February 16, 2017

United States Environmental Protection Agency
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Comments from the Clean Air Task Force on the Environmental Protection Agency's Proposed Rule: Renewable Enhancement and Growth Support Rule; 81 Federal Register 80828 (November 16, 2016); EPA–HQ–OAR–2016–0041; FRL–9953–79–OAR

INTRODUCTION AND SUMMARY OF KEY COMMENTS

The Clean Air Task Force (CATF) is a non-profit environmental organization that works to help safeguard against the worst impacts of climate change by catalyzing the rapid global development and deployment of low carbon energy and other climate-protecting technologies through research and analysis, public advocacy leadership, and partnership with the private sector.[1]

CATF has reviewed and commented on numerous proposals concerning the Environmental Protection Agency's (EPA) implementation of the Renewable Fuel Standard (RFS) since 2009, with a particular focus on the policy's impact on global climate change.[2] CATF appreciates the opportunity to comment on EPA's proposed Renewable Enhancement and Growth Support Rule (hereinafter the REGS rule).[3]

The comments below address four of the measures proposed in the REGS rule: the implementation of carbon capture and sequestration (CCS) under the RFS program, the production of renewable fuels from short-rotation trees, the allocation of renewable identification numbers (RINs) to renewable electricity generators, and the ongoing designation of exempt, or "grandfathered," facilities.

CATF provides detailed comments on the proposed CCS measures and on EPA's proposal to approve short-rotation tree production pathways. In short, we urge EPA to implement the proposed CCS provisions, as the application of CCS represents a potentially important option for reducing the lifecycle greenhouse gas (GHG) emissions associated with ethanol production. In contrast, we urge EPA to not finalize the short-rotation tree pathway until it has addressed

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[1] Please see www.catf.us for additional information about CATF's work.
[2] Previous comments by CATF on EPA's proposed rules concerning the RFS can be found here: http://www.catf.us/resources/filings/biofuels/.
[3] 81 Fed. Reg. 80828 (November 16, 2016).

concerns about the accuracy and the completeness of the fuel type's lifecycle GHG assessment. CATF also recommends that EPA allocate the RINs to producers of electricity made from captured biogas using an equivalence factor that is based on the volume of petroleum displaced, and we urge EPA to stop granting exemptions, or grandfathered status, to biofuel producers seeking to avoid the RFS's GHG reduction requirements.

CCS IMPLEMENTATION UNDER THE RFS PROGRAM

Summary of proposed CCS provision

EPA proposes a set of "registration, recordkeeping, reporting and RIN generation requirements" that the Agency would use if it subsequently decides to allow ethanol production facilities to take credit for reductions in lifecycle GHG emissions that are achieved through the application of CCS equipment.[4]

Summary of CATF position

When Congress amended the RFS in December 2007, it added rapidly escalating production targets for advanced and cellulosic biofuels in hopes that the aggressive annual mandates would spur the development of relatively low-GHG fuels. As CATF has described in previous comments, however, the RFS has remained by and large a corn ethanol mandate (see Fig.1 below), and the continued emphasis on corn ethanol has undermined the policy's environmental performance.[5] According to the assessment conducted by EPA prior to its implementation of the RFS2, the lifecycle GHG emissions associated with corn ethanol that is produced at facilities equipped with industry-standard production technologies are higher than the lifecycle GHG emissions associated with gasoline (see Fig.2 below).[6]

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[4] 81 Fed. Reg. at 80878.

[5] *E.g.*, Comments from the Clean Air Task Force on the Environmental Protection Agency's Proposed Rule: Renewable Fuel Standard: Standards for 2014, 2015, and 2016 and Biomass-Based Diesel for 2017, 6-9 (July 27, 2015) (http://www.catf.us/resources/filings/biofuels/20150727-CATF%20Comments%20on%202014-17%20RVO%20Proposal.pdf).

[6] A fuller description of CATF's analysis of EPA's lifecycle GHG emissions data can be found in a 2013 white paper titled "Corn Ethanol GHG Emissions Under Various RFS Implementation Scenarios," http://www.catf.us/resources/whitepapers/files/20130405-CATF%20White%20Paper-Corn%20GHG%20Emissions%20Under%20Various%20RFS%20Scenarios.pdf.

Fig.1. Cumulative gallons of corn ethanol used to comply with RFS mandates, as a share of total mandated ethanol-equivalent gallons (RVO-adjusted)

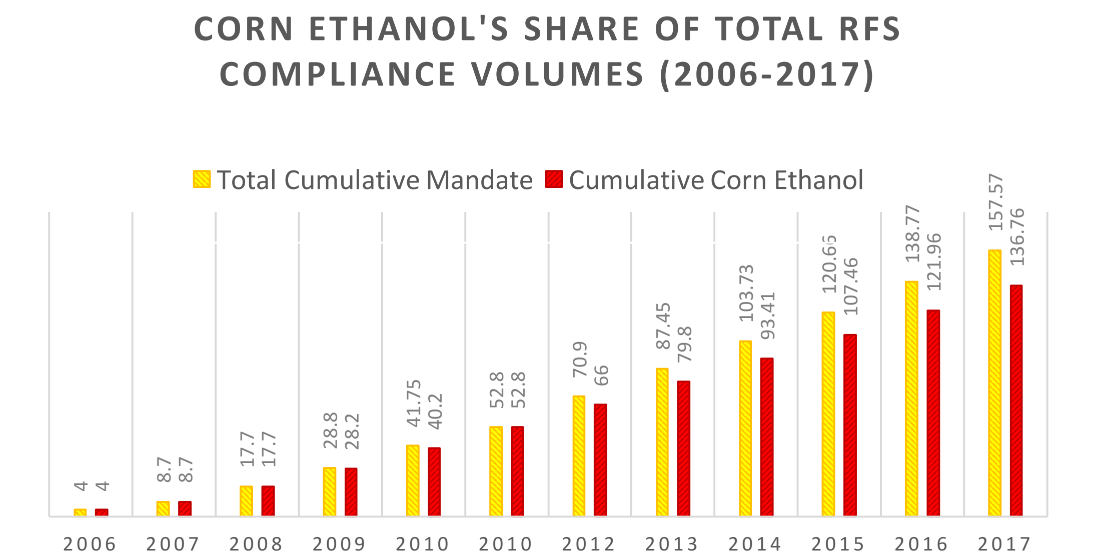
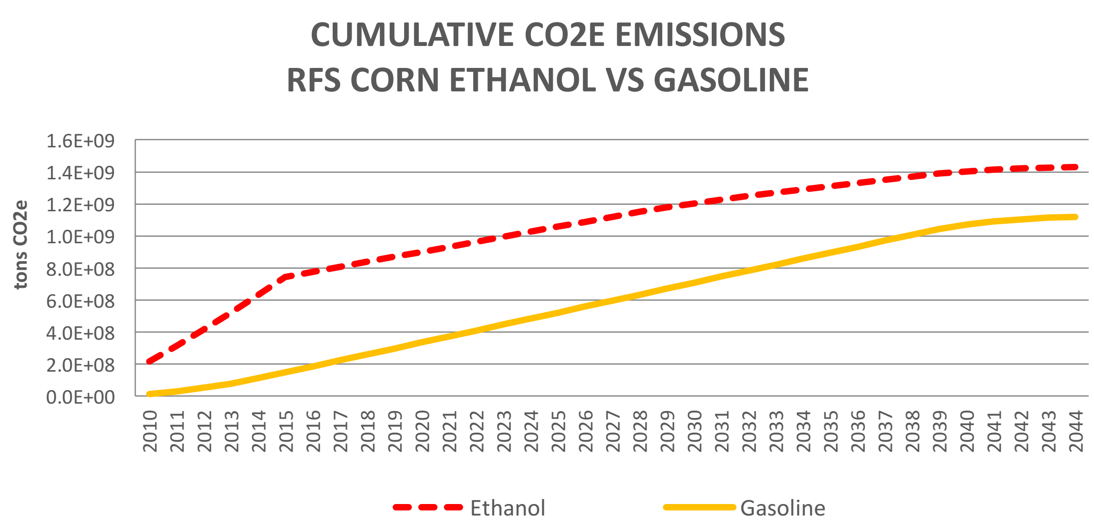


