NRDC
THE EARTH'S BEST DEFENSE

NATURAL RESOURCES DEFENSE COUNCIL

Statement of

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Select Committee on Energy Independence & Global Warming

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Summary

- Biomass feedstocks produced with environmental safeguards, processed efficiently and used in efficient vehicles can reduce our dependence on oil for transportation, reduce emissions of heat-trapping carbon dioxide, and contribute significantly to a vibrant farm economy.
- Pursued without adequate guidelines, large scale biofuels production carries grave risk to our lands, forests, water, wildlife, public health and climate.
- New crops and conversion technologies are developing rapidly that will make it easier to produce lots of biofuels with a smaller environmental footprint, but the technologies are not a guarantee of good environmental performance. We need strong environmental safeguards and performance standards guiding the market so that innovation and competition will drive biofuels to provide the greatest benefits.
- If half of the alternative fuels mandate proposed by the administration were satisfied with coal-derived liquid fuels CO_2 emissions would be 175 million tons higher in 2017 than targeted by the administration. To offset this increase through automobile fuel efficiency standards would require an increase in CAFE standards of 8.6 percent per year, rather than 4% per year as suggested by the administration.
- Congress should cap total greenhouse gas emissions from transportation fuels and require progressive reductions in the average greenhouse gas emissions per gallon of transportation fuels sold, as California is planning to do.
- The comprehensive energy bill being reconciled between the House and the Senate should include an expanded renewable fuels standard that is an amendment to the Clean Air Act, administered by EPA, and:
    - Requires conventional biofuels to achieve at least a 20% reduction in lifecycle greenhouse gas emissions compared to conventional gasoline and advanced biofuels to achieve at least a 50% reduction.
    - Defines lifecycle greenhouse gas emissions to include the full cultivation, production, and combustion cycle of fuels and both the direct and indirect emissions caused by this cycle.
    - Excludes biofuels produced from biomass harvested off of public lands[1], old-growth forest, native grasslands, and "imperiled" ecosystems pursuant to a State Natural Heritage Program.
    - Requires the biomass used to produce biofuels be cultivated and harvested according to a management plan similar to existing commodity crops and that avoids conversion of natural ecosystems.
    - Establishes a straightforward no-backsliding requirement to protect air quality by directing EPA to adopt regulations requiring that the emissions of any air

[1] Biomass obtained from the immediate vicinity of buildings and other areas regularly occupied by people, or of public infrastructure, at risk from wildfire should be excepted from this restriction.

pollutant from vehicles using renewable fuel shall be no greater than the level of such emissions from vehicles when using conventional gasoline.

Introduction

Thank you for the opportunity to share my views regarding implementation of the Renewable Fuels Standard (RFS) and possible modifications to achieve greater energy security and environmental benefits. My name is Nathanael Greene. I'm a senior policy analyst for the Natural Resources Defense Council (NRDC) and one of our main experts on renewable energy technologies. NRDC is a national, nonprofit organization of scientists, lawyers and environmental specialists dedicated to protecting public health and the environment. Founded in 1970, NRDC has more than 1.2 million members and online activists nationwide, served from offices in New York, Washington, Los Angeles and San Francisco.

Mr. Chairman, as you know, U.S. energy policy must address three major challenges: reducing America's dangerous dependence on oil, reducing global warming pollution, and providing affordable energy services that sustain a robust economy. Biofuels have the potential to contribute significantly to all three of these goals. Sustainably produced biomass feedstocks, processed efficiently and used in efficient vehicles can reduce our dependence on oil for transportation, reduce emissions of heat-trapping carbon dioxide, and contribute significantly to a vibrant farm economy. Pursued without adequate guidelines, however, biofuels production carries grave risk to our lands, forests, water, wildlife, public health and climate. Any policy to expand the use of renewable transportation fuels should incorporate effective performance standards and incentives to ensure that biofuels are part of the solution, rather than part of the problem.

For example, unmitigated, expansion of corn cultivation driven by the demand for ethanol threatens to deplete water tables, magnify contamination by fertilizers, pesticides, and herbicides, and undermine vital conservation programs such as the Farm Bill's Conservation Reserve Program. Increased use of ethanol could also impair air quality depending on how it is blended and used. On farms and in forests across the country and abroad, imprudent biomass harvesting would cause soil erosion, water pollution, and habitat destruction, while also substantially reducing the carbon sequestered on land. Advancing a biofuels policy that leads to clearing forests for fuel production, at home or abroad, and hence increased emissions of carbon dioxide would be a particularly perverse result for a policy that is intended, at least in part, to reduce global warming pollution.

The Environmental Impacts of an Expand RFS Could Be Large

Modeling projects done by the United States Department of Agriculture (USDA) and the World Resources Institute (WRI) show how a dramatic increase in the demand for corn to make ethanol can have substantial impacts on soil quality, water quality and the climate.[2] Both projects rely on USDA's Regional Environmental and Agricultural Production (REAP) model coupled with the Environmental Policy Integrated Climate (EPIC) model. USDA looked at increasing from a baseline of 12 billion gallons of corn derived ethanol in 2016 to either 15 billion or 20 billion gallons. WRI analyzed a range of scenarios for 2008, and its analysis is particularly useful for understanding the disproportionate impact of bringing virgin land into active crop management.

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[2] USDA, *An Analysis of the Effects of an Expansion in Biofuels Demand on U.S. Agriculture*, May 2007 (http://www.usda.gov/oce/newsroom/chamblissethanol5-8-07.doc), and Marshall, L. "Thirst for Corn: What 2007 Plantings Could Mean for the Environment," WRI, June 2007 (http://pdf.wri.org/policynote_thirstforcorn.pdf).

