Meeting the Renewable Fuel Standard (RFS) Mandate for Cellulosic Biofuels: Questions and Answers

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Summary

The Renewable Fuel Standard (RFS) was expanded under the Energy Independence and Security Act of 2007 (EISA; P.L. 110-140) in an effort to reduce dependence on foreign oil, promote biofuel use, and stabilize transportation fuel prices, among other goals. Over 15 years, the RFS requires that increasing amounts of biofuels—36 billion gallons by 2022—be used in transportation fuel. The mandate is to be accomplished in part with advanced biofuels, including cellulosic biofuels—fuels produced from cellulosic materials including grasses, trees, and agricultural and municipal wastes—which would increase over time to comprise some 44% of the RFS in 2022.

The U.S. Environmental Protection Agency (EPA) is required to set the annual standard for cellulosic biofuels under the RFS for the following year by November 30. If projected cellulosic biofuel production is less than the volume specified in the statute, EPA can lower the cellulosic biofuels standard. EPA concluded that the nation lacked sufficient production capacity to meet the RFS cellulosic biofuels mandate for 2010, 2011, 2012, and 2013. EPA reduced the mandate (actual volume) for 2010 (from 100 million gallons to 5 million gallons), 2011 (from 250 million gallons to 6.6 million gallons), and 2012 (from 500 million gallons to 8.65 million gallons, later vacated by a federal court decision). EPA proposes to lower the 2013 mandate from 1.0 billion gallons to 11 million gallons.

The 2010, 2011, and 2012 reduced mandates were not met by actual cellulosic biofuel production, which EPA reports was limited. Instead, these mandates were met with renewable identification numbers (RINs) generated under the original RFS, and with cellulosic biofuel waiver credits. The cellulosic biofuels industry may be able to produce the EPA mandates if certain obstacles are overcome: lowering the cost of conversion technology at the initial stages of commercial application, easing access to financing, removing feedstock supply uncertainties, and creating certainty for tax incentives. EPA reports that the industry front-runners—eight production facilities—have addressed many of these concerns, and that their success "will significantly decrease the perceived risk associated with similar future facilities and could potentially lead to the rapid deployment of cellulosic biofuel production facilities around the United States." Another challenge for the cellulosic biofuels industry—and all biofuels industries—is the petroleum industry's opposition to the RFS, in part because it views the RFS as unworkable. Other industries—livestock and poultry in particular—have joined the petroleum industry in requesting that the RFS be modified. Another constraint is the need to comply with the blend wall—the upper limit to the total amount of ethanol that by law can be blended into U.S. gasoline.

Several federal programs assist the cellulosic biofuels industry, including the U.S. Department of Agriculture's (USDA's) Biorefinery Assistance Program and Biomass Crop Assistance Program, and the U.S. Department of Energy's (DOE's) Loan Guarantee Program. EPA reports that some of the cellulosic biofuels front-runners received or were offered significant federal financial support (approximately $637 million) in the form of grants and loan guarantees from USDA and DOE between 2009 and 2012.

Many questions regarding cellulosic biofuels and the RFS may arise as Congress debates energy legislation. Can the RFS mandate for cellulosic biofuels be met? If so, when would it be met? What impact will the continued lowering of the cellulosic biofuels mandate by EPA have on investment in production? Should Congress continue to provide support for cellulosic biofuels, and if so, how? Might Congress statutorily increase the number of qualified feedstocks for the

RFS cellulosic biofuels category, given the 112th Congress amendment of the definition of cellulosic biofuels to include algae for some tax incentives? What impact will other legislative discussions (e.g., military support for biofuels) have on the RFS cellulosic biofuels mandate?

This report, in a question and answer format, discusses some challenges facing the cellulosic biofuels community, including feedstock supply estimates, and potential legislative options to address cellulosic biofuels production uncertainty for the RFS.

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Introduction

The Renewable Fuel Standard (RFS), created by the Energy Policy Act of 2005 (EPAct05, P.L. 109-58) and expanded under the Energy Independence and Security Act of 2007 (EISA; P.L. 110-140), mandates that domestic transportation fuel contain a specified volume of biofuels—including advanced biofuel, cellulosic biofuel, and biomass-based diesel—in an effort to reduce dependence on foreign oil, promote biofuel use, and stabilize transportation fuel prices, among other goals.[1] The mandate is to be accomplished in large part with cellulosic biofuels. The RFS requires that increasing amounts of biofuels be included in transportation fuel over a 15-year period, with the goal of using 36 billion gallons of biofuels annually by 2022, including 16 billion gallons of cellulosic biofuels.

The U.S. Environmental Protection Agency (EPA) is required to set the annual standard for cellulosic biofuels under the RFS for the following year by November 30. If the projected volume of cellulosic biofuel production is less than the volume specified in the statute, then EPA is required to lower the cellulosic biofuels standard. Due to a lack of U.S. production capacity, the EPA, in successive years from 2010 to 2012, issued final rules under its waiver authority for the RFS established in EISA, which lowered the 2010 cellulosic biofuel mandate (actual volume) from 100 million gallons to 5 million gallons,[2] the 2011 mandate from 250 million gallons to 6.6 million gallons,[3] and the 2012 mandate from 500 million gallons to 8.65 million gallons.[4] A January 25, 2013, federal court decision vacated the 2012 RFS cellulosic biofuels standard.[5] EPA issued a proposed rule to set the 2013 actual volume standard for cellulosic biofuels at 11 million gallons (14 million ethanol-equivalent gallons) on January 31, 2013.[6]

Some have questioned whether cellulosic biofuels can be produced in sufficient quantity to satisfy the RFS mandate in future years. Feedstock supply, financial viability and financing, and technology advancement are considered among the limiting factors for cellulosic biofuel production. More than five years after EISA was enacted, progress toward meeting the cellulosic biofuels mandate has been delayed on multiple fronts (e.g., financial, administrative, and technical). Following three consecutive years of RFS cellulosic biofuels mandate reductions and

[1] For more information on the expanded RFS, see CRS Report R40155, *Renewable Fuel Standard (RFS): Overview and Issues*, by Randy Schnepf and Brent D. Yacobucci.

[2] U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program; Final Rule," 75 *Federal Register*, March 26, 2010.

[3] U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: 2011 Renewable Fuel Standards; Final Rule," *Federal Register*, December 9, 2010.

[4] U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: 2012 Renewable Fuel Standards; Final Rule," *Federal Register*, January 9, 2012.

[5] *American Petroleum Institute v. Environmental Protection Agency*, USCA Case #12-1139, January 25, 2013. The American Petroleum Institute (API) petitioned the court about two aspects of the RFS. The first aspect, which is directly related to cellulosic biofuels, was an objection to EPA's 2012 cellulosic biofuels projection. The court agreed with API that "because EPA's methodology for making its cellulosic biofuel projection did not take neutral aim at accuracy, it was an unreasonable exercise of agency discretion." The court went on to explain that EPA is tasked with establishing "a projection that aims at accuracy, not at deliberately indulging a greater risk of overshooting than undershooting." The second aspect of the petition was an objection to EPA not providing a reasoned explanation for its refusal to reduce the 2012 advanced biofuels volume standard.