Fig.2. Comparison of the cumulative CO2e emissions from corn ethanol and gasoline (based on EPA data)



Neither circumstance is likely to change soon. First, "[w]hile the RFS program has had success in promoting the use of conventional biofuel (primarily corn ethanol) … the production and use of cellulosic biofuels has noticeably lagged behind."[7] As long as commercially viable cellulosic biofuels remain scarce, corn ethanol will continue to account for the bulk of RFS compliance (absent near-term legislative reform). Second, when EPA based its determination that corn

[7] 81 Fed. Reg. at 80833/1.

ethanol achieves a 20% reduction in lifecycle GHG emissions on an assumption that by 2022 the ethanol industry would widely adopt a set of cutting-edge production techniques, the Agency effectively credited the industry with process improvements that had not yet been made. In doing so, EPA eliminated any RFS-driven motivation among corn ethanol producers to actually invest in such improvements. Consequently, improving the overall climate impact of the RFS will depend in large part on finding ways to limit the adverse climate impacts of corn ethanol production.

The application of CCS to a corn ethanol refinery can reduce corn ethanol's lifecycle GHG emissions. CCS is an increasingly well-demonstrated technology, and is especially cost-effective when used to capture CO2 released from fermentation during ethanol production. In addition to reducing the amount of GHG emitted by ethanol producers, the use of CCS at ethanol refineries may be helpful across the board in reducing the costs associated with installing and operating the technology and, as a result, could accelerate the rate of CCS deployment at fossil fuel-fired power plants. CATF therefore generally supports the development of registration, recordkeeping, and reporting measures that will be needed in the event that ethanol facilities are authorized to take credit under the RFS for GHG reductions achieved via CCS. As detailed below, however, CATF urges (1) that EPA reject the "displacement approach" as a method of accounting for the commercial use of captured fermentation CO2 when that CO2 is used instead of mined CO2; and (2) that in the event a significant volume of captured fermentation CO2 leaks from a sequestration facility, any affected RINs shall remain invalid unless the ethanol producer that generated the RINs can counteract the leak by obtaining an equivalent level of additional CO2 reductions.

CATF Supports the Application of CCS at Ethanol Refineries to Capture Fermentation CO2

Power plants and factories release over half of the CO2 emissions in the United States. Reducing the amount of CO2 emitted by these diverse sources is an enormous challenge, but CCS can reduce the emissions from these facilities—which range from gas-fired power plants to fuel refineries to steel mills—by as much as 90%. CCS works on both new and existing plants, and can clean the emissions from any carbon-containing fuel—natural gas, oil, biomass, wastes or coal. This versatility makes CCS an essential climate change solution.

Recent developments at power sector CCS projects have validated CCS as a viable and crucial part of the energy decarbonization toolkit. Two projects, Petra Nova in Texas and Boundary Dam Unit 3 in Canada, are particularly compelling:

- Boundary Dam: In 2014, SaskPower began operating a CCS system at a retrofitted 110MW coal-fired generating unit in Saskatchewan. During its first 21 months, the system captured 1,028,000 MT CO2. Between July 2015 and July 2016, the facility produced more than 500,000 carbon-free megawatt hours of energy. The success of the project at Boundary Dam Unit 3 demonstrates that a commercial-scale fossil fuel-fired power plant equipped with CCS can reliably generate a significant amount of energy while also preventing significant volumes of CO2 from reaching the atmosphere.[8]

- Petra Nova: The Petra Nova CCS project at Texas's coal-fired WA Parish Plant began operating in January 2017 and, according to CATF's John Thompson, "mark[s] a turning point for the electric sector." The project was "[c]onstructed on schedule and on budget," and "is poised to become the world's largest power sector capture unit, removing 1.6 million tons per year of CO2." Petra Nova represents an important step forward in the commercialization of CCS because it provides a compelling answer to questions that have been raised about the technology's technical risk and profitability. "Petra Nova's solutions can be applied widely to other power plants, making large-scale expansion of carbon capture by 2050 more likely," says Thompson.[9]

The recent successes at Petra Nova and Boundary Dam follow years of successful CCS testing and operations at Archer Daniels Midland's corn ethanol refinery in Decatur, Illinois. Working in conjunction with the Midwest Geological Sequestration Consortium, Schlumberger, and US Department of Energy on a 3-year injection program, ADM captured 1 million tons of CO2 using Alstom's amine capture process, pipelined the gas 1.9 kilometers, and injected it 7,000 feet into the Cambrian Mt. Simon sandstone formation during 2011-2014. MIT CCS Project Database reports that the test project "is now complete and is now in the monitoring stage and is currently showing no sign of leakage of movement out of the injection zone."Beginning in 2016, a second phase of the project will inject an additional 1 million tons per year. Monitoring tools utilized at the site include four shallow groundwater wells and soil gas measurements, 3-D seismic profiling, a dedicated monitoring well with embedded geophones for walk-away vertical seismic profiling (VSP) and a dedicated in-zone monitoring well.[10] The success of this project demonstrates the availability of commercial scale saline geologic

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[8] For more information on Boundary Dam Unit 3, *see* Ann Weeks, "Alive and Well and Doing Better than Ever! A Boundary Dam Update," *Ahead of the Curve: The CATF Blog* (August 11, 2016) (http://www.catf.us/blogs/ahead/2016/08/11/alive-and-well-and-doing-better-than-ever-a-boundary-dam-update/).

