

Global Sustainable Bioenergy Project offers a new approach to key bioenergy issues

Bioenergy (fuels and electricity from plant biomass) could potentially contribute to addressing sustainability, energy supply and rural economic development challenges. However there is still uncertainty and controversy about the extent to which bioenergy should play a major role in a transition to a sustainable world. The Global Sustainable Bioenergy (GSB) Project seeks to bring clarity and resolution to this situation. In this interview, **Professor Bruce E. Dale** (BD) of Michigan State University, USA and Editor-in-Chief of *Biofuels Bioproducts and Biorefining*, and GSB Project Steering Committee Chair **Professor Lee Lynd** (LL), Dartmouth College, USA, discuss the GSB project and large-scale bioenergy production.

BD: Well Lee as you know there are an awful lot of analyses and meetings going on about bioenergy. Could you tell us how the GSB project is different from those or unique in its own way?

LL: Sure, thanks Bruce. There are lots of useful studies, analyses and meetings. Most of these focus on probable futures, use the present as a point of reference and seek to reflect expert opinion. Although all of these are useful and reasonable, the GSB project differs with respect to each one of these features. It is obvious that the currently most probable paths do not lead to a sustainable world, so there is a need to put aside current reality and probability (in a physical, technological, policy and land use sense) and look at what's physically possible. If it can be shown that it is physically possible to reconcile large scale biofuel production with land use concerns, then we think that we will have really moved



Bruce E. Dale (left), MSU and Lee Lynd (right), Dartmouth College

the understanding of this issue forward and will inform the question of how do we get from here to there? Related to this, our point of reference is not the present but rather possible sustainable futures. Finally, rather than only reflect current expert opinion, which is sharply divided, we want to do new analysis to inform expert opinion and build new understanding and consensus thereby.

BD: OK thank you. If I understand right, you have the project broken up into three stages overall. Could you describe briefly what those are and how they fit together?

LL: Yes, stage one is a set of conventions, one on each continent in the world, scheduled for the first half of 2010. Stage 2 is to consider the physical possibility of gracefully reconciling large-scale bioenergy production with feeding humanity in the future as well as preservation of habitat and environmental quality. Stage 3 is to analyze and recommend transition paths and policies informed by stage 2 results.

BD: Focusing on your stage 1 meetings, can you give us an idea of some of your specific objectives, how you will structure the meetings and what you hope to get out of them?

LL: Essentially the objectives are directly related to the outcomes. We want to gather the advice of the expert community on how to structure stages 2 and 3. So for example, what disciplines, individuals or databases should be involved and how do we go about trying to test the physical hypothesis? Input and advice will also be gathered on stage 3. We want to pass two types of resolutions – one type will be a common resolution that will reflect the thoughts of the attendees of all five meetings. In addition, there will be five continental resolutions. Bioenergy looks pretty different in Africa compared to Europe compared to Latin America. After the continental conventions have been held, we will put into a report input on structuring stages 2 and 3, the five continental resolutions, and the one common resolution. We hope that this report and the process leading to it will build the momentum, visibility and development of ideas that will be necessary to set the stage for stages 2 and 3.

BD: I can imagine a really large number of stakeholders that might be interested in this project. Who are they and how are you planning to involve them in stage 1 and beyond?

LL: We're interested in technical experts in fields related to the production and evaluation of bioenergy with a particular emphasis on feedstocks and land use – to include agriculture, energy crop development and production, soil science, water quality, global climate information systems, demand forecasting, policy analysis, economics, rural development, culture, ethics and equity. We're also interested in people who are involved in the policy domain – who are charged with determining the course the world should steer. Many of those people are in government, some are in NGOs, and we would certainly like their input in the process. So basically our stakeholders are experts, people who are impacted by the perceived merit of bioenergy and also the growth of bioenergy industries, as well as people who are concerned with the environment or economic developments in the developing world. As you say, it's a very broad group of stakeholders because we think frankly that a very broad cross section of people ought to have an interest in bioenergy. In terms of how we are planning to involve people, first of all, we need to publicize the process and the conventions, as well as other similar outreach efforts (using people's networks, address lists, informal contacts etc to get the word out). Secondly, we plan at the conventions to engage the community, get their input and invite their participation. At the meetings we have in mind we will not be passively sitting and listening.

BD: If I understand correctly, the goal of the GSB project is really oriented towards liquid transport fuels but I want to make sure whether that's correct or not – is this primarily liquid fuels or are you also considering biopower?

LL: One of the things that people tell us is that the needs and possibilities for bioenergy in different global locations are different. I was in Kenya recently and cooking, or in general, meeting the needs of rural communities, would probably be the biggest concern in that country and across Africa, probably more than transportation fuels. I think for much of the world one can say the most unique thing that biomass can do relative to other energy sources is probably to provide energy storage for

transportation and therefore it's a focus but not an exclusive focus of the exercise because there are places in the world where there are other natural priorities. So we're considering liquid fuels as well as power and household needs which in much of the world are a significant need that biomass meets now, with various levels of satisfaction.