[6] U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards; Proposed Rule," 78 *Federal Register*, February 7, 2013. EPA had a two-month delay in issuing the 2013 RFS proposed rule. 42 USC 7545(o)(3)(B)(i)

EPA's current proposal to reduce the 2013 mandate, some contend that Congress should reconsider the configuration of the RFS, determine whether additional resources are necessary for cellulosic biofuel production, and assess the success rate of this effort compared to other renewable energy efforts. Others assert that the current structure provides adequate incentives.

What Are Cellulosic Biofuels?

Cellulosic biofuels are liquid, solid, or gaseous fuels made from materials containing cellulose. Cellulose—a complex carbohydrate—is the organic matter found in plant walls that, along with hemicellulose and lignin, helps to give a plant its rigid structure. Cellulose feedstock includes agricultural residues (e.g., corn stover), forestry residues (e.g., wood chips), dedicated energy crops (e.g., switchgrass, hybrid poplar), and urban sources of waste (e.g., municipal solid waste).

The most widely discussed cellulosic biofuel is cellulosic ethanol for transportation.[7] Cellulosic ethanol differs from the corn-starch ethanol currently blended into transportation fuel; it is made from feedstock with no or only limited food value, potentially results in fewer greenhouse gas emissions, and has a higher lifecycle energy balance.[8] Converting cellulosic feedstock to ethanol, however, is more expensive and difficult than converting corn starch to ethanol. The conversion of cellulose to ethanol generally happens in three phases—pretreatment, hydrolysis, and fermentation to ethanol. Pretreatment weakens the plant wall structure so that the cellulose is easier to obtain during hydrolysis. Hydrolysis—acid or enzymatic—separates the cellulose into sugars. Fermentation converts the sugars into ethanol. Cellulose can also be converted to liquid fuels through processes other than fermentation (e.g., thermochemical processes).[9]

Proponents suggest that increased use of cellulosic biofuels for transportation could potentially help to reduce U.S. dependence on foreign oil, strengthen rural economies, and improve the environment. In addition, they contend that cellulosic feedstocks may fare better in the food-energy debate, since crop residue, and not the crop itself, is used for cellulosic biofuel production. In contrast, others argue that cellulosic biofuels at RFS volumes require a substantial feedstock supply that has yet to be verified and may never be cost-competitive without government support.

What Is the Relationship Between Cellulosic Biofuels and the Renewable Fuel Standard?

The RFS established in Section 202 of EISA called for 100 million gallons of cellulosic biofuels to be included in the national transportation fuel supply in 2010 (see **Table 1**). The mandate increases to 16 billion gallons by 2022.[10] Despite the RFS mandate for cellulosic biofuels starting

[7] For more information on cellulosic biofuels, see CRS Report RL34738, *Cellulosic Biofuels: Analysis of Policy Issues for Congress*, by Kelsi Bracmort et al.

[8] For more information on ethanol, see CRS Report RL33290, *Fuel Ethanol: Background and Public Policy Issues*, by Brent D. Yacobucci.

[9] Cellulose feedstocks can also be used to provide heat or generate electricity via gasification, combustion, anaerobic digestion, and other conversion processes. For more information, see CRS Report R40667, *Anaerobic Digestion: Greenhouse Gas Emission Reduction and Energy Generation*, by Kelsi Bracmort; and CRS Report R41440, *Biomass Feedstocks for Biopower: Background and Selected Issues*, by Kelsi Bracmort.

[10] For more information on the RFS, see CRS Report R40155, *Renewable Fuel Standard (RFS): Overview and Issues*, (continued...)

in 2010, the first registered production of cellulosic biofuels in the United States was not achieved until 2012, when 20,069 gallons were reported to the EPA.

Table 1. RFS Biofuels Mandate in EISA: Total Renewable Fuels and Cellulosic Biofuels

(in billions of gallons)

		Cellulosic biofuels	
Year	**Total renewable fuels**	**Original**	**EPA revised (actual volume)**
2006	—	—	—
2007	—	—	—
2008	9.00	0.00	—
2009	11.10	0.00	—
2010	12.95	0.100	0.005[a]
2011	13.95	0.250	0.0066[b]
2012	15.20	0.500	0.00865[c]
2013	16.55	1.00	0.011[d]

Source: EISA (P.L. 110-140), Section 202.

a. U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program; Final Rule," 75 *Federal Register*, March 26, 2010.

b. U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: 2011 Renewable Fuel Standards; Final Rule," *Federal Register*, December 9, 2010.

c. U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: 2012 Renewable Fuel Standards; Final Rule," *Federal Register*, January 9, 2012.

d. U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards; Proposed Rule," 78 *Federal Register*, February 7, 2013.

Data and analysis presented during the RFS debate and ultimate passage of EISA in 2007 supported the idea that these levels of cellulosic biofuel production capacity could be achievable. Some argued that plentiful feedstock was available[11] and that the conversion technology was close to being certified as commercially viable. Moreover, some presumed that the federal government would provide substantial financial support and enhance the infrastructure needed to spur a commercial cellulosic biofuels market.[12] Others were leery about the time frame provided to meet the RFS cellulosic biofuels mandate given the as-yet-undeveloped production capacity.[13]

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by Randy Schnepf and Brent D. Yacobucci.

[11] U.S. Dept. of Energy, U.S. Dept. of Agriculture, *Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-Ton Annual Supply*, April 2005, http://www1.eere.energy.gov/biomass/pdfs/final_billionton_vision_report2.pdf.

[12] Diane Greer, "Creating Cellulosic Ethanol: Spinning Straw into Fuel," *BioCycle*, April 2005; Biotechnology Industry Organization, *Achieving Sustainable Production of Agricultural Biomass for Biorefinery Feedstock*, Washington, DC, 2006, http://www.bio.org/ind/biofuel/SustainableBiomassReport.pdf; and Biotechnology Industry Organization, "Energy Bill Biofuels Mandates Will Be Achievable with Biotechnology Advances," press release, November 18, 2007, http://bio.org/news/pressreleases/newsitem.asp?id=2007_1218_01&p=yes.

[13] Ian Talley, "Renewed Energy: US Biofuel Mandate Calls for Big Production Boost," *Dow Jones International News*, (continued...)

EPA has the authority to waive completely or in part the consumption mandates for cellulosic biofuels established in EISA, under certain circumstances.[14] For instance, the cellulosic biofuels requirement may be waived if the Administrator determines, after public notice and opportunity for comment, that there is an inadequate domestic supply.[15] EPA may also waive the RFS or any specific category of the RFS if there is evidence that full implementation may cause economic harm. EPA generally conducts its cellulosic biofuels volume assessment by using information from the Departments of Energy and Agriculture, and by monitoring the funding, production, and construction status of select companies with planned and existing cellulosic biofuel facilities.[16] EPA also responds to petitions for specific waivers from a state or a fuel provider, or at the EPA Administrator's own discretion.

