IMPlications of Energy and Carbon Policies for the Agriculture and Forestry Sectors

Executive Summary

By
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**BACKGROUND**-Energy and carbon policies could have considerable sector wide impacts on agriculture and on greenhouse gas emissions from agriculture. With this policy consideration, key questions arise regarding how various energy and carbon policy instruments might impact the agricultural and forestry sectors. The 25x'25 Alliance asked the University of Tennessee’s Bio-Based Energy Analysis Group (BEAG) to analyze how several proposed policy instruments might impact land use change, feedstock production, feedstock prices, and farm income, as well as carbon costs and payments for producers. Results in this report focus on agriculture and forestry sector analysis; providing potential impacts on agriculture and forestry as a result of the establishment of a national Renewable Electricity Standard (RES) and the allowance of carbon capture and sequestration payments. This study also evaluates the potential impacts of the carbon policies on the nation’s economy through the agriculture sector impacts.

**ABOUT BEAG**-The Bio-Based Energy Analysis Group, located at the University of Tennessee, is an inter-disciplinary research and outreach group which strives to provide decision makers in government and industry with the most up to date economic and environmental analysis of the bio-based energy industry at the state, regional, and national levels. In 2006, BEAG assessed the ability of the agriculture and forestry sectors to produce 25 percent of the energy consumed by the nation by 2025 while continuing to produce safe, abundant and affordable food, feed and fiber. An additional study was conducted in 2009. Among the key findings, the study found that America’s farms, forests and ranches can play a significant role in meeting the country’s renewable energy needs, that the 25x'25 goal is achievable and that it can be met without compromising the ability of the agricultural sector to reliably produce food, feed and fiber at reasonable prices. These reports can be viewed at [BEAG.ag.utk.edu](http://BEAG.ag.utk.edu)

**ABOUT 25x'25**-25x'25 is a renewable energy initiative backed by organizations and individuals united by a common interest in making America’s energy future more secure, affordable and environmentally sustainable. Through its diverse alliance of agricultural, forestry, environmental, conservation and other organizations and businesses, 25x'25 partners have been working collaboratively since 2005 to advance the goal of securing 25 percent of the nation’s energy needs from renewable sources by the year 2025. 25x'25 is led by a national steering committee composed of volunteer leaders from the agricultural, forestry and renewable energy communities. The initiative is supported by the Energy Future Coalition. More on 25x'25 can be found at [www.25x25.org](http://www.25x25.org)

**PREVIOUS REPORT - Analysis of the Implications of Climate Change and Energy Legislation to the Agriculture Sector** In November 2009, BEAG provided 25x'25 with an analysis of several agricultural offsets scenarios under a cap and trade mechanism. Including a scenario in which emissions, including those from agriculture are regulated by the U.S. Environmental Protection Agency (EPA) and no offsets are included. This analysis projected that under EPA regulation, net farm income would fall below the established baseline, and that the agriculture sector would be subject to higher input costs with no opportunity to be compensated for GHG reduction services. Under a scenario with multiple offsets the income from offsets and from market revenues is higher than any potential increase in input costs including energy and fertilizer, and net returns to the agriculture sector are projected to be positive and exceed the baseline projections for eight of nine crops analyzed.

*The current analysis incorporates a carbon policy scenario from this November 2009 report. The carbon sequestration and capture scenario is combined with a renewable electricity standard and compared to the implementation of a renewable electricity standard alone. This analysis also includes a broader range of woody biomass feedstocks in the scenario building.*

The study has been funded by The Energy Foundation. An electronic copy of the report can be viewed and downloaded at [www.25x25.org](http://www.25x25.org) and at [BEAG.ag.utk.edu](http://BEAG.ag.utk.edu)
This study developed policy scenarios to project how meeting potential energy and carbon policies might impact the U.S. agriculture and forestry sectors. The Renewable Fuels Standard (RFS) established by The Energy Independence and Security Act (EISA) of 2007 is assumed to be continued into the future for the purposes of this analysis and serves as the baseline for comparison. Policy instruments considered in these scenarios include a renewable electricity standard (RES) and a carbon policy including carbon payments to producers. In total, including the baseline, three scenarios are considered:

1) The **EISA (Baseline)** Scenario in which the renewable fuels standard (RFS) that was established under EISA is met;

2) The **EISA+RES** Scenario under which the RFS that was established under EISA is met and a renewable electricity standard (RES) is met; and

3) The **EISA+RES+CPAY** Scenario, which meets the RFS established under EISA, meets a RES, and incorporates a payment system for carbon based environmental services. (These services include conservation tillage, bioenergy crops production, afforestation, grasslands management, and methane capture).

**KEY FINDINGS – EISA+RES Scenario**

The results of this study show that with a properly designed Renewable Electricity Standard (RES), economic returns to the agriculture and forestry sectors are significant and are projected to be widespread across the United States. Implementation of an RES would significantly add to the national economy and create over 700,000 jobs. Demand and production of biomass feedstocks in the form of dedicated energy crops are expected to increase to meet the renewable fuels standard established under EISA and to meet the renewable electricity standard (RES), but there would not be significant changes to commodity cropland use, or crop and livestock prices. With an RES carbon emissions from agricultural lands are reduced by 2025, but not as significantly as when an RES is combined with a carbon capture and sequestration payment program or in the baseline scenario without an RES.

