

Bringing Communities Together for Bioeconomy Discussion

As Iowa communities continue their bioeconomy discussions, they will realize that decisions and actions made in Iowa will have not only local implications, but global significance – just as worldwide events are influencing and challenging Iowa’s citizens, soil, and producers – crop and livestock. In this summary paper, as well as in discussion presentations and individual white papers, Iowa State University Extension experts share current trends and research related to Iowa’s growing bioeconomy.

Iowa’s position in global agriculture and bioenergy

(Chad Hart, Department of Economics) Iowa has been and continues to be a major agricultural production region, currently ranking number one in production of corn, soybeans, hogs and eggs; and now, a top producer in ethanol and wind energy production. The dramatic growth of Iowa’s biofuel industry places the state on the leading edge of the shift toward biorenewable energy.

The choices and issues agricultural producers confront as we progress into this new bioeconomy have economic, environmental, and social implications for all Iowans. A firm understanding of Iowa’s current and future position in the global agricultural and bioenergy markets is needed in order to discuss the opportunities and challenges ahead.

Agricultural markets

U.S. agriculture production has been on an upward trend for the last two decades with crop and livestock both experiencing steady growth, and the crop sector experiencing a highly concentrated growth the last two years. Most of the growth in crops is due to higher crop prices in the U.S. and worldwide. Higher prices are brought on by strong export demand and weak U.S. dollar; the growth of biofuel usage worldwide; lower crop production in several countries due to adverse weather conditions; and higher incomes in developing countries.

But as agriculture production values have climbed so have production costs, more than doubling during the last two decades. The higher crop values translate into higher feed costs for livestock producers. Fuel costs have risen with higher crude oil prices. Fertilizer costs have increased with greater international demand and higher energy prices. And seed, pesticide and land costs are also on the upswing.

Not only values, but production of corn, soybean and wheat has been on the increase in the U.S. and the rest of the world as well. If you exclude the U.S. from the world production totals, the rest of the world corn production has gone up 99 percent since 1980; wheat has increased 63 percent; and soybeans has increased a phenomenal 1,076 percent.

Recent projections from the Food and Agricultural Research Policy Institute (FAPRI) show the production trends for the major crops continuing over the next decade. The higher prices foster additional development of agricultural production, both in terms of land (more being devoted to crops) and technology (more research and development on crop-yield increasing technologies).

Livestock producers in the U.S. and worldwide are dealing with higher feed costs, and adjusting production patterns. In the U.S. we have seen some contractions within the meat sector. Record U.S. net farm income does not imply record incomes for all producers in all areas of the country. Individual producers still face tremendous risks in agriculture, with the potential for sizable rewards. As the world’s population grows, both crop and livestock sectors will be in demand, pressuring price higher.

Looking globally

The world's population continues to grow, putting more pressure on agriculture and energy to provide the food, feed, and fuel needed to support that population. Projections are that the world will have roughly 9.4 billion people by 2050, 2.7 billion more than today. Food, feed and fuel demands will continue to build with the population increase – making it likely that demand for biofuels will remain strong as concerns about long-run continued use of fossil fuels and impacts of climate change grow. Over 40 countries around the world are pursuing biorenewable sources of energy. Agricultural producers worldwide are at the forefront of that charge.

As mentioned above, energy prices have increased dramatically during the last 10 years. Energy prices; U.S. and worldwide economic growth advances in technologies; and future public policy decisions in the U.S. and around the world are affecting trends in energy supply and demand.

Renewable energy's place in the high energy cost picture

(Dan Otto, Department of Economics) Energy prices which had been relatively stable during the 1990s began to increase dramatically in the first decade of the 21st century. Energy markets are changing in response to a number of observable factors:

- Higher energy prices
- Growing influence of developing countries on worldwide energy requirements
- Recently enacted legislation and regulations in the U.S.
- Changing public perceptions on air pollutant emissions, greenhouse gases and alternative fuels
- Economic viability of various energy technologies

Recent historical patterns of U.S. energy consumption provide an indication of trends. Taking a look at 2007 provides a snapshot of 25 years of history and projections based on a continuation of current trends.

- U.S. economy consumed 101.6 quadrillion BTUs of energy in 2007
 - About 40 percent is used for transportation
 - 33 percent for electricity
 - 27 percent for heating and miscellaneous
- Renewable-generated electricity sources currently make up about 7 percent of energy consumed
 - 71 percent hydroelectric energy
 - 16 percent biomass
 - 9 percent wind
 - 4 percent geothermal
 - 0.2 percent solar energy

Wind-generated electricity increased by almost 21 percent in 2007 over 2006; and solar increased by over 19 percent in 2007 over 2006.