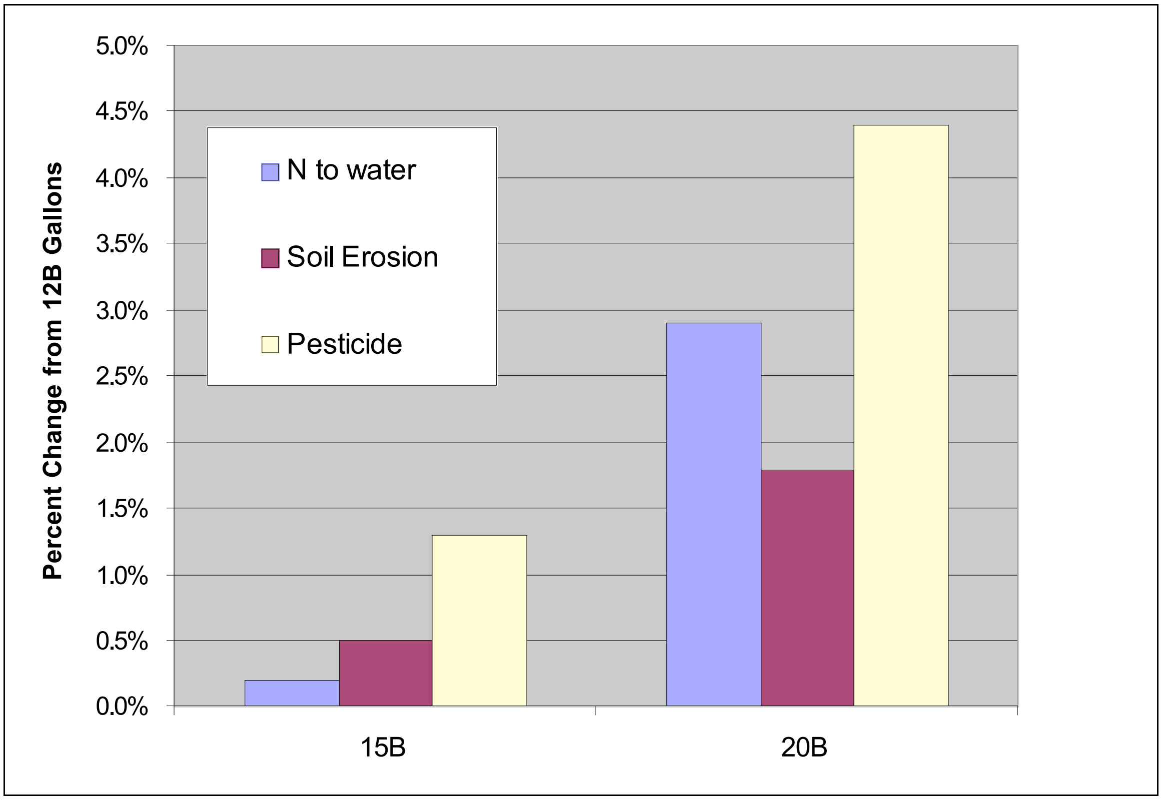

Figure 1. USDA Environmental Impact Modeling Results

The USDA modeling clearly shows that under business as usual, an increase in corn production to meet larger ethanol production goals will mean more fertilizer pollution in our water ways, increased soil erosion, and greater use of pesticides. This conclusion is also supported by the recent report from the National Academy of Science, which stated:

> Staying the current policy path would likely result in the continued trend of expansion of corn-based ethanol production, driven by the economics of input costs and ethanol prices supplemented by the subsidy.[3]

And elsewhere:

> All else being equal, the conversion of other crops or non-crop plants to corn will likely lead to much higher application rates of nitrogen ... Given the correlation of nitrogen application rates to stream concentrations of total nitrogen, and of the

[3] "Water Implications of Biofuels Production in the United States," National Research Council, Committee on Water Implications of Biofuels Production in the United States, page 45 (http://www.nap.edu/catalog/12039.html).

> latter to the increase in hypoxia in the nation's waterbodies, the potential for additional corn-based ethanol production to increase the extent of these hypoxic regions is considerable. Since the dead zone in the Gulf of Mexico is already on the order of 10,000 [sic] square kilometers, the economic stakes are high.[4]

The WRI modeling considered a range of ethanol production levels for 2008 and analyzed them using different assumptions about the amount of virgin land that could be pulled into crop production. Before cultivation, new land must be cleared, which results in a range of impacts not captured in the modeling including habitat destruction and the release of carbon contained in plants both above and below the ground. Furthermore, new land is generally not as productive or conducive to agriculture. The soil is typically not as fertile and the grade may be steep. The net result is that the more virgin land used, the greater the impacts will be.

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[4] "Water Implications of Biofuels Production in the United States," National Research Council, Committee on Water Implications of Biofuels Production in the United States, Page 23 (http://www.nap.edu/catalog/12039.html). Note that the dead zone is actually closer to 20,000 square kilometers. This appears to have been a typo in the NAS report.

