The Role of Biomass in America's Energy Future
Summary of February 2004 Public Meeting

Lee Lynd, Mark Laser, Nathanael Greene, and John Sheehan

A public meeting to present the status and organization of The Role of Biomass in America's Energy Future (RBAEF) was held on Monday, February 23 at the American Association for the Advancement of Science in Washington D.C. Publicity for the meeting was carried out electronically based on mailing lists compiled from lists contributed by several organizations and was ably coordinated by Ms. Billie Christen of the National Renewable Energy Laboratory. A copy of the meeting announcement is attached. The meeting was attended by 113 people representing a broad range of organizations and interests, including academia, industry, government, and NGOs. A list of meeting attendees is attached. The members of The Role of Biomass in America's Energy Future (RBAEF) project would like to thank all who attended the meeting, which enabled the group to introduce the project and receive valuable feedback. It is our hope that meeting attendees find this response to be satisfying, and that those who did not attend the meeting find it to be informative.

The meeting agenda featured morning presentations by the three sponsors—the Department of Energy, the Energy Foundation, and the National Commission on Energy Policy—and by RBAEF members who described the project objectives, themes, and working hypotheses, and provided a task-by-task overview of the project. Key points made in these presentations included:

- Biomass productivity can be much higher than most studies have assumed, especially if the country makes an effort comparable to that invested in increasing the productivity of corn kernels.

- Production of perennial grass could potentially produce the same amount of animal feed protein per acre as soybeans while producing a large amount of feedstock for energy production.

- Advances in conversion technologies are readily foreseeable and offer exciting potential for co-producing light- and heavy-duty vehicle fuels and electricity

- Available information supports the working hypothesis that biomass can play a large energy service supply role on little or no new land

- Preliminary environmental impact analysis suggests mature biomass-based energy has no barriers and many potential benefits—the National Resources Defense Council and Union of Concerned Scientists have endorsed biofuels from an environmental perspective, stating that "cellulosic ethanol is at least as likely as hydrogen to be an energy carrier of choice for a sustainable transportation sector."

In the afternoon, breakout sessions were held at which the floor was open for comments, questions and feedback. Topics for these sessions were: 1) biomass production, 2) conversion

technologies, 3) resource sufficiency, 4) environmental impact, 5) transition paths, and 6) policy options. Lively discussions ensued in each breakout session, with many valuable comments and perspectives offered. *Please note that corrections from meeting attendees to our summary of comments and perspectives will be/were accepted during a six week period following the posting of this summary and electronic notification of meeting attendees.*

A central theme and key working hypothesis of the project is that there are scenarios in which biomass could provide a very large share of energy services in the transportation sector while honoring environmental and wildlife habitat objectives. For example, a scenario was presented at the meeting in which current light duty mobility requirements are met from biomass with no allocation of land beyond that already devoted to agriculture. We had expected this issue to be a major point of discussion. However, few if any comments on resource sufficiency were made in the breakout sessions, which included a session specifically devoted to this topic.

By far the main concern expressed at the meeting was in response to the project's focus on switchgrass and exclusion of other biomass feedstocks. One attendee summed up this sentiment by saying "Perhaps the project should be called *The Role of Switchgrass in America's Energy Future."* In the remainder of this meeting summary we explain the basis for our current focus on switchgrass, describe our interpretation of the feedback we received at the meeting in light of this rationale, and we present what we plan to do in response to this feedback.

Rationale for a focus on switchgrass. In designing the RBAEF project, our central goal was to define and evaluate scenarios by which biomass can make a major contribution to providing energy services. We felt it was important to do detailed analysis of a broad range of conversion technologies in this analysis, and also to pay close attention to environmental issues. We also wanted to contain the scope of the project so that this first-of-a-kind analysis did not become unwieldy and so that the budget did not become so large as to preclude any chance of getting the project funded. Our judgment then, and now, was that the fundamental question of whether biomass can play a large role in supplying energy services while meeting sustainability and environmental objectives can be approached meaningfully based on analysis of a single feedstock, and that switchgrass is a particularly appropriate choice for a model feedstock in this context. Given our desire to contain the project scope as described above, we submitted a proposal with switchgrass as the model substrate.

Interpretation of feedback received. We heard from many attendees various forms of the question 'If we are defining biomass-intensive futures, why not consider many available sources of biomass rather than just one?'. In our view, the importance of this question depends on the stage of the analysis. We believe that examining the question of whether it is possible do define scenarios in which biomass could desirably play a very large role in providing energy services can meaningfully be approached based on analysis with a single feedstock such as switchgrass. Thus, prior to developing a case for an affirmative answer to this question, we think that inclusion of multiple feedstocks is of secondary importance. However, given an affirmative answer to the resource sufficiency question, or at least evidence supporting an affirmative answer, we then agree whole-heartedly that analysis of a diversity of feedstocks becomes a key issue.