[9] For more information about Petra Nova, *see* John Thompson, "Petra Nova Is the Latest Success for Carbon Capture," *Ahead of the Curve: The CATF Blog* (January 10, 2017) (http://www.catf.us/blogs/ahead/2017/01/10/petra-nova-is-the-latest-success-for-carbon-capture/).

[10] MIT CCS Project Database, *Decatur Fact Sheet: Carbon Dioxide Capture and Storage Project* [Phase 1] (http://sequestration.mit.edu/tools/projects/decatur.html); MIT CCS Project Database, *Illinois Industrial Carbon Capture and Storage (IL-CCS) Fact Sheet: Carbon Dioxide Capture and Storage Project* [Phase 2] (https://sequestration.mit.edu/tools/projects/illinois_industrial_ccs.html); *see also* CATF and Conservation Law Foundation, Comments Proposed Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units; Proposed Rule for Subpart TTTT, 67-68 (June 25, 2012) (summarizing status of Phase 1) (http://www.catf.us/resources/filings/EGU_GHG_NSPS_Rule/20120625-Comments_of_CATF_and_CLF_EPA.HQ.OAR.2011.0660.pdf).

sequestration in the Mt. Simon Formation under the Midwest United States, an area of the country that is home to numerous corn ethanol refineries.

The Use of CCS in Ethanol Production

In addition to demonstrating both the availability and viability of geologic sequestration in parts of the Midwest, the Decatur project also highlights the degree to which the fermentation stage of ethanol production is amenable to carbon capture. Carbon dioxide emissions from industrial facilities are often intermixed with the emissions of other combustion products, such as sulfur dioxide, nitrogen oxides, particulate matter, and metals. Post-combustion carbon capture systems need to sift through the blend of pollutants in the exhaust stream in order to extract CO2. In contrast, the CO2 released during ethanol fermentation "is a high purity CO2 stream (greater than 99% purity on a moisture free basis), with water content less than 3% by weight."[11] Compared to capturing CO2 from other industrial emitters, capturing fermentation CO2 at ethanol facilities is relatively uncomplicated due the purity of the CO2 stream.

Ethanol fermentation releases significant volumes of CO2 to the atmosphere. According to *Biofuels Digest*, "A typical ethanol plant producing 50 million gallons of ethanol per year" produces "roughly 150,000 metric tons of CO2 per year."[12] The fermentation process associated with the annual production of 15 billion gallons of corn ethanol—*i.e.*, the implied corn ethanol mandate for 2017—therefore releases approximately 45 million metric tons of CO2 per year. Over the ensuing five-year period (2018-2022), another 225 million metric tons of CO2 will be released during the fermentation process from the production of RIN-generating corn ethanol.[13]

Preventing millions of tons of ethanol fermentation CO2 from reaching the atmosphere would benefit the climate. For example, capturing all of the CO2 currently released during corn ethanol fermentation in the United States (roughly 45 million tons annually) would have the equivalent effect (in terms of CO2 emissions avoided) as removing approximately 9.6 million cars from the road.[14] Avoiding these emissions could also improve the environmental performance of the RFS—particularly with respect to the lifecycle GHG performance of corn

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[11] Sai Gollakota and Scott McDonald. 2014. "Commercial-Scale CCS Project in Decatur, Illinois-Construction Status and Operational Plans for Demonstration." *Energy Procedia*, 5988 (http://www.sciencedirect.com/science/article/pii/S1876610214024485).

[12] Jim Lane, "By-Products: The Key to Ethanol's Struggles," *Biofuels Digest* (December 12, 2012) (http://www.biofuelsdigest.com/bdigest/2012/12/12/by-products-the-key-to-ethanols-struggles/).

[13] A "typical ethanol plant" that produces 50 million gallons of ethanol per year releases 150,000 MT CO2/yr from fermentation. *Id.* It takes 300 such plants to produce 15 billon gallons of corn ethanol: 150,000 MT CO2/yr * 300 = 45 million MT CO2/yr. Over five years, total fermentation CO2 emissions are 225 million MT CO2: 45 million MT CO2/yr * 5yrs = 225 million MT CO2.

[14] *See* EPA, Greenhouse Gas Emissions from a Typical Passenger Vehicle (updated November 21, 2016) ("A typical passenger vehicle emits about 4.7 metric tons of carbon dioxide per year.") (https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle-0).

ethanol, which is again supposed to account for the vast majority (87%) of RFS compliance in 2017.[15]

EPA Must Ensure of the Validity of CCS-Related CO2 Reductions at Ethanol Refineries to Avoid Exacerbating the Existing Uncertainty Around the Climate Impact of the RFS

As a general matter, CATF supports EPA's effort to develop registration, recordkeeping, reporting and RIN generation requirements that could be used by ethanol refineries that utilize CCS systems to capture CO2 from the ethanol fermentation process. CATF's views on several specific elements of EPA's approach are provided here.

Under EPA's proposed Registration provision, an ethanol producer would be required to submit "statements of affirmation" that it intends to inject/store CO2 (presumably via third party) and that the biofuel being produced will meet one of the various GHG reduction thresholds established in the RFS (20% for conventional biofuels, 50% for "advanced biofuels," and 60% for cellulosic biofuels). The producer must also provide the Agency with copies of contracts that memorialize various obligations concerning notice, remediation, and maintenance.[16] The Reporting & Recordkeeping measures would obligate the producer to submit information required by the Greenhouse Gas Reporting Program (GHGRP) and the Underground Injection Control regulations. The biofuel producer would also have to calculate the lifecycle GHG emissions value (LEV) for the ethanol, provide the GHGRP facility number for the relevant sequestration facility, and notify EPA if and when it learns that the sequestration facility is going to cease operations.[17] The Registration provision and the Reporting & Recordkeeping measures proposed by EPA are reasonable and appropriate.