BD: To paraphrase, the major focus of the GSB project is actually a resource sufficiency issue and it's oriented if I understand you correctly to this graceful reconciliation, to use your words, of the many competing demands for the biomass that land can produce, whether that's for transport fuels, food or feed and how can those competing needs for biomass be reconciled, if they can be. As you mentioned earlier, the goal you've set for scale is 25% of total mobility. Can you elaborate on what the thinking is behind that number?

LL: Simply put, we wanted a number that's big enough to clearly matter on the scale of meeting the sustainability and security challenges that the world faces and we feel that 25% meets that threshold. It's not intended to be particularly a target or an upper limit. We don't think it's necessary to think about meeting 100% of any given energy need in order to be very important and so we chose it to be big enough to matter. However, we're not thinking about things on a 2, 3, 4, or 5% scale.

BD: Can you identify for us who the key participants are thus far and the sponsors for the project and how you got the project rolling?

LL: For stage 1 we have a three member steering committee, which is Nathaniel Greene from the Natural Resources Defense Council, Tom Richard from Penn. State and me. One weakness is that for a global project it's all people from the US; that reflects that this project began in the US. We call it the stage 1 steering committee because by the time we get to stage 2 it's expected and desired that we would have a more internationally balanced steering committee. We also have an organizing committee for the stage 1 meetings which consists of the chairs and co-chairs of the five different meetings (see <http://engineering.dartmouth.edu/gsbproject/>). We're

also finding that program committees are also emerging and so it's progressing in a web-like fashion which I think is terrific. Sponsorship for each of the stage 1 meetings has come from the continents in which the meetings are occurring and at this point we have almost completed securing support for the stage 1 meetings. In terms of how the project was initiated, no request for proposals was issued, it was essentially the members of the steering committee and subsequently the organizing committee for stage 1 deciding that this was important to do. We're all volunteers; none of us are compensated in our work for stage 1. That's partly intentional: for this project to succeed as I hope it will, and I would argue it needs to in terms of building a consensus for bioenergy, all sorts of new people have to get involved who aren't identified, who I don't know at this point and it is easier to approach them on the same base as we are, i.e. as volunteers who are not getting compensated. Essentially it was just initiated in a grass roots, bottom up, democratic way in the sense that some people decided that this was important and so far the response has been very gratifying.

BD: Can you tell us about how the project has been received so far and who is participating outside of North America?

LL: The two chairs of the African meeting are Emile van Zyl, who is Professor in Microbiology at the University of Stellenbosch in South Africa, and August Temu, who is Professor of Forestry and Director of Partnership at the World Agroforestry Centre in Nairobi, Kenya. We've had a fascinating series of conversations, for example, involving people in both Africa and also a member of the Latin American program committee (Maria Mercedes Roca), about the possibility of bioenergy being an asset in addressing food security and poverty. As I speak to people within the context of the GSB project, who are actually in countries where food security and poverty are major issues, we are exploring together the potential for bioenergy to be a positive factor, which would be exciting for multiple reasons. So that's just an example of the type of discussion that is ongoing. The first meeting will be in the Netherlands and I must say that the effort being

put in, especially by Patricia Osseweijer, Managing Director of the Kluyver Centre for Genomics of Industrial Fermentation at Delft University of Technology, which will be the host institution, is remarkable. Andre Faaij, Associate Professor and Coordinator of Energy Supply and Systems Studies at Utrecht University, is the co-chair of that meeting and an active program committee has emerged. José Goldemberg is one of the co-chairs of the Latin American meeting along with Carlos Henrique de Brito Cruz, who runs the São Paulo scientific research agency, FAPESP (Fundação de Amparo à Pesquisa do Estado de São Paulo). José Goldemberg is one of the most senior and influential people who has been involved in biofuels, he's the godfather of the Brazilian ethanol industry and recently won the Blue Earth Award in part for his involvement in the first Earth Summit in Rio. In the US, the meeting is going to be in the Twin Cities in Minnesota in May. Jon Foley, Director of the Institute on the Environment at the University of Minnesota, is the meeting chair and John Sheehan is working with him closely on that. Chris Somerville, Director of the Energy Biosciences Institute at the University of California Berkeley, and Anne Swanson, Executive Director of the Chesapeake Bay Commission, are on the program committee for that meeting and plan to attend. The Asian meeting is the least developed. Reinhold Mann, who is Senior Vice President of Research and Development at Battelle Science and Technology Malaysia, formerly of Oak Ridge National Laboratory, is working with us there along with others.

BD: Sounds like you've linked up with some really powerful folks here. Looking back say three or four years from now when the project has concluded and all the reports are written up, what do you hope that you will have accomplished and what would you view as the landmark accomplishment for the GSB project?

