

# Executive Summary

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High crude oil prices and concerns about the environment and energy security have fueled interest in renewable energy sources. With this interest, the U.S. biofuels industry has experienced rapid expansion. This expansion has created both opportunities and challenges for energy producers, agriculture, transporters of agricultural and bioenergy products, and rural communities. As feedstocks for renewable energy are expanded from traditional sources into dedicated energy crops, new sources of risk, changes in infrastructure requirements, and need for new educational programs will likely occur. These rapid and market changes in bioenergy markets have drawn the attention of scientists, energy leaders and policy makers. In June 2008, university, private sector and government researchers were invited to a second in five conference series on the Transition to a Bioeconomy. Risks, infrastructure issues, and the evolution of the industry were the focus of this conference.

The Farm Foundation's Steve Halbrook (now located at the University of Arkansas) and Mary Thompson, along with Peggy Caswell, Jim Duffield, Vernon Eidman, Burton English, Jim Fischer, Janie Hipp, Steve Klose, Suchada Langley, John Miranowski, Joe Outlaw, Laila Racevskis, Felix Spinelli, Wallace Tyner, and David Zilberman, were on the planning team for a series of conferences on the transition to a bioeconomy. The five conferences were to focus on:

1. Integration of Agriculture and Energy Systems
2. Risk, Infrastructure and Industry Evolution
3. Environmental and Rural Development Impacts
4. Implications of a Global Bioeconomy, and
5. Extension Education for a Bioeconomy.

This Executive Summary focuses on the second conference in the series. The conference was held on June 24 and 25, 2008, in Berkeley, California. The conference was a collaborative effort and financially supported by the Farm Foundation, USDA's Office of Energy Policy and New

Uses, USDA's Economic Research Service, and the Energy Biosciences Institute. Conference participants examined feedstock volatility and the forces driving it; the impacts of volatility on the biofuels industry, Rural America, and the nation's infrastructure; and biofuels facility site selection and factors determining the location of the biofuel industry. Topics at the conference included the following:

- The Evolving Bioeconomy Industry,
- Risk and Uncertainty,
- Ownership, Site Selection and Economies of Scale,
- Issues of Second Generation Biofuels,
- Infrastructure and Policy Issues in the Bioeconomy, and
- Challenges and Opportunities of the Next Decade.

Those participating in the last two sessions participated in a round table discussion following a brief presentation.

In the opening session, [Michael Wetzstein](#), University of Georgia, provided information on *New Relationships: Ethanol, Corn, and Gasoline Price Volatility*; [David Zilberman](#), University of California – Berkeley presented *The Distributional Effects of Biofuels*; and *Biofuels, the Rural Economy and Farm Structure* was discussed by [John Miranowski](#), Iowa State University. Michael Wetzstein found that ethanol will increase fuel prices, but that increase in the price of transportation fuels will mitigate a shock's persistence. David Zilberman estimated price response as a result of changes in supply and demand. He noted that the future of the biofuel industry is dependent on innovation, with the need for agriculture to attain higher productivity. Emergence of an educational industrial complex, including public/private partnerships in research and development, will be needed. Increased attention to technology transfer issues will be critical. The evolution of the industry will be impacted by intellectual property rights and regulations regarding land use and carbon. John Miranowski in his

discussion on the impact of the growth in the ethanol industry on Rural America indicated that the expansion would have a positive impact on the rural economy, however, this impact will decrease at the margin over time. Expansion of corn ethanol over 20 billion gallons could ultimately reverse this trend and have a negative impact to the rural economy.

In the second session, elements of risk within the economy, for the farm, and for the renewable transportation fuel-based industry were discussed. Methods for managing risk were also discussed. [Gordon Rausser](#) lead off this session with a presentation, *Managing Risks Associated with Biofuels*, discussing a potential methodological approach to allocating public sector funds for research and development, which incorporates the impact of discovery from those projects, along with the effect those projects would have on the overall research and development portfolio. [Jim Larson](#) followed this talk with a discussion on farm risk. In his presentation, *Risk and Uncertainty at the Farm Level*, a number of potential on-farm risks were discussed, including risks during dedicated energy crop establishment years, harvest risks, and storage risks. In a case study, Jim reported that impacts of weather and input price risk differ depending on soil productivity. He further found that the Biomass Crop Assistance Program, recently signed into law, will have a larger impact on marginal soils. [Seth Meyer](#)'s presentation was titled *Policy Risks and Consequences for the Biofuels Industry*. Seth discussed policy risks and the impact policy might have on the bioeconomy. He indicated that the implementation of current policies in the future was uncertain. Tax credits, tariffs, and mandates and their impacts to the biofuels industry were discussed. Seth concluded with a discussion on how the Renewable Identification Number (RIN) could be used as a market driven policy tool. [Paul Willems](#)' presentation, *Managing Risk in the Bioeconomy*, provided three perspectives on risk – society, value chain, and company. He followed this discussion with how the Energy Biosciences Institute, a public/private entity, will approach research in attempts to mitigate risk.