EPA also solicits comment on an accounting technique, referred to as the "displacement approach," that was suggested by a biofuel producer. Under the "displacement approach," a CCS-equipped biofuel producer could take credit for reducing its GHG emissions irrespective of how the captured fermentation CO2 is sequestered, as long as the fermentation CO2 was sold to an end-user (*e.g.*, a carbonated beverage maker or an enhanced oil recovery operation) that would have otherwise used CO2 that was mined from natural occurring deposits found in geologic formations.[18] EPA should not finalize the "displacement approach," as the approach would create various enforcement challenges. For example, it hinges on an assertion about the mindset of third-party CO2 customers—*i.e.*, EPA would be asked to accept a producer's assertion that the CO2 customer would have purchased mined CO2 instead of the CO2 captured from an ethanol facility, even though neither EPA nor ethanol producers (and potentially not even CO2 off-takers) can reliably predict the nature of future CO2 purchasing decisions, especially given the extent to which the CO2 market is evolving. More importantly,

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[15] *See* Fig.1.
[16] 81 Fed. Reg. at 80879-80.
[17] *Id.* at 80880.
[18] *Id.* at 80881/1-2.

because it is basically indifferent to the fate of the CO2 captured at ethanol facilities, the "displacement approach" would not promote the development of the long-term/permanent, well-managed CO2 sequestration operations that will be critical to power sector decarbonization .

In its proposed approach for addressing surface leaks, EPA would make the ethanol producer ultimately responsible for the RFS regulatory consequences of what happens to CO2 sent by the producer to a sequestration facility—*i.e.*, the producer would bear the risk of leakage, in terms of how that leakage impacts the RFS eligibility of the biofuel it produces.[19] CATF supports this approach because the alternatives (*e.g.*, an approach in which Clean Air Act section 211(o) is cited as the putative authority for regulating CO2 injection operations) could be administratively and legally unwieldy. CATF also supports the proposed mechanisms for preventing potentially invalid RINs from entering the RIN market. In particular, ethanol producers would have to notify EPA of a leak within 24 hours of learning about the leak, at which point EPA would provisionally suspend the producer's ability to generate RINs. CATF believes that the proposed period of time by which the producer must provide the Agency with a remediation plan—30 days—is reasonable and appropriate.

EPA proposes that all RINs generated by an ethanol producer under a CCS pathway over the previous five years would become "potentially invalid" in the event of a leak from the CCS sequestration facility—but the producer would be allowed to spread the CO2 loss from the leakage event over those five years to show that on average, the probationary RINs still met the applicable GHG reduction threshold. CATF agrees that this provision is likely to encourage ethanol producers that utilize a CCS pathway to "over-comply."[20]

Finally, EPA requests comment on what to do in the event of a leak so large that all five years' worth of RINs are to be invalidated.[21] A key concern is the integrity of the RFS program: what should be done to ensure that the nominal level of GHG reductions associated with RFS compliance is matched as closely as possible by actual reductions in GHG emissions? EPA's approach should be guided by its previously articulated principle that the ethanol producer should retain ultimate responsibility for the validity of the RINs it generates. Accordingly, CATF recommends the following approach:

- In the event that any affected RINs remain in the producer's possession and have not yet been transferred to either EPA or a third party at the time the leak is detected, such RINS would become permanently invalid.[22]

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[19] *Id.* at 80881-83

[20] *Id.* 80882, footnote 252.

[21] *Id.* at 80883/1.

[22] EPA might also consider requiring the producer to also pay an administrative per-gallon fine, given that the producer may be able to limit its financial losses by selling the RIN-less ethanol in export markets.

- The validity of RINs that were transferred to EPA or to a third party prior to the detection of the leak would be restored, provided the ethanol producer "makes the atmosphere whole" by expeditiously bringing about CO2 reductions equal to the full volume of CO2 that leaked from the sequestration facility. The producer must describe the restitution plan in the 30-day report provided to EPA. The reductions obtained by the producer must be additional: the producer must demonstrate that the reductions would not have occurred otherwise and that the reductions are not being used to satisfy any other regulatory obligation. If the producer cannot obtain the required additional reduction, the transferred RINs shall remain permanently invalid.

RENEWABLE FUELS PRODUCED FROM SHORT-ROTATION TREES

Summary

To ensure that renewable fuels derived from short-rotation trees meet RFS statutory definitions and reduce GHG emissions by the required 60% for a new pathway approval, EPA must ensure that (1) lifecycle GHG analyses adequately reflect willow and poplar biofuels' likely production methods, (2) future land use changes and their resulting GHG emissions are fully accounted for, and (3) "renewable biomass" definitions in the RFS are effectively monitored and enforced. Otherwise, some of the same mistakes made with corn ethanol (such as *higher*, instead of *lower*, GHG emissions) will be made again with cellulosic biofuels. The first part of this section discusses elements of EPA's proposed rule that deserve more attention, specifically related to willow and poplar's respective lifecycle GHG assessments. The second part focuses on short-rotation tree-based biofuels meeting RFS statutory definitions for "renewable biomass" intended to minimize indirect land use change and resulting GHG emissions while protecting sensitive, carbon-rich land such as native grasslands and forests. In its proposed rule, EPA proposes some steps in the right direction to protect native forests, but by failing to adequately enforce land protections for the production of other biofuels feedstocks such as corn and soybeans, unintended consequences may still result from additional land use change if willow- and poplar-based biofuel production is scaled up.

Accurately Assessing Potential Lifecycle GHG Emissions from Willow and Poplar Cellulosic Biofuels

This section focuses on EPA's assumptions underlying the lifecycle GHG analysis for willow and poplar-based cellulosic biofuels, including more specific comments on the following issues:

- EPA's decision to forgo specific lifecycle GHG analyses for willow and poplar, instead relying on international indirect land use change (ILUC) and other GHG factors from switchgrass's life-cycle analysis (LCA);
- Disparities within EPA's analysis of where willow and poplar would be planted and which types of land these short-rotation trees would replace;
- Assumption that *domestic* ILUC emissions for increased willow and poplar production would be negative, given enhanced carbon stores from planting short-rotation trees on

current annual row crop land, in addition to forest intensification resulting from less forest acres;

- Underlying model assumption that as production of willow and poplar for biofuels feedstocks increases, GHG emissions will decline with lower crop production and less U.S. exports of major crops;
- Assumption that GHG emissions will decline as willow and poplar, which generally require less agricultural inputs (fertilizer and pesticides), replace agricultural production requiring larger amounts of inputs.

