

---

## *Optimizing the Value of Co-Products and Byproducts*

*Panel Discussion and Q&A*

MODERATOR: RICHARD P. HEGGS

*Battelle  
Columbus, OH*

PANELISTS:

DAVID K. JONES

*Ashland, Inc.  
Dublin, OH*

JOHN LUMPE

*Ohio Soybean Council  
Columbus, OH*

CHARLIE CARR

*The Andersons  
Maumee, OH*

*David Jones:* I've worked with Stephen Myers on the board of the Ohio Bioproducts Innovation Center (OBIC), and the key thing from the industry side is that OBIC provides the connection that we need to be able to see where the value is. The big thing about a new industry is the return on investment, and by connecting the value chain, and understanding where that value is going to be, is a huge thing. The next thing is exposure to work typically outside of your sphere of experience. For Ashland it could be genetics. We're not going to be a biotech company. We'll continue to make chemical products, but to be able to understand what is coming in the genetics field is of great value to us. Also OBIC handles some of the social issues that typically affect businesses, and that is important.

Moving on to Dr. Fireovid's talk, I liked the farm-scale concept of having sustainable local production of energy and, even possibly, of chemicals. Our company is moving rapidly overseas into some developing countries, and we see the same issues. We've got to think about how we develop these locally because the supply chains don't exist. The concepts that apply for rural energy production we can take to developing countries. There is no reason to build entire petrochemical industries in these countries when we can achieve it with new technology as you are doing with biotechnology. That excited me. Some of the co-products are crucial to the total value obtained from a biorefinery. I've had some experience in this regard. Ashland and Cargill announced about 18 months ago that we were putting together a project to produce propylene glycol from glycerin and you wouldn't believe the effort required for that, which takes me to the next talk.

Again, Dr. Bozell's talk was excellent. The experience we had with Cargill—we went into it with the exact same mentality. Wow! We are going to make propylene glycol. We're going to have these byproducts, which we will distill and sell as a range of products. Well after almost a year of engineering work, the costs just didn't play out. The whole energy balance is so crucial. When you make propylene glycol, a byproduct is a mixture of alcohols and water. To get to the specific desired alcohol we would have to add two or three more boilers and another \$2 million or \$3 million worth of engineering costs. So, we've changed our minds on this now and are thinking that we have to find a use for the co-product as is. This happens also in the petrochemical industry. For example, when you make nylon you generate a solvent that's sold as dibasic ester, DBE—a blend of various things—which has become a crucial raw material for a lot of our products. The bioindustry is going to have to do the same thing and develop new uses for co-products instead of trying to distill them down to individual chemical components because it's just going to be too expensive.

*John Lumpe:* Our focus at the Ohio Soybean Council, on behalf of soybean farmers in the state of Ohio, who also grow corn, is finding those bioproducts. What can you make with the glycerin from a biodiesel facility? What can you make with byproducts from an ethanol facility? Our focus obviously is on soybean, but our farmers raise both crops and we are seeing a lot of investment in the new-use product categories that were highlighted in the USDA listing, including adhesives and coatings. We have a great powder coating that is based on soy. Much new technology has been created here in Ohio and through the United Soybean Board. Tens of millions of dollars of soybean farmers' money has been invested in developing new markets and new opportunities, for example soy-based foam in the seats of the new Ford Mustang. Ford is talking about expanding green technology. And when such a company starts talking about utilizing soy-based products not only at one level of their vehicles, but across the board, it's real. It's happening and it's coming to fruition. And what's exciting is that the industry is recognizing that agricultural-based products are a part of the future. It's not a silver bullet. It's like energy. Biodiesel isn't the key and neither is ethanol. But put them together with wind, solar, and other new sources of energy and they can help meet the needs of the future. The speakers all hit on some very good components, not only on corn and soybeans but also biomass. What will farmers grow in the future? They will grow what the market demands. And they are excited about these opportunities.