What Challenges Are Associated with Production of Cellulosic Biofuels?

Since the RFS was expanded under EISA,[17] U.S. production of cellulosic biofuels has had a slow start. Impediments to increasing capacity include technology setbacks and financial support.

Commercial cellulosic biofuel facilities are estimated to cost hundreds of millions of dollars, significantly more than a traditional corn ethanol plant, especially when measured in terms of the amount of biofuel produced (measured in million gallons per year, or mgy). For example, the company INEOS Bio reports that its Indian River 8 mgy production capacity plant cost approximately $130 million.[18] American Process, Inc., reports that its Alpena 0.8 mgy pilot plant cost approximately $36 million.[19] In comparison, a 40 mgy corn ethanol plant cost approximately $80 million to construct in 2006.[20] Some lenders find it extremely risky, perhaps even cost-prohibitive, to provide financial backing to cellulosic biofuel plants, mainly because the conversion technology has not been applied or proven on a commercial scale.[21] These costs are likely to decrease if a significant number of commercial-scale plants come online and prove to be economically viable.

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December 18, 2007, at http://www.factiva.com/.

[14] For more information on EPA's waiver authority, see CRS Report RS22870, *Waiver Authority Under the Renewable Fuel Standard (RFS)*, by Brent D. Yacobucci.

[15] 42 U.S.C. 7545(o)(7).

[16] In its proposed rule for Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards, EPA reported it tracked the progress of more than 100 biofuel production facilities.

[17] The original RFS established by §1501 of EPAct05 required 4.0 billion gallons of renewable fuel for 2006, ascending to 7.5 billion gallons by 2012. The original RFS would have required that 250 million gallons of the renewable fuel be derived from cellulosic biomass starting in 2013; whereas the expanded RFS, or RFS2, required 250 million gallons of cellulosic biofuel in 2011.

[18] E-mail from Bryan Stockton of ML Strategies, December 13, 2012.

[19] E-mail from Kim Nelson of American Process, Inc., December 11, 2012.

[20] Clean Fuels Development Corporation, Nebraska Ethanol Board, and U.S. Dept. of Agriculture, *A Guide for Evaluating the Requirements of Ethanol Plants*, 2006, http://www.ethanol.org/pdf/contentmgmt/guide_for_evaluating_the_requirements_of_ethanol_plants.pdf.

[21] For more information on federal spending for cellulosic biofuels, see CRS Report RL34738, *Cellulosic Biofuels: Analysis of Policy Issues for Congress*, by Kelsi Bracmort et al.

In addition to financing issues, other challenges to cellulosic biofuel production include multiple definitions of biomass in various laws, which may confuse investors and lead to legal disputes over what constitutes a "qualified feedstock." For example, incentives for cellulosic biofuel production in the tax code are relatively broad. The renewable biomass definition for the RFS under EISA does not allow for biomass removed from federal lands, and excludes crops from forested lands.[22] Some argue that opening federal lands for biomass removal could provide an inexpensive supply of cellulosic feedstock that would be immediately available to biorefineries for cellulosic biofuel production. Others contend that biomass removal from federal lands is a short-term response to the cellulosic feedstock source problem and might not be carried out in a sustainable manner, leading to deterioration of the nation's parks and recreation areas. The definition of biomass under EISA also excludes most municipal solid waste (MSW), which some view as a potential source for conversion to biofuels.

Also challenging for cellulosic biofuel production are feedstock contracts, which will likely cover multiple years. Agricultural and forestry producers may not agree to a contract for a cellulosic feedstock that requires a lengthy time commitment. For example, it generally takes three years for switchgrass crops to reach maturity.[23] As a result, a producer would have to commit his land to one particular cellulosic feedstock crop for a number of years, thus limiting the producer's choice to grow other, potentially more remunerative crops during that period. The Biomass Crop Assistance Program (BCAP) is designed to assist producers with annual payments that could mitigate some of the risks involved with shifting from traditional crop production to energy crop production. In early 2013, EPA reported that the industry has made significant progress regarding feedstock supply, citing companies that have secured feedstock contracts with local agricultural producers.[24]

How Much Cellulosic Feedstock Exists for Conversion to Biofuels?

An important factor in evaluating whether a commercial cellulosic biofuel production plant will be a favorable investment is whether a steady feedstock supply exists for a biorefinery.[25] However, determining actual availability of feedstock is difficult. Quantifying the amount of feedstock available for conversion to biofuels requires information about feedstock sources, production rates, accessibility, and location restrictions (e.g., public versus private lands if the feedstock is to be used for certain energy purposes). Investors must make feedstock predictions based on data from weather patterns and land use change, as well as an uncertain supply chain (e.g., handling, storage, and transportation costs), among other things. This is particularly important when a biomass feedstock growth season of four to five months must provide biomass feedstock for 12 months of plant operation.[26] To make the supply available throughout the year,

[22] For more information on biomass definitions, see CRS Report R40529, *Biomass: Comparison of Definitions in Legislation Through the 112th Congress*, by Kelsi Bracmort.

[23] University of Tennessee, *Growing and Harvesting Switchgrass for Ethanol Production in Tennessee*, SP701-A, http://www.utextension.utk.edu/publications/spfiles/SP701-A.pdf.

[24] U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards; Proposed Rule," 78 *Federal Register*, February 7, 2013.

[25] A biorefinery is a facility that processes biomass into biofuels.

[26] One company, POET, has devised a feedstock supply plan whereby the feedstock would be stored by the producer, (continued...)

special equipment may be required for feedstock harvest, handling, collection, storage, or transport, as cellulosic feedstock is often too bulky for average farming equipment to handle.

The amount of cellulosic feedstock necessary for conversion to a biofuel depends on the feedstock type, the conversion process, and the desired biofuel.[27] Biofuel conversion yield is measured in gallons per ton. Feedstock, or crop, yield is measured in tons per acre. Total yield, measured in gallons per acre, depends on both the feedstock yield and the conversion yield. Yields are typically much higher on prime cropland than on marginal lands. However, if cellulosic feedstocks are produced on prime cropland, then they likely compete with food crops while significantly raising their cost of production due to the opportunity cost of land.

Some argue that current estimated cellulosic feedstock yields will need to increase markedly over the next decade to meet the RFS mandate of 16 billion gallons of cellulosic biofuel production per year by 2022. Others contend that a significant growth of cellulosic feedstock is not essential, as advances in conversion technologies will afford the opportunity to produce more cellulosic biofuel with less feedstock. If cellulosic feedstock yields do increase, the traditional geographic areas for feedstock cultivation may be subject to additional energy, environmental, and agricultural policy scrutiny.

What Federal Financial Assistance Is Available for the Cellulosic Biofuels Industry?