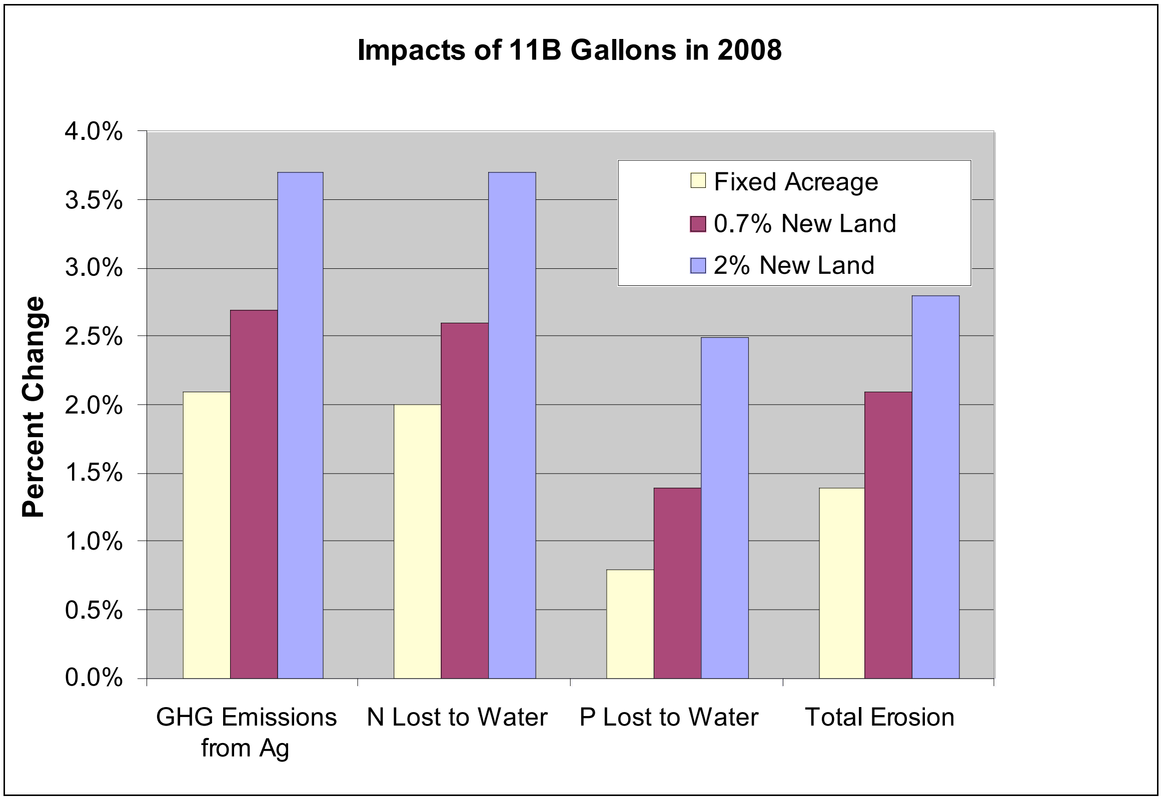

Figure 2. WRI Results Environmental Impacts of More Ethanol and New Land.

The impacts identified in these modeling projects are not an inevitable result of increasing biofuels production or the RFS. To avoid them we must match our increase in corn ethanol production with an increase in funding for Farm Bill conservation programs and reform these programs to get more conservation per dollar. We also need to ensure that biofuels policies do not simply increase the volume of production, but also improve the environment, protect public health, and enhance energy security. Supporting research, development, and deployment of advanced biofuels technologies is also critical, but as I'll discuss later, while these technologies make it easier to sustainably produce biofuels, they are not a silver bullet.

The Need for Performance Standards

To achieve the full potential of biofuels, policies must focus on the benefits that can be achieved by the policies rather than just the feedstocks, conversion technologies or the number of gallons produced. Current federal biofuels policies, from the RFS to the various tax credits, simply reward volume and are based on the assumption that "more is better." Moving forward, it is critical that these policies mature to a "better is better" approach and start to reward good performance.

Nowhere is the need for better performance more evident and urgent than when considering the global warming pollution impacts of biofuels. It is possible to produce ethanol derived from corn in a way that produces less than half of the lifecycle greenhouse gas emissions of gasoline (per BTU of delivered fuel). Conversely it is possible to produce ethanol from cellulosic feedstocks in a manner that produces far more CO_2 than gasoline. Unless our policies value, encourage and ultimately require biofuels to produce greenhouse gas reductions, the market will provide whatever is cheapest and fastest. There is no reason to believe that such fuels will be better than gasoline.

Consider, for example, a dry mill corn ethanol plant. Greenhouse gas emissions from corn production can be minimized by obtaining the corn from a farm that practices no-till cultivation. In addition, by collecting a portion of the corn stover along with the grain the ethanol plant can meet its thermal energy needs with this biomass energy source rather than fossil fuels. Finally, fermentation produces carbon dioxide in a pure stream that can be easily captured for geologic sequestration. Using Argonne National Laboratory's GREET model, we estimate that the lifecycle greenhouse gas emissions from ethanol produced at such a plant would be 7.5 pounds per gasoline gallon equivalent, or more than 70% lower than gasoline. NRDC has examined the greenhouse gas emissions from a wide variety of feedstock and conversion process combinations using the Argonne GREET model (see Figure 3 and Appendix). EPA conducted a similar analysis for a fact sheet released in conjunction with its final rule for implementing the Renewable Fuels Standard enacted in EPACT 2005.[5] EPA's results are shown in Figure 4 and are very similar to ours (note that EPA displays results relative to conventional gasoline, which is set to zero on their chart.)

