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Regulation of Fuels and Fuel Additives: 2011 Renewable Fuel Standards; Proposed Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 80

[EPA–HQ–OAR–2010–0133; FRL–9175–8]

RIN 2060–AQ16

Regulation of Fuels and Fuel Additives: 2011 Renewable Fuel Standards

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of proposed rulemaking.

SUMMARY: Under the Clean Air Act Section 211(o), as amended by the Energy Independence and Security Act of 2007 (EISA), the Environmental Protection Agency is required to set the renewable fuel standards each November for the following year based on gasoline and diesel projections from EIA. Additionally, EPA is required to set the cellulosic biofuel standard each year based on the volume projected to be available during the following year, using EIA projections and assessments of production capability from industry. This regulatory action proposes these annual standards for cellulosic biofuel, biomass-based diesel, advanced biofuel, and renewable fuels that apply to all gasoline and diesel produced or imported in year 2011. This action also presents two proposed changes to the RFS2 regulations. The first would create a temporary and limited means for certain renewable fuel producers to generate delayed RINs after they have produced and sold renewable fuel. This proposed provision would apply only to those producers who use canola oil, grain sorghum, pulpwood, or palm oil to produce renewable fuel. The second proposed regulatory provision would establish criteria for foreign countries to adopt an aggregate approach to compliance with the renewable biomass provision akin to that applicable to the U.S.

DATES: Comments must be received on or before August 19, 2010.

Hearing: We do not expect to hold a public hearing. However, if we receive such a request we will publish information related to the timing and location of the hearing and the timing of a new deadline for public comments.

ADDRESSES: Submit your comments, identified by Docket ID No. EPA–HQ–OAR–2010–0133, by one of the following methods:

- *http://www.regulations.gov: Follow the online instructions for submitting comments.*
- *E-mail: asdinfo@epa.gov.*
- *Mail:* Air and Radiation Docket and Information Center, Environmental Protection Agency, Mailcode: 2822T, 1200 Pennsylvania Ave., NW., Washington, DC 20460.
- *Hand Delivery:* EPA Docket Center, EPA West Building, Room 3334, 1301 Constitution Ave., NW., Washington, DC 20460. Such deliveries are only accepted during the Docket's normal hours of operation, and special arrangements should be made for deliveries of boxed information.

Instructions: Direct your comments to Docket ID No. EPA–HQ–OAR–2010–0133. EPA's policy is that all comments received will be included in the public docket without change and may be made available online at *http://www.regulations.gov,* including any personal information provided, unless the comment includes information claimed to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Do not submit information that you consider to be CBI or otherwise protected through *http://www.regulations.gov* or e-mail. The *http://www.regulations.gov* Web site is an "anonymous access" system, which means EPA will not know your identity or contact information unless you provide it in the body of your comment. If you send an e-mail comment directly to EPA without going through *http://www.regulations.gov* your e-mail address will be automatically captured and included as part of the comment that is placed in the public docket and made available on the Internet. If you submit an electronic comment, EPA recommends that you include your name and other contact information in the body of your comment and with any disk or CD–ROM you submit. If EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, EPA may not be able to consider your comment. Electronic files should avoid the use of special characters, any form of encryption, and be free of any defects or viruses. For additional information about EPA's public docket visit the EPA Docket Center homepage at *http://www.epa.gov/epahome/dockets.htm.* For additional instructions on submitting comments, go to Section I.B of the **SUPPLEMENTARY INFORMATION** section of this document.

Docket: All documents in the docket are listed in the *http://www.regulations.gov* index. Although listed in the index, some information is not publicly available, *e.g.,* CBI or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, will be publicly available only in hard copy. Publicly available docket materials are available either electronically in *http://www.regulations.gov* or in hard copy at the Air and Radiation Docket and Information Center, EPA/DC, EPA West, Room 3334, 1301 Constitution Ave., NW., Washington, DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566–1744, and the telephone number for the Air Docket is (202) 566–1742.

FOR FURTHER INFORMATION CONTACT: Julia MacAllister, Office of Transportation and Air Quality, Assessment and Standards Division, Environmental Protection Agency, 2000 Traverwood Drive, Ann Arbor, MI 48105; Telephone number: 734–214–4131; Fax number: 734–214–4816; E-mail address: *macallister.julia@epa.gov,* or Assessment and Standards Division Hotline; telephone number 734–214–4636; E-mail address *asdinfo@epa.gov.*

SUPPLEMENTARY INFORMATION:

I. General Information

A. Does this action apply to me?

Entities potentially affected by this proposed rule are those involved with the production, distribution, and sale of transportation fuels, including gasoline and diesel fuel or renewable fuels such as ethanol and biodiesel. Potentially regulated categories include:

Category	NAICS [1] codes	SIC [2] codes	Examples of potentially regulated entities
Industry	324110	2911	Petroleum Refineries.
Industry	325193	2869	Ethyl alcohol manufacturing.
Industry	325199	2869	Other basic organic chemical manufacturing.
Industry	424690	5169	Chemical and allied products merchant wholesalers.
Industry	424710	5171	Petroleum bulk stations and terminals.
Industry	424720	5172	Petroleum and petroleum products merchant wholesalers.

Category	NAICS [1] codes	SIC [2] codes	Examples of potentially regulated entities
Industry	454319	5989	Other fuel dealers.

[1] North American Industry Classification System (NAICS).
[2] Standard Industrial Classification (SIC) system code.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be regulated by this proposed action. This table lists the types of entities that EPA is now aware could potentially be regulated by this proposed action. Other types of entities not listed in the table could also be regulated. To determine whether your activities would be regulated by this proposed action, you should carefully examine the applicability criteria in 40 CFR part 80. If you have any questions regarding the applicability of this proposed action to a particular entity, consult the person listed in the preceding section.

B. What should I consider as I prepare my comments for EPA?

1. Submitting CBI

Do not submit this information to EPA through *http://www.regulations.gov* or e-mail. Clearly mark the part or all of the information that you claim to be CBI. For CBI information in a disk or CD–ROM that you mail to EPA, mark the outside of the disk or CD–ROM as CBI and then identify electronically within the disk or CD–ROM the specific information that is claimed as CBI. In addition to one complete version of the comment that includes information claimed as CBI, a copy of the comment that does not contain the information claimed as CBI must be submitted for inclusion in the public docket. Information so marked will not be disclosed except in accordance with procedures set forth in 40 CFR part 2.

2. Tips for Preparing Your Comments

When submitting comments, remember to:

- Identify the rulemaking by docket number and other identifying information (subject heading, **Federal Register** date and page number).
- Follow directions—The agency may ask you to respond to specific questions or organize comments by referencing a Code of Federal Regulations (CFR) part or section number.
- Explain why you agree or disagree, suggest alternatives, and substitute language for your requested changes.
- Describe any assumptions and provide any technical information and/or data that you used.
- If you estimate potential costs or burdens, explain how you arrived at your estimate in sufficient detail to allow for it to be reproduced.
- Provide specific examples to illustrate your concerns, and suggest alternatives.
- Explain your views as clearly as possible, avoiding the use of profanity or personal threats.
- Make sure to submit your comments by the comment period deadline identified.

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I. Executive Summary

The Renewable Fuel Standard (RFS) program began in 2007 following the requirements in Clean Air Act (CAA) section 211(o) which were implemented through the Energy Policy Act of 2005 (EPAct). The statutory requirements for the RFS program were subsequently modified through the Energy Independence and Security Act of 2007 (EISA), resulting in the release of revised regulatory requirements on March 26, 2010 [1]. In general, the transition from the RFS1 requirements of EPAct to the RFS2 requirements of EISA will occur on July 1, 2010.

EPA is required to determine and publish the applicable annual percentage standards for each compliance year by November 30 of the previous year. The determination of the applicable standards under RFS2 requires the EPA to conduct an in-depth evaluation of the volume of qualifying cellulosic biofuel that can be supplied in the following year. If the projected

[1] 75 FR 14670.

volume of cellulosic biofuel production is less than the required volume specified in the statute, EPA must lower the required volume used to set the annual cellulosic biofuel percentage standard to the projected volume of production. We must also determine whether the advanced biofuel and/or total renewable fuel volumes should be reduced by the same or a lesser amount. Since these evaluations will be based on evolving information about emerging segments of the biofuels industry, and may result in the required volumes differing from those in the statute, we believe that a notice-and-comment rulemaking process is appropriate. Today's notice provides our evaluation of the projected production of cellulosic biofuel for 2011, and proposed percentage standards for compliance year 2011. We will complete our evaluation based on comments received in response to this proposal, the Production Outlook Reports due to the Agency on September 1, 2010, the estimate of projected biofuel volumes that the EIA is required to provide to EPA by October 31, and other information that becomes available, and will finalize the standards for 2011 by November 30, 2010.

Today's proposed rule does not include an assessment of the environmental impacts of the standards we are proposing for 2011. All of the impacts of the RFS2 program were addressed in the RFS2 final rule published on March 26, 2010, including impacts of the biofuel standards specified in the statute. Today's rulemaking simply proposes the standards for 2011 whose impacts were already analyzed previously.

Today's notice also presents two proposed changes to the RFS2 regulations. The first would create a temporary and limited means for certain renewable fuel producers to generate RINs after they have produced and sold renewable fuel. This proposed provision for "Delayed RINs" would apply only to those producers who use canola oil, grain sorghum, pulpwood, or palm oil to produce renewable fuel, and only if EPA determines that fuel pathways utilizing these feedstocks provide appropriate greenhouse gas reductions as compared to baseline fuels to enable EPA to list the pathways in Table 1 to § 80.1426. We are proposing that the provision for Delayed RINs would apply only to these four feedstocks because we would have included them in the final RFS2 rule if the lifecycle analyses had been completed in time. The greenhouse gas (GHG) lifecycle impacts of these four feedstocks are currently being analyzed as a supplement to the RFS2 final rule and are expected to be completed in 2010. The second proposed regulatory provision would establish criteria for EPA to use in determining whether to authorize renewable fuel producers using foreign-grown feedstocks to use an aggregate approach to compliance with the renewable biomass verification provisions, akin to that applicable to producers using crops and crop residue grown in the United States. Further discussion of both of these proposed provisions can be found in Section V.

Finally, we note that in the RFS2 final rule we also stated our intent to make two announcements each year:

- Set the price for cellulosic biofuel waiver credits that will be made available to obligated parties in the event that we reduce the volume of cellulosic biofuel below the volume required by EISA.
- Announce the results of our assessment of the aggregate compliance approach for verifying renewable biomass requirements for U.S. crops and crop residue, and our conclusion regarding whether the aggregate compliance provision will continue to apply.

For both of these determinations EPA will use specific sources of data and a methodology laid out in the RFS2 final rule. We intend to present the results of both of these determinations in the final rule following today's proposal.

A. Statutory Requirements for Cellulosic Biofuel

The volumes of renewable fuel that must be used under the RFS2 program each year (absent an adjustment or waiver by EPA) are specified in CAA 211(o)(2). These volumes for 2011 are shown in Table I.A–1.

TABLE I.A–1—REQUIRED VOLUMES IN THE CLEAN AIR ACT FOR 2011

[Bill gal]

	Actual volume	Ethanol equivalent volume
Cellulosic biofuel	0.25	[a] 0.25
Biomass-based diesel	0.80	1.20
Advanced biofuel	1.35	1.35
Renewable fuel	13.95	13.95

[a] This value assumes that all cellulosic biofuel would be ethanol. If any portion of the renewable fuel used to meet the cellulosic biofuel volume mandate has a volumetric energy content greater than that for ethanol, this value will be higher.

By November 30 of each year, the EPA is required under CAA 211(o) to determine and publish in the **Federal Register** the renewable fuel standards for the following year. These standards are to be based in part on transportation fuel volumes estimated by the Energy Information Administration (EIA) for the following year. The calculation of the percentage standards is based on the formulas in § 80.1405(c) which express the required volumes of renewable fuel as a volume percentage of gasoline and diesel sold or introduced into commerce in the 48 contiguous states plus Hawaii.

The statute requires the EPA to determine whether the projected volume of cellulosic biofuel production for the following year is less than the minimum applicable volume shown in Table I.A–1. If this is the case, then the standard for cellulosic biofuel must be based upon the volume projected to be available rather than the applicable volume in the statute. In addition, if EPA reduces the required volume of cellulosic biofuel below the level specified in the statute, the Act also indicates that we may reduce the applicable volume of advanced biofuels and total renewable fuel by the same or a lesser volume.

As described in the final rule for the RFS2 program, we intend to examine EIA's projected volumes and other available data including the Production Outlook Reports required under § 80.1449 in making the determination of the appropriate volumes to require for 2011. Since the first set of Production Outlook Reports are not due until September 1, 2010, they were not available for today's proposal but will be considered for development of the

final rule to be released by November 30, 2010.

B. Assessment of 2011 Cellulosic Biofuel Volume

To estimate the volume of cellulosic biofuel that could be made available in the U.S. in 2011, we researched all potential production sources by company and facility. This included sources that were still in the planning stages, those that were under construction, and those that are already producing some volume of cellulosic ethanol, cellulosic diesel, or some other type of cellulosic biofuel. We considered all pilot and demonstration plants as well as commercial plants. From this universe of potential cellulosic biofuel sources we identified the subset that had a possibility of producing some volume of qualifying cellulosic biofuel for use as transportation fuel in 2011. We then conducted a rigorous process of contacting all of these producers to determine which ones were actually in a position to produce and make available any commercial volumes of cellulosic biofuel in 2011. Based on information gathered in this process, we estimated the maximum potentially available 2011 volumes. For the final rule, we will specify the projected available volume for 2011 that will be the basis for the percentage standard for cellulosic biofuel. To determine the projected available volume, we will consider factors such as the current and expected state of funding, the status of the technology and contracts for feedstocks, and progress towards construction and production goals. A complete list of all the factors we expect to consider in this process is provided in Section II.A.5.

In our assessment we evaluated both domestic and foreign sources of cellulosic biofuel. Of the domestic sources, we estimated that seven facilities have the potential to make volumes of cellulosic biofuel available for transportation use in the U.S. in 2011. We also determined that one facility in Canada has the potential to export some cellulosic biofuel to the U.S. These facilities are listed in Table I.B–1 along with our estimate of the maximum potentially available volume.

TABLE I.B–1—MAXIMUM POTENTIALLY AVAILABLE CELLULOSIC BIOFUEL PLANT VOLUMES FOR 2011

Company	Location	Fuel type	Maximum potentially available volume (million ethanol-equivalent gallons)
AE Advanced Fuels Keyes	Keyes, CA	Ethanol	0.5
Agresti Biofuels	Pike County, KY	Ethanol	1
Bell Bio-Energy	Atlanta, GA	Diesel feedstock	11.9
Cello Energy	Bay Minette, AL	Diesel	8.5
DuPont Dansico	Vonore, TN	Ethanol	0.15
Fiberight	Blairstown, IA	Ethanol	2.8
Iogen Corporation	Ottawa, Ont	Ethanol	0.25
KL Energy Corp/WBE	Upton, WY	Ethanol	0.4
Total			25.5

The volumes in Table I.B–1 for each facility represent the volume that would be produced in 2011 based upon the owner's expected month of startup and an assumed period of production rampup for testing and process validation. However, none of the facilities we evaluated are currently producing cellulosic biofuel at the rates they project for 2011. Moreover, there are other uncertainties associated with each facility's projected volume that could result in less production volume in 2011 than the maximum potentially available values shown in Table I.B–1. These uncertainties include outstanding issues in areas such as technology, funding, and construction. Historical successes in meeting various past milestones also play a role in assessing the likelihood of meeting future milestones. A detailed discussion of these uncertainties is presented in Section II.A. Finally, the volumes that should be considered for setting the 2011 standard are those that result from valid cellulosic biofuel pathways in Table 1 to § 80.1426. As described more fully in Section IV.A, some of the facilities in Table I.B–1 may use feedstocks that have not yet been subjected to lifecycle analyses to determine if the pathway meets the applicable GHG thresholds.

Based on our preliminary assessment for this NPRM, we believe that we could justify a 2011 cellulosic biofuel volume requirement of at least 6.5 million ethanol-equivalent gallons, and potentially as high as 25.5 million gallons. For the final rule we will use additional information that becomes available after publication of this proposal and a more precise assessment of the uncertainties associated with each facility to determine the projected available volume on which to base the cellulosic biofuel percentage standard for 2011.

C. Advanced Biofuel and Total Renewable Fuel

As described in Section I.A above, the statute indicates that we may reduce the applicable volume of advanced biofuel and total renewable fuel if we determine that the projected volume of cellulosic biofuel production for 2011 falls short of the statutory volume of 250 million gallons. As shown in Table I.B–1, we are proposing a determination that this is the case. Therefore, we also needed to evaluate the need to lower the required volumes for advanced biofuel and total renewable fuel.

We first considered whether it appears likely that the required biomass-based diesel volume of 0.8 billion gallons can be met with existing biodiesel production capacity in 2011. As discussed in Section II.D, we believe that the 0.8 billion gallon standard can indeed be met. Since biodiesel has an Equivalence Value of 1.5, 0.8 billion physical gallons of biodiesel would provide 1.20 billion ethanol-equivalent gallons that can be counted towards the advanced biofuel standard of 1.35 billion gallons. Of the remaining 0.15 bill gallons, up to 0.026 bill gallons would be met with the proposed volume of cellulosic biofuel. Based on our analysis as described in Section II.C, there may be sufficient volumes of other advanced biofuels, such as imported sugarcane ethanol, additional biodiesel, or renewable diesel, such that the standard for advanced biofuel could remain at the statutory level of 1.35 billion gallons. However, uncertainty in

the potential volumes of these other advanced biofuels coupled with the range of potential production volumes of cellulosic biofuel could provide a rationale for lowering the advanced biofuel standard. If we do not simultaneously lower the required volume for total renewable fuel, the result would be that additional volumes of conventional renewable fuel, such as corn-starch ethanol, would be produced, effectively replacing some advanced biofuels. In today's NPRM we are proposing that neither the required 2011 volumes for advanced biofuel nor total renewable fuel be lowered below the statutory volumes. However, we request comment on whether the advanced biofuel and/or total renewable fuel volume requirements should be lowered if, as we propose, EPA lowers the required cellulosic biofuel volume from that specified in the Act.

D. Proposed Percentage Standards

The renewable fuel standards are expressed as a volume percentage, and are used by each refiner, blender or importer to determine their renewable fuel volume obligations. The applicable percentages are set so that if each regulated party meets the percentages, and if EIA projections of gasoline and diesel use are accurate, then the amount of renewable fuel, cellulosic biofuel, biomass-based diesel, and advanced biofuel used will meet the volumes required on a nationwide basis. To calculate the percentage standard for cellulosic biofuel for 2011, we have used a potential volume range of 6.5–25.5 million ethanol-equivalent gallons (representing 5–17.1 million physical gallons). For the final rule, EPA intends to pick a single value from within this range to represent the projected available volume on which the 2011 percentage standard for cellulosic biofuel will be based. We are also proposing that the applicable volumes for biomass-based diesel, advanced biofuel, and total renewable fuel for 2011 will be those specified in the statute. These volumes are shown in Table I.D–1.

TABLE I.D–1—PROPOSED VOLUMES FOR 2011

	Actual volume	Ethanol equivalent volume
Cellulosic biofuel	5–17.1 mill gal	6.5–25.5 mill gal.
Biomass-based diesel	0.80 bill gal	1.20 bill gal.
Advanced biofuel	1.35 bill gal	1.35 bill gal.
Renewable fuel	13.95 bill gal	13.95 bill gal.

Four separate standards are required under the RFS2 program, corresponding to the four separate volume requirements shown in Table I.D–1. The specific formulas we use to calculate the renewable fuel percentage standards are contained in the regulations at § 80.1405 and repeated in Section III.B.1. The percentage standards represent the ratio of renewable fuel volume to non-renewable gasoline and diesel volume. The projected volumes of gasoline and renewable fuels used to calculate the standards are provided by EIA's Short-Term Energy Outlook (STEO) [2]. The projected volume of transportation diesel used to calculate the standards is provided by EIA's 2010 Annual Energy Outlook (early release version).[3] Because small refiners and small refineries are also regulated parties beginning in 2011 [4], there is no small refiner/refinery volume adjustment to the 2011 standard as there was for the 2010 standard. Thus, the increase in the percentage standards relative to 2010 appears smaller than would otherwise be the case, since more obligated parties will be participating in the program. The proposed standards for 2011 are shown in Table I.D–2. Detailed calculations can be found in Section III.

