BIOENERGY STAKEHOLDERS SEE PARTS OF THE ELEPHANT

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Abstract

Extended iterative discussions with two sets of bioenergy stakeholders over three years reveal that they see very different things when looking at the shape of possible future bioenergy systems, much like the proverbial blind men examining the elephant. The views and concerns of 116 environmental and farmer/agricultural stakeholders were tracked and compared on key issues such as global warming, genetic engineering of crops, sustainability and economics of bioenergy.

Environmental stakeholders' positions on bioenergy range from support to opposition. They ask for more information including environmental effects, the issues listed above, and net benefit analyses. Most are still awaiting answers. They judge the acceptability of bioenergy based on the characteristics of feedstocks with specific problems (animal wastes and mixed solid wastes) and the few current conversion processes such as producing ethanol from corn. A pattern of selective, conditional support for bioenergy is emerging.

Farmers are waiting for a real bioenergy feedstock market to develop. Except for a small group of sustainable/organic farmers, they are not much moved by the issues that stir environmentalists. Farmers differ in their bioenergy interests according to age, size of holdings, land productivity, owner/contractor status, and economic options in the face of industrial agriculture.

Comparisons of the views of the two sets of stakeholders revealed major differences on genetic engineering, sustainability of high intensity agricultural practices, and the acceptability of combustion for conversion and of ethanol produced from corn.

Factors that contribute to diversity in stakeholder responses are l) the nature, variety and complexity of bioenergy, and 2) that most of the future bioenergy systems are being designed or are under construction. A major information gap results. Better stakeholder understanding is a prerequisite for developing the public acceptance necessary for widespread siting of bioenergy facilities. Suggestions to help realize the promise of bioenergy by bringing the very different visions of two sets of stakeholders closer together include more information, dialogue and stakeholder involvement.

I. Introduction And Scope

Like the blind men and the elephant, bioenergy stakeholders experience very different things when trying to figure out the shape of possible future bioenergy industries and operations. Their visions of the future differ widely, depending upon whether they are directly or indirectly making a living in agriculture or not. Those not dependent upon agriculture for their living focus upon the environmental impacts of bioenergy and its suitability as a renewable energy source. Among the two sets of stakeholders being considered here (environmental and farmer/ agricultural stakeholders), a wide variety of positions relative to bioenergy is developing.

In fact, many different development paths are being considered and/or tried, and few final decisions have been made. What is now visible in the way of bioenergy production (conversion of corn kernels to make ethanol or combustion of wood and/or organic wastes to produce energy/heat) may not resemble major new pathways and technologies being envisioned or developed to produce bioenergy.

Understanding why and how such different views among stakeholders have developed requires looking at both the elephant and the context in which stakeholders operate. Stakeholder views and concerns about bioenergy, their information base, their organizational context (if they work for or belong to organizations) and how their priorities are established are keys to understanding their perceptions. For farmers, their particular economic prospects and the crops they grow will shape their views about bioenergy futures.

The presentation of data and argumentation of ideas in this paper is guided by the following two theses:

Thesis 1. For a variety of reasons, bioenergy stakeholders see only parts of the elephant(s).
Thesis 2. The differences between stakeholder visions of what the elephant(s) will be like are a potential source of difficulty on the long road to establishing viable bioenergy systems.

We comment and speculate on context, situations, and explanations for theses 1 and 2 and offer suggestions for bringing stakeholder visions closer together with information, dialogue, and involvement. Knowing more about *other* stakeholders' (developers and government planners) views of the elephants and how they should be constructed would be valuable but is not included in the current work. The remainder of the paper covers methods and data in section II, examples of stakeholder views and concerns (III), comparisons of responses of the two sets of stakeholders (IV), discussion of the data (V), and conclusions and recommendations (VI).

II. Methods And Data

This paper is based upon a cumulative body of stakeholder investigations over three years, relying primarily upon multiple longitudinal discussions with 116 individuals. Sixty-five were environmental stakeholders and 51 were farmers and agricultural infrastructure people (1, 2, 3). The discussants include individuals in 37 environmental or conservation groups in five states and Washington, DC and agricultural infrastructure people and farmer/producers in the corn belt (Iowa, Nebraska, Illinois, Missouri) and New York state.