Several forms of federal government financial support exist for production of cellulosic biofuels, including the DOE Loan Guarantee Program, the USDA Biorefinery Assistance Program, the USDA Biomass Crop Assistance Program, and tax incentives. Other sources of financial assistance include smaller grants awarded by federal agencies for unique initiatives.[28]

To help promote cleaner energy technologies, including cellulosic biofuel production technologies, Congress established the Department of Energy (DOE) Loan Guarantee Program (LGP).[29] Loans may not exceed 80% of total project costs. The DOE Section 1703 loan program

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under a four-year contract, and delivered to the biorefinery as needed. Jim Lane, "Should the Renewable Fuel Standard be Scrapped, or Revised?" *Biofuels Digest*, November 2, 2011, http://biofuelsdigest.com/bdigest/2011/11/01/are-you-any-less-worried-about-energy-security-today-than-you-were-4-years-ago-asks-bp/.

[27] Several studies have estimated the current or long-term cellulosic feedstock supply available for conversion to biofuels on a national basis. The estimates provided in each study are based on numerous assumptions and modeling techniques unique to each study. DOE studies include the *U.S. Billion-Ton Update: Biomass Supply for a Bioenergy and Bioproducts Industry*, ORNL/TM-2011/224, August 2011; and *Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-Ton Annual Supply*, April 2005. Non-DOE studies include the National Academy of Sciences, *Renewable Fuel Standard: Potential Economic and Environmental Effects of U.S. Biofuel Policy*, 2011; National Academy of Sciences, National Academy of Engineering, National Research Council, *Liquid Transportation Fuels from Coal and Biomass: Technological Status, Costs, and Environmental Impacts*, Washington, DC, 2009; and Biomass Research and Development Initiative, *Increasing Feedstock Production for Biofuels Economic Drivers, Environmental Implications, and the Role of Research*, December 2008.

[28] For example, the DOE awarded $10 million for five advanced biofuel and bio-based product projects. U.S. Department of Energy, *Energy Department Awards $10 Million to Develop Advanced Biofuels and Bio-based Products*, January 3, 2013, http://apps1.eere.energy.gov/news/progress_alerts.cfm/pa_id=822.

[29] A loan guarantee is defined as a "pledge with respect to the payment of all or a part of the principal or interest on any (continued...)

supports clean energy technologies that are high technology risks (e.g., biomass, solar, alternative fuel vehicle technologies). In addition, the DOE Section 1705 loan program, which expired in 2011, supported renewable energy systems, electric power transmission systems, and leading-edge biofuels. Some in the industry are concerned that the LGP is not being carried out at a pace responsive to market momentum for cellulosic biofuels.[30]

The Government Accountability Office (GAO) reviewed DOE's execution of the Loan Guarantee Program in 2010 and again in 2012.[31] In 2012, GAO found that DOE "improved the speed at which it was able to move section 1705 applications through its review process" and that DOE had "not closed any section 1703 loan guarantees or otherwise demonstrated that the program is fully functional." Even though Section 1705 expired in 2011, GAO issued three recommendations for the overall loan guarantee program, including that DOE "implement a consolidated system that enables the tracking of the status of applications and that measures overall program performance."

The USDA Biorefinery Assistance Program (BAP) assists in the development of new and emerging technologies for advanced biofuels.[32] BAP provides competitive grants and loan guarantees for construction and/or retrofitting of demonstration-scale biorefineries to demonstrate the commercial viability of one or more processes for converting renewable biomass to advanced biofuels. Because BAP has not received any discretionary funding needed to implement the grant portion of the program, USDA has only implemented the loan guarantee portion of the program using mandatory funding. USDA reports that seven biorefineries were granted a BAP conditional commitment for a loan guarantee at a total of approximately $704 million from FY2009 through FY2012.[33]

Another federal government program, focused on feedstock development, is the USDA Biomass Crop Assistance Program (BCAP).[34] The two main program objectives of BCAP are to support the establishment and production of eligible crops for conversion to bioenergy in selected areas,

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debt obligation of a non-federal borrower to a non-federal lender." The LGP was first authorized under Title XVII of EPAct05 and then amended under the American Recovery and Reinvestment Act of 2009 (P.L. 111-5). DOE may issue loan guarantees to eligible projects that "avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases" and "employ new or significantly improved technologies as compared to technologies in service in the United States at the time the guarantee is issued." Eligible projects include commercial-scale renewable energy systems. EISA authorized the DOE to issue loan guarantees in part to support renewable energy projects. For more information on loan guarantees, see CRS Report R42152, *Loan Guarantees for Clean Energy Technologies: Goals, Concerns, and Policy Options*, by Phillip Brown.

[30] Renewable Fuels Association, "2010 State of the Industry Address," 2010 National Ethanol Conference, Orlando, FL, February 16, 2010, http://ethanolrfa.3cdn.net/b76292e4bf133edd34_e1m6bhh33.pdf.

[31] U.S. Government Accountability Office, *Further Actions Are Needed to Improve DOE's Ability to Evaluate and Implement the Loan Guarantee Program*, GAO-10-627, July 2010, http://www.gao.gov/new.items/d10627.pdf; U.S. Government Accountability Office, *DOE Loan Guarantees: Further Actions Are Needed to Improve Tracking and Review of Applications*, GAO-12-157, March 2012, http://www.gao.gov/assets/590/589210.pdf.

[32] For more information, see CRS Report R41985, *Renewable Energy Programs and the Farm Bill: Status and Issues*, by Randy Schnepf.

[33] Email from Ashley Martin, USDA, March 1, 2013.

[34] BCAP receives its authorization from Title IX of the Farm Security and Rural Investment Act of 2002 (P.L. 107-171) and was amended by Title IX of the Food, Conservation, and Energy Act of 2008 (P.L. 110-246). For more information on BCAP, see CRS Report R41296, *Biomass Crop Assistance Program (BCAP): Status and Issues*, by Randy Schnepf, or visit http://www.fsa.usda.gov/FSA/webapp?area=home&subject=ener&topic=bcap.

and to assist agricultural and forest land owners and operators with collection, harvest, storage, and transportation of eligible materials for use in a biomass conversion facility. USDA issued the BCAP final rule on October 27, 2010, implementing both program components. BCAP was one of several farm bill energy programs set to expire at the end of FY2012. The American Taxpayer Relief Act of 2012 (ATRA, P.L.112-240) extended BCAP through FY2013. Since the program's inception, 11 BCAP project areas have been established.[35] According to USDA, BCAP matching payments[36] totaled $557,443 for the transportation of nearly 10,320 dry tons of herbaceous crop residue (i.e., corn stover) in FY2012.[37]

Additionally, the government provides tax incentives to support cellulosic biofuel production.[38] The 2008 farm bill offers a production credit of $1.01 per gallon of biofuel produced from qualifying second-generation biofuel feedstocks, including cellulosic matter. The credit expired on December 31, 2012, but ATRA extended it and expanded the credit to include fuels produced from algae. The credit is set to expire at the end of calendar year 2013. There is also a special depreciation allowance for a new cellulosic biofuel plant that originated under the Tax Relief and Health Care Act of 2006 (P.L. 109-432). ATRA amended the allowance to include algae as a qualified feedstock for the special allowance. The allowance also expires at the end of 2013.