Economic net returns to agriculture are projected to be positive in the **EISA+RES** Scenario compared with the baseline; including up to $14 billion in accumulated additional revenues for agriculture and forestry compared with EISA; these increases in net returns are projected to be widespread across the U.S.;

Positive national economic impacts are projected to occur as a result of the **EISA+RES** Scenario, including $215 billion of
additional economic activity, the creation of over 700,000 jobs, and $84 billion added to the nation’s GDP;

Net carbon emissions are reduced under the EISA+RES Scenario, but the environmental performance with regard to carbon is slightly less effective than under EISA alone;

Bioenergy feedstock production increases in the form of dedicated energy crops;

Demand for bioenergy feedstocks will cause shifts to more intensely managed pasture land; forest residues, thinnings and short rotation woody biomass crops will play a significant role in meeting feedstock demands;

Major shifts in commodity cropland use do not occur;

Major crop and livestock prices are not disrupted;

Both prices and production increase over time for beef, pork, and poultry; thus increasing gross returns for all three scenarios.

**KEY FINDINGS – EISA+RES+CPAY Scenario**

A properly designed RES and carbon pricing mechanism, which allows for carbon payments, while limiting agricultural residue removals to appropriate levels, can produce significant reductions in carbon emissions from agriculture. Implementation of these policies would provide positive economic returns to the agriculture and forestry sectors, while simultaneously strengthening the national economy and creating new jobs. Similar to the implementation of an RES alone, the demand and production of biomass feedstocks will increase in the form of dedicated energy crops without significantly changing commodity cropland use and without affecting crop and livestock prices.

Economic net returns to agriculture are projected to be positive in the EISA+RES+CPAY Scenario compared with the baseline, including up to $57 billion in accumulated additional revenues for agriculture and forestry compared with EISA; these increases in net returns are projected to be widespread across the U.S.;

Positive national economic impacts are projected to occur as a result of the EISA+RES+CPAY Scenario, and are greater than in the EISA+RES Scenario. When including multiplier effects through the economy, there is an additional $226 billion in economic activity, an addition of over 800,000 jobs and $87 billion added to the nation’s GDP;
Income from carbon payments and from market revenues are higher than any potential increase in the cost of inputs such as energy and fertilizer; Biomass feedstock production creates significant direct and indirect reduction in greenhouse gases (GHG) in the EISA+RES+CPAY scenario; Net carbon emissions are reduced 76 million tons of carbon dioxide equivalents; Bioenergy feedstock production would increase in the form of dedicated energy crops; Demand for bioenergy feedstocks will cause shifts to more intensely managed pasture land; forest residues, thinnings and tree harvest will play a significant role in meeting feedstock demands; Major shifts in commodity cropland use do not occur; Major crop and livestock prices are not disrupted; Prices and production increase over time for beef, pork, and poultry; thus increasing gross returns for all three scenarios. Adding the carbon policy to increased energy feedstock demands is projected to decrease production of the three livestock sectors by less than 1 percent each.

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*Carbon flux is amount of carbon dioxide (CO₂) released over a specific time interval.

**Many of the impacts reported in this document are estimated by comparing the scenario of interest to the baseline. The baseline contains EISA but no additional energy or carbon policy. Therefore, the impacts of EISA are not included in the impacts reported in this report.

*** Million Metric Tons of Carbon Equivalent
KEY STUDY ASSUMPTIONS

The EISA Scenario contains the RFS, which requires 36 billion gallons of renewable fuels by 2022, with 21 billion gallons coming from cellulosic ethanol and/or advanced biofuels and one billion gallons from biodiesel by 2012.

The EISA+RES and EISA+RES+CPAY Scenarios contain an RES that requires electric utilities with some exceptions to generate 25% of their electricity from renewable energy resources by 2025.

The EISA+RES+CPAY Scenario encompasses a carbon policy which entails several distinct policy instruments:

- **Carbon Price** – It is assumed that carbon use will result in increased costs at a rate of up to $27/ton by 2030.

- **Agricultural Environmental Services** – Agriculture will be paid for environmental carbon capture and sequestering services (conservation tillage, bioenergy crops production, afforestation, grasslands, and methane capture).

- **Residue Removal** – Crop residue removals fields is limited to both a carbon neutral level and a soil erosion limit. The baseline and the EISA + RES Scenario limits residue removal to soil erosion control only.

- **Fertilizer Exemption** – the energy that is used to produce fertilizer is exempt from carbon pricing.

The study used POLYSYS, an agricultural policy simulation model of the U.S. agricultural sector, to project the impacts to the agricultural sector from these potential policy scenarios, while IMPLAN is used to project the economic impacts.

No attempts have been made to estimate the changes in infrastructure requirements to move renewable electricity from where it’s produced to population centers where it can be used nor are the costs or investments of moving cellulose to meet the EISA and RES demands incorporated. Therefore, the costs, investments that would be required, and the impacts to the economy of transporting feedstocks or transmitting electricity are not included in the economic impacts of this analysis.