CORNHUSKER ECONOMICS

University of Nebraska–Lincoln Extension

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Institute of Agriculture & Natural Resources
Department of Agricultural Economics
http://www.agecon.unl.edu/Cornhuskereconomics.html

Nebraska Ethanol's Carbon Footprint

Market Report	Yr Ago	4 Wks Ago	2/5/10
Livestock and Products, Weekly Average			
Nebraska Slaughter Steers, 35-65% Choice, Live Weight	$80.69	$84.27	$84.58
Nebraska Feeder Steers, Med. & Large Frame, 550-600 lb.	112.95	110.10	115.22
Nebraska Feeder Steers, Med. & Large Frame 750-800 lb.	95.52	96.07	98.21
Choice Boxed Beef, 600-750 lb. Carcass	139.72	140.23	139.34
Western Corn Belt Base Hog Price Carcass, Negotiated	55.07	65.15	64.08
Feeder Pigs, National Direct 50 lbs, FOB	60.00	*	*
Pork Carcass Cutout, 185 lb. Carcass, 51-52% Lean	57.18	70.56	68.59
Slaughter Lambs, Ch. & Pr., Heavy, Wooled, South Dakota, Direct	92.50	*	*
National Carcass Lamb Cutout, FOB	248.62	242.93	243.26
Crops, Daily Spot Prices			
Wheat, No. 1, H.W. Imperial, bu.	5.17	4.19	3.72
Corn, No. 2, Yellow Omaha, bu.	3.66	3.59	3.36
Soybeans, No. 1, Yellow Omaha, bu.	9.87	9.63	9.01
Grain Sorghum, No. 2, Yellow Dorchester, cwt.	5.14	5.95	5.21
Oats, No. 2, Heavy Minneapolis, MN , bu.	2.01	2.47	2.26
Feed			
Alfalfa, Large Square Bales, Good to Premium, RFV 160-185 Northeast Nebraska, ton.	140.00	135.00	135.00
Alfalfa, Large Rounds, Good Platte Valley, ton.	77.50	87.50	87.50
Grass Hay, Large Rounds, Premium Nebraska, ton.	*	*	82.50
Dried Distillers Grains, 10% Moisture, Nebraska Average.	140.00	107.50	104.00
Wet Distillers Grains, 65-70% Moisture, Nebraska Average.	46.75	43.75	33.75

*No Market

A Carbon Footprint for Ethanol?

If burning a gallon of ethanol emits less greenhouse gas or GHGs (CO_2, primarily), than the gasoline it replaces then it has a smaller carbon footprint than gasoline. Actually, it is the amount of *fossil* CO_2 emitted that matters, because CO_2 from *fossil fuels* represents "new" carbon in the atmosphere, whereas the CO_2 released by corn ethanol is recycled atmospheric carbon.

By this measure, one might think corn ethanol has no carbon footprint at all. But that would ignore the fossil-based fuel that was used to produce the ethanol, that was used to produce the corn, that was used to produce the ethanol, that was used to produce the fertilizer, that was used to produce the corn, etc.

The University of Nebraska-Lincoln and other scientists have made careful measurements of this "life cycle" carbon footprint for Nebraska corn ethanol. They have found that it amounts to about 45-50 percent of the emissions of gasoline, depending on whether the corn was irrigated, whether the byproducts were dried and other details.

In addition to the direct life-cycle emissions, emissions from indirect land use change (ILUC) are being considered. These result from the fact that when much of our corn is consumed by the ethanol industry, world prices of corn and soybeans are driven up, and this provides stimulus for additional acres of these crops. If those additional acres are converted from grass or rainforest, the conversion to crops could involve substantial emissions of CO_2 that had been stored in the vegetation or in the soil.

Despite the clear logic, estimates of ethanol's ILUC emissions have varied wildly, from very little to an

amount equivalent to the gasoline emissions themselves. If we want to include ILUC emissions, we don't really know if ethanol's carbon footprint is half that of gasoline or 50 percent larger than gasoline.

Why Does It Matter?

Today, the footprint matters only in the general social sense that we'd like to know if corn ethanol is a GHG improvement over gasoline. But starting next year (2011), California rules require the average GHG intensity of their motor fuel supply to be no more than 95.61 grams of CO_2 equivalent per megajoule of energy (gCO2e/MJ). This is a fraction less than the 95.86 gCO2e/MJ for gasoline alone. Californians will need to buy low-carbon fuel to blend with gasoline to meet this standard. As years pass, the standard tightens, falling to 86.27 gCO2e/MJ by 2019 (a ten percent reduction).

Under California rules, a typical Nebraska dry mill ethanol plant using natural gas and selling wet rather than dry byproduct will have access to the California market, while the same plant selling dry byproduct will not. This is because by California reckoning, ethanol from the first plant would be presumed to have a carbon intensity equal to 94 percent of gasoline, while in the second case it would be 102.6 percent of gasoline.

But by 2017, even ethanol from the wet byproduct plant would not be purchased in California because it could not contribute to the five percent reduction in footprint needed by then. Under California's calculations, about a third of ethanol's carbon footprint is attributed to indirect land use change emissions, so calculation of ILUC emissions is very important to Nebraska ethanol.

The Renewable Fuels Association and Growth Energy, ethanol industry support groups, have filed suit against the California rules. We can expect more such litigation, given our clear inability to measure ILUC emissions with any accuracy, despite their possible significance.

At the federal level, the Environmental Protection Agency (EPA) is responsible for implementing the renewable fuel standards mandated by the 2007 Energy Independence and Security Act. According to their February 3, 2010 regulatory announcement, all corn ethanol production will either qualify as emitting less than 20 percent GHGs than gasoline (the threshold to qualify as a renewable fuel), or would be grandfathered to qualify. (By their calculations, corn ethanol produces about 80 percent as much GHGs as gasoline, compared to California's estimate of 94 percent.)

How About Biomass-Fueled Corn Ethanol?

Several researchers at UNL are collaborating on a project being funded by the Nebraska Center for Energy Science Research, to evaluate a technology that could substantially improve the footprint of corn ethanol. The technology, combined heat and power or CHP, is used in manufacturing plants as a source of both process heat and electrical power.

Some versions of CHP technology, such as fluid bed gasifiers, can utilize cellulosic fuels such as corn stover, wheat straw or switchgrass. When these biofuels replace the natural gas and coal that was previously used to produce the plant's heat and power, the carbon footprint of the manufacturing plant is reduced.

Based on preliminary results, the good news is that using this technology *the direct life-cycle footprint of corn ethanol can be reduced from around 50 percent of gasoline to about 25 percent of gasoline*.

The bad news is that it would be very expensive to retro-fit a corn ethanol plant to use CHP instead of natural gas and electricity from the grid. The capital cost at present is about $1.20 per gallon of ethanol plant capacity. This looks ridiculously large relative to the $0.70-0.80/gallon of capacity that the plants themselves have recently sold for. It is also large relative to the potential savings of about $0.10 per gallon by buying corn stover as fuel rather than electricity and natural gas.

The poor economics of CHP can be changed by several factors. Most significantly, if electricity and gas prices return to levels of two years ago, the benefits of corn stover CHP would increase a lot. Also, the federal government has a Biomass Crop Assistance Program to subsidize cellulose use, but it is in effect for only two years. Finally, if cap and trade or other climate change legislation allows for sale of carbon credits, the additional income would contribute to feasibility. Check back in a year or two.

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