Were the Revised 2010, 2011, and 2012 RFS Mandates for Cellulosic Biofuels Met? Will the 2013 Mandate Be Met?

EPA's analyses concluded that the United States did not have sufficient cellulosic biofuel production capacity to meet the scheduled RFS mandates for 2010-2012. Therefore, EPA reduced the mandate (actual volume)[39] for 2010 from 100 million gallons to 5 million gallons,[40] the mandate for 2011 from 250 million gallons to 6.6 million gallons,[41] and the mandate for 2012 from 500 million gallons to 8.65 million gallons.[42] EPA proposes to lower the 2013 mandate from 1.0 billion gallons to 11 million gallons.[43]

[35] BCAP project areas are specific geographic areas where producers may enroll land to grow specified biomass crops. Participants may be eligible to receive financial and technical assistance as well as annual payments to establish these crops.

[36] Matching payments are provided for the collection, harvest, storage and transport of eligible biomass materials to qualified biomass conversion facilities.

[37] Email from Ashley Martin, USDA, March 1, 2013.

[38] For more information, see CRS Report R42566, *Alternative Fuel and Advanced Vehicle Technology Incentives: A Summary of Federal Programs*, by Lynn J. Cunningham et al.

[39] The energy content of renewable fuels differ. There are times when an ethanol-equivalence value for a renewable fuel with a higher energy content than ethanol may allow for that fuel to count more towards a mandate than other biofuels.

[40] U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program; Final Rule," 75 *Federal Register*, March 26, 2010.

[41] U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: 2011 Renewable Fuel Standards; Final Rule," *Federal Register*, December 9, 2010.

[42] Environmental Protection Agency, *Regulation of Fuels and Fuel Additives: 2012 Renewable Fuel Standards, Final Rule*, December 22, 2011.

[43] U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards; (continued...)

EPA monitors RFS compliance by fuel blenders according to their reported accumulation of renewable identification numbers (RINs) for each biofuel's yearly volumetric standard. A RIN is a unique 38-character number that is issued (in accordance with EPA guidelines) by the biofuel producer or importer at the point of biofuel production or the port of importation. Each qualifying gallon of renewable fuel has its own unique RIN. The EPA uses its Moderated Transaction System (EMTS) to manage RIN transactions.[44] Using data generated from EMTS, EPA provides aggregated monthly data on RIN generation and renewable fuel volume production for specific fuel categories, such as cellulosic biofuel.[45] In general, compliance is achieved by a fuel blender when the number of RINS generated and assigned each year for cellulosic biofuels equate to the volume requirement for that year.

As noted above, EPA has the authority to waive the cellulosic biofuel mandate on a yearly basis. In any year that EPA grants a waiver, the agency must also make waiver credits available at a set price, the formula for which is set in statute.[46] Waiver credits may be used by obligated parties to comply with the cellulosic biofuel volume obligation in lieu of RINs generated with the production of the cellulosic biofuel.[47] The 2010, 2011, and 2012 prices and the proposed 2013 price for a cellulosic biofuel waiver credit are $1.56, $1.13, $0.78, and $0.42, respectively. If waiver credits[48] are issued (when the mandate is reduced), compliance is met when the combination of waiver credits and RINs equate to the volume requirement for that year. Previous-year RINs may be used to meet current-year compliance, although there are some stipulations.

Even before enactment of EISA, which expanded the RFS, reported production data indicated that overcoming any or all of the hurdles to increasing cellulosic biofuel production to meet the original 2010 RFS mandate of 100 million gallons set by Congress was unlikely. 2010 was a transition year for the RFS, going from the RFS established under EPAct05 (RFS1) to the RFS established under EISA (RFS2). RFS1 had different production requirements than RFS2 for cellulosic biofuels,[49] including an ethanol-equivalency ratio of 2.5-to-1, where each gallon of cellulosic ethanol counted as 2.5 gallons toward the EPAct05 mandate.[50] EPA reports that zero cellulosic biofuel RINs were produced in 2010 under the RFS2 rules.[51] EPA reports that the

(...continued)

Proposed Rule," 78 *Federal Register*, February 7, 2013.

[44] For more information on EMTS, see http://www.epa.gov/otaq/fuels/rfsdata/2010emts.htm.

[45] Concerns have been raised about fraudulent RINs, especially due to recent biodiesel fraudulent RIN activity. While RIN fraud is possible as discussed in CRS Report R42824, *Analysis of Renewable Identification Numbers (RINs) in the Renewable Fuel Standard (RFS)*, by Brent D. Yacobucci, there has been no reported fraudulent cellulosic biofuel RIN activity. EPA issued a proposed rule to establish a voluntary quality assurance program for verifying the validity of RINs. For more information, see U.S. Environmental Protection agency, *RFS Renewable Identification Number (RIN) Quality Assurance Program*, January 31, 2013, http://www.epa.gov/otaq/fuels/renewablefuels/documents/qap-nprm-pepub.pdf.

[46] 42 USC 7545 (o)(7)(D)(ii)

[47] U.S. Environmental Protection Agency, *Questions and Answers on Changes to the Renewable Fuel Standard Program (RFS2)*, February 2013.

[48] Waiver credits are not allowed to be traded or banked for future use, and are only allowed to be used to meet the cellulosic biofuel standard for the year that they are offered.

[49] The original RFS (RFS1) did not require a cellulosic biofuel production volume until 2013, when 250 million gallons were mandated. Further, the definition of cellulosic biofuel was amended by EISA.

[50] EISA did not stipulate a 2.5-1 ratio for cellulosic biofuel for the RFS2. Instead, the ethanol equivalence value depends on the type of biofuel being produced.