Similar to other new biofuel pathway assessments, EPA decided to forgo specific lifecycle GHG analyses for willow and poplar to be used as feedstocks for cellulosic biofuels in the RFS, instead relying on EPA's previous findings of the international land use change impacts of switchgrass production. As EPA states, "For international impacts, we applied results from the switchgrass analysis performed for the RFS2 final rule."[23] EPA proposes to categorize willow and poplar-based biofuels as "cellulosic biofuels" under the RFS by relying on similarities between production of willow/poplar and switchgrass.[24] Given that EPA already found switchgrass-based biofuels to result in 60% lower GHG emissions as compared to gasoline[25] (meaning switchgrass biofuels can qualify as "cellulosic biofuels" in the RFS), EPA assumes short-rotation tree-based biofuels will also reduce GHG emissions by at least 60% given the following similarities: the types of crops that may be displaced with greater production of these feedstocks, types of land the feedstocks will be grown on, the feedstocks' GHG emissions from international land use change, feedstock transport, and fuel production, distribution, and use.[26] As EPA states in the proposed rule,

> "Switchgrass, short-rotation hybrid poplar, and short-rotation willow are all dedicated bioenergy feedstocks, and are expected to grow on the same types of land and cause the same types of crop displacement. As the EPA assumed for the analysis of energy cane, giant reed, and napier grass, we do not believe that these bioenergy feedstocks will cause large land use change impacts... For analysis of short-rotation hybrid poplar and willow, we scaled the switchgrass international emissions for yield differences in switchgrass, short-rotation hybrid poplar, and short-rotation willow, and applied these adjusted emissions to short-rotation hybrid poplar and willow."[27]

However, EPA fails to provide any sources that justify the Agency's assumptions about these feedstocks being grown on the same types of land and causing the same types of crop displacement. As explained below, significant differences exist between the production of switchgrass and short-rotation trees. EPA should further explain and justify the following

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[23] 81 Fed. Reg. at 80885/2.
[24] *Id.* at 80885/2.
[25] EPA, "Regulation of Fuel and Fuel Additives: Changes to Renewable Fuel Standard Program" at 75 Fed. Reg. 14791 (Mar. 26, 2010).
[26] 81 Fed. Reg. at 80885/2, 80887.
[27] *Id.* at 80885/2.

lifecycle analysis comparisons and assumptions, making adjustments to the lifecycle analyses where necessary. These assumptions have a large impact on whether short-rotation tree-based biofuels may meet the required 60% GHG reduction threshold for cellulosic biofuels. If significant variations exist between switchgrass and willow/poplar's lifecycle GHG analyses, particularly land use change emissions estimates, then new analyses should be performed to better reflect likely GHG emissions.

<u>Location of Feedstock Production and Comparison with Switchgrass</u>

In its proposal, EPA decided to forgo international indirect land use change and other analyses for willow and poplar, instead relying on findings from switchgrass's LCA completed for the 2010 final RFS2 rule. However, according to EPA's own data, switchgrass is not expected to be grown in the same locations as short-rotation trees. In its proposed rule, EPA assumes that to produce 400 million gallons of biofuel, either 950,000 acres of poplar trees would be grown in the US Pacific Northwest East region or 1.2 million acres of willow trees would be grown in the Northeast.[28] Meanwhile, EPA assumed in its 2010 RFS2 final rule that switchgrass would likely be planted in Oklahoma, Kansas, Missouri, Texas, and Arkansas, states that do not overlap with either of the aforementioned areas.[29] Differences in location of likely production and types of land that will be displaced should be fully assessed at both the domestic and international levels if all relevant GHG emissions are to be included in willow and poplar's LCAs.

<u>Types of Land for Feedstock Production</u>

In its proposed rule, EPA initially states that short-rotation trees will be planted on less productive land, but the Agency then goes on to assume that these biofuel feedstocks will be planted on current productive agricultural land in the U.S., displacing commodity crop production.[30] As EPA states, short-rotation trees, "do not generate the economic returns of row crops on productive lands, and are therefore being targeted for development on less productive lands."[31] However, EPA later states in its proposed rule that producing 400 million gallons of willow-or polar-based cellulosic biofuels in 2022 would result in less acres of soybeans, corn, hay, and wheat, at least some of which are produced on productive farmland.[32]

<u>Land Use Change Impacts</u>

Similarly, EPA assumes that willow and poplar production will not result in "large land use change impacts."[33] While EPA assumes *international* indirect land use change GHG emissions

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[28] *Id.* at 80886/2-3.
[29] EPA, "The Renewable Fuel Standard 2 Regulatory Impact Analysis," at 286-287 (February 2010) (Document ID No. EPA-HQ-OAR-2009-0472-1132) (https://www.epa.gov/sites/production/files/2015-08/documents/420r10006.pdf).
[30] 81 Fed. Reg. at 80886/2.
[31] *Id.* at 80885/2.
[32] *Id.*. at 80886.
[33] *Id.* at 80885/2.

would be positive for both feedstocks, meaning GHG emissions would increase with greater production, the Agency estimates that *domestic* indirect land use GHG emissions will be negative for both poplar and willow. EPA arrives at this estimate by assuming short-rotation trees planted on previous agricultural row crop land will sequester more underground carbon than the agricultural crops they replace. In addition, EPA assumes forest intensification will result from market changes.[34] More specifically, EPA states,

> "Domestic land use change emissions are negative for short-rotation hybrid poplar and willow. One reason for this is that most of the land used for short-rotation hybrid poplar or willow production comes from existing cropland. Using this cropland for short-rotation hybrid poplar or willow rather than annual crops like corn or wheat increases the amount of carbon stored in the soil and below-ground biomass (roots) due to the longer rotation and no-tillage characteristics of short-rotation hybrid poplar and willow. Another reason for the decrease in domestic land use change emissions in 2022 is due to more intensive management of forest acres in response to expected pressure on forest acres and forest product supply in the future."[35]

There are two major flaws with EPA's assumptions about underground carbon storage and forest intensification. First, EPA states that short-rotation trees "result in greater accumulation of carbon through below-ground organic matter that goes undisturbed for longer periods of time."[36] The Agency provides only one reference from 1993 for this assertion. Other authors have noted that these findings are dependent on growth and harvest timeframes, with significant variability: "Increases in SOC [soil organic carbon] at sites Hansen sampled in 1993 occurred only after approximately 5 years of growth. Soil samples taken from 15 hybrid poplar plantings at locations across the upper mid-West in 1998 and 1999 show significant variability in SOC both within individual fields and across sites."[37] Other studies found soil organic carbon *losses* (or no change at all) when agricultural land (such as no-till corn) was converted into short-rotation trees.[38] These studies note that soil carbon stores also depend on other factors, including soil type, management practices, and whether the previous crop was tilled.[39,40] EPA