The sample was selected to capture the wide variability among each set of stakeholders. Among environmental groups we sampled to include variety in organizational structure, type of action or operation (study, action, advocacy, legislative influence) as well as policy and subject focus. Some national environmental groups were included as well as their state and local chapters. To capture additional variety, some independent state and local environmental organizations were selected.

Since global warming was identified early as a key issue influencing environmental support of bioenergy, eleven of the 33 member organizations of the U.S. Climate Action Network were included. Old line membership-directed conservation groups (National Wildlife Federation, Izaak Walton League, Audubon Society) were included along with several newer environmental advocacy or policy groups that rely primarily on professional leadership.

For the agricultural discussants, we selected (1) farmers involved in two DOE field trials growing energy crops (switchgrass or willow), 2) corn stover farmer-entrepreneurs experienced with collecting and/or processing this agricultural residue, and 3) some organic, specialty crop farmers and/or those practicing sustainability techniques. Three farmers were also seed salesmen representing three different seed companies. From among the agricultural infrastructure we selected USDA researchers and county agents, state agriculture officials, agriculture college faculty in two states, agricultural sustainability organizations, officials of the American Farm Bureau in two states, national and state corn growers' associations, and farmers' union representatives in two states and DC.

Parameters of the research design were established in part by the nature of the problem and characteristics of the highly variable sample. No formal questionnaire was warranted because there was a wide range in stakeholder background in bioenergy (from zero knowledge to sophisticated technical background). A series of tailored, iterative discussions were held with individuals in which their views

and concerns about issues as well as impacts and prospects of a future bioenergy fuel/power cycle were explored. Next, a series of major, rapid developments in the driver issues (use of genetically modified organisms, global warming) in 1999-2000 necessitated the adoption of a longitudinal time series design. Callbacks were made to selected discussants to track the stability and/or change in stakeholder views on these key issues (3).

In addition to direct conversations with stakeholders, we reviewed supporting secondary materials such as publications, newsletters, membership information, web sites, newspaper files and other information about environmental and agricultural issues and organizations.

Driver Issues

Driver issues are issues of importance to stakeholders which impel them to support or oppose something. They may indicate criteria for (public) stakeholder relationships to particular energy systems such as bioenergy, renewables, or nuclear power. Previously identified driver issues for bioenergy stakeholders are global warming, genetic engineering, and the economics of bioenergy.

III. Examples Of Selective Responses, Views And Concerns Of Stakeholders Toward Bioenergy

Support for renewable energy *in general* among environmental groups is nearly universal. But for about half of our environmental discussants, their support for bioenergy is selective, conditional, tentative or absent. Some are opposed to specific feedstocks (municipal solid waste, forest sources, animal wastes) or certain strategies (carbon sinks) or products such as ethanol from corn kernels. A pattern of partial support for bioenergy is emerging, while some groups omit bioenergy altogether when promoting renewable sources of energy.

For farmers, the picture is quite different. Few of the "driver" issues for environmental stakeholders move them. Their interest depends greatly on their immediate economic prospects, the size of their holdings and the productivity of their soils. Some farmers who have moved away from commodity crops are quite concerned about sustainability of their soils under specific management regimes.

Some examples of selective responses and variation in stakeholder views and concerns toward several key bioenergy issues are presented below.

A. Global Warming

Global climate change (GCC) or global warming (GW) was identified early in this work as a (positive) driver issue for many policy and advocacy environmental groups. Many defined the on-going climate changes as highly detrimental to human populations, cities and species survival, and as a source of too-rapid habitat change for ecosystems. Several see their response to this issue as a means of saving the world and critical environmental habitat by reducing the rapid increases in CO2 and slowing GW. For them, the development of bioenergy and adoption of renewable sources for fuel and power are highly desirable specific goals. In this category are World Wildlife Fund (WWF), National Resources Defense Council (NRDC), Friends of the Earth (FOE), National Wildlife Federation (NWF), Union of Concerned Scientists (UCS), and Environmental Defense (ED).