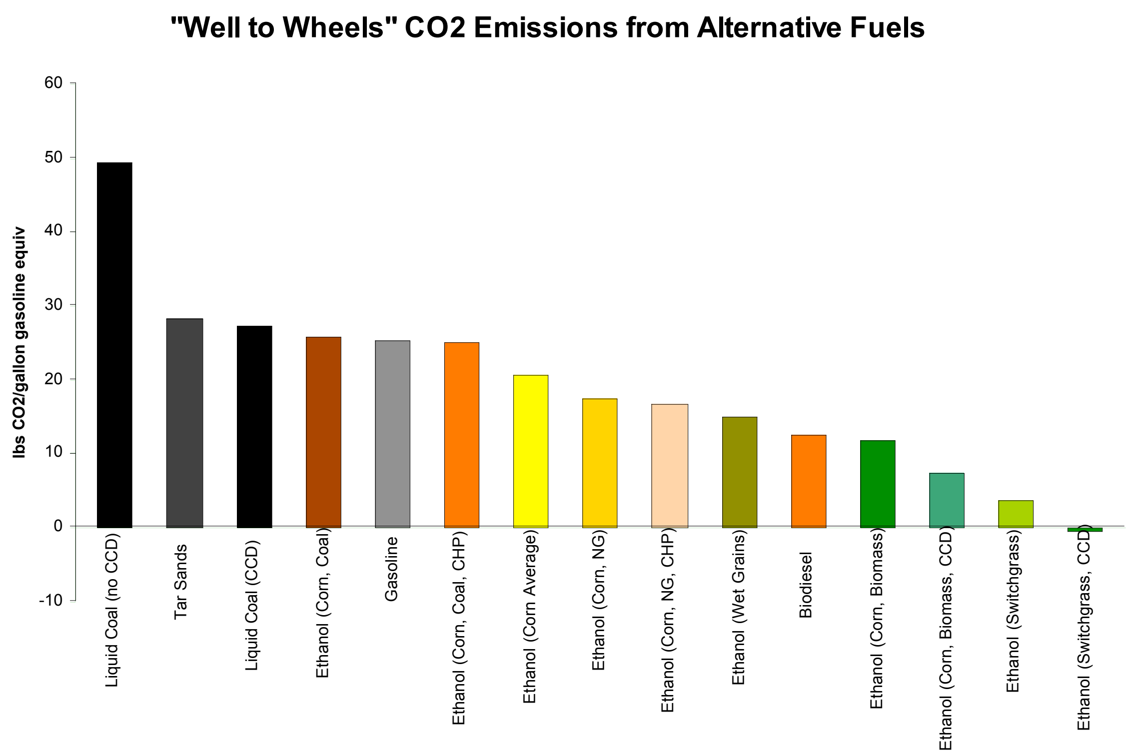

Figure 3. NRDC Lifecycle Greenhouse Gas Analysis

[5] http://www.epa.gov/otaq/renewablefuels/420f07035.htm

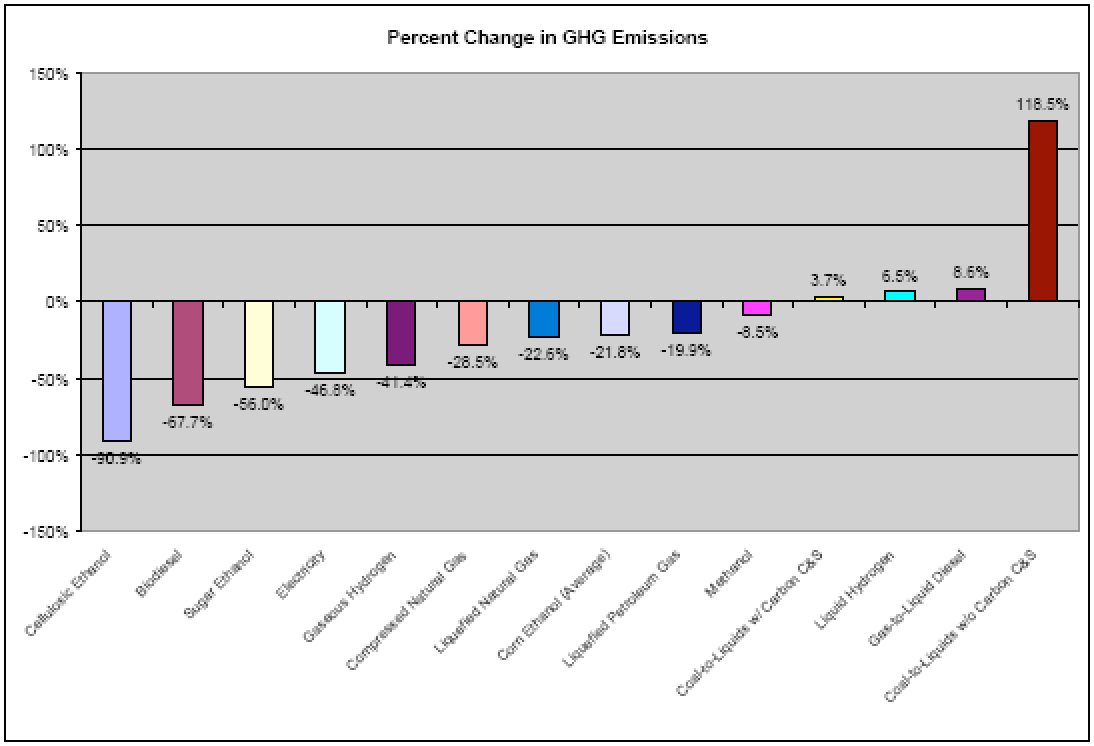

Figure 4. EPA Lifecycle Greenhouse Gas Analysis

Now consider a cellulosic ethanol plant. While such plants are often considered to be environmentally superior to corn ethanol plants, this is not necessarily the case, depending on how the cellulosic feedstock is produced. For example, if the biomass for the cellulosic ethanol plant is obtained by converting to biomass production land that had been enrolled in the conservation reserve program (CRP), then the forgone conservation benefits and carbon benefits must be accounted for. The CRP has enrolled more than 1 million acres in forest cover, including hardwoods, longleaf pine, and other softwoods. These forests provide both important ecological services and sequester a substantial amount of carbon. Converting such lands to biofuels production would not only rapidly return to the atmosphere the carbon sequestered since the trees were planted, but would also forgo future carbon sequestration on this land. The net result would be CO_2

emissions to the atmosphere many times greater than the annual greenhouse gas benefits from cellulosic ethanol production on this land.

Land conversion need not be this direct to undermine the environmental benefits of biofuel production. Devoting an increased share of U.S. agricultural output to fuel production rather than grain exports will result in increased demand for animal feed from sources abroad. If any significant portion of this additional feed is obtained by converting mature forests into pasture or cropland the CO_2 emissions from this land use change could greatly exceed the emission reductions from the use of biofuels. The Argonne GREET model and most lifecycle analyses conducted to date have either ignored these land use related emissions or minimized them. These emissions, however, are unavoidably caused by using certain crops and types of land for biofuels feedstocks and they have the potential to negate all of the global warming benefits of an expanded RFS.

