Global Warming, Biofuels & the Energy Independence and Security Act of 2007

The Energy Independence and Security Act of 2007 (EISA) mandates an increase in biofuel production, reaching 36 billion gallons by 2022, along with numerous energy efficiency measures and renewable energy research and development. Important environmental safeguards are written in the law to ensure that biofuels are developed in an environmentally responsible manner and that they reduce global warming pollution. Scientific research will shape how these advanced biofuels develop, further our understanding of their lifecycle greenhouse gas emissions, and signal how much they can contribute to a sustainable low-carbon transportation sector. Subsequent policies and rulemakings depend on these studies, and together they will determine the true environmental footprint of biofuels.

Why Struggle with Biofuels?

Though demand reductions are almost always the cheapest, cleanest, and fastest way to reduce greenhouse gas emissions, there is no single, easy solution to low-carbon transportation. We will need increases in vehicle efficiency beyond recent increased CAFE standards, reductions of vehicle miles traveled (VMT) via smart growth, further development of plug-in (electric) cars, and a significant amount of biofuels. The pie-charts below illustrate the contributions made by these low-carbon options in achieving an 80% reduction of light duty vehicle GHG emissions below 1990 levels by 2050. This scenario is based on very aggressive forecasts for efficiency, VMT and electricity, illustrating how important it is that we figure out how deploy a significant quantity of truly low-carbon biofuels.

Chart 1: Displacing 240 Billion Gallons of Gasoline Demand in 2050

Units: Gallons of Gasoline Equivalent (GGE)

Note: 38 billion GGE of biofuels = 57 billion gallons ethanol

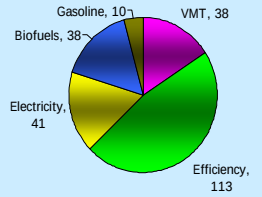


Chart 2: Global Warming Pollution Cumulative Reductions in 2050

Reduction Total = 906 MMTCO2e

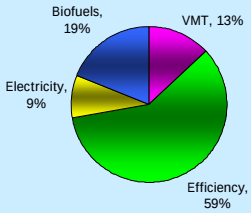
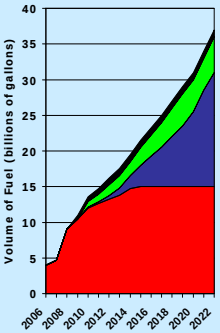


Chart 3: EISA Renewable Fuels Mandate



Biodiesel – Diesel made from renewable biomass that has lifecycle GHG 50% less than traditional diesel

Advanced Biofuel – Renewable fuels, other than those derived from corn starch, that have lifecycle GHG emissions that are at least 50% lower than emissions from gasoline or diesel (which ever is being replaced)

Cellulosic Biofuel - Fuel derived from any cellulose, hemicellulose or lignin and that has lifecycle greenhouse gas emissions that are at least 60% lower than emissions from gasoline or diesel (which ever is being replaced)

Renewable Fuel – Fuel processed from renewable biomass including crops and crop residue, plantation trees, animal waste and by-products, pre-commercial tree thinnings (but not from old-growth, late-successional, rare or imperiled forests), biomass cleared from urban areas, yard waste, food waste and algae