Some had applied their specific staff expertise, e.g., NRDC and UCS, to develop background papers outlining policy options which undergirded the U.S. position at the Kyoto Conference on Global Climate Change in 1997.

Differences in strategy between these several groups, however, led over time to a major split in tactics revealed at the Hague Conference of the Parties (COP6) in November, 2000. The issue became the acceptability of U.S. policy relying exclusively upon carbon sinks and carbon sequestration in forests and agricultural crops for meeting the Kyoto implementation goals. The European Union (EU)

countries and three major international environmental groups (WWF, FOE and Greenpeace) felt that reductions in actual emissions of CO2 were the key objective. They opposed reliance on the carbon sinks strategy or any emission trading mechanisms as proposed by Environmental Defense and its allies. The conference ended in failure with no compromise or balancing among these points of view.

Despite the anti-Kyoto position of the current U.S. administration, the rest of the world (160 of the 178 signers of the Kyoto protocol) went forward without the United States at the Bonn and Marrakesh conferences in 2001. In the absence of the United States, the increased importance of support from Japan, Canada, Australia and Russia necessitated negotiation and compromise that EU countries and European greens had not permitted earlier on two key issues of forests/carbon sinks and emissions trading (4, 5).

Most environmental organizations have regrouped and refocused in 2001 and 2002 around general support for renewables, as they face the supply-side pro-fossil energy proposals of the administration.

Farmers, on the other hand, mostly sit out this issue. Among our sample, views ranged from general acknowledgement that "something different is happening with the weather," to indifference, to a few vehement assertions doubting the reality of climate change. This latter view reflects the positions of major agricultural organizations such as the American Farm Bureau Federation that disavow belief in climate change and challenge the data involved (6). In a wider survey of 500 farmers in 14 states for the American Corn Growers Association, 62% said the debate over global climate change is "either overblown or imaginary," but 56% believed that carbon sequestration can reduce greenhouse gas emissions (7). Global warming is **not** a main concern or driver issue for farmers.

B. Sustainability

The sustainability of bioenergy is a prime concern of several environmental organizations, including the Sierra Club. This largest (650,000) and oldest (1897) of U.S membership-governed environmental organizations remains firm in its anti-ethanol fuel stance. Sierrans in three corn belt states confirmed their opposition to ethanol and their doubts about bioenergy because "corn is not raised sustainably." Some also cited their suspicions of Archer Daniels Midland, a major manufacturer of ethanol from corn kernels. The club's Gasohol Policy was passed in 1982 and has not been revisited.

Various anti-ethanol beliefs and policies of environmentalists (including a key California NRDC staffer) and other interests were in evidence after the gasoline oxygenate methyl tertiary butyl ether (MTBE) was found to have contaminated groundwater in California and elsewhere. The search for a suitable replacement considered ethanol only after EPA declined to give the state a waiver from air quality regulations. The outcome is as yet uncertain.

After a rousing months-long discussion of the suitability and sustainability of biomass on an internal listserver, the Sierra Club issued some guidance (less binding than a policy) as follows (8) in part:

- We believe that biomass projects can be sustainable, but that many biomass projects are not. We are not confident that massive new biomass energy resources are available without risking soil and forest health, given the lack of commitment by governments to preservation, restoration, and conservation of natural resources.
- Biomass is in principle renewable, ...and while it is possible to preserve soil carbon balances, conventional agricultural practices rarely do so.
- We are increasingly concerned that biomass projects may rely on, or create incentives for fuel derived from unsustainable forestry and agricultural practices. **It can be appropriate to concede these concerns to gain a higher benefit in relation to fossil fuel**, but we encourage biomass projects to hold their sources of fuel to high standards for sustainable land management. (emphasis added).

Sustainability concerns about bioenergy also surfaced among some soil scientists, several agricultural sustainability organizations, and among organic farmers and consumers. These discussants are concerned that current intensive agricultural methods result in "mining the soil" despite applications of various agricultural chemicals, e.g., fertilizers, herbicides, and pesticides. Removal of agricultural

residues such as corn stalks raises concerns about further loss of humus and increased soil erosion. If such intensive agricultural methods are also applied to energy crops, short rotation woody crops and certain field residues, the sustainability status of these feedstocks will be questioned by these stakeholders.