Advanced Technologies – Promising but not a Panacea

Much has been written and said about the promise of advanced, second generation biofuels technologies. These technologies do appear poised to greatly increase the amount of biofuels we can produce and make it easier to produce them in a sustainable way. It is critical to realize, however, that these technologies will not be available overnight and just because we can produce biofuels sustainably does not mean that we will.

When I first started looking at biofuels in 2002, all of the cutting edge expertise was in academia and the national energy labs. You could talk to these experts and they would tell you where the technology stood. Over the last 2 years, however, all of the cutting edge research has moved into the private sector and is proprietary. So while it's now much harder to know where things stand, we know that a lot of investor dollars are being bet on near-term commercialization. The research is being driven by venture capitalists and private investors.

Combine these developments with the very impressive number of projects proposed in response to recent government solicitations, and it's hard not to believe that things are moving along quickly. Within the past year, New York issued a solicitation for two pilot cellulosic biofuels projects and DOE issued a solicitation for six small commercial scale cellulosic projects. Both of these solicitations required significant private sector investment and a number of major market players responded. Cellulosic biofuels projects announced in recent weeks inlcude a new pilot cellulosic plant in Nebraska that will be built by Abengoa, a plant using switchgrass as a feedstock that will be constructed in Tennessee by Mascoma, and a commercial line of cellulose processing enzymes by Genencor. International developments include a recent announcement by Royal Nedalco in the Netherlands that it will skip the pilot scale and go straight to building a small commercial scale 50 million gallon a year cellulosic plant. There are also advances being made in radically different technologies including the use of microorganisms in existing ethanol facilities to produce fuels similar to gasoline such as biobutanol, bacterial and catalytic conversion of biomass into renewable diesel and gasoline, and the use of algae to make a synthetic diesel fuel.

It is my understanding, however, that none of these projects will come on line until 2010. Assuming a few of them perform very well, they could be expanded, but it is really the second generation plant that investors will consider a potential cookie-cutter model.

Being optimistic, assume that we go into 2013 with three different technologies that can compete with corn ethanol or gasoline, each with an operating second generation plant of about 50 million gallon per year capacity. Even if the technologies are so promising that orders for more fuel are actually placed in 2012, how fast will capital and engineering capacity flow into the sector? How long will siting and permitting lead times be? One billion gallons of capacity by 2016 seems reasonable to me assuming we have at least one clear success on line by 2010. Three billion would be absolutely fantastic. Such a result would require that by 2013 the cellulosic industry grows as fast as the corn ethanol industry grew from middle of 2006 to middle of 2007.

The ability to convert cellulose into fuels opens up the possibility of using new feedstocks such as cellulosic crops, including switchgrass, that use significantly less chemical inputs and water, agricultural residues and organic waste. However, as we discussed earlier, it is also possible to cultivate and harvest cellulosic biomass in extremely destructive and carbon intensive ways. One of the easiest ways to do cellulosic biofuels wrong is by harvesting feedstocks from inappropriate areas such as our public forests, old growth forests, or other imperiled and fragile ecosystems. While I'm not aware of any projects proposing to use such feedstocks, federal policies should not incentivize the future use of such feedstocks. Environmental safeguards and performance standards are necessary to ensure that federal policy promotes the best production standards for biofuels, such as well-managed cultivation of corn or switchgrass.

The Administration's Proposal

The administration has proposed replacing the existing renewable fuels standard with an "alternative fuels" standard that increases to 35 billion gallons by 2017. The administration has asserted that this standard, in combination with their proposed changes to Corporate Average Fuel Economy standards, would return greenhouse gas emissions from light duty vehicles to current levels in 2017, a reduction of about 170 million metric tons below business-as-usual projections. Unfortunately, nothing in the Administration's proposal would ensure this result. First, while the administration's analysis assumes that ethanol would be used to comply with the standard, their actual proposal opens the door to a variety of fossil fuels as well as renewable fuels, some of which could have lifecycle greenhouse gas emissions as much as twice as high as petroleum-derived fuel. Second, because of the very aggressive schedule for increasing the use of alternative fuels, the administration's proposal would create enormous pressure to convert forests and conservation reserve program lands to biofuels production, potentially contributing a pulse of carbon dioxide emissions that would take many decades to offset through reduced oil consumption. Third, the schedule is too rapid to allow potentially more beneficial processes for producing biofuels, such as cellulosic ethanol and biobutanol, to satisfy most of the alternative fuel mandate, as I discuss above. Fourth, while the administration assumed a 4% per year increase in CAFE standards in their projections, the administration's CAFE proposal does not actually guarantee any increase.

These deficiencies in the administration proposal mean that it could lead to an increase, rather than a reduction, in global warming pollution compared with business as usual. For example, if half of the alternative fuels mandate proposed by the administration were satisfied with coal-derived liquid fuels (liquid coal synfuels) then CO_2 emissions would be 175 million tons higher in 2017 than targeted by the administration. To offset this increase through automobile fuel efficiency standards would require an increase of 8.6 percent per year, rather than 4% per year as suggested by the administration.

Liquids from Coal v. Electricity from Coal for Transportation

Even if liquid coal synfuels plants fully employ carbon capture and storage, full fuelcycle greenhouse gas emissions from using these fuels will be somewhat worse than conventional gasoline (see Figures 1 and 2). There is a straightforward reason for this. Liquid coal synfuels are hydrocarbon fuels with about the same carbon content per BTU as conventional gasoline or diesel fuel, so vehicle tailpipe CO_2 emissions from using liquid coal would be nearly identical to those from using conventional fuels. Any CO_2 emissions released from the synfuels production facility have to be added to the tailpipe emissions. The residual emissions from a liquid coal plant employing CCS are still somewhat higher than emissions from a petroleum refinery, hence lifecycle emissions are higher.