LL: I would like to increase and broaden understanding and consensus with respect to the physical possibility of producing bioenergy on a very large scale without compromising ability to feed the world, wildlife habitat and environmental quality.

I think if we could do that one thing, and my feeling is that really effective projects succeed when they have a defined goal as opposed to a matrix of ends and means, we would be making a really important contribution. If we approach the issue in an unconstrained way with respect to the present, and on a global scale, we would change the bioenergy debate and the understanding that underlies the debate because currently there are very well intentioned people who are totally unconvinced that the graceful reconciliation we seek is physically possible. If you imagine being in the position of a policy maker getting contradictory input from people, it's hard to blame them for wondering what to do and being worried about making a mistake. Now beyond saying that large-scale bioenergy production is possible, I hope we can do two other things. I hope that we will not only say that it can be done but also gain more understanding of how it can be done, informed by the very different circumstances around the world both in human and geographical contexts. That in turn will make clear and put in a new light what we need to do next. So in a nutshell, I hope we can accomplish three things: 1. reconcile and achieve greater consensus on the physical possibility of bioenergy-intensive futures; 2. gain insight into what those desirable and sustainable bioenergy intensive futures would look like; and 3. inform (by virtue of points 1 and 2) what we need to do next to get there.

BD: You've written and presented an awful lot on this overall sustainable resource transition. Other people are commenting on it too and it's a theme that's out there now more than it has been – what we are really involved in today is an unsustainable economy and way of life and we have to get to something that's more sustainable. It's not just energy (although that is a key activity that is a large part of these other transitions), so would you speak to the other aspects of the sustainable resource transition: the similarities and differences, any potential conflicts as you see it, or potential points of synergy between bioenergy and the other sustainable resource transitions that we have to undergo?

LL: Let me try to focus on the similarities and differences. For all sustainable resources and end use sectors, paths to a sustainable world have the following features in common: they all involve changes, these changes in all cases are large, they are multiple changes and they are complementary changes, in the sense that many things change which collectively make something possible when individual changes would not. Also, I think that these changes, in general, are currently improbable. I think that's true of biomass, photovoltaic electricity generation (in the context of it playing a major role), wind and nuclear. In all of these cases we need multiple, large, complementary and currently improbable changes. If we had single solutions that are currently probable and/or small changes, we would make them. The problem is we don't have those options. While bioenergy has much in common with other sustainable energy resources, it differs because it intersects with land use and agricultural and food production issues, and that needs to be addressed. Many people who consider energy policy are not used to thinking that they need to address policy in those spheres but for bioenergy to work, we very likely do.

BD: I think it's likely that for any of these large-scale energy options to work very well for us, people are going to have to get well outside of their comfort zones and many people are going to have to be stretched, perhaps beyond what they have done before. You're actually a very good example of stretching yourself: you've spent three decades in a variety of aspects of biofuels, you've done science issues, technology, public policy, resource and environmental analysis and you're also an entrepreneur. I see elements of many aspects of your background in the GSB project - why do you think this way, what's led you to this point and how do you see your different activities in the past interacting with your GSB activity from here on?

LL: Basically Bruce, I think the sustainable resource transition is the defining challenge of our time. I would point out that there have really only been two prior major resource transitions in

human history. The first one was going from a hunting and gathering society to a pre-industrial agricultural society. The second was going from a pre-industrial agricultural society to a pre-sustainable industrial society which is where we are now. There are many indications that in the next century, which is less time than the first transitions while at the same time there are more people now, we need to undergo this third transition and if we fail it will be a great tragedy for humanity. I want to be of service in trying to address this. I've picked an application, namely bioenergy, and I am very broadly involved in it. That gives me a distinctive perspective but it also means that I have to manage some issues of perception and

association. To some extent I suppose my various activities may compromise each other in some people's eyes; on the other hand being involved in all these pieces makes me see how they might fit together and I hope people give me some credit at least for having been involved in this area for a lifetime. For example, I'm very dedicated to the success of Mascoma Corporation but I've been thinking about the public interest in bioenergy for a lot longer than that. Ultimately, I'm trying to be of service during my time on this earth, I see the sustainable resource transition as a really pressing need for humanity and while I think that there's a place for people who are experts in one thing, there is also a place for people who are trying

to understand how the pieces fit together, and that's basically what I'm trying to do.

BD: Well I happen to agree with you very strongly about the sustainable resource transition being the defining challenge of our time. *Biofuels, Bioproducts and Biorefining*, in its own way, is also seeking to make that transition possible: we're trying to serve in our own niche exactly that particular objective, so we look forward to covering future updates on the GSB project.

Bruce E. Dale, Michigan State University, USA, E-mail: bdale@egr.msu.edu and **Lee Lynd**, Dartmouth College, E-mail: Lee.R.Lynd@Dartmouth.edu