C. Biodiversity

Biodiversity in general, and especially the use of genetically engineered (GE) crops raised great concerns among environmental stakeholders. Over the course of the study, the response to this issue among environmental discussants increased in intensity from watchful waiting and concern in 1999 to anxiety and alarm in 2001. The media attention given the Starlink corn episode in summer 2000 (in which a GE corn approved only for animal feed was found to have widely contaminated grain supplies for human consumption) broadened environmental concerns on this issue.

We now judge the GE issue to be a ***negative driver*** for environmental stakeholders. Many discussants expressed their concerns over the lack of firm research data before widespread adoption of GE crops, the possibility of gene pollution of non-GE plants and especially of weedy relatives of GE plants, and the need to go slowly (if at all) into this unknown future.

Direct threats to biodiversity in native forests are seen by many forest activists from anticipated future bioenergy feedstock demand. Forest activists in several environmental organizations such as Sierra Club, Dogwood Alliance, and American Lands have raised this alarm. Southeastern forest activists, for instance, were opposed to use of any forest sources for bioenergy, or use of any GE feedstocks. They preferred production residues over field residues and put many constraints on use of biomass for cofiring with coal (9). Forest activists in the Sierra Club sought to lead the club toward opposing bioenergy in a vigorous and extended internal listserver discussion in 1999 and 2000. A year later the club issued Guidance on Biomass (see previous section) for members and activists "on this complex and contentious subject... that involve(s) many different aspects of Sierra Club policy." The guidance refers to no less than eight policies and three principles that must be considered.

Again, most large row crop farmers take the opposite view of GE crops, favoring their use because of direct and immediate advantages that they see. Less insecticide is needed for insect-resistant bt corn and less herbicide need be applied to herbicide-resistant Round-Up Ready(**TM)** corn and soybeans. Most dismissed environmental concerns as being overheated and expected the furor to disappear over time. The Starlink contamination episode led to second thoughts among some farmers, mostly because of concerns that existing EU and Japanese market rejection of GE food grains would spread to suspicion of contamination in all grains.

On the other hand, farmers and environmentalists agree on some generalities such as the need for environmental stewardship, conservation of resources, sustainability and need for a level playing field.

Those farmers opposing use of GE seeds were generally raising organic produce or specialty crops for non-GE markets. In the agricultural infrastructure, discussants were about equally split between supporters and doubters/opponents of genetic engineering.

D. Economic Viability

The economic viability of bioenergy is the central but not exclusive issue for farmers. Since their livelihood depends upon prices for their crops being higher than their costs, they want to see markets developed for energy crops and agricultural residues. All wanted to know "if we can make a living growing/collecting these crops/residues." Most appreciated the possibility that marketable energy crops would offer an additional economic option as commodity crop prices continued their slide downward.

With the steady disappearance of small farms over past decades, smaller farmers involved in DOE field trials for willow and switchgrass welcomed an additional opportunity to raise something other than the usual commodity crops. In both cases these farmers owned less productive lands than those used for commodity crops. In western New York many farms are idled. Only a few very large

dairy farm operations remain profitable. For smaller farmers participating in DOE field trials, the regular cash payments for use of their land meant being able to hold on to the land a little longer. One farmer said "At least we can pay the taxes another year."

With the exception of some in the corn belt, most environmental stakeholders did not volunteer concerns about economic survival of farmers. Some environmental organizations supported the conservation measures included in one version of the 2002 farm bill as they recognize the environmental impacts of current agricultural practices upon chemical runoff and soil erosion.

E. Selective Support For Bioenergy

Support for bioenergy, while selective, came from some environmental groups and from some farm organizations. Repowering the Midwest (10), an update of an earlier review of renewable energy suitability, was highly selective in its endorsement of renewables for electricity generation. Produced by eight Midwest environmental groups and UCS, the report endorsed switchgrass and omitted ethanol.

Some cornbelt conservation groups such as the Izaak Walton League and Pheasants Forever support bioenergy for the stream and wildlife enhancement benefits they see arising from energy crops such as switchgrass.