While I believe that there are better alternatives, if coal is to be used to replace gasoline, generating electricity for use in plug-in hybrid vehicles (PHEVs) can be far more efficient and cleaner than making liquid fuels. In fact, a ton of coal used to generate electricity used in a PHEV will displace more than twice as much oil as using the same coal to make liquid fuels, even using optimistic assumptions about the conversion efficiency of liquid coal plants.[6] The difference in CO_2 emissions is even more dramatic. Liquid coal produced with CCS and used in a hybrid vehicle would still result in lifecycle greenhouse gas emissions of approximately 330 grams/mile, or **ten times** as much as the

[6] Assumes production of 84 gallons of liquid fuel per ton of coal, based on the National Coal Council report. Vehicle efficiency is assumed to be 37.1 miles/gallon on liquid fuel and 3.14 miles/kWh on electricity.

33 grams/mile that could be achieve by a PHEV operating on electricity generated in a coal-fired power plant equipped with CCS.[7]

Getting Biofuels Right in the Energy Bill

The benefits of biofuels can be realized, and the potential pitfalls avoided, through carefully crafted policy. The RFS in the Senate energy bill passed last June mandates 36 billion gallons of biofuels production by 2022. Biofuels are divided into two categories, "conventional" and "advanced", based solely on the type of feedstock from which the fuel is produced. "Conventional biofuels" are defined as ethanol derived from corn starch, and "advanced biofuels" are essentially fuel derived from any other form of renewable biomass. In an important first step, the Senate adopted a greenhouse gas performance standard for new biofuels facilities requiring at least a 20 percent reduction relative to gasoline in global warming emissions over the fuel lifecycle from feedstock production through processing and use. The bill would also require that an increasing proportion of the overall renewable fuels standard come from "advanced biofuels", but it does not establish a higher performance standard for such fuels. Structuring the RFS to ensure the diversification of feedstocks used for biofuels production is helpful, but is not an adequate substitute for stronger greenhouse gas performance standards and sustainable feedstock sourcing requirements, such as those included in the Advanced Clean Fuels Act of 2007 introduced by Senators Boxer, Collins, and Lieberman.

Here I outline key principles that should be incorporated into any expansion of the renewable fuels standard through a combination of robust performance standards, careful

[7] Assumes lifecycle greenhouse gas emission from liquid coal of 27.3 lbs/gallon and lifecycle greenhouse gas emissions from an IGCC power plant with CCS of 106 grams/kWh, based on R. Williams et al., paper presented to GHGT-8 Conference, June 2006.

definitions of what qualifies as renewable fuel, and incentives to promote voluntary management practices that protect ecological values.

- ***An increase in the RFS should be done as an amendment to the existing RFS under the Clean Air Act and implemented by EPA***

EPA cannot carry out its job of protecting public health and welfare without having the authority to regulate the quality of our nation's fuel supplies under the Clean Air Act. Among federal agencies, EPA has the most experience and expertise related to transportation fuels, and is already responsible for implementing the current RFS program. Furthermore the Clean Air Act provides important checks and balances, including specific statutory requirements regarding record keeping and public participation in rulemaking, as well as administrative and citizen enforcement measures. Therefore it is critical to keep the renewable fuels standard under the Clean Air Act and EPA's authority.

- ***The use of bioenergy must reduce greenhouse gas emissions.***

To assure benefits, new incentives and requirements for increased use of biofuels need to be tied to significant reductions in the greenhouse gas intensity of these fuels. As discussed above, this requires explicit greenhouse gas performance standards rather than an implicit assumption that certain feedstocks will produce greater benefits than others. The most effective approach is to cap total greenhouse gas emissions from transportation fuels and require progressive reductions in the average greenhouse gas emissions per gallon of transportation fuels sold, as California is planning to do. In the context of the expanded RFS being considered in the energy bill, conventional biofuels should be required to achieve at least a 20% reduction in lifecycle greenhouse gas emissions compared to conventional gasoline, as adopted by the Senate. This level of performance can probably be achieved with efficient corn ethanol plants as shown in Figure 1. Advanced biofuels should achieve at least a 50% reduction in lifecycle greenhouse gas emissions, which can be accomplished through several different feedstock and conversion process combinations. Critical to obtaining any meaningful climate benefits, the definition of lifecycle greenhouse gas emissions must also be improved over the Senate language. To ensure that the emissions from land use changes are included, we recommend that the following definition be used:

> *LIFECYCLE GREENHOUSE GAS EMISSIONS. – The term ``lifecycle greenhouse gas emissions'' means the aggregate quantity of greenhouse gases attributable to the production, transportation, and use of fuel, including the production, extraction, cultivation and related land use change, distribution, marketing, and transportation of feedstocks, as modified by deducting, as determined by the Administrator of the Environmental Protection Agency—*
> *(i) any greenhouse gases captured at the facility and sequestered; and*
> *(ii) the carbon content, expressed in units of carbon dioxide equivalent, of any feedstock that is renewable biomass.*

- ***Bioenergy feedstocks must not be grown or extracted from public forest lands or environmentally sensitive lands.***

Some areas should simply be off limits for biofuels production. First, high conservation value areas, including native grasslands, old growth forests, important wildlife habitat, and ecosystems that are intact, rare, high in species richness or endemism, or exhibit rare ecological phenomena, pursuant to a State Natural Heritage Programs designation should be clearly designated as inappropriate for harvest. *Second,* our public lands cannot be seen as a source for large-scale, sustained biomass harvesting. Feeding biofuels refineries would quickly exhaust any potentially responsible biomass available within economic haul-distances, and place untenable pressure on our public forests which are held in the public trust and not for use as biofuels farms. Biofuels should not qualify toward compliance with any renewable fuels standard if the biomass is obtained from public forest lands or these high conservation value areas.[8]