[51] EMTS reports zero RINs available for 2011 cellulosic biofuel and cellulosic diesel.

majority of compliance for 2010 was met with RINs generated (i.e., production) under RFS1.[52] EMTS records show that 12,186 cellulosic biofuel waiver credits were purchased in 2010, which likely made up for the remainder of 2010 compliance.[53]

More compliance data are available for the 2011 and 2012 RFS cellulosic biofuels mandates. However, evaluation of the available data is difficult. Compliance for both years could have been met with cellulosic biofuel RINs and waiver credits. EPA reports that zero cellulosic biofuel RINS were produced in 2011.[54] Compliance for 2011 was met with excess cellulosic biofuel RINs generated in 2010 under RFS1 and cellulosic biofuel waiver credits.[55] EMTS records report that 4,248,388 RFS2 cellulosic biofuel waiver credits were purchased in 2011.[56] EPA reports that there is no "need to address compliance with the 2012 cellulosic biofuel standard" since there was a federal court decision that vacated the 2012 standard.[57] EMTS reports that 20,069 RINS were assigned for cellulosic biofuel and 1,741 RINS were assigned for cellulosic diesel in 2012.[58]

In its 2013 proposed rule, EPA proposes a 2013 cellulosic biofuel actual volume standard of 11 million gallons (actual volume) that is based on the Energy Information Administration's (EIA's) estimate of available supply,[59] production volumes developed in consultation with the companies expected to produce cellulosic biofuel from commercial-scale facilities in 2013, and EPA's judgment.[60] EPA projects that the 2013 cellulosic biofuels mandate will be met by production from two companies: INEOS Bio and KiOR. The projected production start date for both companies is the first quarter of 2013.[61]

[52] U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards; Proposed Rule," 78 *Federal Register*, February 7, 2013. The design of the RFS2 transition program allowed for RFS1 cellulosic RINs to be used towards compliance under the RFS2 program. EPA reports the 2010 cellulosic biofuel standard could have been met with cellulosic biofuel RINs generated under RFS2 regulations after July 1, 2010, cellulosic biomass ethanol RINs generated under RFS1 regulations between January 1, 2010 and July 1, 2010, and cellulosic biomass ethanol RINs generated under RFS1 regulations in 2009. U.S. Environmental Protection Agency, *Questions and Answers on Changes to the Renewable Fuel Standard Program (RFS2)*, http://www.epa.gov/otaq/fuels/renewablefuels/compliancehelp/rfs2-aq.htm.

[53] See http://www.epa.gov/otaq/fuels/rfsdata/rfs2cellulosicwaivercredits.htm.

[54] EMTS reports zero RINs available for 2011 cellulosic biofuel and cellulosic diesel. For more information, see http://www.epa.gov/otaq/fuels/rfsdata/2011emts.htm.

[55] The statute allows companies to purchase cellulosic biofuel waiver credits in lieu of submitting RINs in years when EPA lowers the mandate. U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards; Proposed Rule," 78 *Federal Register*, February 7, 2013.

[56] See http://www.epa.gov/otaq/fuels/rfsdata/rfs2cellulosicwaivercredits.htm.

[57] U.S. Environmental Protection Agency, Enviroflash, *Update - 2012 Cellulosic Biofuel Standard Mandate Issued*, February 27, 2013.

[58] Blue Sugar Corporation is the first company to be issued cellulosic biofuel RINs. For more information, see http://www.epa.gov/otaq/fuels/rfsdata/2012emts.htm.

[59] EIA estimated that 9.6 million actual gallons of cellulosic biofuel would be available in 2013.

[60] U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards; Proposed Rule," 78 *Federal Register*, February 7, 2013.

[61] They are not online as of publication date of this report.

What Impact Will Significantly Lowering the 2010, 2011, 2012, and 2013 RFS Mandates Have on Investment in Cellulosic Biofuel Production?

EPA's waiver authority creates uncertainty for investors in cellulosic biofuel ventures. Investors may fear that the full cellulosic biofuels mandate will continually be waived to lower amounts by EPA, thus depriving them of the government-mandated market on which they had originally based their investment.

Those in favor of continuing an RFS with a cellulosic biofuels component argue that adequate production and consumption of cellulosic biofuels can be achieved in a cost-effective manner if there is consistent federal policy, possibly allaying the concerns of some investors.[62] However, minimal actual production for three years has led some to question the viability of cellulosic biofuels over the long term.[63] Furthermore, a cellulosic biofuels industry that has regularly missed the reduced mandates has drawn criticism from groups—especially the petroleum industry—that contend they are being unfairly targeted to purchase credits for a fuel that is unlikely to be produced at the required levels.[64]

Another form of uncertainty for all involved parties is the delayed announcement of the proposed annual renewable fuel standards. Each year's standards are supposed to be announced by November 30 of the previous year. EPA was two months late in issuing the 2013 standard. The delay may lead to uncertainty in investments and planning for the biofuel and petroleum industries, among others.

Investors and the cellulosic biofuels community alike may be more apprehensive about the federal policy for advanced biofuels as 2016 draws nearer. There is a provision in the RFS statute that requires the EPA Administrator, starting in 2016, to modify the applicable volumes of the RFS in its entirety for subsequent years if the Administrator waives the renewable fuel mandate, the advanced biofuel mandate, the cellulosic biofuels mandate, or the biomass-based diesel mandate by at least 20% for two consecutive years or by at least 50% for a single year.[65] As a result, in 2016, some biofuel industries (e.g., corn ethanol) that are satisfying their mandates may find that they are being penalized because of another biofuel industry (e.g., cellulosic biofuel) that is not meeting its specified mandate.

[62] John M. Biers, "Non-Food Ethanol Projects Coming to Life," Dow Jones Newswires, November 20, 2012.

[63] Russel Gold and Siobhan Hughes, "Biofuel Production Fall Far Short of Targets," *Wall Street Journal*, February 4, 2010.

[64] "Oil Industry Sues EPA A Second Time Over RFS Mandate," *The Energy Daily*, July 26, 2012.

[65] 42 U.S.C. 7545 (o)(7)(F).

How Many Commercial Cellulosic Biofuel Plants Exist?

EPA reports that cellulosic biofuel production in the United States remains limited.[66] In its 2013 proposed rule, EPA provides information on eight companies with the potential to produce cellulosic biofuels, including their biofuel production estimates, technology process, and anticipated start dates.[67] Six of the facilities identified in the 2013 proposed rule were also identified in the 2012 final rule. EPA reports that five of these six facilities are structurally complete. In addition, at least six companies have registered with the EPA fuels program, which may indicate they have already started or are close to actual cellulosic biofuel production.[68]

As observed over the last few years, due to unforeseen financial and technical issues, it can be difficult to gauge when or if cellulosic biofuel companies will actually come online and how much cellulosic biofuel will be produced. Approximately two dozen demonstration- or pilot-scale cellulosic ethanol plants are reported to exist currently in the United States.[69] The Advanced Ethanol Council reports that there are nine cellulosic biofuel pilot/demonstration facilities, eight commercial facilities under construction or commissioning, and seven commercial facilities at the engineering stage.[70] Environmental Entrepreneurs—a national community of business leaders—reports that 16 commercial cellulosic ethanol facilities will come online by 2015.[71]

What's Next for the RFS Cellulosic Biofuels Mandate?

The shift toward large-scale, economically feasible production of cellulosic biofuels has thus far proven to be illusive. Advancements have been made, but not in step with the pace set by Congress for the RFS. Multiple factors have contributed to the cellulosic biofuels market being at the stage it is today, with the two major factors being technological issues and a recession that slowed the economy, including energy demand. Due to production shortfalls, EPA has significantly reduced the cellulosic biofuels mandate. It appears that Congress overestimated how

[66] U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards; Proposed Rule," 78 *Federal Register*, February 7, 2013.

[67] Ibid.