TABLE I.D–2—PROPOSED PERCENTAGE STANDARDS FOR 2011

	Percent
Cellulosic biofuel	0.004–0.015
Biomass-based diesel	0.68
Advanced biofuel	0.77
Renewable fuel	7.95

II. Volume Production and Import Potential for 2011

In order to project production volumes of cellulosic biofuel in 2011 for use in setting the percentage standards, we collected information on individual facilities that have the potential to produce qualifying volumes for consumption as transportation fuel, heating oil, or jet fuel in the U.S. in 2011. This section describes the potential volumes that we believe could be produced or imported in 2011 as well as the uncertainties associated with those volumes. The volumes listed in this section do not represent the projected available volume of cellulosic biofuel that will be used to finalize the cellulosic biofuel percentage standard for 2011. Rather, for today's NPRM we have assessed the maximum potentially available volume for 2011, which is intended to represent an upper bound of the volume of fuel that may be produced and made available. The production of cellulosic biofuel remains highly uncertain, and EPA expects that the volume of cellulosic biofuel used to set the 2011 percentage standard will be a lesser volume than this maximum potentially available volume. Section III describes the conversion of our maximum potentially available volumes for cellulosic biofuel into a range of percentage standards.

While the 2011 volume projections in today's proposal were based on our own assessment of the cellulosic biofuel industry, by the time we announce the final 2011 volumes and percentage standards we will have additional information. First, in addition to comments in response to today's proposal, we will have updated and more detailed information about how the industry is progressing in 2010. Second, by September 1 all registered producers and importers of renewable fuel must submit Production Outlook Reports describing their expectations for new or expanded biofuel supply for the next five years, according to § 80.1449. Finally, by October 2010 the Energy

[2] The March 2010 issue of STEO was used for today's proposal. We intend to use the October 2010 version for the final rule.

[3] EIA has recommended the use of the Annual Energy Outlook (AEO) rather than the Short Term Energy Outlook as a better representation of the estimated transportation sector diesel fuel use. We will use the most recent version of AEO in the final values of the standards.

[4] The Department of Energy concluded that there is no reason to believe that any small refinery would be disproportionately harmed by inclusion in the proposed RFS2 program for 2011 and beyond. See DOE report "EPACT 2005 Section 1501 Small Refineries Exemption Study", (January 2009). We will revisit extensions to the exemption for small refiners and refineries if DOE revises their study and provides a different conclusion, or an individual small refinery is able to demonstrate that it will suffer a disproportionate economic hardship under the RFS program.

Information Administration (EIA) is required by statute to provide EPA with an estimate of the volumes of transportation fuel, biomass-based diesel, and cellulosic biofuel projected to be sold or introduced into commerce in the U.S. in 2011.

A. Cellulosic Biofuel

The task of projecting the volume of cellulosic biofuels that will be produced in 2011 is a difficult one. Currently there are no facilities consistently producing cellulosic biofuels for commercial sale. Announcements of new projects, changes in project plans, project delays, and cancellations occur with great regularity. Biofuel producers face not only the challenge of the scale up of innovative, first-of-a-kind technology, but also the challenge of securing funding in a difficult economy.

In order to project cellulosic biofuel production in 2011, EPA has tracked the progress of over 100 biofuel production facilities. From this list of facilities we used publicly available information, as well as information provided by DOE and USDA, to determine which facilities were the most likely candidates to produce cellulosic biofuel and make it commercially available in 2011. Each of these companies was contacted by EPA in order to determine the current status of their facilities and discuss their commercialization plans for the coming years. Our estimate of the maximum potentially available cellulosic biofuel production in 2011 is based on the information we received in conversations with these companies as well as our own assessment of the likelihood of these facilities successfully producing cellulosic biofuel in the volumes indicated.

A brief description of each of the companies we believe may produce cellulosic biofuel and make it commercially available can be found below. These companies have been grouped according to the type of biofuel they produce. For the purpose of setting the cellulosic biofuel standard for 2011 this is a convenient grouping, as the number of RINs generated per gallon of fuel produced is dependent on the type of fuel. A more in depth discussion of the technologies used to produce cellulosic biofuels can be found in Section IV.

In today's NPRM EPA is proposing a range, rather than a single value, for the required 2011 cellulosic biofuel volume. At a minimum, we believe that a volume of 6.5 million gallons could be justified based on currently available information. This is the cellulosic biofuel volume that was required in 2010, and absent a waiver for some portion of this volume, producers will be aiming to meet it. Therefore, it is reasonable to project that this same volume could, at minimum, also be produced in 2011.

For a maximum potentially available cellulosic biofuel volume for 2011, we are proposing 25.5 million ethanol equivalent gallons, representing the highest volume of fuel that can reasonably be expected to be produced and made available based on current information. In order for this volume of cellulosic biofuel to be produced in 2011, each of the companies discussed below would have to achieve their production targets in their projected timeframes. However, historical trends among cellulosic biofuel producers suggests that this is unlikely to be the case, as there are many factors which have the potential to result in production delays. For instance, several of the companies we considered when setting the 2010 cellulosic biofuel standard have yet to sell cellulosic biofuel in the United States and appear unlikely to do so by the end of 2010. This fact demonstrates the uncertainty of cellulosic biofuel production estimates, and is one of many factors EPA will consider when setting the cellulosic biofuel standard for 2011.

The rest of this section describes the analyses that were used as the basis for this maximum value. We will continue to gather more information to help inform our decision on the final cellulosic biofuel standard for 2011, and we will specify a single volume in the final rule that will be the basis for the cellulosic biofuel percentage standard for 2011.

1. Domestic Cellulosic Ethanol

Based on our assessment of the cellulosic biofuel industry we believe that there are five companies in the United States with the potential to produce cellulosic ethanol and make it commercially available in 2011. These companies are AE Biofuels, Agresti Biofuels, DuPont Danisco Cellulosic Ethanol, Fiberight, and KL Energy Corporation. This section will provide a brief description of each of these companies and our assessment of their potential fuel production in 2011. This section also provides a brief update on companies from whom we do not expect any commercial sales of transportation fuel in 2011 in the U.S. but were included in prior assessments.

AE Biofuels is a company that plans to convert corn cobs and corn stover to ethanol using an enzymatic hydrolysis. They plan to use an integrated process that converts both starch and cellulose to ethanol. In August 2008 they opened a demonstration plant in Butte, Montana to test their technology and gather information for their first commercial scale plant. AE Biofuels has reached a lease agreement with Cilion to operate Cilion's 55 MGY corn ethanol plant in Keyes, CA under the name AE Advanced Fuels Keyes. This facility has been idled since April 2009 and will require repairs before being operational. AE Biofuels plans to start up production with a starch feedstock in late-2010 and then begin to transition some production to cellulosic feedstock in mid-2011. AE Biofuels plans to eventually use up to 25% cellulosic feedstock for ethanol production in this facility. EPA projects that up to 0.5 million gallons of ethanol may be produced by this facility in 2011.

Agresti Biofuels plans to produce ethanol from separated municipal solid waste (separated MSW) at a facility in Pike County, Kentucky. Their process uses a gravity pressure vessel licensed from GeneSyst to crack the lignin in their feedstock and then a combination of weak bases and acids to convert the cellulose and hemicellulose into simple sugars for later fermentation into ethanol. Agresti plans to begin construction on their first production facility in Pike County sometime in the summer of 2010 and hope to be producing ethanol by the end of 2011. The full production capacity of this facility will be 20 million gallons of ethanol per year. Due to the fact that construction on this facility has not yet begun and production is not expected until late in 2011 EPA expects no more than 1 million gallons of cellulosic ethanol to be produced by Agresti Biofuels in 2011.

DuPont Danisco Cellulosic Ethanol (DDCE) began start up operations at a small demonstration facility in Vonore, Tennessee in early 2010. This facility has a maximum production capacity of 250,000 gallons of ethanol per year and uses an enzymatic hydrolysis process to convert corn cobs into ethanol. The main purpose of this facility is not to produce ethanol to be sold commercially, but rather to provide information for the future construction and optimization of larger, commercial scale cellulosic ethanol production facilities. DDCE have indicated that they do not intend to produce more than 150,000 gallons of ethanol in 2011 from the Vonore facility.

Fiberight is another company planning to convert MSW to ethanol. Fiberight purchased a small corn ethanol plant in Blairstown, IA and has converted it to produce cellulosic ethanol. They use an enzymatic hydrolysis process, with enzymes

provided by Novozymes, to convert the cellulosic waste materials to simple sugars and eventually to ethanol. Fiberight has a unique enzyme recycle and recovery process that allows them to affordably use high concentrations of enzymes to increase the speed and conversion rate of the cellulose to simple sugars. Fiberight plans to begin ethanol production in the summer of 2010 and ramp up to full production capacity of 5.7 million gallons of ethanol per year by late 2011. Based on company estimates, EPA projects Fiberight could produce as much as 2.8 million gallons of cellulosic ethanol in 2011.

The fifth company that EPA is aware of with the potential to produce cellulosic ethanol in 2011 is KL Energy Corporation. KL Energy has a small facility in Upton, Wyoming that uses an enzymatic hydrolysis process to convert wood chips and wood waste to ethanol. This facility has a maximum annual production volume of 1.5 million gallons and has been operational since the fall of 2007. Since KL Energy completed construction on this facility they have been slowly ramping up production and gathering information to optimize this and future ethanol production facilities. KL has informed EPA that they intend to produce 400,000 gallons of cellulosic ethanol from their Upton, WY facility in 2011.

In addition to the five companies mentioned above, EPA is also tracking the progress of more than 70 ethanol production facilities in various stages ranging from construction to planning stages. Several of these companies, including Abengoa, BlueFire Ethanol, Coskata, Fulcrum, POET, and Vercipia all intend to begin the production and commercial sale of cellulosic ethanol in 2012. These facilities range in maximum production capacity from 10 to 100 million gallons of ethanol. EPA anticipates a significant increase in the production and sale of cellulosic ethanol in 2012, and strong continued growth in the following years. In addition, if any of these or other companies accelerates their production plans to make cellulosic biofuel available for commercial sale in 2011, we will take those volumes into account in our final rule.

2. Domestic Cellulosic Diesel

EPA is also aware of two companies in the United States with the potential of producing cellulosic diesel fuel in 2011. The first of these companies is Cello Energy. Cello Energy plans to use a catalytic depolymerization process to produce diesel fuel from wood chips and hay. Cello currently has a structurally complete facility in Bay Minette, Alabama with an annual production capacity of 20 million gallons of diesel per year. While having a structurally complete facility puts Cello ahead of many other potential biofuel producers they have yet to be able to produce biofuel at anywhere near the production capacity. They are currently assessing feedstock preparation and handling issues that must be resolved before they are able to again attempt start up and production at this facility. If these issues are successfully addressed EPA believes that Cello could, at most, produce up to 5 million gallons (8.5 million ethanol equivalent gallons) of cellulosic diesel fuel in 2011.

Another potential producer of cellulosic biofuel in 2011 is Bell Bio-Energy. Bell Bio-Energy uses proprietary organisms to convert waste materials to liquid fuels and compost in a single step. The company currently has an agreement in place for the sale of the compost they produce and are searching for a location for their first plant and a partner to supply the waste materials they intend to use as feedstock. The liquid fuel they produce is not a finished transportation fuel, but could be upgraded to jet or diesel fuel. Bell Bio-Energy is currently working with a refining company to analyze the fuel they produce and determine the extent of upgrading necessary for the fuel to qualify as transportation fuel. They plan to begin construction on their first facility, which will have an annual fuel production capacity of 14.4 million gallons per year, as soon as a suitable site and partner are found. The simplicity and low capital costs of Bell Bio-Energy's single step production process allow them to construct plants very rapidly, in as little as six weeks. This would make it possible for Bell Bio-Energy to produce cellulosic biofuel in 2011 despite the fact that they have not yet begun construction on their first commercial scale facility. It is unclear when fuel will be produced at this facility, and whether it would qualify under the RFS2 program. If Bell Bio-Energy is successful in producing and upgrading their fuel EPA estimates the maximum volume of fuel they could produce in 2011 would be 7 million gallons (11.9 million ethanol equivalent gallons) of jet or diesel fuel.

EPA is also tracking the progress of 17 other facilities that plan to produce cellulosic diesel. Flambeau Rivers Biofuels, New Page, and Terrabon are planning on opening commercial scale cellulosic diesel facilities in 2012. Both Bell Bio-Energy and Cello have plans to build additional facilities if their initial projects are successful. As with cellulosic ethanol, cellulosic diesel production has the potential for rapid growth in 2012 and the following years.

3. Other Domestic Cellulosic Biofuels

We are currently unaware of any companies in the United States planning on producing cellulosic biofuel other than ethanol and diesel and making it commercially available. EPA is currently tracking the efforts of 10 companies that plan to produce fuels such as gasoline, jet fuel, dimethyl ether (DME), and others. Many of these companies have reported that they are still developing their technologies and waiting for funding, and that they are not expecting to make any cellulosic fuel commercially available until 2012 at the earliest. There are several companies, such as Gevo and Virent, with small demonstration facilities who intend to produce other fuels from cellulosic feedstocks, but are currently optimizing their technology with sugar or starch feedstocks. EPA anticipates that in the future this may be a significant source of cellulosic biofuel, however we are only expecting cellulosic ethanol and diesel to be produced in 2011.

4. Imports of Cellulosic Biofuel

In addition to the companies located in the United States, EPA is also aware of two Canadian companies with the potential for cellulosic biofuel production in 2011. If this fuel was imported into the United States, these companies would be eligible to participate in the RFS2 program. Counting on cellulosic biofuel produced internationally in setting the 2011 standard brings with it the additional uncertainty associated with the fact that the fuel may be used locally rather than imported into the United States.

Iogen uses a steam explosion pre-treatment process followed by enzymatic hydrolysis to produce cellulosic ethanol from wheat, oat, and barley straw. They have a demonstration facility with an annual production capacity of 500,000 gallons of ethanol located in Ontario, Canada. This facility has been operational and producing small volumes of ethanol since 2004. So far all of the ethanol produced by this facility has been used locally and in racing and other promotional events. Iogen, however, is exploring the possibility of participating in the RFS2 program. If they do decide to import ethanol to the United States, EPA projects that they could provide as much as 250,000 gallons of cellulosic ethanol in 2011 based on production volumes from previous years.

Another Canadian company with the potential to produce cellulosic ethanol in 2011 is Enerkem. Enerkem plans to use a thermo-chemical process to gasify separated MSW and other waste products and then use a catalyst to convert the synthesis (syn) gas into ethanol. Enerkem is currently finishing construction on a 1.3 million gallon per year facility in Westbury, Quebec and plans to begin producing ethanol in the summer of 2010. They are also planning a 10 million gallon per year facility in Edmonton, Alberta, however production from this facility is not expected until 2012. Enerkem has informed EPA that they plan to market ethanol they produce locally, and have no intentions to import cellulosic ethanol into the United States. We are therefore not projecting any available cellulosic fuel from Enerkem in 2011.

While Canada may be the most likely source of imported cellulosic biofuels due to its close proximity, it is possible that cellulosic biofuels produced in other countries may be imported into the United States as well. Another potential source of cellulosic biofuel imports is Brazil, due to its established ethanol industry and history of importing ethanol into the United States. EPA is aware of several companies exploring the possibility of cellulosic biofuel production in Brazil; however none of these companies are likely to make cellulosic biofuels commercially available in the United States in 2011. With the exception of Iogen, as mentioned above, EPA has not projected imports of cellulosic biofuels from outside the United States in 2011.

5. Summary of Volume Projections

The information EPA has gathered on the potential cellulosic biofuel producers in 2011, summarized in Section II.A above, allows us to project a maximum potentially available biofuel volume for each facility in 2011. After the appropriate ethanol equivalence value has been applied to the volumes of those facilities producing diesel fuel, the overall maximum potentially available volume of cellulosic biofuels for 2011 can be calculated by summing the maximum potential of each facility. EPA is not proposing to set the 2011 cellulosic biofuel standard at this maximum potentially available volume, rather this is intended to serve as an upper bound. This information is summarized in Table II.A.5–1 below.

TABLE II.A.5–1—CELLULOSIC BIOFUEL MAXIMUM 2011 POTENTIALLY AVAILABLE VOLUME

Company name	Location	Feedstock	Fuel	Capacity (MGY)	Earliest production	Maximum 2011 potentially available volume (MG)	Ethanol equivalent gallons (MG)
AE Advanced Fuels Keyes.	Keyes, CA	Corn, then stover	Ethanol	20	June 2011	0.5	0.5
Agresti Biofuels	Pike County, KY	MSW	Ethanol	20	Oct. 2011	1	1
Bell Bio-Energy	Atlanta, GA	MSW or other cellulosic biomass.	Diesel Feedstock	14.4	June 2011	7	11.9
Cello Energy	Bay Minette, AL	Wood, hay	Diesel	20	Online	5	8.5
DuPont Danisco [a]	Vonore, TN	Corn cobs, then switchgrass.	Ethanol	0.25	Online	0.15	0.15
Fiberight [a]	Blairstown, IA	MSW	Ethanol	6	April 2010	2.8	2.8
Iogen	Ottawa, Ontario	Wheat, oat & barley straw.	Ethanol	0.5	Online	0.25	0.25
KL Energy [a]	Upton, WY	Wood	Ethanol	1.5	Online	0.4	0.4
Total						17.1	25.5

[a] Maximum Production/Import Potential represents company estimate.

It is important to note that this maximum potentially available volume of 17.1 million gallons of cellulosic biofuel, or 25.5 million ethanol equivalent gallons, is not the volume on which the final 2011 cellulosic biofuel standard will be based. This number represents the maximum amount of fuel EPA believes could reasonably be expected to be produced or imported and made available for use as transportation fuel, heating oil, or jet fuel in 2011. It incorporates some reductions from the annual production capacity of each facility based on when the facilities anticipate fuel production will begin and assumptions regarding a ramp up period to full production. However, as stated earlier, in order for this volume of cellulosic biofuel to be produced in 2011, each of the companies listed in Table II.A.5–1 would have to achieve their production targets in their projected timeframes. The history of the cellulosic biofuels industry has many examples of delays in achieving full production capacity in new facilities. Also, there are many other factors that increase the uncertainty of fuel production facilities being able to achieve their maximum potential production. These factors may include:

- Difficulty/delays in securing necessary funding.
- Delays in permitting and/or construction.
- Difficulty in scale up, especially for 1st of their kind technologies.
- Volumes from pilot and demonstration plants may not be sold commercially.
- Not all feedstocks may qualify to produce cellulosic RINs; some still awaiting evaluation of lifecycle impacts.
- Likelihood that fuels produced internationally will be exported to the United States rather than consumed locally.

Each of the facilities listed in Table II.A.5–1 may experience some of the difficulties listed above, and as a result may produce a volume of fuel less than that listed as their maximum 2011 potentially available volume. Despite this uncertainty, EPA believes that the volume of cellulosic biofuel produced in 2011 will, at minimum, be able to meet or exceed the 2010 standard of 6.5 million ethanol equivalent gallons. However, we will have more detailed and accurate information for the final rule, including the first round of Production Outlook Reports, due on

September 1, 2010[5] which will provide information from each producer or importer on the type or types of fuel they plan to make available, the volume of fuel, and the number of RINs they plan to generate for the next five calendar years.[6] Therefore, in today's NPRM we are proposing a range of values, from a minimum of 6.5 million ethanol equivalent gallons to a maximum of 25.5 million ethanol equivalent gallons for the 2011 cellulosic biofuel standard. As time progresses and we are able to track whether or not the cellulosic biofuels producers are able to meet the construction and ramp up schedules they have presented, we will have a better idea of the appropriate volume of fuel that we can reasonably expect to be produced and made commercially available in 2011. Additionally, each year by October 31 EIA is required to provide an estimate of the volume of cellulosic biofuel they expect to be sold or introduced into commerce in the United States in the following year. EPA will consider this information as well when finalizing a single volume for use in setting the 2011 cellulosic biofuel standard.

Although we are currently projecting that the potentially available volume of cellulosic biofuel in 2011 will be in the range of 6.5 to 25.5 million ethanol-equivalent gallons, we expect that volumes of cellulosic biofuel will increase rapidly in the years following 2011. As stated before, we are aware of more than 100 companies that are actively investigating or making plans to produce cellulosic biofuel in the near future. Many of these companies intend to begin construction in 2011 or 2012. We will be monitoring these companies carefully as we project the potential volumes of cellulosic biofuel for years 2012 and beyond.