- ***All feedstocks should be produced and harvested in compliance with a conservation plan to promote environmentally protective agriculture practices and avoid conversion of natural ecosystems.***

Habitat loss from the conversion of natural ecosystems represents the primary driving force in the loss of biological diversity worldwide. Activities to be avoided include those that alter the native habitat to such an extent that it no longer supports most characteristic native species and ecological processes. In particular, wetlands drained and forest plantations established after the RFS is enacted should be excluded from the definition of allowable sources of biomass. Secondly, crops grown as feedstocks for biofuels used to comply with the RFS production need to meet a valid conservation plan similar to what commodity crop farmers must in order to qualify for commodity payments. While EPA should implement the RFS overall, approving plans and monitoring compliance with these plans is more appropriately done by USDA. Specifically, we would recommend that all planted crops and crop residues be produced and harvested in compliance with a

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[8] [8] Biomass obtained from the immediate vicinity of buildings and other areas regularly occupied by people, or of public infrastructure, at risk from wildfire should be excepted from this restriction.

conservation plan that meets the standards, guidelines and restrictions provided for by Subtitle B of Title XII of the Food Security Act of 1985, as amended, and with the restrictions provided for by Subtitle C of Title XII of the Food Security Act of 1985, as amended.

- ***Before the "advanced biofuels" requirement goes into effect, there should be an assured market for fuel made from lignocellulosic feedstocks.***

Shifting the definition of "advanced biofuels" to include all renewable fuels with a lifecycle greenhouse gas emissions 50% below gasoline ensures that the RFS will provide greater global warming benefits overtime. It does not, however, provide a guaranteed market pull to technologies that can convert lignocellulosic feedstocks into transportation fuels. (We recommend that the definition be strictly limited to these feedstocks and not include conversion facilities just on the basis of not using fossil fuels for process energy. While using renewable energy for processing biofuel is an important for reducing greenhouse gas emissions, it does not necessarily address the technical challenges of deriving fuels from lignocellulosic biomass.) As discussed earlier, these technologies promise to make it easier to produce biofuels sustainably and are essential if biofuels are to make a major contribution to energy security and fighting global warming. To ensure that these technologies are pulled into the market through the RFS, we recommend that the advanced biofuels requirement of the RFS include a provision assuring a market to transportation fuels produced before the advanced biofuels requirement starts in 2016. This provision would require that up to the initial 3 billion gallon starting amount of the advanced biofuels requirement, all transportation fuels produced from lignocellulosic feedstock before 2016 would have to be purchased by blenders.

- ***Prevent backsliding on air quality by requiring vehicles using renewable fuels to be no dirtier than vehicles using conventional fuels.***

It is widely recognized that when ethanol, whether derived from corn or cellulosic biomass, is mixed with gasoline and burned in today's vehicles, some emissions go up and others go down. Further, it is understood that the magnitude of these emissions is significantly affected by both the parameters of the fuel in which the ethanol is used and the air pollution control and other equipment on the vehicles that burn the fuel. NRDC has focused most on the emissions that contribute to ground-level ozone, but we must not ignore the potential for increases in particle pollution and toxic air pollutants. I would like to emphasize that the latest scientific research indicates that our current National Ambient Air Quality Standard for ground-level ozone does not provide an adequate level of safety. Therefore, it is critically important that we continue to reduce the emissions that contribute to ozone even as we promote ways to transition our nation's transportation system to low-carbon biofuels.

EPA's Regulatory Impact Analysis that accompanied its recent RFS rulemaking found that, particularly in the areas that do not use gasoline with special limits to volatility, the use of the mandated levels in the current RFS will increase ozone emissions 4-6 percent with the possibility that NOx emissions might increase as much as 10 percent. Clearly the prospect of adopting an RFS that more than quadruples the amount of ethanol mandated to be used in the nation's fuel supply demands an examination of such fuel use on ozone impacts.

The RFS should establish a straightforward no-backsliding requirement to protect air quality by directing EPA to adopt regulations that require the emissions of any air pollutant from vehicles using renewable fuel be no greater than the level of such emissions from vehicles when using conventional gasoline. We recommend the following language:

Not later than two years after enactment of this Act, the Administrator shall promulgate regulations to ensure that standards issued under this Act shall not cause any increase in emissions of any air pollutant per vehicle mile over emissions resulting from the use of fuel meeting all standards required or adopted under provisions of the Clean Air Act in effect before the date of enactment of this Act.

- ***As an additional safeguard to the critica protections articulated above, the EPA should study the impacts as the RFS is implemented, and use its existing statutory authorities to mitigate any impacts, and waive further compliance with the RFS if significant impacts cannot be avoided.***

The RFS being contemplated as part of the energy bill would require an unprecedented scale-up of biofuels production, which will create an unprecedented shift in land use and result in many additional impacts to our natural resources. While providing safeguards now is essential to avoid swapping one set of environmental harms for another, it is also highly likely that there will be unexpected and unintended consequences from this increase. Some of the consequences may be good, but to ensure that bad ones are identified and addressed, EPA should study the impacts of the RFS on environmental and public health issues, including:

1. air quality;
2. effects on hypoxia;
3. pesticides, sediment, nutrient and pathogen levels in waters of the United States;
4. acreage and function of waters of the United States;
5. soil environmental quality;
6. resource conservation issues, including soil conservation, water availability, and ecosystem health and biodiversity, including impacts on forests, grasslands, and wetlands.

If the Administrator determines that the RFS is resulting or is reasonably likely to result in significant adverse impact in any of these areas, the Administrator should be required, using EPA's existing statutory authorities, to promulgate regulations to remedy these impacts to the maximum extent achievable or prevent them from occurring. If the impacts are unavoidable at a given level of the RFS, the Administrator should reduce the RFS volume to a level that avoids the negative impacts.

