

# Policies key as ethanol 'revolution' links agriculture, energy sectors

**The recent boom in production of ethanol from corn grain has tightly linked the agriculture and energy sectors in an unprecedented fashion.**

Purdue University researchers developed a model, based on a range of possible oil prices, that predicts impacts of federal economic policies on future consumer and government costs, ethanol production and many other aspects of the two sectors.

"We are living through a revolution in American agriculture," said Wally Tyner, a Purdue professor of agricultural economics. Tyner presented his results Friday at the annual meeting of the American Association for the Advancement of Science in Boston.

Tyner said the prices of corn and crude oil, which prior to 2007 fluctuated almost independent of one another, have become more closely linked thanks to the use of massive quantities of corn to make ethanol. This year that's about one-third of the total national harvest.

"Now, oil and ethanol are both big players in agriculture," he said. "In the future, they will march together, and their march will depend upon government policies."

The model shows that the fixed 51-cent per gallon subsidy paid to ethanol producers will become increasingly expensive for the federal government as oil prices - and levels of ethanol production - rise.

One alternative policy option, a variable subsidy that changes relative to crude oil prices, would only be paid by the government when crude oil sinks to less than \$70 per barrel. When oil prices are higher, ethanol production should be profitable and would not need to be subsidized, Tyner predicts.

Tyner analyzed four policy options - the current 51-cent fixed subsidy, the variable subsidy, no subsidy and a renewable fuel standard - at oil prices ranging from \$40 per barrel to \$120 per barrel. The renewable fuel standard contained in the 2007 Energy Act mandates that energy companies purchase 35 billion gallons of ethanol by 2022, with a maximum of 15 billion gallons coming from corn.

"Regardless of the policy, results become similar at high crude oil prices where the market dominates," Tyner said. "At low oil prices, however, government policies have huge effects, and all the results are enormously different. The policy choices we make will be critical."

With oil at \$40 per barrel, for example, ethanol production is not profitable without a subsidy or higher fuel costs. With a fixed or variable subsidy in effect at this oil price, the government spends \$5 billion per year to subsidize ethanol production, Tyner said. Ethanol is considerably more expensive than fuel made from petroleum in this scenario, but with the renewable fuel standard in effect, fuel companies are required to buy 15 billion gallons of corn ethanol per year. At \$40 crude, the standard would cost consumers an extra \$12 billion per year at the pump, Tyner said.

Subsidies are paid out of taxpayer dollars by the federal government, while the renewable fuel standard costs consumers at the pump, Tyner said.

Therefore, the standard does imply costs at low oil prices, when buying ethanol would otherwise be uneconomical. His model calculates the hidden cost of the standard, which tacks on an extra \$1.05 per gallon when oil is \$40. In such a situation, in other words, ethanol costs \$1.05 more per gallon to produce from corn grain than gasoline costs to produce from crude oil, and the consumer indirectly makes up the

difference, he said.

If oil surpasses \$100 per barrel, however, the renewable fuel standard costs consumers little or nothing extra. That's because at this price, ethanol production costs are very close to gasoline production costs, he said.

With today's oil greater than \$90 per barrel, \$40 oil might seem unlikely. In the last two decades, however, oil has only surpassed \$40 since 2004 and cost an average of only \$20 per barrel for most of that period, Tyner said. Reduced oil demand, global recession or any number of factors could cause oil prices to sink to \$40 once again, he said.

One of the most dramatic aspects of the ethanol "revolution" is a ballooning percentage of corn crops being made into ethanol, which prior to 2004 had always been lower than 10 percent. This year, for the first time, ethanol replaced exports to become the second largest use of the grain behind that of domestic animal feed. With a fixed subsidy in effect, the amount of corn used for ethanol increases from 12 percent for \$40 oil to 52 percent for \$120 oil, the model predicts. With the renewable fuel standard, the ethanol share is quite stable, ranging from 44 percent for \$40 oil to 47 percent for \$120 oil, Tyner said.

With the fixed subsidy in effect, ethanol production ranges from 3.3 billion gallons a year at \$40 oil to 17.6 billion gallons with \$120 oil, according to Tyner. The variable and no-subsidy policies yield 6.5 billion gallons at \$80 oil and 12.7 billion for \$120 oil.

The renewable fuel standard seems to guarantee ethanol's future, but further decisions need to be made to develop a "bridge policy" to spur investment in cellulosic ethanol, Tyner said. Cellulosic ethanol - derived from grasses, waste materials and agricultural residues - has potential to be more efficient than ethanol from corn grain, he said.

Cellulose, a complex carbohydrate present in all plant tissues, is more abundant in plants than starch. The renewable fuel standard mandates that fuel companies purchase 20 billion gallons of cellulosic ethanol by 2022. But exactly how this will be achieved remains to be seen, and future policies need to take into account the newly emerged oil-corn link, he said.

Predictions from Tyner's model point to a time in the future, roughly 2020, when gasoline and ethanol pricing follow a more stable long-run pattern, he said.

Ethanol has potential to reduce America's dependence on foreign petroleum and reduce greenhouse gas emissions, which are goals that cannot be fixed by the market alone, Tyner said. Economists call these "externalities" and suggest fixing these market failures through taxes, subsidies or some form of regulation. In this work, Tyner has focused on subsidies or regulations because taxes have not generally been used in this situation in the United States, he said.

Tyner's paper will be published this year in the Review of Agricultural Economics, co-authored by Purdue researcher Farzad Taheripour. The authors evaluated two future scenarios: one assumes that fuel standards will increase sufficiently to reduce oil demand while the other assumes global oil demand will grow faster than oil supply, resulting in what economists call a demand shock.

Tyner's paper, entitled "Policy Options for Integrated Energy and Agricultural Markets," and others are available online at <http://www.agecon.purdue.edu/papers/>.

"In the past, when you asked people what policies were important for agriculture, they would talk about target prices, loan rates and efficient payments," Tyner said. "For now all of these are gone, inoperative with high corn prices. It's a whole new paradigm."

Source: Purdue University

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