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[34] EPA Office of Transportation and Air Quality (OTAQ), Short-Rotation Trees Technical Memorandum, at 7 (Oct. 3, 2016) (Docket ID No. EPA-HQ-OAR-2016-0041) (https://www.regulations.gov/contentStreamer?documentId=EPA-HQ-OAR-2016-0041-0009&disposition=attachment&contentType=pdf).
[35] 81 Fed. Reg. at 80888/2.
[36] *Id.* at 80884/1.
[37] V.R. Tolbert, *et al.* 2002. Changes in Soil Quality and Below-ground Carbon Storage with Conversion of Traditional Agricultural Crop Lands to Bioenergy Crop. *Environmental Pollution* 116. (http://www.forestthreats.org/products/publications/s97-s106.pdf/?searchterm=).
[38] Helen McKay (ed). 2011. Short Rotation Forestry: Review of Growth and Environmental Impacts. *Forest Research Monograph* 2 (Report by Forest Research, an Agency of the UK Forestry Commission) (http://www.forestry.gov.uk/pdf/FRMG002_Short_rotation_forestry.pdf/$file/FRMG002_Short_rotation_forestry.pdf).
[39] Tolbert, *et al.* (2002).
[40] Annette Cowie, *et al.* 2006. Does Soil Carbon Loss in Biomass Production Systems Negate the Greenhouse Benefits of Bioenergy? *Mitigation and Adaptation Strategies for Global Change* 11: 979–1002. DOI: 10.1007/s11027-006-9030-0

does not specify whether it is comparing carbon stores of short-rotation trees with tilled or no-till agricultural systems even though carbon emissions may differ based on which type is assumed. And while the Agency does not expect short-rotation trees to be planted on native grasslands, for instance, this potential should be fully assessed given that other biofuel feedstocks have been planted on this carbon-rich land despite the prohibition at CAA section 211(o)(1)(I),[41] in addition to an expectation that willow and poplar will be planted on former hay acres located near current acres of pasture and grasslands.[42] Several experts have found that planting short-rotation trees on former pasture[43] or grasslands could cause "high losses of soil carbon."[44] EPA should be forthcoming about which types of land conversions would result in carbon gains vs. losses, and about the relative likelihood that these kinds of conversions will occur.

Second, regarding forest intensification, EPA partially arrives at its lower GHG emission estimate for domestic land use change by assuming forest acres would decline and forest intensification would follow, resulting in more carbon sequestered overall. EPA assumes that as short-rotation tree production increases domestically and puts pressure on current land uses, forested acres will be converted to cropland.[45] Specifically, EPA assumes that increased *willow* production will cause 212,000 acres of former forested acres to come into cropland production, while greater *poplar* production will result in 57,000 forested acres being converted into cropland.[46] EPA then assumes forest management would intensify, resulting in an increase in total carbon stocks: "The decrease in forest acres causes pressure on forest resources, which results in intensification on remaining forest acres and net carbon sequestration…The model responds to the expected pressures on forest inventories by enhancing inventories in the near term to meet later demand, leading to an increase in total forest carbon stocks in 2022."[47]

However, not only should EPA fully assess the GHG emission impact of converting forested acres into cropland, but EPA's intensification expectations should also be reassessed. Several authors have challenged EPA's assumptions about yield response. Steven Berry has challenged

(https://plbrgen.cals.cornell.edu/sites/plbrgen.cals.cornell.edu/files/shared/documents/forage/doessoilcarbonloss.pdf).

[41] *See, e.g.,* Tyler Lark, et al. 2015. Cropland Expansion Outpaces Agricultural and Biofuel Policies in the United States. *Environmental Research Letters* 10. DOI: 10.1088. (http://iopscience.iop.org/article/10.1088/1748-9326/10/4/044003/meta); C. K. Wright and M. C. Wimberly. 2013. Recent Land Use Change in the Western Corn Belt Threatens Grasslands and Wetlands. *Proc Natl Acad Sci USA* 110(10): 4134-9. DOI: 10.1073 (http://www.ncbi.nlm.nih.gov/pubmed/23431143).

[42] 81 Fed. Reg. at 80886/2.

[43] Cowie, *et al.* (2006).

[44] McKay (ed) (2011).

[45] 81 Fed. Reg. at 80886/2-3.

[46] *Id.* at 80886/3.

[47] EPA OTAQ, Short-Rotation Trees Technical Memorandum, at 8 (Oct. 3, 2016) (Docket ID No. EPA-HQ-OAR-2016-0041) (https://www.regulations.gov/contentStreamer?documentId=EPA-HQ-OAR-2016-0041-0009&disposition=attachment&contentType=pdf).

the notion of price-induced yield increases, finding from a review of numerous studies that yield price elasticity "was mostly zero and the largest value that could be used was 0.1."[48] David Locke found similar results in a study completed for the California Air Resources Board.[49] Looking back at the RFS's history tells a similar tale of EPA's high corn yield assumptions not being met in reality;[50] as a result, GHG emissions increased as cropland extensification occurred in the form of millions of acres of carbon-rich land coming into production for the first time.[51] When making new pathway determinations, EPA should fully assess whether these optimistic assumptions are likely to occur in reality, and if not, adjust its assumptions accordingly.

GHG Emissions from Displaced Agricultural Production

EPA should also assess whether its assumptions of lower production of commodity crops is likely to occur in reality. EPA assumes that greater production of short-rotation trees for biofuels will result in lower production of agricultural commodity crops used for food and feed, resulting in higher crop prices.[52] Specifically, wheat, barley, and hay production is expected to decline with increased *poplar* production while hay, corn, and soybean production is expected to drop with increased *willow* production.[53] EPA also expects higher crop prices in 2022[54] and lower U.S. exports of wheat (from greater *poplar* production) and lower exports of corn (due to greater *willow* production). [55] As EPA states,

> The increased short-rotation hybrid *poplar* production in the Pacific Northwest East causes cropland in this region to be shifted away from wheat, barley, and hay. Although production of these crops increases in other regions, overall the national production of these crops decreases (see Table VI.C.2–1). The total active cropland in the U.S. increases by 260,000 acres in 2022 (see Table VI.C.2–2). These additional acres primarily come from the conversion of idle cropland (131,000 acres), pastureland (72,000 acres), and forests (57,000 acres) to active

[48] California Air Resources Board (ARB), Staff Report-Appendix I: Detailed Analysis for Indirect Land Use Change (December 30, 2014) at Attachment 1-2.
[49] *Id.*.
[50] M. Flugge, *et al*. 2017. A Life-Cycle Analysis of the Greenhouse Gas Emissions of Corn-Based Ethanol, at 20 (Report prepared by ICF under USDA Contract No. AG-3142-D-16-0243). (https://www.usda.gov/oce/climate_change/mitigation_technologies/USDAEthanolReport_20170107.pdf).
[51] *See, e.g.,* Tyler Lark, et al. 2015. Cropland Expansion Outpaces Agricultural and Biofuel Policies in the United States. *Environmental Research Letters* 10. DOI: 10.1088. (http://iopscience.iop.org/article/10.1088/1748-9326/10/4/044003/meta); C. K. Wright and M. C. Wimberly. 2013. Recent Land Use Change in the Western Corn Belt Threatens Grasslands and Wetlands. *Proc Natl Acad Sci USA* 110(10): 4134-9. DOI: 10.1073 (http://www.ncbi.nlm.nih.gov/pubmed/23431143).
[52] 81 Fed. Reg. at 80886/2-3.
[53] *Id.*
[54] EPA OTAQ, Short-Rotation Trees Technical Memorandum, at 8-9 (Oct. 3, 2016) (Docket ID No. EPA-HQ-OAR-2016-0041) (https://www.regulations.gov/contentStreamer?documentId=EPA-HQ-OAR-2016-0041-0009&disposition=attachment&contentType=pdf).
[55] 81 Fed. Reg. at 80887/1.