B. Potential Limitations

In addition to production capacity, a variety of other factors have the potential to limit the amount of cellulosic biofuel that can be produced and used in the U.S. For instance, there may be limitations in the availability of qualifying cellulosic feedstocks at reasonable prices. Most of the cellulosic biofuel producers that we project will produce commercial volumes in 2011 have indicated that they will use some type of cellulosic waste, such as separated municipal solid waste, wastes from the forestry industry, and agricultural residues. Based on the analyses of cellulosic feedstock availability in the RFS2 final rule, we believe that there will be significantly more than enough sources of these feedstocks for 2011. For producers that intend to use dedicated energy crops, we do not believe that the availability of existing cropland will limit production in 2011. We plan to continue to evaluate the availability of valid feedstocks in future years as the required volumes of cellulosic biofuel increase.

Another factor that has the potential to limit the amount of renewable fuel that can be produced and used in the U.S. is distribution and storage capacity. In the longer term, most biofuels are expected to be produced in the heartland of the country and then be shipped towards the coasts, flowing roughly in the opposite direction of petroleum-based fuels. The physical and chemical nature of many of these biofuels may limit the extent to which they can be shipped and/or stored fungibly with petroleum-based fuels. As a result, new and expanded rail, barge and tank truck transport will need to be put in place. Dedicated biofuels pipelines are also being investigated. For instance, a short gasoline pipeline in Florida is currently shipping batches of ethanol.[7] Evaluations are also currently underway regarding the feasibility of constructing a new dedicated ethanol pipeline from the Midwest to the East coast.[8] However, for 2011 the volumes of cellulosic biofuel are small enough that long-distance transport will be unnecessary; with the exception of foreign-produced biofuels, much of the cellulosic biofuel volumes can be consumed in regions close to their production facilities. We also expect existing distribution and storage capacity to be sufficient to accommodate the small increase in cellulosic biofuel volumes in 2011.

C. Advanced Biofuel and Total Renewable Fuel

Under CAA 211(o)(7)(D)(i), EPA has the flexibility to reduce the applicable volume of the advanced biofuel and total renewable fuel requirements in the event that the projected volume of cellulosic biofuel is determined to be below the volume specified in the statute. As described in Section II.A above, even the largest potential volumes of cellulosic biofuel supply for 2011 are significantly below the statutory volume of 250 million gallons. Therefore, we must consider whether and to what degree to lower the advanced biofuel and total renewable fuel standards for 2011.

As described in the RFS2 final rule, we believe it may be appropriate to allow excess advanced biofuels to make up some or all of the shortfall in cellulosic biofuel. This could include excess biomass-based diesel, sugarcane ethanol, or other biofuels categorized as advanced biofuel. We believe that Congress wanted to encourage the development of advanced renewable fuels and allow in appropriate circumstances for the use of additional volumes of those fuels in the event that the projected volume of cellulosic biofuel falls below the statutory mandate.

If we were to maintain the advanced biofuel and total renewable fuel volume requirements at the levels specified in the statute, we estimate that 125–144 million ethanol-equivalent gallons of additional advanced biofuels would be needed, depending on the standard we set for cellulosic biofuel. *See* Table II.C–1.

TABLE II.C–1—PROJECTED IMPACT OF CELLULOSIC VOLUME ON USE OF OTHER BIOFUELS IN 2011

[Mill gallons]

	Ethanol-equivalent volume	Physical volume
Total renewable fuel	13,950	13,500–13,549
Conventional renewable fuel [a]	12,600	12,600
Total advanced biofuel	1,350	900–949
Cellulosic biofuel	6.5–25.5	5–17.1
Biomass-based diesel	1200	800
Other advanced biofuel [b]	125–144	83 [c]–144 [d]

[a] Predominantly corn-starch ethanol.

[b] Rounded to nearest million gallons for simplicity.

[c] Lowest volume of other advanced biofuel assumes cellulosic biofuel standard is based on 25.5 mill gallons and only excess biodiesel (with an equivalence value (EV) of 1.5) is used to fill the need for other advanced biofuel.

[d] Highest volume of other advanced biofuel assumes cellulosic biofuel standard is based on 6.5 mill gallons and only imported sugarcane ethanol (with an EV of 1.0) is used to fill the need for other advanced biofuel.

[5] In future years, Production Outlook Reports will be due on March 1. As a result, they may be considered during development of the NPRM in year 2011 and beyond.

[6] For more information on the annual production outlook reports see § 80.1449 of the RFS2 regulations.

[7] Kinder Morgan announcement that their Central Florida Pipeline from Tampa to Orlando ships batches of ethanol along with batches of gasoline. *http://www.kindermorgan.com/business/products_pipelines/.*

[8] "POET Joins Magellan Midstream Partners to Assess Dedicated Ethanol Pipeline", March 2009, *http://www.poet.com/news/showRelease.asp?id=155.*

To determine if there are likely to be sufficient volumes of imported sugarcane ethanol and/or excess biodiesel to meet the need for 125–144 million gallons of other advanced biofuel, we examined historical data on ethanol imports and EIA projections for 2011. For instance, as shown in Table II.C–2 below, recent annual import volumes of ethanol were higher than what would be needed in 2011.

TABLE II.C–2—HISTORICAL IMPORTS OF ETHANOL

[Mill gallons] [9]

2007	439
2008	530
2009	194

Brazilian imports have made up a sizeable portion of total ethanol imported into the U.S. However, as shown above, these import volumes decreased significantly in 2009. Part of the reason for this decline in imports is the cessation of the duty drawback that became effective on October 1, 2008, but also changes in world sugar prices.[10] However, Brazil produces the most ethanol in the world, reaching about 9 billion gallons in 2008.[11] Thus if there were a demand in the U.S. in 2011 for 125–144 million gallons of advanced biofuel, it may be economical for Brazil to export at least this volume of sugarcane ethanol to the U.S.

EIA's projections for 2011 suggest that there may be sufficient volumes of imported sugarcane ethanol and excess biodiesel production to make up for our proposed reduction in the required volume of cellulosic biofuel. See Table II.C–3.

TABLE II.C–3—EIA PROJECTED IMPORTED ETHANOL AND BIODIESEL AVAILABILITY IN 2011

[Mill gallons] [12]

Imported ethanol	202
Total domestic biodiesel production	860
Biodiesel needed to meet biomass-based diesel standard	800
Excess biodiesel	60

Further discussion of the potential availability of biomass-based diesel in 2011 can be found in the next Section II.D below.

Based on these projections, there would be a total of 60 million gallons of excess biodiesel production (90 million gallons ethanol-equivalent), plus another 202 million gallons of imported sugarcane ethanol. The total would therefore be 292 million gallons ethanol-equivalent. Since we are projecting that the need for other advanced biofuel would be in the range of 125–144 million gallons depending on the cellulosic biofuel standard that we set, 292 million gallons would likely be sufficient. Moreover, the projections in Table II.C–3 do not account for other potential sources of advanced biofuels. For instance, California's Low Carbon Fuel Standard goes into effect in 2011, and may compel some refiners to import additional volumes of sugarcane ethanol from Brazil into California. These same volumes could count towards the Federal RFS2 program as well. There may also be other types of advanced biofuel not included in the EIA projections that could help meet our projected shortfall. These other advanced biofuels include, for instance, renewable fuels made from separated yard and food waste such as waste cooking oil or restaurant grease used as a diesel fuel additive. Finally, additional market demand for imported sugarcane ethanol and biodiesel would likely be created if we chose not to lower the advanced biofuel standard for 2011. Given these factors, we believe that there are likely to be sufficient volumes of other advanced biofuels such that the advanced biofuel standard need not be lowered below 1.35 billion gallons. Thus, we are proposing to leave the required volume of advanced biofuel for 2011 at 1.35 billion gallons. Nevertheless, we request comment on whether we should lower the advanced biofuel standard. If we do lower the advanced biofuel standard, we request comment on the degree to which we should take into account other potential sources of advanced biofuel as discussed above.

If we lower the cellulosic biofuel standard, we would also need to determine if the total renewable standard should be lowered. Lowering both the advanced biofuel standard and the total renewable fuel standard by the same amount would mean that the expected amount of conventional renewable fuel use, such as corn-ethanol, would remained unchanged at 12,600 million gallons ethanol equivalent, the same as shown in Table II.C–1.

If instead we were to lower the advanced biofuel standard but retain the total renewable fuel standard at 13,950 million gallons, then we would expect the use of conventional renewable fuels such as corn ethanol to increase. For instance, if we were to lower the advanced biofuel standard by 144 million gallons to 1,206 million gallons, we would expect the amount of corn-ethanol used would increase by 144 million gallons in order to satisfy the total renewable fuel standard of 13,950 million gallons. According to EIA, projected volumes of corn-ethanol are indeed expected to be higher than 12,600 million gallons in 2011, producing an excess of 1050 million gallons. See Table II.C–4.

TABLE II.C–4—PROJECTED EXCESS CORN ETHANOL IN 2011

[Mill gallons]

Total domestic corn ethanol production [13]	13,650
Corn ethanol needed to meet total renewable fuel standard	12,600
Excess corn ethanol	1050

[13] EIA STEO, June 2010, Table 8.

However, the market potential for ethanol in the U.S. is also a function of the ethanol blender's tax credit, set to expire at the end of 2010. If this tax credit is not renewed, the excess ethanol volume shown in Table II.C–4 may be smaller. Thus, while we are proposing that the required volume of total renewable fuel for 2011 be set at the statutory level of 13.95 billion gallons, we request comment on whether the total renewable fuel standard should be lowered.

D. Biomass-Based Diesel

While the statutory requirement that we project volumes of cellulosic biofuel for next year does not explicitly apply to biomass-based diesel as well, there are two other statutory requirements that compel us to investigate current and potential future volumes of biomass-based diesel. First, the Clean Air Act provides limited waiver authority specific to biomass-based diesel under 211(o)(7)(E) if a significant renewable feedstock disruption or other market circumstance would make the price of biomass-based diesel fuel increase significantly. Second, as described more fully in Section II.C above, we must determine whether the required volumes of advanced biofuel and/or total renewable fuel should be reduced at the same time that we reduce the required volume of cellulosic biofuel. The amount of biomass-based diesel that we project can be available

[9] "Monthly U.S. Imports of Fuel Ethanol," EIA, released 4/8/2010.

[10] Lundell, Drake, "Brazilian Ethanol Export Surge to End; U.S. Customs Loophole Closed Oct. 1," Ethanol and Biodiesel News, Issue 45, November 4, 2008.

[11] Renewable Fuels Association (RFA), "2008 World Fuel Ethanol Production," *http://www.ethanolrfa.org/industry/statistics/#E,* March 31, 2009.

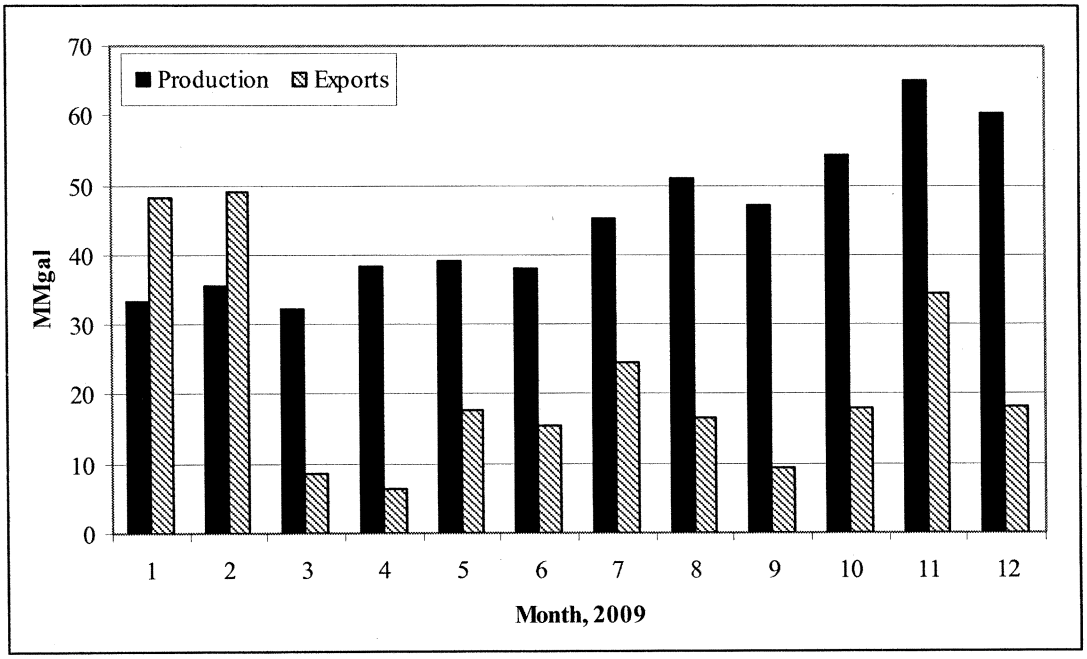
[12] EIA STEO, June 2010, Table 8.

will directly affect our consideration of adjustments to the volumetric requirements for advanced biofuel and total renewable fuel.

To project biodiesel production volumes for 2011, we examined both production capacity of the industry as well as actual recent production rates. As of April 2010, the aggregate production capacity of biodiesel plants in the U.S. was estimated at 2.2 billion gallons per year across approximately 137 facilities.[14] Biodiesel production for calendar year 2009, according to the most recently available information, was 540 million gallons, with an estimated 351 mill gallons (or 65%) being used domestically. Domestic production rates in the second half of 2009 increased above production rates in the first half as economic conditions improved, to an annualized rate of around 646 mill gal per year. Meanwhile, exports appeared to stabilize at an annualized rate of about 242 mill gal per year, after recovering from changes in European import regulations early in the year. These trends for 2009 are shown inFigure II.D–1.

Figure II.D-1

U.S. Biodiesel Production and Export Trends for 2009. [15]



In the early part of 2010, industry reports of monthly biodiesel production indicated that production rates have dropped below the 2009 average. The most likely cause is the expiration of the biodiesel tax credit. However, EIA's Short-Term Energy Outlook projects that, for the year as a whole, average monthly biodiesel production rates in 2010 will actually exceed those in 2009. The projected increase in monthly biodiesel production rates later in 2010 is consistent with the fact that obligated parties are not required to demonstrate compliance with the 2010 biomass-based diesel volume requirement of 1.15 billion gallons until February 28, 2011. For development of our final rule setting the standards for 2011, we will have more complete data with which to evaluate the progress of the biodiesel industry in meeting the 2010 volume mandate and thus its preparedness for 2011.

In order to meet a 2011 biomass-based diesel volume requirement of 0.8 billion gallons to be consumed in the United States, the biodiesel industry will need to produce approximately 725 million gal of fuel. This value accounts for the production of 75 million gallons of renewable diesel at one renewable diesel facility in Geismar, Louisiana, set to begin operations later this year.[16] Assuming imports and exports continue at a rate equivalent to that in the second half of 2009, biodiesel production in the U.S. would need to total approximately 900 million gal in 2011. While this production rate would be about 10% higher than the production rate projected by EIA for the second half of 2010, it would be significantly lower than the current 2.2 billion gallon biodiesel production capacity of the industry. Indications from the biodiesel industry are that these idled facilities can be brought back into production with a relatively short leadtime, and can thus meet the 2011 requirements for biomass-based diesel. Moreover, as shown in Table II.C–3, EIA is projecting that biodiesel availability will in fact exceed the minimum volume needed to meet the biomass-based diesel standard in 2011.

Finally, we believe that there will be sufficient sources of qualifying renewable biomass to meet the needs of the biodiesel industry in 2011. The largest sources of feedstock for biodiesel in 2011 are expected to be soy oil, rendered fats, and potentially some corn

[14] Figures taken from National Biodiesel Board list of operating plants as of April 5, 2010.

[15] Data taken from Energy Information Administration Monthly Energy Review, Table 10.4, March 2010.

[16] Project status updates are available via the Syntroleum Web site, *http://dynamicfuelsllc.com/wp-news/*.

oil extracted during production of fuel ethanol, as this technology continues to proliferate. Moreover, comments we received from a large rendering company after the May 2009 RFS2 proposed rule suggest that there will be adequate fats and greases feedstocks to supply biofuels production as well as other historical uses.[17]

III. Proposed Percentage Standards for 2011

A. Background

The renewable fuel standards are expressed as a volume percentage, and are used by each refiner, blender or importer to determine their renewable volume obligations (RVO). Since there are four separate standards under the RFS2 program, there are likewise four separate RVOs applicable to each obligated party. Each standard applies to the sum of all gasoline and diesel produced or imported. The applicable percentage standards are set so that if each regulated party meets the percentages, then the amount of renewable fuel, cellulosic biofuel, biomass-based diesel, and advanced biofuel used will meet the volumes required on a nationwide basis.

As discussed in Section II.A.5, we are proposing a required volume of cellulosic biofuel for 2011 in the range of 5–17.1 million gallons (6.5–25.5 million ethanol equivalent gallons). The single volume we select for the final rule will be used as the basis for setting the percentage standard for cellulosic biofuel for 2011. We are also proposing that the advanced biofuel and total renewable fuel volumes would not be reduced below the statutory requirements. The proposed 2011 volumes used to determine the four percentage standards are shown in Table III.A–1.

TABLE III.A–1—PROPOSED VOLUMES FOR 2011

	Actual volume	Ethanol equivalent volume
Cellulosic biofuel	5–17.1 mill gal	6.5–25.5 mill gal.
Biomass-based diesel	0.80 bill gal	1.20 bill gal.
Advanced biofuel	1.35 bill gal	1.35 bill gal.
Renewable fuel	13.95 bill gal	13.95 bill gal.

The formulas used in deriving the annual renewable fuel standards are based in part on an estimate of combined gasoline and diesel volumes, for both highway and nonroad uses, for the year in which the standards will apply. Producers of other transportation fuels, such as natural gas, propane, and electricity from fossil fuels, are not subject to the standards. Since the standards apply to producers and importers of gasoline and diesel, these are the transportation fuels used to set the standards, and then again to determine the annual volume obligations of an individual producer or importer.

B. Calculation of Standards

1. How are the standards calculated?

The following formulas are used to calculate the four percentage standards applicable to producers and importers of gasoline and diesel (*see* § 80.1405):

$$\mathrm{Std}_{\mathrm{CB,i}} = 100\% \times \frac{\mathrm{RFV}_{\mathrm{CB,i}}}{(G_i - RG_i) + (GS_i - RGS_i) - GE_i + (D_i - RD_i) + (DS_i - RDS_i) - DE_i}$$

$$\mathrm{Std}_{\mathrm{BBD,i}} = 100\% \times \frac{\mathrm{RFV}_{\mathrm{BBD,i}} \times 1.5}{(G_i - RG_i) + (GS_i - RGS_i) - GE_i + (D_i - RD_i) + (DS_i - RDS_i) - DE_i}$$

$$\mathrm{Std}_{\mathrm{AB,i}} = 100\% \times \frac{\mathrm{RFV}_{\mathrm{AB,i}}}{(G_i - RG_i) + (GS_i - RGS_i) - GE_i + (D_i - RD_i) + (DS_i - RDS_i) - DE_i}$$

$$\mathrm{Std}_{\mathrm{RF,i}} = 100\% \times \frac{\mathrm{RFV}_{\mathrm{RF,i}}}{(G_i - RG_i) + (GS_i - RGS_i) - GE_i + (D_i - RD_i) + (DS_i - RDS_i) - DE_i}$$

Where

$\mathrm{Std}_{\mathrm{CB,i}}$ = The cellulosic biofuel standard for year i, in percent.

$\mathrm{Std}_{\mathrm{BBD,i}}$ = The biomass-based diesel standard (ethanol-equivalent basis) for year i, in percent.

$\mathrm{Std}_{\mathrm{AB,i}}$ = The advanced biofuel standard for year i, in percent.

$\mathrm{Std}_{\mathrm{RF,i}}$ = The renewable fuel standard for year i, in percent.

$\mathrm{RFV}_{\mathrm{CB,i}}$ = Annual volume of cellulosic biofuel required by section 211(o) of the Clean Air Act for year i, in gallons.