Renewable energy sources and electricity generating technologies are environmentally friendly compared with fossil fuel and nuclear technologies, but there are two main factors limiting more renewable energy use. (1) Renewable energy plants are expensive to build and operate. (2) Renewable resources are often geographically remote, making transmission expensive.

Prospects for more renewable energy increase as attention turns towards understanding and dealing with greenhouse gases, primarily carbon dioxide. The increases in demand for energy services are partially offset by efficiency improvements and shifts toward cleaner alternative energy sources and less energy-intensive industries.

Federal and state governments are offering several kinds of policies to increase the use of renewable energy. (1) Renewable Electricity Production Tax Credit, which expires at the end of 2008, has

encouraged a quadrupling of wind energy capacity over the past few years. (2) Many states have Renewable Portfolio Standards (RPS) which require electricity providers to generate or acquire a percentage of generation from renewable sources. (3) Iowa and many other states have built Renewable Energy Certificates/Credits into their RPS which allow providers to sell renewable energy certificates/credits and use proceeds for renewable projects. (4) The Renewable Fuels Standard is a phase-in for renewable fuel volumes beginning with 9 billion gallons in 2008 and ending at 36 billion gallons in 2022. It includes target biofuel amounts.

There is an excitement in rural America that comes with the rapid emergence of the renewable energy industry. But that excitement is joined by great controversy inside and outside of agriculture. At times, pitting traditionally allied agricultural interests, such as livestock and grain producers, on opposite sides of policy issues.

Renewable energy changing Iowa crop distribution and processing

(Charles Hurburgh, Department of Agricultural and Biosystems Engineering; John Lawrence, Department of Economics) Since 2005, grain prices have tripled and additional income is flowing into rural communities; land prices increased 20 percent in the last year, generating new wealth for landowners. Twenty-five to 40 percent increases in land rents are also being reported. There are many opportunities and challenges created by these economic shifts.

In addition to new demand for grain and oilseeds, biofuels have created several clear benefits.

- Some biofuels reduce overall carbon dioxide emissions compared to petroleum
- The cost of biofuels continues to drop in comparison to petroleum
- Biofuels have spurred investment in rural communities
- First-generation biofuels demonstrate the feasibility of large-scale biorefining – creating investment in second generation technology
- Farm receipts increased over a billion dollars in Iowa
- Equipment sales, housing, building construction and other services have increased sharply
- Additional rural income has spurred economic activity in rural areas

These gains have come with two challenges: uneven distribution of benefits and higher risk to agricultural producers.

The higher prices have brought more land acreage into production of carbohydrate crops. U.S. corn acreage increased by nearly 15 million acres in 2007 from 2006 and was the highest since 1944. The higher prices since 2006 should encourage farms around the world to bring more land into production and to farm existing land more intensively. Technologies such as irrigation, fertilizer and improved varieties make economic sense even to subsistence farmers as prices increase.

The future of the biofuel sector will be influenced by these opportunities and challenges. With the present and planned ethanol plants, approximately 70 percent of Iowa corn will be processed for ethanol by 2010. The growing opportunity is to modify the process by fractionation so that protein, oil and fiber streams of value are created for poultry and swine in addition to cattle feed.

Technology and policy are pursuing biofuels beyond ethanol - soy biodiesel as one example. Soybean oil, a food product, had a market before biodiesel developments, with Iowa plants capable of processing essentially all the soybeans grown in Iowa. The biodiesel plants already on line and under construction could consume 72 percent of soybean oil produced in Iowa.

The trade-off between feed and fuel may be more one of distribution and processing rather than a total quantity shortage. Processors and end users continue to adjust to the new supply and demand conditions.

Farmers are also adjusting to the new costs and returns in the bioeconomy. Higher prices and revenue will encourage adoption of yield increasing technologies that were not practical at lower crop prices. As yields increase, a much greater supply of nutrient components not used by biofuel production could become available. New demand for corn and soybeans driven by biofuels is expected to bring more land into production and increase yields. In addition to larger supplies of grain and oilseeds, larger supplies of components of the crop not used for fuel will be available relieving some pressure on feed and food prices.