The third and fourth sessions incorporated selected papers on ownership, site selection, scales of economy, and the second generation biofuel industry. [Tony Crooks](#) discussed *Bioenergy Ownership and Investment Models for Rural America*. In his presentation, the attributes of four different ownership business models -- Corporate, Farmer-Owned, Engineer/Builder-Owned, and Franchise -- were discussed. This was followed by a discussion on how Rural America might have the capital to invest in the biofuels industry in order to capture additional benefits through the establishment of a close-ended renewable energy fund created for investment by farmers and rural residents.

[Lance Stewart](#) and [Dayton Lambert](#)'s presentation was titled *Spatial Heterogeneity of Factors Determining Ethanol Production Site Selection, 2000-2007*. They evaluated the factors influencing ethanol production site selection using data from 2000-2007. They found that extremely rural areas may not be attractive to the ethanol industry. The primary drivers for location were feedstock access, lack of direct competition, and infrastructure availability. Applying their model, they projected potential future areas where corn ethanol plants might locate. [David Perkis](#) discussed the location of cellulosic ethanol plants in Indiana in his presentation titled *Spatial Optimization and Economies of Scale for Cellulose to Ethanol Facilities in Indiana*. He found that the northern part of Indiana had sufficient feedstocks and the density required to support larger ethanol plants than in the southern part. Based on feedstock supplies, Indiana could produce between 400 million and one billion gallons of cellulosic ethanol. In [Abhishek Goel](#) and [Cole Gustafson](#)'s presentation, *Economic Feasibility of Supplementing Corn Ethanol Feedstock with Fractionated Dry Peas: A Risk Analysis*, they evaluated the use of fractionated dry peas with corn in the production of ethanol. They found that replacing 10 percent of the corn with dry peas would reduce profits by \$0.43 per gallon. Corn prices would have to increase by 20 percent in order to break even. [Danielle Carrier](#)'s presentation was titled *The Cellulosic Biorefinery: Coproducts and Required Infrastructure*. Carriers suggested that valuable phytochemicals could be extracted with subcritical water prior to the biochemical or thermochemical conversion. This could be done at the refinery, on the farm or anywhere in between. [Sarah Brechbill](#)'s presentation was titled *The Economies of Biomass Collection and Transportation and its Supply to Indiana Cellulosic and Electric Utility Facilities*. In a companion paper to Perkis', Brechbill evaluated the potential of using Indiana cellulose production capability in electric power generation. Evaluating three power plant locations, she found that due to cost, corn stover was the preferred feedstock over switchgrass. At the Knox electric generating plant, in order to attain a 10 percent cofire, corn stover from 80 miles away would be required. However, the power generated from this cofire would be more expensive than just using coal. If a carbon credit existed for replacing coal with corn stover, the utility would require a \$10.03 per ton of CO<sub>2</sub> at the Knox plant to \$5.79 per ton of CO<sub>2</sub> at the Tippecanoe plant.

In the fourth session, [Thomas Dorr](#) discussed the role USDA Rural Development will have in the transition to a bioeconomy in a presentation titled *Rural Policy for the 21st Century*. He indicated that education regarding the various business models and partnership arrangements are needed. He suggested farmers hold \$2.3 trillion in equity, but need a roadmap and technical support, to assist in investments to

benefit from the emerging biofuels industry. He concluded that USDA Rural Development will have a significant role in the development of the infrastructure required by a mature biofuels industry and in developing an entrepreneurial spirit in Rural America. Greater resources will be focused on outreach, education, and technical support for the biofuels industry development. [Frank Dooley](#)'s presentation was titled *Infrastructure for the Bioeconomy*. He examined the demands a rapid expansion of the ethanol industry will have on this nation's infrastructure. Dooley indicated that modal shares of grain traffic will likely change in the near future, with relatively more corn being shipped to local ethanol plants by truck instead of distance markets by rail or barge. Furthermore, he indicated that rail and barge will see growth in DDGS export shipments as the U.S. market for this feed becomes saturated. He noted that, currently, ethanol shipment patterns are characterized by an industry located in the Corn Belt with demand scattered across the country. The industry is reconsidering their investments in transportation equipment and infrastructure, while government adjusts policies to effectively move ethanol to market. In [Paul Hammes](#)'s presentation, *Transportation Infrastructure for the Bioeconomy*, he discussed rail transportation and the impacts biofuels expansion has had and will have on the ethanol supply chain. Currently, unit trains are sent to California and the northeast with 20 percent of the deliveries done by unit train. Investments are being made to establish both loading and unloading unit train terminals, so that by 2015, 50 percent of the deliveries will be by unit train made to all parts of the United States. Hammes summarized by saying that the biofuels industry development occurred quite quickly placing pressure on the rail network. In particular, it presented challenges at the destination markets for the unloading of ethanol. One of the challenges has been that ethanol is moved in small units and in concentrated areas. Future challenges will be the development of rail infrastructure to meet capacity demands and more development at destination terminals. [Mark Hanson](#) presented *Legal Structures and Issues for the Bioeconomy*. Starting from the premise that bioenergy companies will be required to manage for both supply and price risk, the bioenergy companies will require a predictable supply, longer range pricing, greater control over the supply chain, and will focus on components of the plant such as oil content, sugar content, etc. Farmers will likely be faced with fewer open markets, more contract markets, and will seek ways to reduce downward market risk. These will likely lead farmers to selling production rights and the use of component pricing. New opportunities for storage and fractionation will emerge.