*Charlie Carr:* I've been with the Andersons for 36 years of the company's 61-year history. About 7 years ago, President Mike Anderson approached a couple of us and said that we had some facilities that were busy for only 5 or 6 months of the year—grain and agricultural fertilizer facilities. We needed to find what else we could do with those locations and the sky was the limit. We were free to go after anything and everything. These locations are now busy 11 or 12 months of the year; employees who previously worked part time now have full-time jobs and benefits. Diversifying our business was a key to growing our business. And diversification is what we are talking about today—the

number of items that we can produce with ingredients that we work with. We handle liquid and dry products. We mix them. We bag them. We blend, package and bottle them. And it's amazing what opportunities we have in Ohio, Michigan and Indiana where we are located. And we just purchased a business in Florida. My point is, there is much opportunity for everyone in this room to work with these various products and technologies. It's a nice problem to have when you can't sort out what you should go after and what you shouldn't go after. Every week, we get calls from people asking us to work with them, asking us to support them. It's hard to sort through who has the technology that will work and what is best for us; groups like OBIC put us in touch with the right people in the right businesses to help us decide. The Third Frontier Project<sup>1</sup> has brought many dollars to the state of Ohio and my hat is off to the governors who have supported it. And along with OBIC we've got the Regional Growth Partnership and its subsidiary Rocket Ventures, the Edison Institute and USDA has jumped in with some things, and the polymer industry has large potential for us. It's hard for us to get our arms around all of the groups that are approaching us and wanting us to work with them. It's a nice problem to have, but somehow we've got to all work together and prioritize who should be working on what. At times the biggest entities are coming at us with similar offers and thoughts and that is a challenge for us.

There's been some talk about how ethanol has affected food prices and how it's a bad thing. Well, ethanol was a natural for our company to get into and we have three facilities. I don't know how the public is going to get educated, but it has been clearly shown that ethanol does not affect food prices as suggested by the news media and politicians. Informa Economics put a statement out that there's only a 0.3% increase in food prices for every dollar rise in corn. So, since 2005 until now, there's been a \$4 increase in corn and that equals 1.2% in food inflation. Now there are many other sources, but that nails it. With \$4 corn, the price of a box of corn flakes in the store is increased by \$.09 or \$.10 cents. We need to educate our world on how much ethanol really does affect food prices. Transportation costs do affect food prices; according to Informa Economics, \$.20 out of every dollar in food is for transportation. So, we need to be looking at some of that. When we talk about waste products from ethanol production, right now we are able to market 100% of distillers dry grains (DDGs) with the majority going to animal feed. At some point there are going to be more DDGs than we can sell to feed producers, so many companies are working on alternative uses. That's an opportunity for many people in this room and an opportunity for us.

When we talk about the polymer and other industries needing corn or soybeans to develop new enzymes, everyone says that it's in place. We can identity-preserve those crops and store them separately. The only caution I have about that is to start planning now, because to identity-preserve and store small quantities is a challenge for a larger company, and then as the business grows and you need to do it in larger quantities, that's another challenge. So we keep saying that we are prepared, that we are ready, and we do know how to do it. We've done it in soybeans for years but each industry is different and each

---

<sup>1</sup><http://www.thirdfrontier.com/>

volume requirement is different. So we need to be talking about that now if it's going to happen 5 years from now, 10 years from now, whatever the plan is.

Our company cooperates with the coal-fired power industry to produce electricity. We supply the reagent that is sprayed into the stacks to bring the “bad guys” down. One compound thus captured—ammonium sulfate—comes out in a liquid stream for reuse as fertilizer for agriculture and turf production. We can't haul water very far so we employ a technology that granulates the stream into fertilizer. That's a prime example of what we can do with a waste product to everyone's benefit

*Richard Heggs:* Now is the audience-participation portion of the session.

*Tom Richard (The Pennsylvania State University):* When we talk about co-products and making materials and polymers from them, we need a feedstock to start with. And that feedstock could be a co-product from an energy facility, but also could be the primary feedstock of the energy facility, sugar for example. First-generation biomaterials companies, NatureWorks and now DuPont, for example, are using sugar as a feedstock for polymers. The question I can't work through is, if you're making sugar from a feedstock and you have different pathways—given the diseconomies of scale in a biorefinery because of feedstock aggregation—why would you employ two processes that produce small quantities of energy and small quantities of materials or biochemicals versus choosing one and focusing on that?