Things to Remember

- Biofuels are part of a comprehensive energy program – but not a total replacement for all petroleum.
- Bringing more land into production and using more intensive farming practices will present environmental challenges and require best management practices.
- The promise and policy of biofuel is pointed toward cellulosic feedstocks – cellulosic ethanol production is technically possible, but it is not commercially feasible at this time.
- Iowa and the U.S. are leaders in the emerging bioeconomy.
- Biofuel production is in its infancy.
- Iowa is well positioned to capture the opportunities in the years ahead.

Iowa has moved to the forefront amid the shift to biorenewable sources of energy. In the past few years, Iowa has become a leading producer of ethanol and one of the top producers in wind energy. During this time there has been a substantial increase in global fuel, commodity, and food prices. Media outlets have keyed on the food price increases as a negative and deflected blame onto growth in the biofuels industry. However, there are a number of factors contributing to food cost increases.

Factors that determine the Cost of Food

(Chad Hart and John Lawrence, Department of Economics) The U.S. food marketing system is a complex system linking farms to food consumers through a number of different entities. The layers of this system include agricultural production, food processing and manufacturing, wholesale distribution, retail distribution, and consumption. The cost of food is based on the costs at each stage in the marketing system. One way to compare the various costs that make up food prices is to examine the food dollar; a breakdown of what a dollar spent on food actually pays for.

The U.S. Department of Agriculture tracks the costs in food. Their latest food dollar estimate is based on 2006 data and reveals the following.

- 19 cents of each food dollar is used to purchase farm production; the other 81 cents covers the transformation for production to the foods we purchase.
 - 39 cents goes to labor costs
 - 8 cents is attributed to food packaging.
 - 7.5 cents pays for transportation and energy.
- By comparison, over 40 percent of the food dollar was used to purchase farm production in the 1950s.
- In the 1950s, roughly one-quarter of all food was purchased and consumed away from home – today it is nearly 50 percent.
- The food dollar is also not constant across food products. In 2006 the USDA reported, by food groups, the food dollar portion attributed to farm production as:
 - Cereals and bakery products - 6 percent
 - Fats and oils - 16 percent
 - Dairy products - 27 percent
 - Processed fruits and vegetables - 16 percent
 - Fresh vegetables - 25 percent

- Fresh fruits - 30 percent
- The food dollar continues to evolve with our eating patterns and changes in food technology – linkage between farm and food prices has declined dramatically over the last half-century.

While biofuel production has been one of the major reasons for higher commodity prices, it has little impact on food costs beyond the farm gate. Higher energy prices and general economic conditions also have impacts on food costs at and beyond the farm.

The economic, environmental, and social dynamics of Iowa are affected by the recent usage increases of the state's biological bounty for food, feed and fuel. As Iowa's leaders, entrepreneurs, policy makers and researchers look to accelerate development of the state's biorenewable resources, we are seeing that other impacts emerge. Today we are making choices about our economic, environmental, and social development as well as hurdling technical issues.

Rising Energy and Food Prices: Effects on Families

(Cynthia Fletcher, Department of Human Development and Family Resources) Rising food prices and the surge in energy costs are reflected in the escalating cost of living. As measured by the Consumer Price Index, the cost of living rose during the past 12 months at the fastest pace since 1991. Since most families' incomes are not keeping pace with rising costs for everything from food to gasoline, many are facing hard choices – especially those at the bottom of the income ladder.

The energy index rose nearly 30 percent and the food index jumped 6 percent in the 12 months ending in July 2008. Because energy and food represent significant shares of consumer spending – about 10 percent and 14 percent, respectively, these price increases over the past year have had a noticeable impact on consumers' purchasing power.

Wages, on average, have failed to keep up with consumer prices, eroding the purchasing power of family incomes. Credit card debt has grown, banks are now more selective in granting loans, and those on Social Security will receive the highest cost-of-living increase since 1982.

Rising prices and declines in real wages have had differential impacts on families. Low-income families have borne the brunt of this wage-price squeeze. Using 2006 Consumer Expenditure Survey data to illustrate, families with incomes in the upper 20 percent of the income distribution spend roughly 7 percent of after-tax income on food and about 2.5 percent on gasoline and motor oil. In contrast, families in the lowest 20 percent of the income ladder spend nearly one-third of their after-tax income on food and about 10 percent on gasoline and motor oil. Their average food expenditures would have grown from about \$3,200 to \$3,400 and their gasoline bill from about \$1,000 to nearly \$1,400.