$\mathrm{RFV}_{\mathrm{BBD,i}}$ = Annual volume of biomass-based diesel required by section 211(o) of the Clean Air Act for year i, in gallons.

$\mathrm{RFV}_{\mathrm{AB,i}}$ = Annual volume of advanced biofuel required by section 211(o) of the Clean Air Act for year i, in gallons.

$\mathrm{RFV}_{\mathrm{RF,i}}$ = Annual volume of renewable fuel required by section 211(o) of the Clean Air Act for year i, in gallons.

G_i = Amount of gasoline projected to be used in the 48 contiguous states and Hawaii, in year i, in gallons.

D_i = Amount of diesel projected to be used in the 48 contiguous states and Hawaii, in year i, in gallons.

RG_i = Amount of renewable fuel blended into gasoline that is projected to be consumed in the 48 contiguous states and Hawaii, in year i, in gallons.

RD_i = Amount of renewable fuel blended into diesel that is projected to be consumed

[17] See **Federal Register** v.74 n.99 p.24903. Comments are available in docket EPA–HQ–OAR–2005–0161.

in the 48 contiguous states and Hawaii, in year i, in gallons.

GS_i = Amount of gasoline projected to be used in Alaska or a U.S. territory in year i if the state or territory opts-in, in gallons.

RGS_i = Amount of renewable fuel blended into gasoline that is projected to be consumed in Alaska or a U.S. territory in year i if the state or territory opts-in, in gallons.

DS_i = Amount of diesel projected to be used in Alaska or a U.S. territory in year i if the state or territory opts-in, in gallons.

RDS_i = Amount of renewable fuel blended into diesel that is projected to be consumed in Alaska or a U.S. territory in year i if the state or territory opts-in, in gallons.

GE_i = The amount of gasoline projected to be produced by exempt small refineries and small refiners in year i, in gallons, in any year they are exempt per §§ 80.1441 and 80.1442, respectively. For 2011, this value is zero. *See* further discussion in Section III.B.2 below.

DE_i = The amount of diesel projected to be produced by exempt small refineries and small refiners in year i, in gallons, in any year they are exempt per §§ 80.1441 and 80.1442, respectively. For 2011, this value is zero. *See* further discussion in Section III.B.2 below.

The four separate renewable fuel standards for 2011 are based on the 49-state gasoline and diesel consumption volumes projected by EIA. The Act requires EPA to base the standards on an EIA estimate of the amount of gasoline and diesel that will be sold or introduced into commerce for that year. The projected volume of gasoline used to calculate the final percentage standards will continue to be provided by the October issue of EIA's Short-Term Energy Outlook (STEO). For the purposes of this proposal, we have used the March 2010 issue of STEO. The projected volume of transportation diesel used to calculate the final percentage standards will be provided by the most recent Annual Energy Outlook (AEO). For the purposes of this proposal, we have used the Early Release version of AEO2010. Gasoline and diesel volumes are adjusted to account for renewable fuel contained in the EIA projections. Beginning in 2011, gasoline and diesel volumes produced by small refineries and small refiners are not exempt, and thus there is no adjustment to the gasoline and diesel volumes in today's proposal to account for such an exemption, as there has been in past years. However, as discussed more fully in Section III.B.2 below, depending upon the results of a Congressionally-mandated DOE study, it is possible that the exemption for gasoline and diesel volumes produced by small refineries and small refiners may be extended. In addition, EPA may extend the exemption for individual small refineries on a case-by-case basis if they demonstrate disproportionate economic hardship.

As finalized in the March 26, 2010 RFS2 rule, the standards are expressed in terms of energy-equivalent gallons of renewable fuel, with the cellulosic biofuel, advanced biofuel, and total renewable fuel standards based on ethanol equivalence and the biomass-based diesel standard based on biodiesel equivalence. However, all RIN generation is based on ethanol-equivalence. More specifically, the RFS2 regulations provide that production or import of a gallon of biodiesel will lead to the generation of 1.5 RINs. In order to ensure that demand for 0.8 billion physical gallons of biomass-based diesel will be created in 2011, the calculation of the biomass-based diesel standard provides that the required volume be multiplied by 1.5. The net result is a biomass-based diesel gallon being worth 1.0 gallons toward the biomass-based diesel standard, but worth 1.5 gallons toward the other standards.

The levels of the percentage standards would be reduced if Alaska or a U.S. territory chooses to participate in the RFS2 program, as gasoline and diesel produced in or imported into that state or territory would then be subject to the standard. Neither Alaska nor any U.S. territory has chosen to participate in the RFS2 program at this time, and thus the value of the related terms in the calculation of the standards is zero.

Note that the terms for projected volumes of gasoline and diesel use include gasoline and diesel that has been blended with renewable fuel. Because the gasoline and diesel volumes described above include renewable fuel use, we must subtract the total renewable fuel volume from the total gasoline and diesel volume to get total non-renewable gasoline and diesel volumes. The values of the variables described above are shown in Table III.B.1–1. Terms not included in this table have a value of zero.

TABLE III.B.1–1—VALUES FOR TERMS IN CALCULATION OF THE STANDARDS

[Bill gallons]

Term	Value
$RFV_{CB,2011}$	0.0065–0.0255
$RFV_{BBD,2011}$	0.80
$RFV_{AB,2011}$	1.35
$RFV_{RF,2011}$	13.95
G_{2011}	139.66
D_{2011}	50.01
RG_{2011}	13.38
RD_{2011}	0.74

Using the volumes shown in Table III.B.1–1, we have calculated the proposed percentage standards for 2011 as shown in Table III.B.1–2.

TABLE III.B.1–2—PROPOSED PERCENTAGE STANDARDS FOR 2011

Cellulosic biofuel	0.004–0.015%
Biomass-based diesel	0.68%
Advanced biofuel	0.77%
Renewable fuel	7.95%

2. Small Refineries and Small Refiners

In CAA section 211(o)(9), enacted as part of EPAct, Congress provided a temporary exemption to small refineries (those refineries with a crude throughput of no more than 75,000 barrels of crude per day) through December 31, 2010. In RFS1, we exercised our discretion under section 211(o)(3)(B) and extended this temporary exemption to the few remaining small refiners that met the Small Business Administration's (SBA) definition of a small business (1,500 employees or less company-wide) but did not meet the statutory small refinery definition as noted above. Because EISA did not alter the small refinery exemption in any way, the RFS2 program regulations exempt gasoline and diesel produced by small refineries and small refiners in 2010 from the renewable fuels standard (unless the exemption was waived), see 40 CFR § 80.1141.

Under the RFS program, Congress has provided two ways that small refineries can receive a temporary extension of the exemption beyond 2010. One is based on the results of a study conducted by

the Department of Energy (DOE) to determine if small refineries would face a disproportionate economic hardship under the RFS program. The other is based on EPA determination of disproportionate economic hardship on a case-by-case basis in response to refiner petitions.

In January 2009, DOE issued a *Small Refineries Exemption Study* which did not find that small refineries would face a disproportionate economic hardship under the RFS program. The conclusions were based in part on the expected robust availability of RINs and EPA's ability to grant relief on a case-by-case basis. Subsequently, Congress directed DOE to complete a reassessment and issue a revised report by June 30, 2010. DOE had not revised its study at the time of the RFS2 final rulemaking nor at the time of this writing. Additionally, we have not received any requests for relief on a case-by-case basis from any small refinery. If DOE prepares a revised study, and the results of that study show a disproportionate economic hardship for any small refineries under the RFS program, we will take appropriate action to extend the exemption. However, until and unless a DOE study supporting an extension to the temporary exemption for small refineries beyond 2010 is used, or any petitions to EPA from individual small refineries claiming disproportionate economic hardship are approved, we are not proposing to change the required inclusion of small refineries and small refiners in the RFS2 program beginning with the 2011 compliance period.

IV. Cellulosic Biofuel Technology Assessment

In projecting the volumes of cellulosic biofuel for 2011, we conducted a technical assessment of the production technologies that are under consideration by the broad universe of companies we investigated. Many of these companies are still in the research phase, resolving outstanding issues with specific technologies, and/or in the design phase to implement those technologies for the production of commercial-scale volumes of cellulosic biofuel. A subset of the companies we investigated have moved beyond the research and design phase and are actively preparing for production. This smaller group of companies formed the basis for our projection of potential 2011 volumes of cellulosic biofuel.

This section discusses the full range of cellulosic biofuel technologies being considered among producers, with reference to those individual companies that are focusing on each technology and those we project will be most likely to use those technologies to produce cellulosic biofuel in 2011.

A. What pathways are valid for the production of cellulosic biofuel?

In determining the appropriate volume of cellulosic biofuel on which to base the percentage standard for 2011, we must ensure that the production facilities we use as the basis for this volume are using fuel pathways that are valid for the production of cellulosic biofuel. In general this means that each facility's pathway (combination of feedstock, production process, and fuel type) must be included in Table 1 to § 80.1426 and be assigned a D code of either 3 or 7. As of this writing, there are three valid pathways available as shown in Table IV.A–1 below.

TABLE IV.A–1—CELLULOSIC BIOFUEL PATHWAYS FOR USE IN GENERATING RINS

Fuel type	Feedstock	Production process requirements	D–Code
Ethanol	Cellulosic Biomass from agricultural residues, slash, forest thinnings and forest product residues, annual covercrops; switchgrass, and miscanthus; cellulosic components of separated yard wastes; cellulosic components of separated food wastes; and cellulosic components of separated MSW.	Any	3 (cellulosic biofuel).
Cellulosic Diesel, Jet Fuel and Heating Oil.	Cellulosic Biomass from agricultural residues, slash, forest thinnings and forest product residues, annual covercrops, switchgrass, and miscanthus; cellulosic components of separated yard wastes; cellulosic components of separated food wastes; and cellulosic components of separated MSW.	Any	7 (cellulosic diesel).
Cellulosic Naphtha	Cellulosic Biomass from agricultural residues, slash, forest thinnings and forest product residues, annual covercrops, switchgrass, and miscanthus; cellulosic components of separated yard wastes; cellulosic components of separated food wastes; and cellulosic components of separated MSW.	Fischer-Tropsch process	3 (cellulosic biofuel).

Of the eight facilities that we currently believe could contribute to the volume of commercially available cellulosic biofuel in 2011, six would produce ethanol from cellulosic biomass and two would produce diesel from cellulosic biomass. None of the facilities we have evaluated would produce cellulosic naphtha through a Fischer-Tropsch process.

Two of the facilities shown in Table II.A.5–1, Cello Energy and KL Energy, intend to use wood as the primary feedstock. The only types of wood that are currently allowed as a valid feedstock are those derived from various types of waste. If either of these two companies choose to use trees from a tree plantation instead of qualifying waste wood, its pathway would not fall into the any of the pathways currently listed in Table 1 to § 80.1426. However, as described more fully in Section V.A, we are currently evaluating the lifecycle GHG impacts of biofuel made from pulpwood, including wood from tree plantations. If such a pathway is determined to meet the 60% GHG threshold required for cellulosic biofuel, we expect that it will be added to Table 1 to § 80.1426 in time to apply to fuel produced in 2011. For the purposes of this proposal, we have chosen to retain the volumes from these two companies in our projections of 2011 cellulosic biofuel volume, but we will revisit this issue for the final rule.

B. Cellulosic Feedstocks

Cellulosic biofuel technologies are different from other biofuel technologies because they convert the cellulose and

other very difficult to convert compounds into biofuels. Unlike grain feedstocks where the major carbohydrate is starch (very simply combined sugars), lignocellulosic biomass is composed mainly of cellulose (40–60%) and hemicellulose (20–40%).[18] Cellulose and hemicellulose are made up of sugars linked together in long chains called polysaccharides. Once hydrolyzed, they can be fermented into ethanol. Most all the remainder of cellulosic feedstocks consists of lignin, a complex polymer which serves as a stiffening and hydrophobic (water-repelling) agent in cell walls. Currently, lignin cannot be fermented into ethanol, but could be burned as a by-product to generate electricity. Thermochemical, pyrolysis and depolymerization processing, however, can convert some or even most of the lignin, in addition to the cellulosic and hemicellulose, into biofuels.

C. Emerging Technologies

When evaluating the array of biofuel technologies which could produce one or more fuels from cellulose that could qualify under RFS2, we found that it is helpful to organize them into fuel technology categories. Organizing them into categories eases the task of understanding the technologies, and also simplifies our understanding of the costs and lifecycle impacts of these technologies because similar technologies likely have similar cost and lifecycle impacts. The simplest organization is by the fuel produced. However, we frequently found that additional subdivisions were also helpful. Table IV.C–1 provides a list of technologies, the cellulosic fuels produced and a list of many of the companies which we learned are pursuing the technology (or something very similar to the technology listed in the category).

TABLE IV.C–1—LIST OF TECHNOLOGY CATEGORIES, THE FUELS PRODUCED THROUGH EACH TYPE OF TECHNOLOGY, AND THE COMPANIES PURSUING THEM

Technology category	Technology	Fuels produced	Companies
Biochemical	Enzymatic Hydrolysis	Ethanol	Abengoa, AE Fuels, DuPont Danisco, Florida Crystals, Gevo, Poet, ICM, Iogen, BPI, Energy, Fiberight, KL Energy.
	Acid Hydrolysis	Ethanol	Agresti, Arkenol, Blue Fire, Pencor, Pangen, Raven Biofuels.
	Dilute Acid, Steam Explosion of Cellulose.	Ethanol	Verenium, BP, Central Minnesota Ethanol Coop.
	Consolidated Bioprocessing (one step hydrolysis and fermentation) of Cellulose.	Ethanol	Mascoma, Qteros.
	Conversion of Cellulose via carboxylic acid.	Ethanol, Gasoline, Jet Fuel, Diesel Fuel.	Terrabon, Swift Fuels.
	One step Conversion of Cellulose to distillate.	Diesel, Jet Fuel or Naphtha	Bell Bioenergy, LS9.
Thermochemical	Thermochemical/Fischer Tropsch	Diesel Fuel and Naphtha	Choren, Flambeau River Biofuels, Baard, Clearfuels, Gulf Coast Energy, Rentech, TRI.
	Thermochemical/Fischer Tropsch	DME	Chemrec, New Page.
	Thermochemical/Catalytic conversion of syngas to alcohols.	Ethanol	Range Fuels, Pearson Technologies, Fulcrum Bioenergy, Enerkem, and Gulf Coast Energy.
Hybrid	Thermochemical w/Biochemical catalyst.	Ethanol	Coskata, INEOS Bio.
	Acid Hydrolysis of cellulose to intermediate; hydrogenation using Thermochemical syngas from non-cellulose fraction.	Ethanol, Other alcohols	Zeachem.
Depolymerization	Catalytic Depolymerization of Cellulose.	Diesel, Jet Fuel or Naphtha	Cello Energy.
	Pyrolysis of Cellulose	Diesel, Jet Fuel, or Gasoline	Envergent (UOP/Ensyn), Dynamotive, Petrobras, Univ. of Mass, KIOR.
Other	Catalytic Reforming of Sugars from Cellulose.	Gasoline.	Virent.

Of the technologies listed above, many of them are considered to be "second generation" biofuels or new biofuel technologies capable of meeting either the advanced biofuel or cellulosic biofuel RFS standard. The following sections describe specific companies and the new biofuel technologies which the companies have developed or are developing. This summary is not meant to be an unabridged list of new biofuel technologies, but rather a description of some of the more prominent of the new biofuel technologies that serve to provide a sense of the technology categories listed above. The process technology summaries are based on information provided by the respective companies. EPA has not been able to confirm all of the information, statements, process conditions, and the process flow steps necessary for any of these processes and companies.

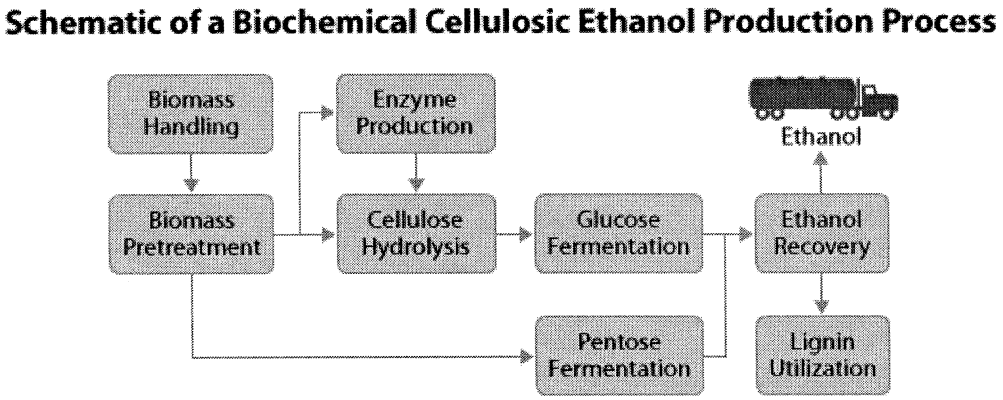
1. Biochemical

Biochemical conversion refers to a broad grouping of processes that use

[18] DOE. "Biomass Program: ABC's of Biofuels". Accessed at: *http://www1.eere.energy.govbiomass/abcs_biofuels.html#content.*

biological organisms to convert cellulosic feedstocks into biofuels. While no two processes are identical, many of these processes follow a similar basic pathway to convert cellulosic materials to biofuel. The general process of most biochemical cellulosic biofuel processes consists of five main steps: feedstock handling, pretreatment, hydrolysis, fermentation/fuel conversion, and distillation/separation. The feedstock handling step reduces the particle size of the incoming feedstock and removes any contaminants that may negatively impact the rest of the process. In the pretreatment step the structure of the lignin and hemicellulose is disrupted, usually using some combination of heat, pressure, acid, or base, to allow for a more effective hydrolysis of the cellulosic material to simple sugars. In the hydrolysis stage the cellulose and any remaining hemicellulose is converted into simple sugars, usually using an enzyme or strong acid. In the fermentation or fuel conversion step, the simple sugars are converted to the desired fuel by a biological organism. In the final step the fuel that is produced is separated from the water and other byproducts by distillation or some other means. A basic diagram of the biochemical conversion process can be found in Figure IV.C.1–1 below.

Figure IV.C.1-1[19]



While this diagram shows the production of ethanol from cellulosic biomass, it is possible to use the same process to produce other fuels or specialty chemicals using different biological organisms.

The following sections will discuss each of these steps in greater detail, discuss some of the variations to this general process, and discuss some of the advantages and disadvantages of the biochemical process of producing biofuel from cellulosic materials as compared to other fuel production processes.

Seven of the eight companies that EPA believes may produce cellulosic biofuel in 2011 plan to use a biochemical process to produce biofuels. Five of these companies, AE Biofuels, Dupont Danisco Cellulosic Ethanol, Fiberight, Iogen, and KL energy, all plan to use an enzymatic hydrolysis, while Agresti Biofuels and Bell Bio-Energy are pursuing gravity pressure vessel and single step process technologies, respectively. The main reason for the dominance of biochemical technologies in 2011 is the relatively low capital costs of these projects compared to other cellulosic biofuel facilities. Biochemical projects also benefit less from economies of scale, making smaller and less capital intensive commercial facilities more feasible. The following sections, as well as a technical memorandum that has been added to the docket[20], provide more information on the biochemical processes being pursued by majority of the companies we expect to produce cellulosic biofuels and make them commercially available in 2011, as well as many other companies planning to begin production in later years.

a. Feedstock Handling

The first step of the biochemical conversion process is to insure that the biomass stream can be utilized by the rest of the conversion process. This most often takes the form of size reduction, either by grinding or chipping as appropriate for the type of biomass. While this is a relatively simple process it is essential to allow the following steps of the process to function as designed. It is also a potentially energy intensive process. It may be possible for biofuel producers to purchase cellulosic material that is already of the appropriate size, however we believe that in the near term this is unlikely and most biofuel producers will have to invest in equipment to reduce the size of the material they receive as needed for their process. In coming years, as the market for cellulosic materials expands, purchasing feedstock that has already been ground or chipped may be possible and cost effective, as these processes increase the density of this material and may reduce transportation costs.

In addition to size reduction, steps must also be taken to remove any material from the feedstock that might be detrimental to the fuel production process. Contaminants in the feedstock, such as dirt, rocks, plastics, metals, and other non-biogenic materials, would at best travel through the fuel production process unchanged, resulting in reduced fuel production capacity. Depending on the type of contaminant they may also be converted to undesired byproducts that must be separated from the fuel. They could also be toxic to the biological organisms being used to convert the sugars to fuel, necessitating a shut down and restart of the plant. Any of these scenarios would result in a significant cost to the fuel producer. Feedstocks such as agricultural residues, wood chips, or herbaceous or woody energy crops are likely to contain far fewer contaminants than more heterogeneous feedstocks such as municipal solid waste (MSW).