Energy Independence and Security Act (EISA) Biofuel Provisions

Issues:	Energy Bill Provisions	Environmental Relevance	Regulatory Process & Time Line
Greenhouse Gas (GHG) Reduction Requirements	Transportation fuel sold or introduced into commerce in the US (except noncontiguous states and territories) must contain increasing amounts of renewable fuel, as illustrated in Chart 3. Renewable fuels produced from new biorefineries are required to reduce lifecycle GHG emissions by 20% compared to lifecycle emissions of gasoline/diesel (which ever is being replaced). Lifecycle GHG emissions are defined as the net emissions/reductions associated with feedstock and fuel production, and include direct and significant indirect emissions such as land-use changes. Measured against a gasoline baseline, advanced fuels are required to reduce emissions by 50% and cellulosic fuels by 60%. However, biofuels produced from existing and under-construction facilities are exempted from these standards under a "grandfathering" provision. While the term "under construction" is ill defined, it is possible that as much as 13 billion gallons of corn ethanol and biodiesel production capacity will be exempted.	Warming of the climate is unequivocal, and how we respond to global warming and our growing demand for energy – and whether we respond in time – will determine what kind of planet we have for generations to come. The oil that powers our cars and trucks accounts for two-thirds of our total oil use and generates one-third of the U.S. carbon dioxide emissions that cause global warming. We are already seeing significant environmental and economic impacts: severe and persistent drought, sea-level rise, coral bleaching, infestation and disease, disruptions in the food chain and more intense heat waves and tropical storms. Scientists are increasingly concerned that if global temperatures rise by more than another 1 degree C, very dangerous impacts may be inevitable, including the irreversible melting of the Greenland ice sheet and dramatic sea-level rise.	GHG reduction requirements go into effect in accordance with the established timeline, as depicted in the Chart 3. According to the bill, the regulatory timeline requires the EPA to promulgate the rules by the end of 2008, however this is thought to be highly unrealistic. More likely EPA will release draft rules in late fall and final rules in the middle of next summer. National Academy of Sciences (NAS) will conduct a study which, among other things, will examine the effects of the required GHG reductions on affected industries such as feed grains, livestock, food, forest products and energy, identifying circumstances in which requirements (211(o)) of the Clean Air Act should be suspended or reduced. The NAS report is due July 1, 2010.
Land Use Protections	Renewable biomass may be harvested from crops and crop residue from agricultural land cleared or cultivated prior to the enactment of this law if it is either actively managed or fallow and non-forested. Renewable biomass may be harvested from planted trees and tree residue from actively managed tree plantations on non-federal land cleared prior to enactment. Renewable biomass can be made from slash and precommercial thinnings from nonfederal forestland, including those of Indian ownership, but not from forest lands that are ecological communities with a global or state ranking of critically imperiled, imperiled, rare, old-growth or late-successional forest. Renewable biomass may not be produced from federal forest lands, unless from the immediate vicinity of regularly occupied buildings and areas, or public infrastructure at risk from wildfire.	Conversion of native ecosystems represents a primary threat to global biodiversity loss. Natural forests provide habitat to 90% of plant and animal species living on land. Native grasslands represent the most endangered ecosystem in US. 96% of old-growth forest has been logged on private lands. Public forests represent some of the last large-scale ecosystems and contain the majority of the remaining old-growth forest and they contain vital habitat for threatened, rare and endangered species, and they provide clean water, clean air, and essential corridors for wildlife connectivity. What little native habitat remains represents the last vestiges of critical wildlife habitat and a unique ecosystem that provides many important values.	
Advanced Biofuel Studies	Grants will be awarded to proposals with the greatest reductions in lifecycle greenhouse gases, and will not be awarded to projects that achieve less than 80% GHG reductions from baseline gasoline/diesel GHG emissions.	These studies will be critical to developing the technologies needed to achieve a low carbon future. A low carbon fuel standard could be a definitive policy tool in assuring minimal greenhouse gas impacts from future fuels.	The Secretary of Energy will establish award grants and report to Congress on the feasibility of different feedstock, such as algae. $500 million dollars has been authorized to be awarded between 2008 and 2015.
Environmental and Resource Conservation Reports	Periodic reports will be submitted to Congress which will review the impacts of the GHG reduction requirements, including environmental issues such as air quality, hypoxia, pesticides, sediment, nutrient and pathogen levels in waters, acreage and function of waters, soil quality, invasive and noxious plants, and resource issues such as soil conservation, water supply, ecosystem health and biodiversity and impacts on forests, wetlands and grasslands.	Agricultural lands leach fertilizer, pesticides and sediment into water systems, causing local pollution problems as well as problems further away, such as in the Gulf of Mexico where the accumulation of environmental pressures has created a region in which no marine life can be sustained. Natural resources such as forests, wetlands and grasslands provide critical habitat to a vast variety of wildlife species in the US. The renewable fuel mandate could increase demands on these lands, possibly exacerbating pollution conditions and damaging ecosystem health.	Reviews will be conducted every 3 years by the EPA Administrator in consultation with the Secretary of Agriculture, the Secretary Energy and NAS or other independent research institute.