Farm organizations supporting the DOE Chariton Valley switchgrass project include the American Farm Bureau, the American Corn Growers, and Iowa Farmers Union.

Not only was the Union of Concerned Scientists the only non-midwestern environmental group helping update Repowering the MidWest, it has also developed midwestern connections and published colorful pamphlets on agriculture and renewable energies such as solar, wind and biomass as an energy crop. UCS urges farmers to consider the environmental and economic advantages of switchgrass or residues for cofiring as in the Chariton Valley project in Iowa. They discuss other conversion methods, their efficiency and the relative advantages of selling biomass feedstocks as a commodity vs. using them directly on the farm (11).

Green-e has made selective endorsements of bioenergy. Creative Resource Solutions (CRS) assembles regional stakeholder panels to set criteria for endorsing energy production processes as "green." After extended consideration, biomass and bioenergy have been omitted in some regions. Because of disagreement and uncertainty about the sustainability of various bioenergy feedstocks and processes, it was decided to omit those types about which questions remained. For example, in the case of cofiring with coal, biomass was omitted because it does not comprise at least 50% of the fuel (12, 13).

Sierra Club Biomass Guidance supports switchgrass conditionally. After a long list of problems and warnings related to biomass, switchgrass is described in some detail and specifically mentioned as having "some promising aspects (and) potential benefits" for fuel farming. Bioenergy and biodiesel are each described as an "interim step" (8).

F. Siting Concerns Emerge

As specific plans for facilities were proposed in some locations or as "principles for biomass" were considered, siting concerns emerged. The Minnesota River Valley Alfalfa Production Project (MNVAPP) project in Minnesota in 1999 drew considerable local opposition as a specific site was proposed. The project has since been cancelled because of withdrawal of the major financial backers and partners. After considering the suitability of biomass feedstocks and conversion to bioenergy over a one year period, 14 southeastern environmental groups expressed strong opposition to biomass as an energy source and demanded detailed siting protections and community involvement in their "principles for biomass energy in the South" (9).

IV. Comparisons Of The Two Sets Of Stakeholders

After laying out the views and concerns of the two sets of stakeholders in the previous section, we now compare their similarities and differences. While their differences were usually specific and definite, **t**heir agreements were primarily on very general principles.

Unlike environmental stakeholders, farmers have compelling economic concerns about the issues raised by new crops and their cultivation. Marketing prospects for their standard crops are a keen concern while new crops without demonstrated markets are a question mark for most.

Differences between the two sets of stakeholders involved most of the key issues of greatest concern to environmentalists. With a few exceptions farmers were either of the opposite opinion or showed little concern. Key areas of disagreement involved genetic engineering of seeds and plants, combustion as a means of converting biomass to energy, sustainability of current high intensity agricultural practices, and acceptability of ethanol from biomass.

For instance, some environmentalists expressed reservations or opposition to combustion as a means of converting biomass to energy, while farmers had "no problem" with burning trees or energy crops for this purpose. Most environmentalists had serious concerns or opposition to use of genetic engineering of seeds or plants, while most farmers strongly supported use of GE products and pointed out advantages of reduced chemical use. Sustainability of current high intensity agricultural practices is of great concern to environmentalists as well as to some soil scientists and alternative agriculture and organic farmers. This group is also concerned about the status of soil health under current patterns of use in which crop rotation is no longer a common practice for commodity crops. Most farmers assert that current practices are acceptable and necessary for economic survival. The final area of disagreement concerns the acceptability of ethanol as currently produced from corn kernels - strongly supported by most corn farmers and rejected by many environmentalists as unsustainable.

Agreement of the two sets of stakeholders occurs on general principles where specifics are undefined: on the need for protecting the environment, on conservation of resources (farmers consider themselves the first conservationists), and on the importance of safeguarding the soil resource and preventing erosion. Both sets usually agreed upon the need for a "level playing field" for bioenergy to counter the substantial subsidies going to fossil energy.

Some support from environmental organizations has emerged for including conservation measures in the 2002 farm bill as previously discussed. This support does not necessarily indicate support for biomass or biomass subsidies, however.