> cropland… Short-rotation *willow* production causes decreases in the production of hay, corn, and soybeans in the Northeast. Although production increases in other regions, overall the national production of these crops decreases (see Table VI.C.2–1). For this high-volume willow scenario, the total active cropland in the U.S. increases by 363,000 acres (see Table VI.C.2–2). The cropland comes primarily from the conversion of forest (212,000 acres), pastureland (90,000 acres), and idle cropland (60,000 acres) to active cropland [emphasis added].[56]

With a growing world population, EPA's assumptions about U.S. crop production declining in 2022 (and not being replaced) is inconsistent with findings from other authors, including Searchinger and Heimlich (2015).[57] Hence, EPA's assumptions about lower GHG emissions from less agricultural row crop production may not occur in reality. If one instead makes the following two different assumptions from EPA's proposed thermochemical ethanol production analysis, overall willow and poplar biofuel GHG reductions are closer to the 60% requirement (from EPA's currently proposed 69% and 76% reductions, respectively): (1) domestic ILUC emissions would be positive (2,717 g CO2-eq/mmBtu for willow[58] and 2,597 g CO2-eq/mmBtu for poplar[59] instead of EPA's current assumption of -2,717 and -2,597 values), and (2) "net agriculture" emissions would be equal to the baseline (instead of EPA's assumption that willow would result in -2,717 g CO2-eq/mmBtu and poplar would result in -4,714 g CO2-eq/mmBtu). This would result in willow and poplar each receiving a GHG reduction score of 66%,[60] which is closer to the 60% threshold for qualifying as cellulosic biofuels in the RFS. EPA should fully account for potential land use change emissions resulting from land expansion as production of biofuels feedstocks increases, displacing food and feed production elsewhere, not to mention the GHG impact of converting forested land to cropland. Otherwise, GHG emissions will be underestimated at the expense of global food security, and one of the primary goals of the RFS—lower GHG emissions—will fail to be met in reality.[61]

Lower Agricultural Inputs

As part of its LCA for willow and poplar, EPA also assumes that the use of agricultural inputs such as fertilizer and pesticides (and their associated GHG emissions) will decline if short-rotation trees are planted on former cropland.[62] As EPA states, "Short-rotation hybrid poplar and short-rotation willow use fewer agricultural inputs than corn, soybeans, barley, and wheat.

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[56] *Id.* at 80886/3.

[57] Tim Searchinger and Ralph Heimlich. 2015. Avoiding Bioenergy Competition for Food Crops and Land. (Working Paper by the World Resources Institute, Washington, DC, Installment 9 of Creating a Sustainable Food Future) (http://www.wri.org/sites/default/files/avoiding_bioenergy_competition_food_crops_land.pdf).

[58] 81 Fed. Reg. at 80889.

[59] *Id.* at 80888.

[60] *Id.* at 80888.

[61] *See, e.g.,* Searchinger and Heimlich (2015); Tim Searchinger *et al.* 2015. Do Biofuel Policies Seek to Cut Emissions by Cutting Food? *Science* 347 (6229): 1420-1422.
DOI: 10.1126/science.1261221 (http://science.sciencemag.org/content/347/6229/1420).

[62] 81 Fed. Reg. at 80888/2.

Because land was converted from these crops to short-rotation hybrid poplar or short-rotation willow production, there was a reduction in the usage of agricultural inputs, and a corresponding reduction in the emissions from farm inputs."[63] However, if this lost agricultural production simply moves elsewhere to make up for lower food and feed production, the use of agricultural inputs will not decline overall. Instead, it will simply be applied to different locations—but impact the same atmosphere. EPA should fully account for these potential GHG emissions in the LCAs for willow- and poplar-based cellulosic biofuels.

Short-Rotation Tree Plantings' Adherence to RFS "Renewable Biomass" Definitions

Finally, EPA must enforce the RFS's "renewable biomass" definition to ensure that short-rotation trees and other feedstocks used to produce biofuels are not unlawfully planted on sensitive land such as native grasslands and forests. In its proposed rule, EPA proposes some steps in the right direction to protect native forests,[64] but by failing to adequately implement land protections for the production of other biofuels feedstocks such as corn and soybeans, unintended consequences may still result from additional land use change. Specifically, EPA proposes to modify "the definition of tree plantation to allow… [short-rotation tree] placement on land that was actively managed for any *agricultural* purpose on December 19, 2007 [emphasis added]."[65] EPA believes this "will facilitate the production of cellulosic biofuels, which is consistent with the purpose of the statute to promote the rapid development and use of such fuels." [66] In other words, EPA intends to allow willow and poplar trees to be planted not only on former tree plantations but also on current agricultural land. However, if EPA continues to fail to effectively monitor and enforce the RFS's current renewable biomass definitions, its proposal would only allow more unlawful conversion of sensitive land to biofuel feedstock production. By failing to stop the unlawful conversion of native grasslands to biofuels feedstock production, for instance, EPA is failing to fully account for land use change emissions associated with today's biofuel production. Therefore, the original intent of the RFS – significantly lower lifecycle GHG emissions – is not being met, and will unlikely be met in the future.[67]

GENERATING RINS FOR RENEWABLE ELECTRICITY

EPA asks for comment on whether it should develop and utilize a special equivalence value for RINs that are generated when biogas is converted into electricity by a power plant, and the resulting "renewable electricity" is then used to power electric vehicles.[68] CATF believes a

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[63] *Id.* at 80888/2.
[64] *Id.* at 80890/1-2
[65] *Id.* at 80890/1.
[66] *Id.* at 80890/1.
[67] *See, e.g.,* Lester Lave, *et al.* 2011. Renewable Fuel Standard: Potential Economic and Environmental Effects of U.S. Biofuel Policy. (Report by the National Research Council Committee on Economic and Environmental Impacts of Increasing Biofuels Production) (http://www.nap.edu/openbook.php?record_id=13105).
[68] 81 Fed. Reg. at 80896.