- ***Labeling, independent certification, and performance-based incentives will speed the development of advanced biofuels and encourage the adoption of the best technologies and practices.***

EPA should develop a labeling program so that consumers and policy makers can reward biomass farmers and biofuels producers who use the most environmentally responsible practices. The USDA, working with the EPA, should develop certification standards for biomass from private lands that address key environmental and social objectives, such as protection of wildlife habitat, prevention of erosion, conservation of soil and water resources, nutrient management, selection of appropriate feedstock species, and biologically-integrated pest management. We also recommend that the energy bill include two incentive programs tied to the labeling and certification. The first should reward the initial 1 billion gallons of advanced biofuels and the second should focus on those renewable fuels produced with the best possible voluntary management practices.

An expanded RFS should also be updated to accommodate renewable electricity used for transportation in emerging vehicles, such as Plug-in Hybrid Electric Vehicles (PHEVs). This can be accomplished by allowing electricity providers to opt into the program as fuel providers as long as they use smart meters to track separately renewable electricity supplied for transportation purposes. With the emergence of PHEVs and other electric vehicles, renewable electricity can be an important additional option to augment renewable biofuels to supply non-petroleum, low greenhouse gas fuels for transportation.

Conclusion

Renewable fuels hold great promise as a tool for reducing global warming pollution, breaking our dangerous oil addiction, and revitalizing rural economies, as long as appropriate standards and incentives are used to shape the nascent bioenergy industry to provide these benefits in a sound and truly sustainable fashion. I look forward to working with the Committee to accomplish this important goal.

Appendix. Basis for Figure 3.

Figure 3 compares the well-to-wheels (or full fuel cycle) emissions from alternative transportation fuels in pounds of CO2-equivalent per gallon of gasoline energy content equivalent. These estimates are largely based on GREET 1.7 beta, which does not include greenhouse gas emissions from indirect or induced land-use changes. The basis for each bar is described briefly below:

Liquid Coal (no CCD): Fischer-Tropsch fuel produced from coal without carbon dioxide capture and disposal (CCD). Based on a stand-alone plant (R. Williams, Princeton University).

Tar Sands: Gasoline made from synthetic petroleum produced from Canadian tar sands. (Based on Oil Sands Fever, Pembina Institute, November 2005)

Ethanol (Corn, Coal): Ethanol produced from corn using coal for process energy at the ethanol plant. (Based GREET 1.7 beta as modified by Turner et al.)

Liquid Coal (CCD): Fischer-Tropsch fuel produced from coal with carbon dioxide capture and disposal (CCD) from the production plant and assuming a stand-alone plant. (R. Williams, Princeton University).

Gasoline: Conventional gasoline, including upstream emissions. (Based on GREET 1.7 beta)

Ethanol (Corn, Coal, CHP): Ethanol produced from corn using coal for process energy in a combined heat and power system at a new dry mill ethanol plant. (Based GREET 1.7 beta as modified by Turner et al.)

Ethanol (Corn Average): Estimate of the national average emissions rate from the current mix of fuel used for ethanol production and the current mix of dry and wet mills. (Based on GREET 1.7 beta as presented in Wang et al., "Life-Cycle Energy and Greenhouse Gas Emissions Impacts of Different Corn Ethanol Plant Types," presentation to 16th International Symposium on Alcohol Fuels, November 2006.)

Ethanol (Corn, NG): Ethanol produced from corn using natural gas for process energy at a dry mill ethanol plant. (Based GREET 1.7 beta as modified by Turner et al.)

Ethanol (Corn, NG, CHP): Ethanol produced from corn using natural gas for process energy in a combined heat and power system at a new dry mill ethanol plant. (Based on GREET 1.7 beta as presented in Wang et al., "Life-Cycle Energy and Greenhouse Gas Emissions Impacts of Different Corn Ethanol Plant Types," presentation to 16th International Symposium on Alcohol Fuels, November 2006.)

Ethanol (Wet Grains): Same as "Corn, NG," except that plant sells wet distiller grains as a coproduct, saving the energy of drying the grains. (Based GREET 1.7 beta as modified by Turner et al.)

Biodiesel: Biodiesel derived from soy oil through fatty-acid methol-esterfication estimate including upstream emissions. (Based on GREET 1.7 beta)

Ethanol (Corn, Biomass): Same as Corn No Till, except that biomass is used for process energy. (Based GREET 1.7 beta as modified by Turner et al.)

Ethanol (Corn, Biomass, CCD): Ethanol produced from corn using biomass for process energy at a dry mill ethanol plant with capture and disposal of the CO2 produced from the fermentation process. Corn is grown with no-till practices and plant sells wet grains. (Based GREET 1.7 beta as modified by Turner et al. subtracting fermentation CO2 of 6.6 pounds of CO2 per gallon of ethanol per http://www.kgs.ku.edu/PRS/Poster/2002/2002-6/P2-05.html.)

Ethanol (Switchgrass): Ethanol produced from the cellulose in switchgrass using the lignin for process energy. (Based GREET 1.7 beta as modified by Turner et al.)

Ethanol (Switchgrass, CCD): Ethanol produced from the cellulose in switchgrass using the lignin for process energy with capture and disposal of the CO2 produced from the fermentation process. (Based GREET 1.7 beta as modified by Turner et al. subtracting fermentation CO2 of 6.6 pounds of CO2 per gallon of ethanol per http://www.kgs.ku.edu/PRS/Poster/2002/2002-6/P2-05.html.)

Sources:
The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model, GREET 1, Version 1.7, developed by the UChicago Argonne, LLC as Operator of Argonne National Laboratory under Contract No. DE-AC02-06CH11357 with the Department of Energy (DOE).

Turner et al., "Creating Markets for Green Biofuels, Measuring and Improving Environmental Performance," UC Berkeley Transportation Sustainability Research Center, publication pending.