[19] Image From: *http://www.afdc.energy.gov/afdc/ethanol/production_cellulosic.html.*

[20] Wyborny, Lester. "In-Depth Assessment of Advanced Biofuels Technologies." Memo to the docket, May 2010.

b. Biomass Pretreatment

The purpose of the biomass pretreatment stage is to disrupt the structure of the cellulosic biomass to allow for the hydrolysis of the cellulose and hemicellulose into simple sugars. The ideal pretreatment stage would allow for a high conversion of the cellulose and hemicellulose to simple sugars, minimize the degradation of these sugars to undesired forms that reduce fuel yields and inhibit fermentation, not require especially large or expensive reaction vessels, and be a relatively robust and simple process. No single biomass pretreatment method has yet been discovered that meets all of these goals, but rather a variety of options are being used by various cellulosic fuel producers, each with their own strengths and weaknesses. Dilute acid pretreatment and alkaline pretreatment are two methods currently being used that attack the hemicellulose and lignin portions of the cellulosic biomass respectively. Other methods, such as steam explosion and ammonia fiber expansion, seek to use high temperature and pressure, followed by rapid decompression to disrupt the structure of the cellulosic biomass and allow for a more efficient hydrolysis of the cellulose and hemicellulose to simple sugars. Each of these methods is discussed in more detail in a technical memo that has been added to the docket.[21] The cost and characteristics of the cellulosic feedstock being processed is likely to have a significant impact on the pretreatment process that is used.

c. Hydrolysis

In the hydrolysis step the cellulose and any remaining hemicellulose are converted to simple sugars. There are two main methods of hydrolysis, acid hydrolysis and enzymatic hydrolysis. Acid hydrolysis is the oldest technology for the conversion of cellulosic feedstock to ethanol and can only be used following an acid pretreatment process. An alternative method is to use a combination of enzymes to perform the hydrolysis after the biomass has been pretreated. This process is potentially more effective at hydrolyzing pretreated biomass but in the past has not been economically feasible due to the prohibitively high cost of the enzymes. The falling cost of these enzymes in recent years has made the production of cellulosic biofuels using enzymatic hydrolysis possible. The lignin is largely unaffected by the hydrolysis and fuel production steps but is carried through these processes until it is separated out in the fuel separation step and burned for process energy or sold as a co-product.

i. Acid Hydrolysis

Acid hydrolysis is a technique that has been used for over 100 years to convert cellulosic feedstocks into fuels. In the acid hydrolysis process the lignin and cellulose portions of the feedstock that remain after the hemicellulose has been dissolved, hydrolyzed, and separated during the dilute acid pretreatment process is treated with a second acid stream. This second acid treatment uses a less concentrated acid than the pretreatment stage but at a higher temperature, as high as 215° C. This treatment hydrolyzes the cellulose into glucose and other 6 carbon sugars that are then fed to biological organisms to produce the desired fuel. It is necessary to hydrolyze the hemicellulose and cellulose in two separate steps to prevent the conversion of the pentose sugars that result from the hydrolysis of the hemicellulose from being further converted into furfural and other chemicals. This would not only reduce the total production of sugars from the cellulosic feedstock, but also inhibit the production of fuel from the sugars in later stages of the process.

The acidic solution containing the sugars produced as a result of the hydrolysis reaction must also be treated so that this stream can be fed to the biological organisms that will convert these sugars into fuel. In order to operate an acid hydrolysis process cost effectively the acid must be recovered, not simply neutralized. Methods currently being used to recover this acid include membrane separation and continuous ion exchange. The advantages of using an acid hydrolysis are that this process is well understood and capable of producing high sugar yields from a wide variety of feedstocks. Capital costs are high however, as materials compatible with the acidic streams must be extensively utilized. The high temperatures necessary for acid hydrolysis also result in considerable energy costs, and profitability is highly dependent on the ability to effectively recover and reuse the acid.

ii. Enzymatic Hydrolysis

The enzymatic hydrolysis process uses enzymes, rather than acids, to hydrolyze the cellulose and any remaining hemicellulose from the pretreatment process. This process is much more versatile than the acid hydrolysis and can be used in combination with any of the pretreatment processes described above, provided that the structure of the lignocellulosic feedstock has been disrupted enough to allow the enzymes to easily access the hemicellulose and cellulose. After the feedstock has gone through pretreatment a cocktail of cellulose enzymes is added. These enzymes can be produced by the cellulosic biofuel producer or purchased from enzyme producers such as Novozymes, Genencor, and others. The exact mixture of enzymes used in the enzymatic hydrolysis stage can vary greatly depending on which of the pretreatment stages is used as well as the composition of the feedstock.

The main advantages of the enzymatic hydrolysis process are a result of the mild operating conditions. Because no acid is used special materials are not required for the reaction vessels. Enzymatic hydrolysis is carried out at relatively low temperatures, usually around 50° C, and atmospheric pressure and therefore has low energy requirements. These conditions also result in less undesired reactions that would reduce the production of sugars and potentially inhibit fuel production. Enzymatic hydrolysis works best with a uniform feedstock, such as agricultural residues or energy crops, where the concentration and combination of enzymes can be optimized for maximum sugar production. If the composition of the feedstock varies daily, as can be the case with fuel producers utilizing MSW or other waste streams, or even seasonally, it would make it more difficult to ensure that the correct enzyme cocktail is being used to carry out the hydrolysis as efficiently as possible. The main hurdle to using an enzymatic hydrolysis has been and continues to be the costs of the enzymes. Recent advances by companies that produce enzymes for the hydrolysis of cellulosic materials have resulted in a drastic cost reduction of these enzymes. If, as many researchers and cellulosic biofuel producers expect, the cost of these enzymes continues to fall it is likely that enzymatic hydrolysis will be a lower cost option than acid hydrolysis, especially for cellulosic biofuel producers utilizing uniform feedstocks.

d. Fuel Production

After the cellulosic biomass has been hydrolyzed to simple sugars this sugar solution is converted to fuel by biological organisms. In some biochemical fuel production processes the sugars produced from the fermentation of the hemicellulose, which are mainly five carbon sugars, are

[21] Wyborny, Lester. "In-Depth Assessment of Advanced Biofuels Technologies." Memo to the docket, May 2010.

converted to fuel in a separate reactor and with a different set of organisms than the sugars produced from the cellulose hydrolysis, which are mainly six carbon sugars. Others processes, however, produce fuel from the five and six carbon sugars in the same reaction vessel.

A wide range of biological organisms can be used to convert the simple sugars into fuel. These include yeasts, bacteria, and other microbes, some of which are naturally occurring and others that have been genetically modified. The ideal biological organism converts both five and six carbon sugars to fuel with a high efficiency, is able to tolerate a range of conditions, and is adaptable to process sugar streams of varying compositions that may result from variations in feedstock. Many cellulosic biofuel producers have their own proprietary organism or organisms optimized to produce the desired fuel from their unique combination of feedstock, pretreatment and hydrolysis processes, and fuel conversion conditions. Other cellulosic fuel producers license these organisms from biotechnology companies who specialize in their discovery and production.

The many different biological organisms being considered for cellulosic biofuel production are capable of producing many different types of fuels. Many cellulosic biofuel producers are working with organisms that produce ethanol. In many ways this is the most simple fuel to produce from lignocellulosic biomass as the production of ethanol from simple sugars is a well understood process. Others intend to produce butanol or other alcohols that have higher energy content. Butanol may be able to be blended into gasoline in greater proportion to ethanol and therefore has a potentially greater market as well as value due to its higher energy content. Yields for butanol, however, are currently significantly lower per ton of feedstock than ethanol. Some of the fuel producers who plan to produce alcohols are considering purchasing and modifying already existing grain ethanol plants. This would potentially have significant capital cost savings as many of the units used in a grain ethanol process are very similar to those required by the biochemical fuel production process and could be used with minimal modification.

Other cellulosic biofuel producers intend to produce hydrocarbon fuels very similar to gasoline, diesel, and jet fuel. These fuels command a higher price than alcohols, have a greater energy density, and are potentially drop in fuels that could be used in any conventional vehicles without strict blending limits. They could also be transported by existing pipelines and utilize the same infrastructure as the petroleum industry. Some of the processes being researched by fuel producers produce a single compound, such as iso-octane, that would need to be blended into petroleum gasoline in order to be used while others produce a range of hydrocarbons very similar to those found in gasoline or diesel fuel refined from petroleum and could potentially be used in conventional vehicles without blending. While the prospect of producing hydrocarbon fuels from cellulosic feedstock is promising, the current yields of fuel produced by these organisms are significantly lower than those that are producing ethanol and other alcohols. Improvement in the yields of these organisms will have to be realized in order for cellulosic hydrocarbon fuels produced via a biochemical process to compete with cellulosic ethanol, and ultimately petroleum based fuels.

e. Fuel Separation

In the fuel separation stage the fuel produced is separated from the water, lignin, any un-reacted hemicellulose and cellulose, and any other compounds remaining after the fuel production stage. The complexity of this stage is highly dependent on the type of fuel produced. For processes producing hydrocarbon fuels this stage can be as simple as a settling tank, where the hydrocarbons are allowed to float to the top and removed. Recovering the ethanol is a much more difficult task. To recover the ethanol a distillation process, nearly identical to that used in the grain ethanol industry, is used. The ethanol solution is first separated from the solids before being sent to a distillation column called a beer column. The overheads of the beer column are fed to a second distillation column, called a rectifier for further separation. The rectifier produces a stream with an ethanol of approximately 96%. A molecular sieve unit is then used to dehydrate this stream to produce fuel grade ethanol with purity greater than 99.5%. Gasoline is added to the fuel ethanol as a denaturant before the fuel is stored. The distillation of ethanol is a very energy intensive process and new technologies, such as membrane separation, are being developed that could potentially reduce the energy intensity, and thus the cost, of the ethanol dehydration process. After the fuel has been recovered the remaining lignin and solids are dried and either burned on site to provide process heat and electricity or sold as a byproduct of the fuel production process. The waste water is either recycled or sent to a water treatment facility.

f. Process Variations

While the process described above outlines the general biochemical process used by many cellulosic biofuel producers, there are several prominent variations being pursued by prospective biofuel producers. These variations usually seek to simplify the biochemical fuel production process by combining several steps into a single step or using other means to reduce the capital or operating costs of the process. Simultaneous Saccharification and Fermentation (SSF), Simultaneous Saccharification and Co-Fermentation (SSCF), Consolidated Bio-Processing (CBP), and Single Step Fuel Production are all production methods being developed by various biofuel production companies to combine two or more of the steps outlined above. These process variations are discussed in more detail in a technical memo that can be found in the docket.[22] These modifications are usually enabled by a proprietary technology or biological organism that makes these changes possible.

g. Current Status of Biochemical Conversion Technology

The biochemical cellulosic fuel production industry is currently transitioning from an industry consisting mostly of small scale research and optimization focused facilities to one capable of producing fuel at a commercial scale. Companies such as Iogen, DuPont Danisco Cellulosic Ethanol, and KL Energy are just beginning to market the fuel they are producing at their first small scale commercial fuel production facilities. By 2011 we expect several other cellulosic fuel production facilities using biochemical processes to come online, including the first commercial scale facilities of AE Advanced Fuels, Agresti Biofuels, Bell Bio-Energy, and Fiberight. Many other facilities, including some large scale facilities capable of producing tens of millions of gallons of fuel are planned to come online starting in 2012 and in the following years.

There are many factors that are likely to continue to drive the expansion of the cellulosic biofuel industry. The high price of petroleum fuels and the mandates put into place by the RFS2

[22] Wyborny, Lester. "In-Depth Assessment of Advanced Biofuels Technologies." Memo to the docket, May 2010.

program have created a large demand for cellulosic biofuels. The biochemical production process also has several advantages over other methods of producing fuel from cellulosic feedstocks including relatively low capital costs, highly selective fuel production, flexibility in the type of fuel produced, and the promise of future production cost reductions.

While the poor worldwide economy and tight credit markets has had a negative impact on the biofuel industry as a whole the cellulosic biofuel producers utilizing biochemical processes have not been as hard hit as many others in the industry. This is partially due to the relatively low capital costs of biochemical production plants as a result of the relative simplicity and mild operating conditions of these plants. Several companies have been able to purchase distressed grain ethanol plants and are in the process of modifying them to produce cellulosic ethanol, further reducing the capital costs of their initial facilities. Once biochemical fuel production facilities have been constructed another advantage they have over other fuel production processes is that their high selectivity in the fuels they produce. Unlike chemical catalysts, which often produce a range of products and byproducts, biological organisms often produce a single type of fuel, which leads to very high fuel production rates per unit sugar. Finally, there is a large potential to further decrease the production costs of cellulosic biofuels using the biochemical processes. Unlike other production methods such as gasification which are relatively mature technologies, biochemical production of fuels is a young technology. One of the major costs of the biochemical fuel production processes currently are the enzymes. Great strides have been made recently in reducing the cost of these enzymes, and as the price of enzymes continues to fall so will the operating costs of biochemical fuel production processes.

h. Major Hurdles to Commercialization

Despite the many promising qualities of the biochemical fuel production process several significant hurdles remain. Improvements must be made to the pretreatment processes of the cellulosic materials to maximize the conversion of cellulose and hemicellulose to simple sugars and to minimize the production of other undesired compounds, especially those that may inhibit the fuel production process. The ability of the biological fuel production organisms to process a wide range of both five and six carbon sugars must also continue to be improved. Both these improvements will increase the fuel yield per ton of cellulosic feedstock, reducing the operating costs of the process. The cost of enzymes must continue to decrease to allow the fuel produced by biochemical processes to be cost competitive with petroleum and other cellulosic biofuels.

Another significant hurdle that must be overcome is the profitable utilization of the lignin portion of the cellulosic feedstock. Unlike some of the other cellulosic biofuel production processes, the biochemical process does not convert the lignin to fuel. Cellulosic feedstock can contain up to 40% lignin, depending on the type of feedstock used, so the effective utilization of this lignin is an important piece of the profitability of the biochemical process. One option for the use of the lignin is to burn it to provide process heat and electricity, as well as excess electricity to the grid. While this would provide good value for the lignin, it would require fairly expensive boilers and turbines that increases the capital cost of the facility. If the lignin cannot be used as part of the fuel production process it may be able to be marketed as a solid fuel with high energy density and low carbon intensity.

2. Thermochemical

Thermochemical conversion involves biomass being broken down into syngas using heat and upgraded to fuels using a combination of heat and pressure in the presence of catalysts.[23] For generating the syngas, thermochemical processes partially oxidize biomass in the presence of a gasifying agent, usually air, oxygen, and/or steam. It is important to note that these processing steps are also applicable to other feedstocks (*e.g.,* coal or natural gas); the only difference is that a renewable feedstock is used (*i.e.,* biomass) to produce cellulosic biofuel. The cellulosic biofuel produced can be mixed alcohols, but optimizing the process to produce ethanol, or it could be diesel fuel and naphtha. A thermochemical unit can also complement a biochemical processing plant to enhance the economics of an integrated biorefinery by converting lignin-rich, non-fermentable material left over from high-starch or cellulosic feedstocks conversion.[24] Compared to corn ethanol or biochemical cellulosic ethanol plants, the use of biomass gasification may allow for greater flexibility to utilize different biomass feedstocks at a specific plant. Mixed biomass feedstocks may be used, based on availability of long-term suppliers, seasonal availability, harvest cycle, and costs.

The general steps of the gasification thermochemical process include: feedstock handling, gasification, gas cleanup and conditioning, fuel synthesis, and separation. Refer to Figure IV.C.2–1 for a schematic of the thermochemical cellulosic ethanol production process through gasification. For greater detail on the thermochemical mixed-alcohols route refer to NREL technical documentation.[25]

[23] U.S. DOE. Technologies: Processing and Conversion. Accessed at: *http://www1.eere.energy.gov/biomass/processing_conversion.html* on October 28, 2008.

[24] EERE, DOE, *Thermochemical Conversion,* & *Biochemical Conversion, Biomass Program Thermochemical R&D. http://www1.eere.energy.gov/biomass/thermochemical_conversion.html http://www1.eere.energy.gov/biomass/biochemical_conversion.html.*

[25] Aden, Andy, Mixed Alcohols from Woody Biomass—2010, 2015, 2022, National Renewable Energy Laboratory (NREL), September 23, 2009.

Figure IV.C.2-1

Cellulosic Ethanol Thermochemical Gasification Process

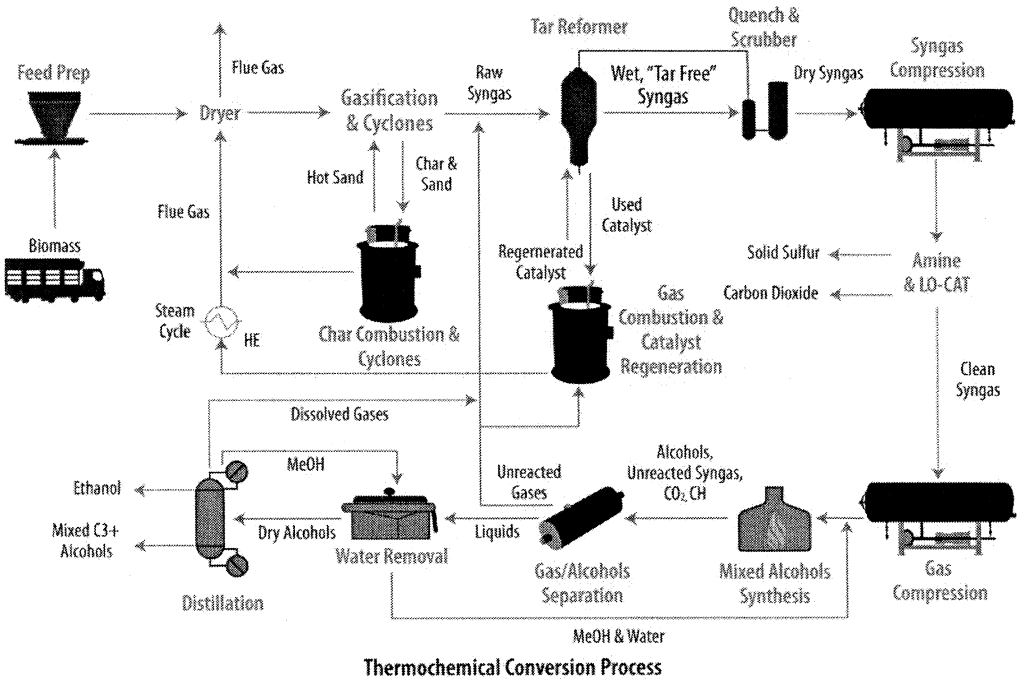
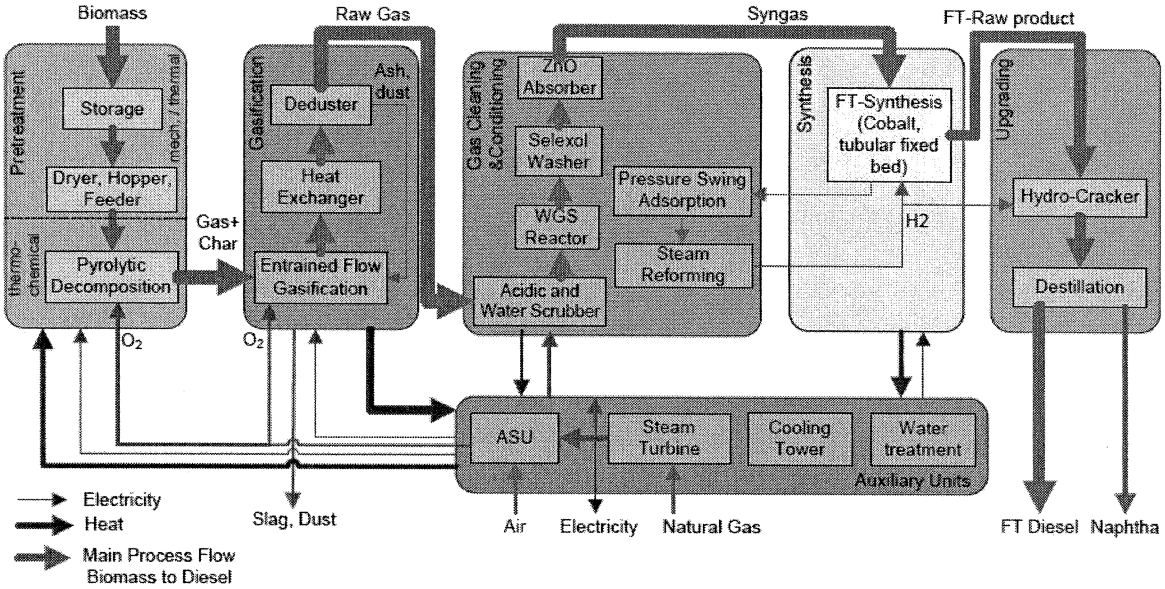


Figure IV.C.2–2 is a block diagram of a biomass to liquids (BTL) process which produces diesel fuel and naphtha through a thermochemical process.