*Joseph Bozell:* I guess the issue is what would a biorefinery look like with regards to scale. In our evaluations we are not looking at small operations making small amounts of fuel and small amounts of chemicals. We would be looking at something that we would hope would begin to approach the scale that would give you economies similar to a petrochemical operation where you make a large amount of fuel and a sufficient amount of chemicals to economically support that large amount of fuel. If a process makes 50 million pounds a year of something, that is probably not going to pay off. Certainly, it isn't going to pay off for a fuel operation. It might pay off for a chemical operation and there may be chemical facilities, chemical producers, that would like to take sugar, make sugar, buy sugar, and use it as one portion of a larger chemical operation because it's profitable. One of the things we are trying to look at, though, is how one can incorporate the nation's energy needs into this and that takes you to a different level of operation. It scales up the biorefinery where we would hope we wouldn't run into those diseconomies of scale you are talking about.

*Richard:* That's one model. We are going to have these very large biorefineries, but I think there is another paradigm out there and maybe Bob could speak to that—the decentralized strategy and whether it makes sense to have the two.

*Robert Fireovid:* This is an interesting question because we just went through a lengthy dialogue internally in ARS, the national program staff, about how we are going to organize

the bioproducts and bioenergy programs, because they are separate programs, specifically in relation to co-products. And the final decision that we came up with is that co-products that are very much associated with a biorefinery—like DDGs or DDG-derived products or glycerol or glycerol-derived products—will be managed under the bioenergy program. Other co-products, not necessarily from a biorefinery for fuel production, but from a corn wet-milling operation or something like that, will still be managed under the bioproducts program. And you've got examples today of the economies-of-scale kind of situation; for instance in Blaire, Nebraska, Cargill is putting its PLA plant right next to its huge corn wet-milling plant. Wet milling, of course, is a large-scale operation and in such situations you are going to have multiple products based on sugars. For dry-grind and particularly small-scale dry-grind operations, they won't have enough byproducts in many cases to justify the capital investment required to make value-added products. It's going to be economics driven on a case-by-case basis by the investors in the facilities. We are interested in developing, to the extent that we can, co-products that can be economically made at a smaller scale for the reasons that have been elucidated before. We want to help the rural economies. We think that this is the best way to do it, to help rural communities capture the lion's share, or as much as possible of the economic returns that are going to be generated in this new industry. We can do research that will push it in that direction, but ultimately it's simply an economics-based business decision.

*Heggs:* Let's say a forward-thinking and progressive state government was going to put a pot of money out there, let's say \$50 million, to foster innovation and grow this industry. How would each of you prioritize the spending of that \$50 million to get the best return?

*Stephen Myers:* Well, in this particular case, I think that hypothetical \$50 million has some caveats in it. They are expecting a pretty quick return on the investment in terms of job creation, so that begins to set some guidelines about what projects it should support. The other thing is there are going to be caveats that there needs to be strong leverage in private sector with that funding. So, since you have a short time frame you would want to use some existing groups, already in place, that focus around that area and put together an evaluation of particular projects that fit the criteria, for implementation as fast as you can and try to do it faster than other groups.

*Fireovid:* At the Advanced Technology Program at National Institute of Standards and Technology, we had pots of money like this. It was higher risk and a bit longer term, and was made available to for-profit companies for research. They could involve university or federal labs, *etc.*, as well as their own. That worked well for us because market pull was involved in whatever they were doing.

*Bozell:* We had a similar hypothetical in Tennessee. Just last year the state government authorized \$40 million for construction of an ethanol-from-switchgrass biorefinery and eventually co-products, and also a fairly large pile of money for operating expenses and a component for research. The prioritization process was to make sure that we had alloca-

tions to all parts of the value chain, and one of the key components was getting it through the Tennessee legislature in 18 months, which was presented to me as unbelievably fast. And one of the components was making sure that the people on the producing end, the farmers, were intimately involved from the start. The producers were already on board with a guaranteed income for 3 years to allow us to have the feedstock that we could then feed into our biorefinery development along with an allocation for research funds to develop the technology that is the gap that I pointed out, in order to try to fill that gap all across the value chain. And we are hopeful that that is a model that will also work. It certainly has received a lot of favorable play in Tennessee and we are hoping it will be a model that others will want to consider.

*Carr:* If anyone in the audience gets the \$50 million, remember The Andersons—we want to work with you. We are Ohio. We've been here since 1947 and we are here to stay. We want to work with Ohio people and when we start hearing that these dollars are available, we want to make sure we stay on top of what is going on in Ohio and we stay in touch with the companies that have the ideas for co-products and byproducts in this great industry in this great state. If we are the ones who receive the \$50 million, we've got to organize our thoughts, determine what the best products are for us to market but it will take other companies and other associations in Ohio to make it happen. Each of us should assume that that money is going to hit somewhere and we've got to work together to bring the most dollars and the most new jobs to Ohio. That would be our game plan—to see what we can do to contribute the most.