In this latter context, environmentally-sound utilization of biomass residues can make a potentially significant contribution to overall biomass feedstock supply while decreasing land requirements and hence easing pressure on habitat. Different feedstocks are best-suited to different regions/locations, and grass is not best suited to all regions. Thus, we have to look beyond grass if the potential for biomass-based energy supply is to be realized fully, and also in order for associated benefits to be realized in all regions. In short, we understand the arguments for looking at multiple feedstocks.

Our interpretation of the gap between our project's emphasis on switchgrass and the widely-expressed view of meeting attendees that we should consider multiple feedstocks boils down to different assumptions about the stage of our analysis. Whereas both our original project proposal and our presentation were focused on the question of resource-sufficiency, attendees seemed to accept that biomass could make a very large energy supply contribution, or at least looked beyond this question. Thus we see moving the question of multiple feedstocks as a natural evolution of the project as it progresses, and we are pleased that meeting attendees felt that we had reached the point where this question becomes appropriate to focus upon.

What we plan to do in response the feedback received. We have given serious thought to the matter of adding analysis of multiple feedstocks to the scope of work of our current project. Notwithstanding the merits of such analysis, we have concluded that we cannot accommodate this significant added work element to our existing project. What we can and will do is to seek support for work on multiple feedstocks as a follow-on to the current project. Such follow-on work could be initiated in January of 2005, at which time most aspects of the current project are scheduled for completion.

Summary of Questions and Comments from February Meeting

1. Resource Sufficiency (1:00 – 1:50)

- Project is placing too much emphasis on switchgrass. Agricultural and forest residues should be considered as well.
- Why isn't the project considering GMOs?
- Water use, conservation, and availability are important considerations.
- The renewable portfolio standard, as currently stated, might exclude the co-production of power in a cellulosic ethanol plant.
- The project should not limit its scope to the U.S.
- The project should provide a state-by-state breakdown
- How does the quality of switchgrass protein compare with that of soybeans?

2. Transition Paths (1:00 – 1:50)

- The project should be precise about what was meant by "pedal to the metal" policies.

Regarding feedstock production, the project should consider: 1) the collection and use of wastes and residues; 2) farmer response to energy crop production and the dynamics of farmer adoption.

- Regarding biomass conversion: 1) navigating the transition to large plants; 2) conversion to products other than ethanol—should be considered carefully; 3) permitting as an important issue; 4) converting starch plants to cellulosic plants.
- Regarding biofuels usage: 1) local versus centralized efforts; 2) marketing strategies; 3) target fuels and vehicles; 4) how to make people more aware of flexible fueled vehicles (FFVs); 5) How would FFVs affect transition dynamics; 6) market effects: effect of fuel volume on viability; vehicle/fuel turnover; 7) biobased fuels as an additive or a replacement—how would this impact dynamics?
- Regarding dynamics oil prices: 1) how will oil prices respond to large scale introduction of biofuels? 2) How to analyze pricing scenarios? 3) How might ethanol imports from Brazil affect dynamics? 4) How will biofuels affect competition among vehicle manufacturers and vice versa?

3. Biomass Production (2:00 – 2:50)

- The project should address the methods and implications of seasonal harvesting to recover protein, and the ease/difficulty of protein storage.

- Switchgrass harvesting logistics should be specified.

- The project's processing facility scale—5,000 ton/day—is very big, comparable to a 200,000 bushel per day corn plant..

- Feedstock-flexible plants are an important goal.

- The project should identify the key challenges associated with switchgrass production.

- Combined cultures including switchgrass and other species should be considered.

- Why not hybrid poplar as an energy crop?

4. Policy Options (2:00 – 2:50)

- What about other biomass resources (e.g. residues and wastes)?

- In developing R&D policy, the project should consider other models in addition to the NIH.

- It's important to strike the proper balance between R&D geared toward basic understanding and that geared toward commercialization.

- Regarding policies aimed at commercialization: what about longer term investment beyond pioneer plants?

- Should biorefineries be kept as a central concept?

- The project should also consider dynamics of imported biofuels.

- Regarding competition from petroleum, the project should address current subsidies going to petroleum industry.

5. Conversion Technologies (3:00 – 3:50)

- With respect to variable feedstocks, how robust are the conversion processes under consideration?

- Protein processing requires further development.

- Feedstock consistency is desirable.

- How much silica is in switchgrass? How does it compare to rice straw?
- The project should build flexibility into its analysis to allow for balancing ratios of products.
- There will likely be a spectrum of processing scales: plants in the Northeast, for example, would probably be smaller than those in the Midwest.
- What are the energy efficiencies for the various conversion processes?
- Is the project considering on-board reforming for use in fuel cell vehicles?
- What's the current status of biomass gasification?

6. Environmental Impacts (3:00 – 3:50)

- Why isn't the project considering biodiesel, woody crops, or other grasses?
- In the transition dynamics analysis, the project should consider other technologies such as co-firing biomass and coal gasification.
- Comment: specific direction will be to look at the potential of switchgrass used as a buffer crop or on CRP land.
- How with the project evaluate the environmental impacts of replacing petroleum-derived organic chemicals and materials with those derived from biomass?
- The project should consider the interaction of imports/exports and trade.