Current discussion of the impacts of rising food and fuel costs can also provide a setting for exploration of the underlying causes of the widening gap between “haves” and “have nots” and a search for solutions at individual, community, national and global levels.

As Iowans consider those social issues, they are also faced with environmental issues brought on by an increasing demand for food, feed and fuel and a greater demand from the non-farm population for ecosystem services such as clean water for recreation and drinking.

From Vulnerability to Resiliency: Iowa Agriculture in the Age of Biorenewables

(J. Gordon Arbuckle Jr., Department of Sociology; Matt Liebman, Department of Agronomy; Matt Helmers, Department of Agricultural and Biosystems Engineering; and Lisa Schulte, Department of Natural Resource Ecology and Management) At a time when demand for the food, feed, and fuel that

Iowa produces is increasing *AND* demand among non-farm populations for ecosystem services such as clean water for recreation and drinking is on the rise, we must take a look at Iowa's agricultural vulnerability and resiliency in terms of the bioeconomy.

We can strike a balance between agricultural production and ecosystem services. Decades of conservation innovation by farmers and university and government researchers have resulted in a wide array of agricultural systems and conservation practices that can dramatically improve the environmental performance of agriculture. There are pathways toward that goal and ways we can work together to improve agriculture's environmental, economic, and social resilience and sustainability.

The natural fertility of much of Iowa farmland continues to be degraded through uses that are inappropriate given local conditions. This is happening despite more than seven decades of conservation efforts by farmers, extension and conservation organizations. This creates an ecological vulnerability of the resource base that is critical to Iowa agriculture. Iowa's ecological vulnerability extends across Iowa's landscape, traverses both rural and urban areas, and crosses state borders through waterways in the form of sediment and contaminants such as nitrogen and phosphorous that impact ecosystems as far away as the Gulf of Mexico.

In the dominant agricultural system of specialized corn and soybean production, there are two areas of major concern at the farm level – nutrient loss and soil erosion. Because Iowa's heaviest precipitation periods coincide with the seasons during which corn and soybeans use little water – spring and fall – excess water travels through and over the soil, removing nutrients as it flows. Consequently, corn and soybean are “leaky” crops in that nutrients move off the farm and into streams and rivers. Each drop of water that “leaks” out of the system takes important nutrients and soil particles with it, slowly leaching away the soil's fertility, resulting in nutrient and soil loss from farms that degrades their productive capacity. These same nutrients and sediments degrade water quality and lead to contaminated streams, rivers, and lakes and contribute to hypoxia in the Gulf of Mexico.

Farm families represent only six percent of Iowa's population. Demand for ecosystem services – benefits such as agricultural production, water and air purification, flood control, insect pest suppression, pollination, and outdoor recreation that natural resources and processes provide – continues to grow among the non-farming population. As expectations about how the state's natural resources should be used change, conflicts between productive (i.e., growing crops) and consumptive (i.e., fishing) uses of the landscape will likely increase.

In terms of water quality, a unifying message to producers is to “slow the flow.” Water that is flowing more slowly transports less sediment and nutrients. Many agricultural systems and practices exist - such as terracing, grassed waterways and filter strips, and streamside buffers - that can all but eliminate the negative environmental impacts of farming.

Attainment of necessary levels of conservation will require increased cooperation between public and private organizations and individuals. We should strive for better watershed-level collaboration among farmers, agricultural associations, community groups, conservation agencies, and civic organizations that sets priorities and plans for strategically targeted application of conservation practices.

Major improvements in the environmental performance of agriculture, without significant impacts on agricultural production, can be made with targeted conservation practices. Targeted conservation is the strategic deployment of conservation practices and systems in portions of the landscape where they have the most impact. Moving toward a system of targeted conservation would take a major shift in the institutional orientations of state and federal conservation agencies. Because state agencies do not use targeted approaches, it is often up to communities to do so. Cooperation among community members at

the watershed level is an effective pathway to the simultaneous maintenance of agricultural productivity and reduction of environmental impacts. Across Iowa and the nation, people have come together at the watershed level to bring innovative solutions to environmental problems. Watershed and similar groups represent an effective means for setting priorities – targeting – and working together to address them.

The long-term sustainability of Iowa agriculture depends on collaborative efforts in which public agencies, private organizations and associations, community groups, and private individuals work together to plan and implement necessary conservation systems.