[68] American Process Inc., INEOS Bio, Poet, Western Biomass Energy, Range Fuels, and KiOR have registered cellulosic biofuel production facilities under the RFS program and are eligible to generate cellulosic biofuel D3 RINS or cellulosic diesel D7 RINs.

[69] Wallace E. Tyner and Sarah Brechbill, "Cellulosic Biofuels: Feedstocks, Conversion Technologies, Economics, and Policy Issues," CRS Workshop on the Development of the U.S. Cellulosic Biofuels Industry, Washington, DC, October 6, 2009; and conversation with Wallace Tyner from Purdue University, February 2, 2010; CRS Report R41460, *Cellulosic Ethanol: Feedstocks, Conversion Technologies, Economics, and Policy Options*, by Randy Schnepf; EPA, *Renewable Fuel Standard Program (RFS2) Regulatory Impact Analysis*, EPA-420-R-10-006, Washington, DC, February 2010, pp. 171 and 186, http://www.epa.gov/oms/renewablefuels/420r10006.pdf.

[70] Advanced Ethanol Council (AEC), *Cellulosic Biofuels Industry Progress Report 2012-2013*, December 2012, http://ethanolrfa.org/page/-/PDFs/AEC%20Cellulosic%20Biofuels%20Industry%20Progress%20Report%202012-2013.pdf?nocdn=1.' AEC acknowledges the report does not profile all cellulosic biofuel projects under development in the United States.

[71] Environmental Entrepreneurs, *Advanced Biofuel Market Report 2012: Meeting U.S. Fuel Standards*, 2012.

much cellulosic biofuel production would occur on an annual basis. It also appears that projecting the production amount continues to be a challenge for both EPA and EIA.[72] Thus, it is difficult to state with certainty how much cellulosic biofuel may be produced in the future and in what time frame.

If mandate reductions and continual production shortfalls signify that the cellulosic biofuels mandate is not working as intended, Congress could decide modifications are necessary. Advocates of cellulosic biofuels may find it beneficial for Congress to make the mandate more attainable in the near term (e.g., two to five years), primarily so that the industry has more time to show whether large-scale commercial production is economically feasible. Opponents may view any additional congressional action to assist the cellulosic biofuels community as harmful to the entire renewable energy market in the long run, as some believe that it could be extending the life of dead-end technologies.

The Role of Congress

Congress will continue to be the final arbiter over the future of the RFS. Should the RFS be continued in its present form, abridged, or eliminated completely? What additional public costs would each of these options engender? The discussion about whether the cellulosic biofuels industry requires additional federal support to meet the RFS mandate has occurred since the inception of the RFS; however, the discussion became more pronounced when the RFS was expanded in 2007 to call for a much larger volume of cellulosic biofuel to be produced in a shorter timeframe. In response, Members of the 111th and 112th Congresses proposed a variety of bills that could have impacted the cellulosic biofuels industry (see **Table 2**). The 112th Congress passed legislation that may aid the industry. In particular, the American Taxpayer Relief Act of 2012 (ATRA, P.L.112-240) extended the cellulosic biofuel production tax credit and the cellulosic biofuel plant special depreciation allowance to 2013, and included algae as a qualified feedstock for both tax incentives. ATRA also renamed the tax credit and depreciation allowance to "second generation" biofuel, removing the term "cellulosic."

One option for Congress could be modification of the cellulosic biofuels mandate, and thus the RFS. This option could require an analysis of the cellulosic biofuels market and, perhaps more importantly, consideration of circumstances that were not as prevalent when the RFS was expanded in 2007. Some of these circumstances include budget concerns, the blend wall,[73] military interest in renewable fuels,[74] and the slow development of the cellulosic biofuels production sector. Such an analysis might quantify the amount of federal support already granted to the cellulosic biofuels industry. EPA reports that six of the eight production facilities considered to be front-runners for the industry have received or were offered significant federal financial support (approximately $637 million) in the form of grants and loan guarantees from

[72] EIA reports that "its forecasts and projections to date have proven to be too optimistic, as volumes have been below expectations." U.S. Energy Information Administration, *Cellulosic biofuels begin to flow but in lower volumes than foreseen by statutory targets*, February 26, 2013.

[73] The blend wall is the upper limit to the total amount of ethanol that can be blended into U.S. gasoline. For more information, see CRS Report R40445, *Intermediate-Level Blends of Ethanol in Gasoline, and the Ethanol "Blend Wall"*, by Brent D. Yacobucci.

[74] Keith Johnson, "Navy's Biofuel Plan Gets Senate Support," The Wall Street Journal, November 28, 2012; P.L. 112-81; H.Rept. 112-329.

USDA and DOE between 2009 and 2012.[75] One analysis of federal and public funding data for advanced biofuel projects provided by Environmental Entrepreneurs suggest that, since 2009, USDA and DOE have provided or offered some $1.28 billion in grants and loan guarantees to a dozen companies that Environmental Entrepreneurs expects to have cellulosic ethanol facilities come online by 2015.[76]

Table 2. Selected Proposed Legislation from the 111th and 112th Congresses Pertaining to Cellulosic Biofuels

Congress	Legislation
111th	• S. 943 and H.R. 2283 would have waived the lifecycle greenhouse gas emission reduction requirements for renewable fuel production.
	• Section 129 of the American Clean Energy and Security Act of 2009 (H.R. 2454, also known as Waxman-Markey) would have amended the Loan Guarantee Program to incorporate renewable fuel pipeline construction.1
	• Title I of the American Clean Energy Leadership Act of 2009 (ACELA, S. 1462) would have amended the Loan Guarantee Program and created a Clean Energy Deployment Administration, under DOE, to advance lending and implementation of commercial clean energy technologies.
112th	• H.R. 230 would have modified the DOE Loan Guarantee Program, appropriating funds for EPAct05 Section 1512 Conversion Assistance for Cellulosic Biomass Waste-Derived Ethanol Approved Renewable Fuels, establishing a loan guarantee program for cellulosic ethanol production technology development.
	• H.R. 424 would have amended the RFS to revert back to RFS1 targets and eliminated all advanced biofuel mandates
	• H.R. 851, H.R. 2231, S. 884, S. 1294 would have implemented new financial support mechanisms, extending relevant tax provisions.
	• H.R. 6047 would have modified the way EPA projects yearly cellulosic biofuel volume mandates.

Source: CRS.

Notes: Legislation is presented in order of House introduction.

When expanding the RFS in EISA, Congress in effect made a technology choice by selecting a preferred technology (i.e., cellulosic biofuel) among many unknown technologies. Undoing that commitment could involve substantial costs to both public and private investors. Another issue to be analyzed may be a technology assessment to determine if selecting one unproven technology for financial and policy incentives fits into a larger energy policy context.

[75] U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards; Proposed Rule," 78 *Federal Register*, February 7, 2013.