Lifecycle GHG Calculation: Direct and Indirect CO2 Changes from Biofuels

A recent study published in Science Magazine* has expanded the scope of the lifecycle greenhouse gas model for biofuels to include land use changes. According to this study corn ethanol and cellulosic ethanol, originally thought to produce greenhouse gases 20% and 70% lower than gasoline, respectively, actually have emissions 93% and 50% higher than gasoline, respectively. The difference is attributed to land-use changes that were not fully accounted for earlier.

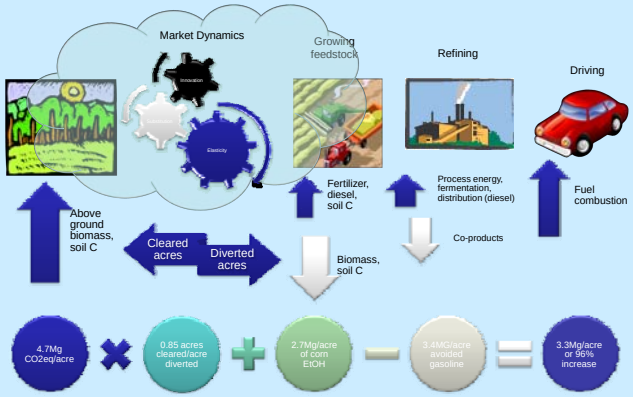
The study argues that as more corn in the US is dedicated to biofuels, agricultural exports have been reduced relative to what they otherwise would have been, creating a market signal to other countries, such as Brazil, Malaysia, India and China, to increase grain production for food and animal feed and/or to increase feedstock production for biofuels. The type of land converted plays a significant role in the lifecycle greenhouse gas calculation. Forest land conversion adds the most CO_2 to the atmosphere because of the large amounts of carbon sequestered by forests, between 604 and 1146 MT depending on the type and maturity of forest, while the conversion of grassland and savannah lands adds 75-305 MT.

While the underlying dynamics of the supply and demand for land seem undeniable, there has been significant criticism of the study's assumption, the predictive accuracy of the model, and the need to apply the concept of indirect impacts evenly between biofuels and petroleum fuels. As noted in the table on EISA biofuels provisions, the dynamics of land use change are a required part of the lifecycle GHG calculations. This means that in very short order, we need to clarify the system boundaries for indirect impacts to allow an "apples-to-apples" comparison, improve the science of modeling these impacts, and develop regulatory tools that allow enforcement of the standards required under the new law.

* T. Searchinger et al, (Feb 7 2008). Use of US Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land Use Change. *Science*

Lifecycle GHG for Biofuels Including Land-use Changes

(Based on Searchinger, et al.)



Policy Pathways to Achieving Low-Carbon Transportation Energy

To implement the minimum lifecycle GHG standards that are part of the RFS we need to:

1. Clarify the system boundaries with respect to indirect land-use changes and other indirect impacts to ensure that we are making appropriate comparisons between biofuels, petroleum fuels, and other alternatives.

2. Improve the science and predictive accuracy of the economic and physical science models used to forecast GHG emissions from indirect land-use changes and other indirect impacts so that there is a strong scientific basis for values used in state and federal regulations.

3. Optimize and transform these models into a useable and cost-effective tool for industry regulation and enforcement.

It is possible, and taking Searchinger's numbers at face value very likely, that the amount of low-carbon biofuels we can procure through real politics and real markets is much smaller than we would hope. This makes the urgency around getting a federal low-carbon fuel standard (LCFS) all the greater. An LCFS is a better approach to encouraging innovation among fuels and reducing global warming pollution than a Renewable Fuel Standard (RFS) because it is technology-neutral, allowing any type of low-carbon fuel to compete in reducing the average GHG intensity of fuels, including electricity. Furthermore while the new RFS provides a minimum level of lifecycle GHG performance, an LCFS encourages the best performance. Finally, an LCFS discourages high-carbon fuels such as liquid coal, oil shale, and tar sands, while an RFS has no direct impact on them. The stakes are high for producing biofuels in the right way: global warming, disrupted agricultural markets, eco-system destruction and more. EISA is driving forward low-carbon biofuels with an eye to these issues, but only by coupling this policy and eventually a LCFS with the best scientific and economic research can we actually get there.