Figure IV.C.2-2

Biomass to Liquids (BTL) Thermochemical Gasification Process



The first step in a thermochemical plant is feedstock size reduction. The particle size requirement for a thermochemical process is around 10-mm to 100-mm in diameter.[26] Once the feed is ground to the proper size, flue gases from the char combustor and tar reformer catalyst regenerator dry the feed from the as received moisture level of around 30% to 50% moisture to the level required by the gasifier.

The dried, ground feedstock is fed to a gasification reactor for producing syngas. There are two general classes of gasifiers, partial oxidation (POx) and indirect gasifiers. Partial oxidation gasifiers (directly-heated gasifiers) use the exothermic reaction between oxygen and organics to provide the heat necessary to devolatilize biomass and to convert residual carbon-rich chars. Indirect gasifiers use steam to accomplish gasification through heat transfer from a hot solid or through a heat transfer surface. Either the byproduct char and/or a portion of the product gas can be combusted with air (external to the gasifier itself) to provide the energy required for gasification. The raw syngas produced from either type of gasifier has a low to medium energy content which consists mainly of CO, H_2, CO_2, H_2O, N_2, and hydrocarbons.

Once the biomass is gasified and converted to syngas, the syngas must be cleaned and conditioned, as minor components of tars, sulfur, nitrogen oxides, alkali metals, and particulates have the potential to negatively affect the syngas conversion steps. Therefore, unwanted impurities are removed in a gas cleanup step and the gas composition is further modified during gas conditioning. Because this step is a necessary part of the thermochemical process, thermochemical plants are good candidates for processing municipal solid waste (MSW) which may contain a significant amount of toxic material. Gas conditioning steps include sulfur polishing to remove trace levels of H_2S and water-gas shift to adjust the final H_2/CO ratio for optimized fuel synthesis.

After cleanup and conditioning, the "clean" syngas is comprised of essentially CO and H_2. The syngas is then converted into a liquid fuel by a catalytic process. The fuel producer has the choice of producing diesel fuel or alcohols from syngas by optimizing the type of catalyst used and the H_2/CO ratio. Diesel fuel has historically been the primary focus of such processes by using a Fischer Tropsch reactor, as it produces a high quality distillate product. However, with a $1.01 per gallon cellulosic biofuel tax deduction which favors the less energy dense ethanol, it may be economically advantageous for fuel producers to convert syngas to ethanol instead of to diesel fuel.

A carefully integrated conventional steam cycle produces process heat and electricity (excess electricity is exported). Pre-heaters, steam generators, and super-heaters generate steam that drives turbines on compressors and electrical generators. The heat balance around a thermochemical unit or thermochemical combined unit must be carefully designed and tuned in order to avoid unnecessary heat losses.[27] These facilities greatly increase the thermal efficiency of these plants, but they add to the very high capital costs of these technologies.

a. Ethanol Based on a Thermochemical Platform

Conceptual designs and techno-economic models have been developed for ethanol production via mixed alcohol synthesis using catalytic processes. The proposed mixed alcohol process produces a mixture of ethanol along with higher normal alcohols (*e.g.,* n-propanol, n-butanol, and n-pentanol). The by-product higher normal alcohols have value as commodity chemicals and fuel additives.

The liquid rundown from the low-pressure separator is dehydrated in vapor-phase molecular sieves, producing the dehydrated mixed alcohol feed into a methanol/ethanol overhead stream and a mixed, higher molecular weight alcohol bottom stream. The overhead stream is further separated into a methanol stream and an ethanol stream.

Two companies which are pursuing ethanol based on a thermochemical route are Range Fuels and Enerkem. Range has operated a pilot plant for over 7 years using over 20 different nonfood feedstocks. Range broke ground building its first commercial plant late in late 2008 and is expected to be operational in 2010. This plant will be located in Soperton, Georgia and is partially funded from proceeds of a DOE grant. The plant will use wood, grasses, and corn stover as feedstocks. In its initial phase, the Range plant is expected to produce 4 million gallons per year of methanol. After the company is confident in its operations, Range will begin efforts to expand the plant and add additional reaction capacity to convert the methanol to ethanol.

Enerkem is pursuing cellulosic ethanol production via the thermochemical route. The Canadian-based company was recently announced as a recipient of a $50 million grant from DOE to build a 10 MGY woody biomass-to-ethanol plant in Pontotoc, MS. The U.S. plant is not scheduled to come online until 2012, but Enerkem is currently building a 1.3 MGY demonstration plant in Westbury, Quebec. According to the company, plant construction in Westbury started in October 2007 and the facility is currently scheduled to come online around the middle of 2010. While it's unclear at this time whether the cellulosic ethanol produced will be exported to the United States, Enerkem has expressed interest in selling its fuel commercially. If Enerkem does export some of its cellulosic biofuel to the U.S., it could help to enable refiners meet the 2011 cellulosic biofuel standard.

b. Diesel and Naphtha Production Based on a Thermochemical Platform

The cleaned and water-shifted syngas is sent to the Fischer Tropsch (FT) reactor where the carbon monoxide and hydrogen are reacted over a FT catalyst. Current FT catalysts include iron-based catalysts, and cobalt-based catalysts. The FT reactor creates a syncrude, which is a variety of hydrocarbons that boil over a wide distillation range (a mix of heavy and light hydrocarbons) which are separated into various components based on their vapor pressure, mainly liquid petroleum gas (LPG), naphtha, distillate and wax fractions. The heavier compounds are hydrocracked to maximize the production of diesel fuel. Conversely, the naphtha material is very low in octane thus, it would either have to be upgraded, or blended down with high octane blendstocks (*i.e.,* ethanol), or be upgraded to a higher octane blendstock to have much value for use in gasoline.

Choren is an European company which is pursuing a thermochemical technology for producing diesel fuel and naphtha. The principal aspect of Choren's process is their patented three stage gasification reactor. The three-stage gasification reactor includes low temperature gasification, high

[26] Lin Wei, Graduate Research Assistant, Lester O. Pordesimo, Assistant Professor Willam D. Batchelor, Professor, Department of Agricultural and Biological Engineering, Mississippi State University, MS 39762, USA, *Ethanol Production from Wood: Comparison of Hydrolysis Fermentation and Gasification Biosynthesis,* Paper Number: 076036, Written for presentation at the 2007 ASABE Annual International Meeting. Minneapolis Convention Center, Minneapolis, MN, 17-20 June 2007.

[27] S. Phillips, A. Aden, J. Jechura, and D. Dayton, National Renewable Energy Laboratory, Golden, Colorado 80401–3393, T. Eggeman, Neoterics International, Inc., *Thermochemical Ethanol via Indirect Gasification and Mixed Alcohol Synthesis of Lignocellulosic Biomass,* Technical Report, NREL/TP–510–41168, April 2007.

temperature gasification and endothermic entrained bed gasification. Choren designed its gasification reactor with three stages to more fully convert the feedstock to syngas. Choren will be building a commercial Plant in Freiberg/Saxony Germany that is expected to be operational in 2011 or 2012. Initially, the plant will use biomass from nearby forests, the wood-processing industry and straw from farmland. Although any fuel produced in 2011 by its Freiberg/Saxony plant and marketed commercially would most likely be used in Europe, it is possible that some of that fuel could be exported to the U.S. Choren is also planning to build a commercial thermochemical/biomass-to-liquids (BTL) plant in the U.S. after their Freiberg/Saxony plant is operational in Germany.

Baard Energy is a U.S. company which plans on utilizing a thermochemical technology for producing diesel fuel and naphtha. Baard, however, plans on primarily combusting coal and cofiring biomass with the coal. Cofiring the biomass with the coal will make their first plant more like the coal-to-liquids plants which are operating today, which may help to convince investors that this technology is already tested. Baard's coal and biomass-to-liquids plant is not expected to be operational until at least 2012.

Probably the largest commercialization hurdle for the companies pursing the thermochemical route is the very high capital costs associated with these technologies. Because of the economic hardships associated with recent global recession, banks are less willing to make loans to fund new technologies which are likely to be considered riskier investments. The capital costs are very high because there are two significant reactors required for each plant—the gasification reactor and the syngas to fuel reactor. Additionally, the syngas must be cleaned to protect the catalysts used in the downstream syngas to fuel reactor which requires additional capital costs. Because the syngas would be cleaned anyways, this technology is a very good candidate for processing MSW which may contain toxic compounds. When considering the cost savings for not having to pay the tipping fees at municipal dumping grounds, MSW feedstocks may avoid almost all the purchase costs for MSW feedstocks which would significantly help offset the high capital costs.

3. Hybrid Thermochemical/Biochemical Processes

Hybrid technologies include process elements involving both the gasification stage of a typical thermochemical process, as well as the fermentation stage of a typical biochemical process and therefore cannot be placed easily into either category. For more specific information regarding either biochemical processes or thermochemical, please see Sections IV.C.1 and IV.C.2 respectively. Currently, there are several strategies for the production of ethanol through hybrid processes; these strategies are differentiated by the order in which the thermochemical and biochemical steps take place within the process, as well as how the intermediate products from each step are used.

While we do not expect significant commercial production from hybrid processes in 2011, there are several companies pursing this approach for the future. Examples of the first process strategy, described in the paragraph below, include both INEOS Bio and Coskata. INEOS Bio (along with partner New Planet Energy) has recently been selected for a $50MM DOE grant for the construction of an 8 MGPY plant in River County, Florida; predicted to finish construction in late 2011. Coskata is currently running a 40,000 gallon per year pilot plant that became operational in 2009 in Madison, Pennsylvania. Coskata is targeting to design and build a 50 MGPY commercial plant that it expects to be operational in 2012. A company currently pursing the second process strategy, described in the following third paragraph, is Zeachem Inc. Zeachem is currently constructing a 250 KGPY demonstration plant in Boardman, Oregon. They have received a $25MM DOE grant and expect to have a full commercial production facility operational in 2013.

One strategy involves the gasification of all feedstock material to syngas before being processed into ethanol using a biochemical fermenter. Further information regarding gasification can also be found in Section IV.C.2. After gasification, the syngas stream is cooled and bubbled into a fermenter containing modified microorganisms, usually bacteria or yeast. This fermenter replaces the typical catalysts found after gasification in a traditional thermochemical process. Further information regarding fermentation can be found in Section IV.C.1. Unlike traditional fermentation (which break down C5 and C6 sugars), these microorganisms are engineered to convert the carbon monoxide and hydrogen contained in the syngas stream directly into ethanol. After fermentation, the effluent water/ethanol stream from the fermenter is separated similarly to a biochemical process; usually using a combination of distillation and molecular sieves. The separated water can then be recycled back into the fermentation stage of the process. Typical yields of ethanol are predicted in the 100–120 gallon per ton range.

Since gasification converts all carbonaceous feedstock material to a uniform syngas before fermentation, there is a higher flexibility of feedstock choices than if these materials were to be fermented directly; including agricultural residues, switchgrass, farm-grown trees, sorted MSW, or any combination of such. In addition, processing incoming feedstock with gasification does not require the addition of enzymes or acid hydrolysis necessary in a biochemical process to aid in the breakdown of cellulosic materials. Fermenting syngas also captures all available carbon contained in the feedstock, including lignin that would not be processed in a typical biochemical fermentation. However, more energy is lost as waste heat as well as secondary carbon dioxide production in the gasification process than would be lost for biochemical feedstock preparation. Using a fermenter in a hybrid process replaces the catalyst needed in a typical thermochemical process. These microorganisms allow for a higher variation of the incoming syngas stream properties, avoid the necessity of a water-shift reaction preceding traditional catalytic conversion, and are able to operate at lower temperatures and pressures than those required for a catalytic conversion to ethanol. Microorganisms, unlike a catalyst, are also self-sustaining and do not require periodic replacement. They are, however, susceptible to bacterial and viral infections which requires periodic cleaning of the fermentation reactors.

Another hybrid production strategy involves gasification of the typically unfermentable feedstock fraction (lignin) concurrently with a typical fermentation step for the cellulose and hemicellulose fraction. These steps are subsequently combined in a hydrogenation reaction of the produced syngas with the product of the fermented stream. Feedstock first undergoes acid hydrolysis to break down contained cellulose and hemicellulose. Before fermentation, the unfermentable portion of feedstock (lignin, ash and other residue) is fractioned and sent to a gasifier. Concurrently, the remaining fraction of hydrolyzed feedstock is fermented using an acetogen microorganism. These acetogens occur naturally, and therefore do not have to be modified for this

process. These acetogen convert both C6 and C5 portions of the hydrolized feedstock to acetic acid. This reaction creates no carbon dioxide, unlike traditional fermentation using yeast, preserving the maximum amount of carbon for the finished fuel. The acetic acid stream then undergoes esterification to create ethyl acetate. Meanwhile, the syngas stream from the gasification of lignin and other residue is separated into its carbon monoxide and hydrogen components. The carbon monoxide stream can be further combusted to provide process heat or energy. The hydrogen stream is combined with the ethyl acetate in a hydrolysis reaction to form ethanol. Acetic acid and ethyl acetate also form the precursors to many other chemical compounds and therefore may also be sold in addition to ethanol. Typical yields for this technology are predicted in the 130–150 gallon per ton range.

4. Pyrolysis and Depolymerization

Pyrolysis and depolymerization is a group of technologies which are capable of creating biofuels from cellulose by either thermally or catalytically breaking them down into molecules which fall within the boiling range of transportation fuels. Pyrolysis technologies are usually thought of being primarily a thermal technology, however, newer pyrolysis technologies are being developed which are attempting to integrate some catalysts into the technology. These are all unique processes, typically with single companies developing the technologies, so they are discussed separately.

a. Pyrolysis Diesel Fuel and Gasoline

Pyrolysis oils, or bio-oils, are produced by decomposing cellulosic biomass at lower temperatures than the gasification process, thus producing a liquid bio oil instead of a synthesis gas.[28] The reaction can occur either with or without the use of catalysts, but it occurs without any additional oxygen being present. The resulting oil which is produced must have particulates and ash removed in filtration to create a homogenous "dirty" crude oil type of product. This dirty crude oil must be further upgraded to hydrocarbon fuels via hydrotreating and hydrocracking processing, which reduces its total oxygen content and cracks the heaviest of the hydrocarbon compounds. One of the finished fuels produced by the pyrolysis process is diesel fuel, however, a significant amount of gasoline would likely be produced as well. There are two main reaction pathways currently being explored: A two step pyrolysis pathway, and a one step pyrolysis pathway.

The simplest technology used for the two-step pyrolysis approach is called fast pyrolysis. The fast pyrolysis technology uses sand in a fluidized bed to transform bio-fuels into a product named bio-oil. This is purely a thermal process, where the sand's (or other solid) role is to transport heat to the biomass. Fast pyrolysis technology has two problems to be solved. First, fast pyrolysis oil is unstable, acidic, viscous and may separate itself into two phases so it must be immediately upgraded or it will begin to degrade and repolymerize. The second issue is that pyrolysis bio-oil must be upgraded before it can be used as a transportation fuel.

Another approach to Fast Pyrolysis being pursued by several companies would be to substitute a catalyst in place of sand and the catalyst would be able to stabilize the resulting bio-oil in addition to helping depolymerize the biomass to liquids. Although the resulting bio-oil is stable, it still has to be upgraded into a transportation fuel, since it would still have a high level of oxygenated compounds.

The National Renewable Energy Laboratory (NREL) is working on a "hot filtration" technology that apparently is able to stabilize bio-oil created using the fast pyrolysis process for a very long period of time (years). This would allow the bio-oil to be stored and transported to an upgrading facility without significant degradation.

It is possible to use a sophisticated catalyst (instead of sand) in a single step pyrolysis reaction to create pyrolysis oils that exhibit much improved bio-oil properties. The catalysts would not only be able to help depolymerize cellulosic feedstocks, but they produce a bio-oil which could possibly be used directly as transportation fuel. Thus, a second upgrading step may not be necessary. The difficulty encountered by this technology is that catalysts which have been used in the one step process are relatively expensive and they degrade quickly due to the metals which are present in the biomass. Development work on the two-step and one-step pyrolysis processes is ongoing.

Dynamotive Energy Systems Corporation is a Canadian company which has developed a pyrolysis technology that uses medium temperatures and oxygen free reactions to convert dry waste biomass and energy crops into different products. The liquid product produced by the Dynamotive process is called BioOil. The BioOil contains up to 25% water, though the water is intimately mixed and does not easily separate into another phase with time. Since the BioOil contains significant amounts of water, it is not directly useable as fuel in conventional vehicles and would have to be converted via another catalytic conversion processing step. The additional catalytic step envisioned by Dynamotive to upgrade the BioOil into a transportation fuel would combust the material into a synthesis gas which would then be converted into diesel fuel or bio-methanol via a catalytic reaction (the BTL process). The diesel fuel produced is expected to be compatible with existing petroleum diesel fuels. The poor quality BioOil, though, could be used in the No. 2 industrial heating oil market at industrial facilities. However, because of its high acidity level, users would need to change equipment metallurgy to stainless steel for pipes, pumps, tanks, nozzles etc.

Dynamotive has two small demonstration plants. One demonstration plant is located in Guelph, Ontario, Canada and its capacity is 66,000 dry tons of biomass a year with an energy output equivalent to 130,000 barrels of oil. The other of its demonstration plants is located in West Lorne Ontario, Canada. Dynamotive continues to work on a technology for converting its BioOil to transportation fuels, although they have not announced plans for building such a facility due to funding limits. While Dynamotive is expected to continue to sell its fuel into the chemicals market, it could find a fuel oil user in the U.S. to use its fuel under the RFS2 program that refiners could use to comply with the 2011 cellulosic biofuel standard.

Envergent is a company formed through a joint venture between Honeywell's UOP and the Ensyn Corporation. Although Ensyn has been using fast pyrolysis for more than a decade to produce specialty chemicals, UOP is relying on its decades of experience developing refining technologies to convert the pyrolysis oils into transportation fuels. Envergent is also working with Federal laboratories to further their technology. Based on their current technology and depending on the feedstock processed, about 70% of the feedstock is converted into liquid products. The gasoline range products produced are high in octane, while the diesel fuel products are low in cetane. Envergen estimates that if it was able to procure cellulosic feedstocks at 70 per ton, that their technology would be competitive with

[28] DOE EERE Biomass Program. "Thermochemical Conversion Processes: Pyrolysis" *http://www1.eere.energy.gov/biomass/thermochemical_processes.html,* November 6, 2008.

#2 fuel oil produced from crude oil priced at about $40 per barrel. Envergent is licensing this technology as well as working with a U.S. oil company to test out this technology in a commercial setting here in the U.S.

Petrobras is a Brazilian oil company also working to develop a pyrolysis technology. Because of Petrobas' work in this area (and other areas on biofuels), a Memorandum of Understanding was signed by United States' Secretary of State and Brazil's External Relations Minister on March 9, 2007 to advance the cooperation on biofuels. A second Memorandum of Understanding was signed by PETROBRAS and NREL on September 2008 aiming at collaborating to maximize the benefit of their respective institutional interests in second generation biofuels. Petrobras is negotiating a Cooperation Agreement with NREL to develop a two step pyrolysis route to produce biofuels from agricultural wastes such as sugar cane bagasse, wood chips or corn stover. Petrobras is optimistic that a catalytic pyrolysis technology can be developed that will produce a stable bio-oil (pyrolysis oil). Petrobras is hopeful that a one-step pyrolysis technology can be developed to convert biomass directly to transportation fuels, although in the end Petrobras believes that the two step process may be more economically attractive.

b. Catalytic Depolymerization

Two companies that are pursuing catalytic depolymerization are Green Power Inc. and Cello Energy.