In the final session, Challenges and Opportunities of the Next Decade were examined. Gale Buchanan's presentation

focused on opportunities for *Research and Education for the Bioeconomy*. He noted that tremendous amounts of research are still needed to foster development of the bioeconomy. Production, harvest, storage, and conversion all beg for additional research and education programs. In [Paul Bryan](#)'s presentation, *Integrating the BioPetroleum Sector*, he discussed factors that will lead to the integration of biofuels with the current petroleum sector. Paul identified key components as the development of large concentrated supplies of feedstock, second generation technologies, industrial scale infrastructure, and sustainable business models. The products developed needed to be compatible with storage and distribution infrastructure, the existing fleet, broad blending with petroleum fuels, and in addition, must meet consumer expectations for superior performance. [Chris Groobey](#) presented *Financing the Bioeconomy* and discussed challenges to the biofuels industry, forecasting that a number of project level restructuring are going to take place along with increased bankruptcy filings. These events will occur, because ethanol margins are below the level required as a result of increased feedstock prices and lower ethanol prices. If we are to transition to a new bioeconomy, Groobey suggests that state support is essential and that the AgBanks need to come back to the market. A combination of making more money from existing plants by co-locating other facilities or finding other sources of income from the same plant is needed, and there is also a need for more and bigger business structures.

Concluding the conference, [Peggy Caswell](#) presented *What we Know and What We Need to Know*. Peggy discussed what was learned at the conference and what remains to be learned. Caswell indicated that we need to know how farmers and feedstock providers are going to have modify their business practices to meet the needs of the emerging industry. Different types of contracts and financing will need to be examined, with pros and cons of each weighed. Furthermore, educational programs regarding business structures and arrangements will need to be developed. Ethanol companies are going to need a consistent and reliable source of product, while farming by nature is very variable. In order to secure financing, the companies will need reliable supply and farmers will be taking on risks when contracts are signed. Caswell indicated much more research is needed to address these issues.

The authors and paper titles included in this book are:

- Zibin Zhang and Michael Wetzstein: [New Relationships: Ethanol, Corn, and Gasoline Volatility](#);
- Steven Sexton, Deepak Rajagopal, Gal Hochman, David Roland-Holts, and David Zilberman: [Biofuel: Distributional and Other Implications of Current and the Next Generation Technologies](#);

- John Miranowski, David Swenson, Liesl Eathington, and Alicia Rosburg: [Biofuel, the Rural Economy, and Farm Structure](#);
- Gordon Rausser and Mary Papineau: [Managing R&D Risk in Renewable Energy](#);
- James Larson: [Risk and Uncertainty at the Farm Level](#);
- Anthony Crooks, James Baarda, and David Chesnick: [Bioenergy Ownership and Investment Models for Rural America](#);
- Lance Stewart and Dayton Lambert: [Factors Determining Corn-Based Ethanol Plant Site Selection, 2000-2007](#);
- David Perkis: [Spatial Optimization and Economies of Scale for Cellulose to Ethanol Facilities in Indiana](#);
- Cole Gustafson: [Economic Feasibility of Supplementing Corn Ethanol Feedstock with Fractionated Dry Peas: A Risk Perspective](#);
- Danielle Carrier and Edgar Clausen: [The Cellulosic Biorefinery: Coproducts Extraction from Biomass](#);
- Sarah Brechbill, Wallace Tyner, and Klein Illeleji: [The Economics of Biomass Collection and Transportation and its Supply to Indiana Cellulosic and electric Utility Facilities](#);
- Thomas Dorr: [Rural Policy for the 21st Century](#); and
- Frank Dooley: [Infrastructure for the Bioeconomy](#).