[76] Environmental Entrepreneurs, *Advanced Biofuel Market Report 2012: Meeting U.S. Fuel Standards*, 2012. CRS tallied federal funding from Appendix D of the report for those companies with facilities coming online in the United States before 2015 that were identified as producing the fuel type cellulosic ethanol in Appendix B of the report.

Alternatively, Congress could take a wait-and-see approach to addressing concerns with the cellulosic biofuels mandate. Given EPA's consecutive lowering of the mandate by approximately 95% to 98% for each of the last four years, some question whether the cellulosic biofuels industry can ramp up production over the next two years to meet the scheduled RFS mandates. There may be an upcoming shift where some corn ethanol facilities plan to transition to cellulosic biofuel production, and it is not known what effect this might have on cellulosic biofuel production estimates.[77] Further, some anticipate that additional feedstocks and production pathways may qualify in the near future for the RFS cellulosic biofuel mandate. For instance, in February 2013, EPA released a final rule that identifies additional qualified fuel pathways to generate cellulosic biofuels, and allows renewable gasoline and renewable gasoline blendstock made from certain feedstocks to qualify as cellulosic biofuels.[78]

Congress may find that a substantial portion of the cellulosic biofuels volume mandate is unattainable for years to come. EIA reports that while "cellulosic biofuels volumes are expected to grow significantly relative to current levels, they will likely remain well below the targets envisioned in the Energy Independence and Security Act of 2007."[79] Congress has multiple options to address the lack of cellulosic biofuels production. Congress could make a statutory change to the definition of cellulosic biofuels for the RFS to open it up to additional feedstocks that can assist with meeting the annual production targets. Or Congress may continue to require EPA to set the cellulosic biofuels mandate based on the best available evidence. In the 113th Congress, some Members have proposed legislation (e.g., H.R. 550, S. 251) that would require EPA to base the cellulosic mandate on actual production from the previous year. Congress could also eliminate the cellulosic biofuels portion of the mandate, or the RFS entirely. Alternatively, Congress could maintain the status quo.

The Role of EPA

Congress directed EPA to implement the RFS. After assessing the cellulosic biofuels market, consulting with EIA, and taking other measures, EPA has lowered—and in 2013 proposes to lower again—the cellulosic biofuel mandate if the scheduled mandate cannot be met. Some contend that EPA has not carried out its responsibilities regarding the RFS cellulosic biofuels standard as expeditiously or accurately as desired. Some are not satisfied with the success rate of meeting the cellulosic biofuels standard. Some could argue that EPA has a difficult job trying to follow through on Congress's directions, given the challenges in the cellulosic biofuels industry. Further, it could be argued that any federal agency would likely find it difficult to accurately project when a new technology selected by Congress, not yet proven at commercial scale, would come online and at what pace. EPA can modify its projection procedure for cellulosic biofuels, but any major changes to its procedure would likely require additional instruction from Congress.

With regard to the 2012 standard, a federal court responded to the question of whether EPA is using an appropriate methodology to estimate the amount of cellulosic biofuels that can be produced. The court ruling contains principles that EPA will have to apply in future standards as

[77] POET LLC, "POET and Agrivida sign technology collaboration joint development agreement," press release, August 21, 2012.

[78] U.S. Environmental Protection Agency, *Regulation of Fuels and Fuel Additives: Identification of Additional Qualifying Renewable Fuel Pathways under the Renewable Fuel Standard Program*, February 22, 2013.

[79] U.S. Energy Information Administration, *Cellulosic biofuels begin to flow but in lower volumes than foreseen by statutory targets*, February 26, 2013.

well. EPA accepted the federal court's decision to vacate the 2012 cellulosic biofuel standard.[80] EPA's proposed 2013 cellulosic biofuel standard of 11 million gallons (actual volume) is 2.35 million gallons more than the 2012 cellulosic biofuel standard of 8.65 million gallons. One could interpret EPA's 2013 cellulosic biofuels projection as being based on the same methodology the court faulted for the 2012 standard. EPA stated, when issuing its proposed 2013 RFS cellulosic biofuel standard, that the projection was consistent with the January 2013 ruling by the U.S. Court of Appeals directing that EPA base its projection on the EIA estimate of available feedstock supply.[81] But the ruling does not require EPA to issue a carbon-copy projection based on EIA's analysis. However, the court discusses, at length, one significant factor that EPA does not appear to address in the 2013 proposed standard—that is, EPA's responsibility to accurately project how much cellulosic biofuel will be produced, not to "individually advance a technology-forcing [cellulosic biofuels] agenda."[82]

There are at least two significant distinctions in the 2013 proposed rule compared to previous rules: the discussions regarding feedstock supply, and the facility start dates and corresponding ramp-up periods. In its proposed rule, EPA discusses feedstock supply more thoroughly than in previous rules. EPA notes that feedstock agreements or contracts have been reached for structurally complete facilities and for facilities expected to be complete by the end of the year.[83] Additionally, EPA notes the possibility for cellulosic biofuel to be produced from other sources, such as from corn fiber or landfill biogas, depending on if and when these pathways are approved by EPA. Also, the proposed rule describes production start dates and ramp-up periods to reach full production. However, there is minimal consideration of what happens if the production start dates and ramp-up periods do not occur in the time frame projected by EPA, or if glitches occur with feedstock arrangements during the first year of a commercial facility's operation. Based on the information provided in the proposed rule, there appears to be little margin for the cellulosic biofuels industry to meet the proposed mandate. Given the success rate of meeting previous cellulosic biofuels mandates, the approach outlined in the 2013 proposed rule seems optimistic about what can happen without altogether accounting for what may occur (e.g., significant delays in construction and start-up).

EPA has not been given much guidance by the court, or Congress, on how to calculate a cellulosic biofuels projection, although the methodology the agency is currently using is under scrutiny from the oil industry, among others, as evidenced by the recent court case concerning the 2012 cellulosic biofuels production projection and a pending court case addressing the 2011 projection. If a projection is repeatedly not met and sources enlisted for assistance provide projections that turn out to be wrong (e.g., EIA, cellulosic biofuel industry), should EPA at some point have set the cellulosic biofuels standard at close to zero (e.g., 100,000 gallons) until actual commercial production of a certain threshold was reached? Arguably, setting a standard too low could impact federal support (e.g., grants, tax incentives) and private investment for the technology. This could have hindered the overall goals of the RFS, economic development in rural areas, and more. Prospects for the cellulosic biofuels industry could be affected if EPA continues to incorrectly project annual amounts of cellulosic biofuel production.

[80] U.S. Environmental Protection Agency, Enviroflash, *Update - 2012 Cellulosic Biofuel Standard Mandate Issued*, February 27, 2013.

[81] U.S. Environmental Protection Agency, "Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards; Proposed Rule," 78 *Federal Register*, February 7, 2013.

[82] *American Petroleum Institute v. Environmental Protection Agency*, USCA Case #12-1139, January 25, 2013.

[83] EPA reports that the INEOS Bio, KiOR, Poet, and Abengoa facilities all have feedstock agreements or contracts in place.

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