The Green Power process catalytically depolymerizes cellulosic feedstocks at moderate temperatures into liquid hydrocarbon fuels. The proposed feedstock is municipal solid waste (MSW) or other waste material such as animal waste, plastics, agriculture residue, woody biomass and sewage waste. The feedstock is first ground to a size finer than 5 mm. The feedstock is placed along with a catalyst, some lime, which serves as a neutralizing agent, and some fuel which provides a liquid medium, into a reactor and heated to around 350 degrees Celsius. As described, this technology may fit the description for catalyzed pyrolysis reactions described above, but because we are not certain of the reaction kinetics, we have categorized this as a separate catalytic depolymerization technology. In the reactor, the feedstock is catalytically converted to liquid fuels which primarily fall within the gasoline and diesel fuel boiling ranges, although these fuels may need further upgrading. The liquid fuels are separated from some solids which are present and are distilled into typical fuel streams including naphtha, diesel fuel, kerosene and fuel oil. According to the literature writing about this technology, the process reportedly produces 120 gallons per ton of feedstock inputted into the process. A light hydrocarbon gas, which is mostly methane, is also produced, but this gas is expected to be burned in a turbine to generate electricity and the waste heat is used for heating the process. Apparently, some carbon dioxide is also formed and is released from the process.

Greenpower completed construction on a demonstration plant located in Fife, Washington about March of 2008. Greenpower is working on obtaining additional funding and to obtain an air permit through the State of Washington Environmental Office. While we don't believe that Greenpower will have its plant operational in 2011 due to financial and other issues the company faces, those issues could be resolved to allow this company to produce fuel that could help refiners comply with the cellulosic biofuel volume standard for 2011.

The Cello-Energy process is also a catalytic depolymerization technology. At moderate pressure and temperature, the Cello-Energy process catalytically removes the oxygen and minerals from the hydrocarbons that comprise finely ground cellulose. This results in a mixture of short chain (3, 6 and 9 carbon) hydrocarbon compounds. These short chain hydrocarbon compounds are polymerized to form compounds that boil in the diesel boiling range, though the process can also be adjusted to produce gasoline or jet fuel. The resulting diesel fuel meets the ASTM standards, is in the range of 50 cetane to 55 cetane and typically contains 3 ppm of sulfur.

The Cello process is reported to be on the order of 82% efficient at converting the feedstock energy content into the energy content of the product, which is very high compared to most of today's biochemical and thermochemical processes which are on the order of 50% efficient, or less. Because of the simplicity of the process, the capital costs are very low. A 50 million gallon per year plant is claimed to only incur a total cost of $45 million. Because of its high efficiency in converting feedstocks into liquid fuel, the production and operating costs are estimated to be very low.

In December 2008, Cello completed construction on a 20 million gallon per year commercial demonstration plant. However, at the present they are still working to resolve process issues that have arisen upon scaleup from their pilot plant. We expect that Cello will be able to produce some volume of cellulosic biofuel in 2011.

5. Catalytic Reforming of Sugars to Gasoline

Virent Biorefining is pursuing a process called "Bioforming" which functions similarly as the gasoline reforming process used in the refining industry. Hence, this is a very different technology to any of those other cellulosic biofuel technologies discussed above. While refinery-based catalytic reforming technologies raise natural gasoline's octane value and produces aromatic compounds, Bioforming reforms biomass-derived sugars into hydrocarbons for blending into gasoline and diesel fuel. The process operates at moderate temperatures and pressures. In March of 2010, Virent announced that they had begun operating a larger pilot plant capable of about 30 gallons per day. Commercialization of the Virent process will happen sometime after 2011.

For this technology to become a cellulosic biofuel technology, it will be necessary to link this reforming technology with a technology which breaks cellulose down into starch or sugars. In parallel with its Bioreforming work, Virent is working on a technology to break down cellulose into sugars upstream of its technology which reforms sugars to gasoline.

V. Proposed Changes to RFS2 Regulations

Following publication of the final RFS2 program regulations ,[29] EPA identified two program areas that could benefit from the addition of new regulatory provisions. The first would provide for the generation of RINs for fuel produced between July 1, 2010 and December 31, 2010 representing certain fuel pathways that are not currently in Table 1 to § 80.1426, but which could possibly be added later this year if they are determined to meet the applicable GHG thresholds. Under this proposal RINs could be generated only if the pathways are indeed approved, and only for quantities reflecting fuel produced between the effective date of the RFS2 regulations and the effective date of a new pathway added to Table 1 to § 80.1426. The second program addition would establish procedures for petitions requesting EPA authorization of an aggregate compliance approach to renewable biomass verification for feedstocks grown in foreign countries, akin to that applicable to crops and crop

[29] 75 FR 14670, March 26, 2010.

residue grown within the U.S. We are proposing to make amendments to the RFS regulations in Subpart M to implement both of these provisions.

A. Delayed RIN Generation for New Pathways

As described in the RFS2 final rule, we did not have sufficient time to complete the necessary lifecycle GHG impact assessment for certain fuel pathways. We indicated that we would model and evaluate several additional pathways after the final rule (*see* Section V.C of the RFS2 final rule, 75 FR 14796). EPA anticipates modeling and publishing the lifecycle GHG analyses for the following four pathways later this year:

- Grain sorghum ethanol.
- Pulpwood biofuel.
- Palm oil biodiesel.
- Canola oil biodiesel.

Depending on how these lifecycle GHG results compare with the required GHG thresholds for cellulosic biofuel, biomass-based diesel, advanced biofuel, and conventional renewable fuel, we may add one or more of these pathways to Table 1 to § 80.1426. Once a new pathway is approved, producers using that pathway could generate RINs with the specified D code.

We consider the four new fuel pathways currently being analyzed to be an extension of the RFS2 final rule. Had we been able to complete these analyses for the RFS2 final rule and verified that the GHG thresholds had been met, D codes to represent these pathways would have been included in Table 1 to § 80.1426 promulgated on March 26, 2010, and renewable fuel producers could have begun using those pathways to generate RINs beginning on July 1, 2010. Indeed, we are aware of a number of producers who intend to produce biofuel using one of the four pathways listed above despite the fact that a determination regarding their lifecycle GHG impact has not yet been made.

Based on the fact that we may have included the four pathways listed above in the RFS2 final rule if the lifecycle modeling had been completed in time, we believe that it would be appropriate to allow renewable fuel producers using any of these four pathways that are ultimately approved for inclusion in Table 1 to § 80.1426 to generate RINs for all fuel they produce and sell on and after July 1, 2010. However, while EPA is expeditiously working to complete its GHG assessments for these four fuel pathways in 2010, the determination of whether any of the four pathways will meet the 20%, 50%, or 60% GHG thresholds may not occur until after July 1, 2010. Therefore, RINs representing fuel produced between July 1, 2010 and any EPA approval of a new fuel pathway could only be generated after the renewable fuel in question had been produced and sold, after the time when EPA announces the results of the lifecycle analyses and specifies the applicable D code in Table 1 to § 80.1426. Thus we are proposing a new regulatory provision for the generation of "Delayed RINs" that would allow RINs with newly specified D codes to be generated for eligible fuel produced between July 1, 2010 and the date any new D code is approved for one of the four fuel pathways listed above. This Delayed RINs provision would only be applicable for any of the four pathways described above that are determined to meet the applicable GHG thresholds. We are also proposing that this provision would apply only for renewable fuel produced in 2010, since the lifecycle GHG assessments for the four pathways listed above is expected to be completed in 2010. Our proposed regulatory provision for Delayed RIN generation would be inserted into § 80.1426 as new paragraph (g). As for any RIN generation, producers using this new regulatory provision would need to be registered under RFS2 before they could generate Delayed RINs, and would need to comply with the recordkeeping and reporting requirements of the regulations.

We do not believe that this proposed provision for Delayed RINs should be extended to any other pathways. The four pathways listed above are the only pathways currently under evaluation that would have been included in the RFS2 final rule if we had completed the modeling in time. Moreover, we have provided a petition process in § 80.1416 for other fuel pathways for which lifecycle GHG assessments have not yet been made.

In developing this proposed provision for Delayed RIN Generation, we have accounted for renewable fuel producers who are eligible for an exemption from the 20% GHG reduction requirement for their fuel under § 80.1403 ("grandfathered" producers) and those that are not. Grandfathered producers can generate RINs for their renewable fuel starting on July 1, 2010, but must designate the D code as 6 for such fuel, identifying it as conventional renewable fuel. They must also transfer those RINs with renewable fuel they sell. If one of the four fuel pathways described above is approved between July 1, 2010 and December 31, 2010 for use of a D code other than 6, and the producer wishes to apply this new D code to fuel they have already produced and transferred, the RINs they already generated and transferred with renewable fuel they produced must be accounted for. We are proposing a process whereby these grandfathered producers would be required to acquire and retire RINs from the open market with a D code of 6 prior to the generation of Delayed RINs. The number of RINs retired in this fashion must be no greater than the number they generated between July 1, 2010 and the effective date of the new applicable pathway. Producers who are not grandfathered under § 80.1403 cannot generate RINs starting on July 1, 2010, and so would not be required to acquire and retire any RINs prior to the generation of Delayed RINs.

The generation of Delayed RINs would also differ for grandfathered producers and non-grandfathered producers. Grandfathered producers would base the number of Delayed RINs they generate on the number of RINs with a D code of 6 that they retired as described above. In contrast, non-grandfathered producers would base the number of Delayed RINs they generate on the volume of renewable fuel they produced and sold between July 1, 2010 and the effective date of the new pathway. Since all Delayed RINs will be generated after the renewable fuel in question had been produced and sold, they would be assigned a K code of 2 and thus could be sold by the producer separately from renewable fuel.

Finally, we believe that there should be a deadline for the generation of Delayed RINs to ensure that they are entering the market as close as possible to the date of production of the renewable fuel that they represent. We are proposing that all Delayed RINs must be generated within 30 days of the effective date of a new pathway added to Table 1 to § 80.1426 between July 1, 2010 and December 31, 2010. We believe that 30 days would provide sufficient time for producers who are grandfathered to first acquire and retire RINs from the open market, and would be sufficient to allow any producer to generate Delayed RINs according to the procedures in the regulations. However, we request comment on a longer period within which Delayed RINs must be generated.

We request comment on our proposed provision for Delayed RINs.

B. Criteria and Process for Adoption of Aggregate Approach to Renewable Biomass for Foreign Countries

In the preamble to the final RFS2 regulations, EPA indicated that, while we did not have sufficient data at the time to make a finding that the aggregate compliance approach adopted for domestically-grown crops and crop

residues would be appropriate for foreign-grown feedstocks, we would consider applying the aggregate compliance approach for renewable biomass on a country by country basis if adequate land use data becomes available.

Since promulgation of the final RFS2 regulations, we have received several inquiries regarding the process, criteria, and data needed for EPA to approve the aggregate compliance approach for planted crops and crop residue grown in areas outside the U.S. Thus, in today's rule, EPA is proposing a process by which entities may petition EPA for approval of the aggregate compliance approach for specified renewable fuel feedstocks either in a foreign country as a whole or in a specified geographical area within a country. The proposed regulations include a general criterion and a number of considerations that EPA will use in evaluating petitions. They also include a list of submissions that are required, absent an explanation by petitioner of why they should not be required for EPA to approve a petition. The proposed rule also includes a description of the proposed process by which EPA would make decisions concerning any petitions received.

1. Criterion and Considerations

In developing these proposed regulations, EPA relied substantially on the approach we used to determine that an aggregate compliance approach was appropriate for planted crops and crop residue from U.S. agricultural land. The fundamental finding that would be required of EPA in approving a petition for application of the aggregate approach would be that an aggregate compliance approach will provide reasonable assurance that specified renewable fuel feedstocks from a given geographical area meet the definition of renewable biomass and will continue to meet the definition of renewable biomass, based on the submission of credible, reliable and verifiable data. Based on our experience in making the comparable finding for U.S.-grown crops and crop residues, we are also proposing a number of more specific factors that would be considered in determining whether this finding should be made, as described below. EPA is proposing to consider:

- Whether there has been a reasonable identification of the aggregate amount of agricultural land in the specified geographical area on December 19, 2007 that was available for the production of the specified feedstock(s) and that satisfy the definition of renewable biomass, taking into account the definitions of terms such as "cropland," "pastureland," "planted crop," and "crop residue" included in the final RFS2 regulations.
- Whether information from years preceding and following 2007 shows that the identified aggregate amount of land in the specific geographical area, called the 2007 baseline area of land, is not likely to be exceeded in the future.
- Whether economic considerations, legal constraints, historical land use and agricultural practices and other factors show that it is likely that producers of the feedstock(s) will continue to use agricultural land within the baseline area of land identified into the future, as opposed to clearing and cultivating land not eligible under the 2007 baseline.
- Whether there is a reliable method to evaluate on a continuing basis whether the 2007 baseline area of land is being or has been exceeded.
- Whether an entity has been identified to conduct data gathering and analysis needed for an annual EPA evaluation of the aggregate compliance approach if EPA grants the petition.

EPA is requesting comments on the proposed general criterion and specific considerations for approving the aggregate compliance approach for non-domestically grown feedstocks. The existing approved aggregate approach for U.S. domestic feedstocks applies to all crops and crop residue that could be used in renewable fuel production. EPA has received inquiries on the extent to which approval could be obtained for a single, or limited number, of feedstocks. The proposed regulations leave open the possibility of feedstock-specific petitions, but EPA particularly solicits comment on the extent to which different or additional data submittals or inquiries would be appropriate for such petitions.

2. Data Sources

To make the aggregate compliance determination for U.S. agricultural lands, EPA obtained USDA data from three independently gathered national land use data sources (the Farm Service Agency (FSA) Crop History Data, the USDA Census of Agriculture (2007), and the satellite-based USDA Crop Data Layer (CDL)). Please see Section II.C.4.c.iii. of the preamble to the final RFS2 rule (75 FR 14701 (March 26, 2010)) for a more detailed description of the data sources used. Using these data sources, EPA was able assess the area of land (acreage) available in the United States under EISA for production of crops and crop residues that meet the definition of renewable biomass. In the case of a petition to apply the aggregate compliance approach to feedstocks from a specific geographical area in a foreign country, when considering the information and data submitted by the petitioner, EPA will evaluate such information on a case-by-case basis, but suggests that petitioners obtain data from sources that are at least as credible, reliable, and verifiable as the USDA data used to make the determination for U.S. agricultural land.

When evaluating whether the data relied on are credible, reliable, and verifiable, EPA will take into account whether the data is submitted by, generated by, or approved by the national government of the foreign country in question, as well as how comprehensive and accurate the data source is. It is important for the national government of the area seeking consideration be involved in this process, and we seek comment on whether or not involvement of the national government should be required as part of the petitioning and/or data submittal processes. Additionally, EPA will take into consideration whether the data is publically available, whether the data collection and analysis methodologies and information on the primary data source are available to EPA, and whether the data has been generated, analyzed, and/or approved or endorsed by an independent third party. EPA would also take into account the quality of the data that is available on an annual basis for EPA's annual assessments of any approved aggregate compliance approach, as well as whether the petitioner has identified an entity who will provide to EPA an analysis of the data updates each year following EPA's approval of the aggregate compliance approach for that area. Furthermore, EPA will consider agricultural land use trends from several years preceding 2007, as well as the years following 2007 to the time the petition is submitted in order to evaluate whether or not it is likely that a 2007 baseline would be exceeded in the future. EPA will consider whether there are laws in place in the area for which the petition was submitted that might prohibit or incentivize the clearing of new agricultural lands and the efficacy of these laws. EPA will also assess whether any market factors are expected to drive an increase in the demand for agricultural land.

3. Petition Submission

EPA is proposing that all submittals, including the petition, supporting documentation, and annual data and analyses, be submitted in English. We are also proposing that petitioners submit specified information as part of their formal petition submission package, or explain why such

information is not necessary for EPA to approve their petition. Petitioners would need to submit an assessment of the total amount of land that is cropland or pastureland that was cleared or cultivated prior to December 19, 2007 and that was actively managed or fallow and nonforested on that date. For example, in assessing the amount of total existing agricultural land in the U.S. on the enactment date of EISA, EPA used FSA Crop History data to show that there were 402 million acres of agricultural land existing in the U.S. in 2007. Additionally, if the petitioner is seeking approval of the aggregate compliance approach for a particular feedstock, they would also need to submit an assessment of the total amount of agricultural land dedicated to that feedstock in 2007 within the specified area. Petitioners would also be required to provide EPA with maps or electronic data identifying the boundaries of the land in question and a description of the feedstock(s) for which the petitioner is submitting the petition.

As part of the petition, the petitioner would be required to submit to EPA land use data that demonstrates that the land in question is agricultural land that was cleared or cultivated prior to December 19, 2007 and that was actively managed or fallow and nonforested on that date, which may include satellite imagery data, aerial photography, census data, agricultural surveys, and/or agricultural economic modeling data. As mentioned above, the FSA crop history data used for the U.S. aggregate compliance approach determination consists of annual records of farm-level land use data that includes all cropland and pastureland in the U.S. EPA also considered USDA Census of Agriculture data, which consists of a full census of the U.S. agricultural sector once every five years, as well as the USDA Nation Agricultural Statistics Service (NASS) Crop Data Layer (CDL), which is based on satellite data.

In establishing the total amount of existing agricultural land for the U.S. aggregate compliance approach determination, EPA relied on the RFS2 definitions of the relevant terms, including planted crops, crop residue, and agricultural land, which is defined as consisting of cropland, pastureland and CRP land. EPA will take into consideration whether the data submitted by the petitioner relies on comparable definitions. For purposes of RFS2, planted crops are defined as all annual or perennial agricultural crops from existing agricultural land that may be used as feedstocks for renewable fuel, such as grains, oilseeds, sugarcane, switchgrass, prairie grass, duckweed, and other species (but not including algae species or planted trees), providing they were intentionally applied by humans to the ground, a growth medium, a pond or tank, either by direct application as seed or plant, or through intentional natural seeding or vegetative propagation by mature plants introduced or left undisturbed for that purpose. Crop residue is defined as the biomass left over from the harvesting or processing of planted crops from existing agricultural land and any biomass removed from existing agricultural land that facilitates crop management (including biomass removed from such lands in relation to invasive species control or fire management), whether or not the biomass includes any portion of a crop or crop plant. Cropland is defined as land used for production of crops for harvest and includes cultivated cropland, such as for row crops or close-grown crops, and non-cultivated cropland, such as for horticultural or aquatic crops. Pastureland is land managed for the production of indigenous or introduced forage plants for livestock grazing or hay production, and to prevent succession to other plant types. It is important to note that EPA considers pastureland to be distinctly different from rangeland, which may be used for livestock grazing, but is not managed to prevent succession to other plant types. Finally, CRP land is land enrolled in the US Conservation Reserve Program (administered by USDA's Farm Service Agency), which encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filterstrips, or riparian buffers. EPA recognizes that the CRP is only applicable to U.S. agricultural land. EPA solicits comments on whether the final rules should allow EPA to consider land that is equivalent or similar to US CRP land as existing agricultural land for purposes of RFS2-compliant feedstock cultivation in a foreign country, and whether EPA should be able to make such a determination in the context of a petition for application of the aggregate approach to a foreign country.

The petitioner would also be required to provide EPA with historical land use data for the land in question, covering the years from prior to 2007 to the current year. For the U.S. aggregate compliance approach determination, EPA analyzed the FSA Crop History data from the years 2005 through 2007 and the USDA Census of Agriculture from 1997 through 2007, finding that there was an overall decade trend of contraction of agricultural land utilization in the U.S. The petitioner would need to provide a description of any applicable laws, agricultural practices, economic considerations, or other relevant factors that had or may have an effect on the use of the land in question. For the U.S. aggregate compliance approach determination, EPA also took in account the EISA renewable fuel obligations, the unsuitability and high cost of developing previously undeveloped land for agricultural purposes, as well as projected increases in crop yields on existing agricultural land.

Finally, the petitioner would be required to provide EPA with a plan describing how the entity who will, on a continuing yearly basis, conduct any data gathering and analysis necessary to assist EPA in its annual assessment of any approved aggregate approach. In the plan, the petitioner would describe the data, the data source, and the schedule on which the data would be updated and made available to EPA and the public. Additionally, the plan would include the entity's strategy and schedule for conducting an annual analysis of the data and providing it to EPA.

