgy, the additional 3 mgy would be grandfathered along with the original 60 mgy.

IV. Equivalence Values

The EPA is retaining the equivalence values based on energy content that were established under RFS1. These equivalence values essentially allow producers of biofuels with higher BTU content per gallon than ethanol to assign additional RINs to each gallon of fuel produced. For example, a gallon of butanol would be assigned 1.3 RINs in comparison to the 1.0 RIN assigned to each gallon of ethanol (regardless of feedstock). The 2.5-to-1 RIN values for cellulosic ethanol established in the RFS1 were eliminated for the RFS2 because cellulosic ethanol has its own "nested standard" and because the equivalence values are based on energy content. During the comment period, the RFA argued for elimination of any equivalency values since EISA created "nested standards" for advanced biofuels and biomass-based diesel. The nested standards for various biofuels established by EISA clearly eliminated the need for the equivalence values established under RFS1. It was Congress' intent that the RFS2 be based on straight volumes. The effect of maintaining equivalence values will be to reduce the actual volumes of imported oil that will be displaced by renewable fuels.

V. Cellulosic Ethanol Standard

The EPA made several noteworthy changes to the cellulosic ethanol provisions that were in the proposed rulemaking. Some of the meaningful changes are discussed below.

- *2010 Standard*: Based on the Energy Information Administration (EIA) projections and industry information, the EPA set the 2010 renewable volume obligation for cellulosic ethanol at 0.004%. This percentage is based on expected available supply of 5.04 million gallons. Because EPA expects 2.09 million of these gallons to come from cellulosic diesel and bio-crude with higher relative energy content, the agency often refers to the 5.04 million gallons as "6.5 million ethanol equivalent gallons."

- *Cellulosic Waiver Credits*: Cellulosic waiver credits (no longer called "allowances") will only be available for the current compliance year for which the EPA has waived some portion of the cellulosic biofuel standard, they will only be available to obligated parties, and they will be nontransferable and nonrefundable. Further, obligated parties may only purchase waiver credits up to the level of their cellulosic biofuel RVO less the number of cellulosic biofuel RINs that they own. A company owning cellulosic biofuel RINs and cellulosic waiver credits may use both types of credits if desired to meet their RVOs, but unlike RINs obligated parties will not be able to carry waiver credits over to the next calendar year. For the 2010 compliance period, since the cellulosic standard is lower than the level otherwise required by EISA, the EPA is making cellulosic waiver credits available to obligated parties for end-of-year compliance should they need them at a price of $1.58 per gallon-RIN.

COMPARISON OF CORN ETHANOL LIFECYCLE GHGs, PROPOSED RULE v. FINAL RULE

All figures in: grams CO2equivalent/megajoule (g/MJ)
Timeframe: 30 years (0% discount)

LIFECYCLE PHASE ↓	Final Rule	Proposed Rule	Change	Likely Reason(s) for Change
Net Domestic Agriculture	3.8	-11	14.8	Updated fertilizer production emissions; updated N2O emissions (?)
Net International Agriculture	11.4	9.9	1.5	Updated fertilizer production emissions; updated fertilizer application
Domestic Land Use Change	-1.9	2.9	-4.8	DGS assumptions; price-induced yield increases; Brazil de-aggregation; more pasture/less forest conversion; FASOM forestry module activated; Timeframe for satellite data extended; foregone sequestration assumptions revised
International Land Use Change	30.3	60.4	-30.1	
Fuel Production**	26.5	30.9	-4.4	Assumptions on fractionation/oil sep/DGS
Fuel and Feedstock Transport	3.8	3.8	0	N/A
Tailpipe Emissions	0.9	0.8	0.1	N/a
NET TOTAL EMISSIONS	74.8	97.7	-22.9	
GASOLINE	92.9	93.3	-0.4	Used NETL analysis rather than GREET

**Final Rule=natural gas dry mill; 63% DDG/37% WDG; with fractionation
**Proposed Rule=natural gas dry mill; 100% DDG