*Lumpe:* The money is available. The \$50 million is going to be there, but it's the value chain, it's working together. It's groups like OBIC, who have been out in the forefront of this. We were one of its founding members. It's very important to us and to the farmers that we represent that this industry now is in—many of you have heard the term—the “valley of death.” This is where capital from government is necessary to catapult this industry forward and make it happen. But, it needs all sectors of the value chain working together to make it happen. And it's going to be an investment portfolio. I believe they are looking at a 3-year payback out of this, so you are going to have to look at short term, medium and long term, but it has to be job related. And we can't sit around and do a bunch of studies and that type of thing. We have to look at what is here and what is the future of this and make sure that it happens, because this is our time for Ohio to shine. It's very exciting. The first bioproduct project that we invested in was back in 1994, so now that we can see this happening we have products being commercialized. We are selling licenses. It's an exciting time to be an Ohioan. Now is the time to make it happen. We have to work together.

*Jones:* As the others mentioned, this money is about job growth and we need to focus on things that are going to create jobs. For me it's not a long-term research program but maybe taking some of these projects that were mentioned earlier and even yesterday, some of these things that are coming from soy or coming from the grains that The Andersons

deals with and expanding those to make Ohio a leader in those types of products. One that was mentioned yesterday was a soy toner for print cartridges. Where is that manufacturer? Is it in Ohio? Well, why not? Lets get somebody making that. A paint plant, can employ twenty to thirty people. That's where I think the money should be spent, because it's for job growth.

*Steve Pueppke (Michigan State University):* My question relates to the interface between industries and the universities or the Agricultural Research Service. I'd like your thoughts on what makes it tough. To some extent, I exist in this space and am involved in discussions of this sort. They are tough in the sense of structures and how we work, getting from the universities what needs to move out into the private sector.

*Jones:* I spend a lot of time with universities, trying to license technology, and it can be frustrating. Every state has its own rules about what companies can have and not have. We want to make money on this technology, but the university also wants to make money so you have this back and forth. I am encouraged that, across the nation, universities are investing a tremendous amount in this space. Michigan State is an example of a leader in making investments here. And I like the fact that start-up companies are spinning off from these universities and then the university licenses that start-up company, and then we as a bigger company can move technology faster with those small companies than we can with a state university. So I like what's coming. The trends are there. I keep hearing about the new kids coming up with biochemistry majors and all the great things universities are doing. You guys are the ones who are really developing the infrastructure and the new work force. Somebody used the phrase "the green collar work force." I see the young kids today becoming that, but the ease with which the state government makes it possible for industry to license technology is still the hang up.

*Fireovid:* The university and corporate relationships that work best are those that are true partnerships. Situations where a technology is developed and then is given to the Office of Technology Transfer to find a potential customer or licensee don't work as well as partnering with a company up front, early on. You have champions on both sides. You have a champion on the commercial side and one on the academic, research side, and they work together throughout the process to develop something that can be used by the companies successfully, and everybody, of course, wins. For government-university collaborations, we are pushing our scientists to work with the best and the brightest, wherever they are, in terms of alliances and research collaboration. That may be inside ARS. It may be outside ARS. Finding the right partners and then working with them is the key.

*Myers:* We have interacted with many different cultures; even within academia—colleges and departments—every situation is a little different as it is with different companies. If you are working on a huge grant proposal, it's advantageous, as Bob mentioned, to get everybody together in the very beginning. We've found that independent facilitation can be advantageous, maybe a private group to coordinate a grant, or some other kind of

neutral body to facilitate discussions, but get everybody in the room in the very beginning to lay out expectations very clearly. Lay out the milestones very clearly. Everybody moves at a different speed. Sometimes a researcher is moving at 20 mph and if you bring that person into 70-mph traffic that doesn't work. Expectations have to be established quickly so that people know what's going on and can choose whether to be involved or not. The interface between cultures is a challenge, but it's also an opportunity to figure out how to deal with it.

*Carr:* I agree with everything said, but I think the important thing is not to wait until you have a project and contact a university. It's better to build relationships, as we have, over the years. We have a great working relationship with Ohio State and a wonderful working relationship with Michigan State.