4. Petition Process

We believe that it will be important to incorporate a public comment component into EPA's deliberations on a petition made to incorporate an aggregate compliance approach for a new area. EPA plans to publish a **Federal Register** notice informing the public of incoming petitions, with information on how to view the petitions and any supporting information. EPA proposes to then accept public comment on the petition for a specified period of time. Once the public comment period closes, EPA will make an assessment, taking into account the information submitted in the petition as well as the comments received, and will then publish a decision in the **Federal Register** to either approve or deny the petitioner's request. If the petition has been approved, the **Federal Register** notice will specify an effective date at which time producers using the specified feedstocks from the specified areas identified in EPA's approval will be subject to the aggregate compliance approach requirements in 40 CFR 80.1454(g) in lieu of the renewable biomass recordkeeping and reporting requirements. In the event that the annual data submitted by the petitioner

is insufficient to demonstrate that the baseline amount of land has not been exceeded or if the annual data is not submitted in a timely manner, EPA will make a finding that the baseline acreage has been exceeded and producers using crops or crop residue from the specified area will be subject to the individual recordkeeping and reporting requirements described in the regulations. EPA is seeking comments on this proposed process. Additionally, EPA requests comment on whether the burden associated with the petition process is reasonable, and how it might be minimized while still remaining adequately robust. Specific estimates about the time and cost of preparing a petition will be published in Information Collection Request associated with this proposed rulemaking.

VI. Public Participation

We request comment on all aspects of this proposal. This section describes how you can participate in this process.

A. How do I submit comments?

We are opening a formal comment period by publishing this document. We will accept comments during the period indicated under **DATES** in the first part of this proposal. If you have an interest in the proposed standards and changes to the RFS regulations described in this document, we encourage you to comment on any aspect of this rulemaking. We also request comment on specific topics identified throughout this proposal.

Your comments will be most useful if you include appropriate and detailed supporting rationale, data, and analysis. Commenters are especially encouraged to provide specific suggestions for any changes that they believe need to be made. You should send all comments, except those containing proprietary information, to our Air Docket (*see* **ADDRESSES** in the first part of this proposal) before the end of the comment period.

You may submit comments electronically, by mail, or through hand delivery/courier. To ensure proper receipt by EPA, identify the appropriate docket identification number in the subject line on the first page of your comment. Please ensure that your comments are submitted within the specified comment period. Comments received after the close of the comment period will be marked "late." EPA is not required to consider these late comments. If you wish to submit Confidential Business Information (CBI) or information that is otherwise protected by statute, please follow the instructions in Section VI.B.

B. How should I submit CBI to the agency?

Do not submit information that you consider to be CBI electronically through the electronic public docket, *http://www.regulations.gov,* or by e-mail. Send or deliver information identified as CBI only to the following address: U.S. Environmental Protection Agency, Assessment and Standards Division, 2000 Traverwood Drive, Ann Arbor, MI 48105, Attention Docket ID EPA–HQ–OAR–2010–0133. You may claim information that you submit to EPA as CBI by marking any part or all of that information as CBI (if you submit CBI on disk or CD–ROM, mark the outside of the disk or CD–ROM as CBI and then identify electronically within the disk or CD–ROM the specific information that is CBI). Information so marked will not be disclosed except in accordance with procedures set forth in 40 CFR part 2.

In addition to one complete version of the comments that include any information claimed as CBI, a copy of the comments that does not contain the information claimed as CBI must be submitted for inclusion in the public docket. If you submit the copy that does not contain CBI on disk or CD–ROM, mark the outside of the disk or CD–ROM clearly that it does not contain CBI. Information not marked as CBI will be included in the public docket without prior notice. If you have any questions about CBI or the procedures for claiming CBI, please consult the person identified in the **FOR FURTHER INFORMATION CONTACT** section.

VII. Statutory and Executive Order Reviews

A. Executive Order 12866: Regulatory Planning and Review

Under Executive Order (EO) 12866 (58 FR 51735, October 4, 1993), this action is a "significant regulatory action" because it raises novel legal or policy issues. Accordingly, EPA submitted this action to the Office of Management and Budget (OMB) for review under EO 12866 and any changes made in response to OMB recommendations have been documented in the docket for this action.

The economic impacts of the RFS2 program on regulated parties, including the impacts of the required volumes of renewable fuel, were already addressed in the RFS2 final rule promulgated on March 26, 2010 (75 FR 14670). This action proposes the percentage standards applicable in 2011 based on the volumes that were analyzed in the RFS2 final rule. This action also proposes two new regulatory provisions that have been determined to have no adverse economic impact on regulated parties since they would increase flexibility to produce qualifying renewable fuel under the RFS2 program.

B. Paperwork Reduction Act

The information collection requirements in this proposed rule have been submitted for approval to the Office of Management and Budget (OMB) under the *Paperwork Reduction Act,* 44 U.S.C. 3501 *et seq.* The Information Collection Request (ICR) document prepared by EPA has been assigned EPA ICR number 2398.01.

This proposed regulation has a provision that EPA would use to authorize renewable fuel producers using foreign-grown feedstocks to use an aggregate approach to comply with the renewable biomass verification provisions, similar to that applicable to producers using crops and crop residue grown in the United States. See discussion in Section V.B. For this authorization, foreign based entities could petition EPA for approval of the aggregate compliance approach for specified renewable fuel feedstocks either in a foreign country as a whole or in a specified geographical area within a country. This petition request for crops from foreign grown land areas would be voluntary. If approved by EPA, such a petition would allow biomass produced in a foreign country or geographical area to be counted as feedstock to make renewable fuel under the RFS2 program. Other actions in this proposed regulation would not impose any new information collection burdens on regulated entities beyond those already required under RFS2. The submission of this information is required in order for EPA to evaluate and act on the petitions. Respondents may assert claims of business confidentiality (CBI) for any or all of the information they submit. We do not believe that most respondents would characterize the information they submit to us under this information collection as CBI. However, any information claimed as confidential would be treated in accordance with 40 CFR Part 2 and established Agency procedures. Information that is received without a claim of confidentiality may be made available to the public without further notice to the submitter under 40 CFR 2.203.

EPA estimates that there would be 15 respondents (petitioners), submitting 15 responses (petitions) in response to this provision. The estimated burden annual

burden, assuming 15 respondents, would be 200 hours and annual cost is $14,196. Burden is defined at 5 CFR 1320.3(b).

An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations in 40 CFR are listed in 40 CFR part 9.

To comment on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, EPA has established a public docket for this rule, which includes this ICR, under Docket ID number EPA–HQ–OAR–2010–0133. Submit any comments related to the ICR to EPA and OMB. *See* **ADDRESSES** section at the beginning of this notice for where to submit comments to EPA. Send comments to OMB at the Office of Information and Regulatory Affairs, Office of Management and Budget, 725 17th Street, NW., Washington, DC 20503, Attention: Desk Office for EPA. Since OMB is required to make a decision concerning the ICR between 30 and 60 days after July 20, 2010, a comment to OMB is best assured of having its full effect if OMB receives it by August 19, 2010. The final rule will respond to any OMB or public comments on the information collection requirements contained in this proposal.

C. Regulatory Flexibility Act

The Regulatory Flexibility Act (RFA) generally requires an agency to prepare a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small organizations, and small governmental jurisdictions.

For purposes of assessing the impacts of today's rule on small entities, small entity is defined as: (1) A small business as defined by the Small Business Administration's (SBA) regulations at 13 CFR 121.201; (2) a small governmental jurisdiction that is a government of a city, county, town, school district or special district with a population of less than 50,000; and (3) a small organization that is any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.

After considering the economic impacts of today's proposed rule on small entities, we certify that this proposed action will not have a significant economic impact on a substantial number of small entities. This rule sets the annual standard for cellulosic biofuels, proposes a regulatory provision for the generation of Delayed RINs, and establishes criteria for foreign countries to adopt an aggregate approach of compliance with the renewable biomass provision similar to that used in the U.S. However, the impacts of the RFS2 program on small entities were already addressed in the RFS2 final rule promulgated on March 26, 2010 (75 FR 14670). Therefore, this proposed rule will not impose any additional requirements on small entities. We continue to be interested in the potential impacts of the proposed rule on small entities and welcome comments on issues related to such impacts.

D. Unfunded Mandates Reform Act

This action contains no Federal mandates under the provisions of Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), 2 U.S.C. 1531–1538 for State, local, or tribal governments or the private sector. The action imposes no enforceable duty on any State, local or tribal governments or the private sector. Therefore, this action is not subject to the requirements of sections 202 or 205 of the UMRA.

This action is also not subject to the requirements of section 203 of UMRA because it contains no regulatory requirements that might significantly or uniquely affect small governments.

E. Executive Order 13132: Federalism

This action does not have federalism implications. It will not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132. This proposed rule does not have federalism implications. It will not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132. Thus, Executive Order 13132 does not apply to this rule.

In the spirit of Executive Order 13132, and consistent with EPA policy to promote communications between EPA and State and local governments, EPA specifically solicits comment on this proposed rule from State and local officials.

F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

This action does not have tribal implications, as specified in Executive Order 13175 (65 FR 67249, November 9, 2000). This proposed rule does not have tribal implications, as this rule will be implemented at the Federal level and impose compliance costs only on transportation fuel refiners, blenders, marketers, distributors, importers, and exporters. Tribal governments would be affected only to the extent they purchase and use regulated fuels. Thus, Executive Order 13175 does not apply to this action.

G. Executive Order 13045: Protection of Children From Environmental Health Risks and Safety Risks

EPA interprets EO 13045 (62 FR 19885, April 23, 1997) as applying only to those regulatory actions that concern health or safety risks, such that the analysis required under section 5–501 of the EO has the potential to influence the regulation. This action is not subject to EO 13045 because it does not establish an environmental standard intended to mitigate health or safety risks and because it implements specific standards established by Congress in statutes.

H. Executive Order 13211: Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use

This rule is not a "significant energy action" as defined in Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use" (66 FR 28355 (May 22, 2001)) because it is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

I. National Technology Transfer Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 ("NTTAA"), Public Law 104–113, 12(d) (15 U.S.C. 272 note) directs EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (*e.g.,* materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies. NTTAA directs EPA to provide Congress, through OMB, explanations when the Agency decides not to use available and applicable voluntary consensus standards.

This proposed rulemaking does not involve technical standards. Therefore, EPA is not considering the use of any voluntary consensus standards.

J. Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order (EO) 12898 (59 FR 7629 (Feb. 16, 1994)) establishes Federal executive policy on environmental justice. Its main provision directs Federal agencies, to the greatest extent practicable and permitted by law, to make environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations in the United States.

EPA has determined that this proposed rule will not have disproportionately high and adverse human health or environmental effects on minority or low-income populations because it does not affect the level of protection provided to human health or the environment. This action does not relax the control measures on sources regulated by the RFS2 regulations and therefore will not cause emissions increases from these sources.

VIII. Statutory Authority

Statutory authority for this action comes from section 211 of the Clean Air Act, 42 U.S.C. 7545. Additional support for the procedural and compliance related aspects of today's proposal, including the proposed recordkeeping requirements, come from Sections 114, 208, and 301(a) of the Clean Air Act, 42 U.S.C. Sections 7414, 7542, and 7601(a).

List of Subjects in 40 CFR Part 80

Environmental protection, Air pollution control, Diesel Fuel, Fuel additives, Gasoline, Imports, Labeling, Motor vehicle pollution, Penalties, Reporting and recordkeeping requirements.

Dated: July 9, 2010.

Lisa P. Jackson,

Administrator.

For the reasons set forth in the preamble, 40 CFR part 80 is proposed to be amended as follows:

PART 80—REGULATION OF FUELS AND FUEL ADDITIVES

1. The authority citation for part 80 continues to read as follows:

Authority: 42 U.S.C. 7414, 7542, 7545, and 7601(a).

2. Section 80.1426 is amended by revising paragraph (e)(1) and adding paragraph (g) to read as follows:

§ 80.1426 How are RINs generated and assigned to batches of renewable fuel by renewable fuel producers or importers?

* * * * *

(e) * * *

(1) Except as provided in paragraph (g)(7) of this section for delayed RINs, the producer or importer of renewable fuel must assign all RINs generated to volumes of renewable fuel.

* * * * *

(g) *Delayed RIN generation.* Parties who produce or import renewable fuel may generate delayed RINs to represent renewable fuel volumes that have already been transferred to another party if those renewable fuel volumes can be described by a pathway that has been added to Table 1 to § 80.1426 on or after July 1, 2010 and before January 1, 2011.

(1) When a new pathway is added to Table 1 to § 80.1426, EPA will specify the effective date of that new pathway.

(2) Delayed RINs must be generated within 30 days of the effective date of the rule in which the pathway is added.

(3) Delayed RINs may only be generated to represent renewable fuel produced or imported between July 1, 2010 and the effective date of the rule in which the pathway is added.

(4) If a party originally generated and transferred RINs with renewable fuel volumes, and those RINs can be described by a pathway added to Table 1 to § 80.1426 on or after July 1, 2010 and before January 1, 2011, that party must retire a number of gallon-RINs prior to generating delayed RINs.

(i) The number of gallon-RINs retired must not exceed the number of gallon-RINs originally generated to represent the renewable fuel volumes produced or imported between July 1, 2010 and the effective date of the rule in which the pathway is added.

(ii) Retired RINs must have a D code of 6.

(iii) Retired RINs must have a K code of 2.

(iv) Retired RINs must have been generated in 2010.

(5) For parties that retire RINs pursuant to paragraph (g)(4) of this section, the number of delayed gallon-RINs generated shall be equal to the number of gallon-RINs retired.

(6) For parties that did not retire RINs pursuant to paragraph (g)(4) of this section, the number of delayed gallon-RINs generated shall be determined pursuant to paragraph (f) of this section.

(i) The standardized volume of fuel (V_s) used to determine the RIN volume (V_{RIN}) under paragraph (f) of this section shall be the standardized volume of renewable fuel produced or imported between July 1, 2010 and the effective date of the rule in which the pathway is added.

(ii) The renewable fuel for which delayed RINs are generated must be described by a pathway that has been added to Table 1 to § 80.1426 on or after July 1, 2010 and before January 1, 2011.

(7) All delayed RINs generated by a renewable fuel producer must be generated on the same date.

(8) Delayed RINs shall have a K code of 2.

(9) The D code that shall be used in delayed RINs generated shall be the D code specified in Table 1 to § 80.1426 which corresponds to the pathway that describes the producer's operations.

3. Section 80.1454 is amended by revising paragraph (g) introductory text to read as follows:

§ 80.1454 What are the recordkeeping requirements under the RFS Program?

* * * * *

(g) *Aggregate compliance with renewable biomass requirement.* Any producer or RIN-generating importer of renewable fuel made from planted crops or crop residue from existing U.S. agricultural land as defined in § 80.1401, or any producer or RIN-generating importer of renewable fuel made from feedstock covered by a petition approved pursuant to § 80.1457, is subject to the aggregate compliance approach and is not required to maintain feedstock records unless EPA publishes a finding that the 2007 baseline amount of agricultural land has been exceeded or that the criterion in § 80.1457(a) is no longer satisfied.

* * * * *

4. Section 80.1457 is added to read as follows:

§ 80.1457 Petition process for international aggregate compliance approach.

(a) EPA may approve a petition for application of the aggregate compliance approach to non-U.S. planted crops and crop residues from existing foreign agricultural land if it determines that an aggregate compliance approach will provide reasonable assurance that specified renewable fuel feedstocks from a given geographical area meet the definition of renewable biomass and will continue to meet the definition of renewable biomass, based on the submission of credible, reliable, and verifiable data.

(1) As part of its evaluation, EPA will consider:

(i) Whether there has been a reasonable identification of the

aggregate amount of agricultural land in the specified geographical area as of December 19, 2007 that was available for the production of the specified feedstock(s) and that satisfy the definition of renewable biomass;

(ii) Whether information from years preceding and following 2007 shows that the 2007 amount of agricultural land identified in paragraph (a)(1)(i) of this section is not likely to be exceeded in the future;

(iii) Whether economic considerations, legal constraints, historical land use and agricultural practices, and/or other factors show that it is likely that producers of the feedstock(s) will continue to use agricultural land within area of land identified in paragraph (a)(1)(i) of this section in the future as opposed to clearing and cultivating land that was not included in that area of land.

(iv) Whether there is a reliable method to evaluate on a continuing basis whether the 2007 area of land identified in paragraph (a)(1)(i) of this section is being exceeded; and

(v) Whether an entity has been identified to conduct data gathering and analysis needed for the evaluation specified in paragraph (a)(1)(iv) of this section, for submission to EPA on an annual basis if EPA grants the petition.

(2) [Reserved]

(b) Any petition submitted under paragraph (a) of this section must be in the English language, and must include all of the following, or an explanation of why it is not needed for EPA to approve the petition:

(1) Maps or electronic data identifying the boundaries of the land for which the petitioner seeks approval of an aggregate compliance approach.

(2)(i) For petitions regarding crops or crop residue, the total amount of land that is cropland or pastureland within the geographic boundaries specified in paragraph (b)(1) of this section that was cleared or cultivated prior to December 19, 2007 and that was actively managed or fallow and nonforested on that date, and the total amount of land that is cropland or pastureland within the geographic boundaries specified in paragraph (b)(1) of this section that was not cleared or cultivated prior to December 19, 2007 and actively managed or fallow and nonforested on that date.

(ii) If the petitioner is seeking approval of the aggregate compliance approach for a particular planted crop or crop residue, the total amount of land within the geographic boundaries specified in paragraph (b)(1) of this section that was used for the production of that feedstock in 2007 and that was actively managed or fallow and nonforested on that date, and the total amount of land within the geographic boundaries specified in paragraph (b)(1) of this section that was used for the production of that feedstock in 2007 that was not cleared or cultivated prior to December 19, 2007 and actively managed or fallow and nonforested on that date.

(3) A description of the feedstock(s) for which the petitioner is submitting the petition.

(4) Land use data that demonstrates that the land in question in paragraph (b)(1) of this section is cropland or pastureland that was cleared or cultivated prior to December 19, 2007 and that was actively managed or fallow and nonforested on that date, which may include any of the following:

(i) Satellite imagery data.

(ii) Aerial photography.

(iii) Census data.

(iv) Agricultural surveys.

(v) Agricultural economic modeling data.

(5) Historical land use data for the land within the geographic boundaries specified in paragraph (b)(1) of this section to the current year, which may include any of the following:

(i) Satellite imagery data.

(ii) Aerial photography.

(iii) Census data.

(iv) Agricultural surveys.

(v) Agricultural economic modeling data.

(6) A description of any applicable laws, agricultural practices, economic considerations, or other relevant factors that had or may have an effect on the use of the land within the geographic boundaries specified in paragraph (b)(1) of this section.

(7) A plan describing how the petitioner will identify an entity who will, on a continuing basis, conduct data gathering, analysis, and submittal to assist EPA in making an annual determination of whether the criterion specified in paragraph (a) of this section remains satisfied.

(8) Any additional information the Administrator may require.

(c) If EPA approves a petition it will issue a **Federal Register** notice announcing its decision and specifying an effective date for the application of the aggregate compliance approach to the specified feedstock(s) from the specific geographical area. Thereafter, the specified feedstocks from the specified area will be covered by the aggregate compliance approach set forth in § 80.1454(g), or as otherwise specified pursuant to paragraph (d) of this section.

(d) If EPA grants a petition to establish an aggregate compliance approach for a specified feedstock(s) from a specific geographical area, it may include any conditions that EPA considers appropriate in light of the conditions and circumstances involved.

(e)(1) EPA may withdraw its approval of the aggregate approach for the area and feedstocks in question if:

(i) EPA determines that the data submitted pursuant to the plan described in paragraph (b)(7) of this section does not demonstrate that the amount of cropland and pastureland within the geographic boundaries covered by the approved petition does not exceed the 2007 baseline amount of land;

(ii) EPA determines based on other information that the criterion specified in paragraph (a) of this section is no longer satisfied; or

(iii) EPA determines that the data needed for its annual evaluation has not been collected and submitted in a timely and appropriate manner.

(2) If EPA withdraws its approval, then producers using feedstocks from that area will be subject to the individual recordkeeping and reporting requirements of § 80.1454(b) through (d) in accordance with the schedule specified in § 80.1454(g).

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