special equivalence factor for renewable electricity is warranted, mainly because we agree with other stakeholders that the continued application of the existing equivalence value (22.6 kWh per gallon of corn ethanol) "may unduly affect the renewable electricity pathway"[69] by limiting the potential of renewable electricity to shift the RFS, however slightly, away from its overdependence on farm-grown, food-based feedstocks.[70]

CATF endorses the comments submitted to this docket by Waxman Strategies on the appropriate equivalence factor for renewable electricity:

> We support having the EPA use a 5.24 kWh equivalence value for renewable electricity that charges plug-in hybrid vehicles.
>
> In its proposed version of the REGS rule, the EPA proposes using a 22.6 kWh equivalence value as the basis for awarding 1 RIN. This is based on a calculation of the energy content of renewable electricity from biogas compared to ethanol (1 RIN per 22.6 kWh). While this calculation represents the actual energy content in the renewable electricity, it does not represent the amount of petroleum displaced. Electric vehicles are much more efficient than vehicles with internal combustion engines, and, according the International Council on Clean Transportation, "one gallon of ethanol can drive a typical new internal combustion care 16 miles, [while] 22.6 kWh of electricity will drive the typical new electric car about 70 miles, displacing 4.3 ethanol equivalent gallons of gasoline." Calculating the equivalence value based on displaced petroleum would mean arriving at the 5.24 kWh number.
>
> Furthermore, crediting renewable electricity according to the amount of petroleum displaced is consistent with other major low carbon fuel policies around the world.[71]

CATF believes this approach is most consistent with EPA's interest in "incentiviz[ing] the growth of the EV market in the U.S. while simultaneously the goals of the CAA to reduce air pollution and GHG emissions from mobile sources and the fuels that power them."[72]

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[69] *Id.*

[70] *Id.* at 80890 ("The EPA expects that the potential annual generation of RINs for generated for renewable electricity could increase by roughly 10 million per annum over the next few years.")

[71] Waxman Strategies, Comments to EPA on "Proposed Renewables Enhancement and Growth Support (REGS) Rule" Notice of Proposed Rulemaking (EPA-HQ-OAR-2016-0041), submitted 2017 (internal citations omitted to Stephanie Searle/The International Council on Clean Transportation, "Memorandum on the equivalence value of electricity in the Renewable Fuel Standard," 1-2 (January 2017) (memo appended to Waxman Strategies comments)).

[72] 81 Fed. Reg. at 80890/3.

REGISTRATION OF NEW AND EXPANDED GRANDFATHERED VOLUMES

The Energy Independence and Security Act of 2007 (EISA) requires that biofuel produced at facilities that were neither operational nor under construction as of December 19, 2007 to "achieve[] at least a 20 percent reduction in lifecycle greenhouse gas emissions compared to baseline [petroleum-based] lifecycle greenhouse gas emissions."[73] Facilities that were already operational or had commenced construction were deemed exempt, or "grandfathered," from having to meet the GHG reduction requirement for their "baseline volume" of biofuel production.

Incredibly, biofuel producers are still applying to EPA for grandfathered status[74] in an attempt to skirt the requirement that their fuels achieve even a modest GHG reduction relative to petroleum fuels. These applications are being made to the Agency despite the periodic claims by the ethanol industry and by its supporters in government about corn ethanol's dramatically shrinking carbon footprint,[75] and despite the fact that it has been more than nine years since Congress passed EISA and almost seven years since EPA finalized the RFS2 implementation rule.[76]

The continuing interest among ethanol producers to take advantage of the exemption not only undermines the assertions that lifecycle GHG emissions associated with corn ethanol production are improving significantly, it further discredits EPA's 2010 decision to base its determination that corn ethanol achieves a 21% reduction in lifecycle GHG on an assumption that the corn ethanol industry would broadly invest in cleaner production technologies and methods by 2022. Facilities that are currently seeking grandfathered status clearly have no intention of investing in the suite of technologies and methodologies that EPA assumed would be commonplace by 2022. If they did, they would have little need for the exemption.

EPA now proposes to establish a "firm" deadline for new applications claiming an exemption from the GHG reduction requirement, after having extended and/or waived the deadline multiple times previously.[77] CATF urges EPA to finalize the proposed November 16, 2016 deadline. Biofuel producers have had more than ample opportunity to claim the exemption. Allowing producers to submit additional claims would complicate the verification challenges that EPA already faces.[78] Perhaps more importantly, allowing additional producers to take

[73] CAA §211(o)(2)(A)(i). An additional exemption at 40 C.F.R. 801403(d) extends grandfathered status to a limited class of natural gas- and biomass-fired ethanol producers.
[74] 81 Fed. Reg. at 80901/3.
[75] Renewable Fuels Association, *Why Is Ethanol Important?* (http://ethanolrfa.org/consumers/why-is-ethanol-important/); ICF, *A Life-Cycle Analysis of Greenhouse Gas Emissions of Corn-Based Ethanol* (January 12, 2017) (produced under contract for the United States Department of Agriculture).
[76] P.L. 110-140, Energy Independence and Security Act of 2007 (December 19, 2007); 75 Fed. Reg. 14670 (March 26, 2010).
[77] 81 Fed. Reg. at 80901/3.
[78] *See id.*

advantage of the exemption would deepen doubts about whether RFS-compliant biofuels actually achieve a net reduction in GHG emissions.[79]

CONCLUSION

CATF appreciates the opportunity to comment on the proposed REGS rule. We recommend that EPA implement the proposed CCS provisions, withdraw its proposed approval of the short-rotation tree pathways, allocate RINs to producers of electricity made from captured biogas using an equivalence factor that is based on the volume of petroleum displaced, and refuse to consider any new applications for grandfathered status to biofuel producers.

Thank you for your consideration of these comments.

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[79] *See, e.g.*, Jason Hill *et al.* 2016. Climate consequences of low-carbon fuels: the United States Renewable Fuel Standard., *Energy Policy* 352 (http://dx.doi.org/10.1016/j.enpol.2016.07.035) (authors assume that the biofuels used to comply with the RFS achieve the applicable threshold for lifecycle GHG reductions (*e.g.*, corn ethanol achieves a 20% reduction); nevertheless, their study finds that the use of RFS-compliant biofuels will result in "a net increase in GHG emissions of 22 million metric tons in 2022, and of 431 million metric tons cumulatively from 2006 to 2022.")