V. Discussion

Faced with this great variety of responses and reactions to bioenergy among its stakeholders, we seek reasons or at least better understanding of such variability. These "reasons" include the complex nature of bioenergy, the incomplete state of bioenergy development, major uncertainties about bioenergy, information gaps, the absence of public discussion and the organizational context of the environmental stakeholders. The special concerns of farmers about bioenergy occur in the context of the farm belt upheavals caused by the continuing industrialization and globalization of agriculture. We look briefly at the wider context of the stakeholders' views and issues and into the future where siting concerns become a consideration.

A. Complex Nature Of Bioenergy

Since bioenergy is more complex and various in its forms than other renewable energy sources such as solar or wind, it presents special problems in the public policy arena and in relations with its stakeholders. Both solar and wind energy, for instance, are familiar to everyone. Solar energy can be used directly in the form of light or heat (for instance, in passive solar construction) or converted to

electricity by photovoltaics technology. Wind has only one means of conversion to usable energy - through windmills or wind machines.

For bioenergy, in contrast, the pathways to usability are more complex and diverse. First, there are many different possible feedstocks, ranging from energy crops and agricultural residues to wastes of several varieties. Waste feedstocks may come from industrial processes, forest trimmings, industrial and construction wood wastes, animal and human wastes, urban garbage, landfill gases, and other sources. Each of these feedstocks has its own set of environmental impacts as it is planted, cultivated, harvested, collected, transported, stored and processed for use.

Second, many possible types of conversion processes might be used to convert the feedstocks into energy or intermediate products. Finally, there are at least three main types of useful bioenergy outputs that result: power (electricity and heat), fuels (ethanol, hydrogen) and bioproducts (chemicals, biodegradable plastics, solvents, glues, fibers, etc.) Each of these inputs and pathways can affect sustainability and biodiversity in different ways.

Explaining the variety and complexity of bioenergy feedstocks, its different conversion processes and resulting environmental impacts presents a challenging problem for bioenergy.

B. Incomplete State Of Bioenergy Development

Only part of the elephant envisioned by its developers and entrepreneurs is really there now. Existing bioenergy conversion processes (pieces of the elephant "seen" today) may or may not represent future bioenergy sysems. For instance, the current production of ethanol fuel from corn kernels uses starch conversion processes whereas in the future very different feedstocks and chemical processes would be used to produce ethanol from cellulosic sources. Future cellulosic conversion processes would use a much larger and more varied set of feedstocks, e.g., whole corn plants, bagasse, rice straw, switchgrass, and various woody crops. Likewise, the many wood burning facilities of today that produce power and heat (bioenergy conversion through combustion) rarely use advanced gasification or other combined heat and power (CHP) conversion processes that are envisioned for the future.

In fact, current bioenergy conversion processes and facilities are the source of much of the opposition from environmental groups because of their low efficiencies and adverse environmental impacts. Consider the nature of present anti-ethanol ("corn is not raised sustainably") and anti-combustion ("this is just another excuse for incineration") campaigns.

But while newer processes under development are promising and may indeed become the bioenergy industry of the future, they are (mostly) not yet commercially available and their economic viability is untested and/or unproven.

In other words, final decisions cannot be made as yet on most specific real-world bioenergy conversion processes of the future, or on creation of the supporting infrastructure that would enable their widespread use.

Another "leg of the elephant" exists but is largely unrecognized. Numerous products made from bio-materials are in regular commerce already but are not thought of as "bioproducts" and hence are invisible to most stakeholders. These include glues, finishes, vitamins, solvents, adhesives, and biodegradable plastics.

C. Uncertainty As A Cause Of Variability In Response

Great uncertainty about the actual nature, size and shape of future bioenergy systems is thus unavoidable for the present and for some time into the future. Since broad outlines are unknown, details that affect decisions about impacts are unknowable for the time being. Major issues such as global warming and the Kyoto protocol, genetic engineering of seeds, biodiversity and sustainability are unresolved. The outcomes of these complicated and contentious issues are not known as yet. Both issue outcomes and technology emplacements may affect the acceptability of bioenergy in a future world.

This is not to denigrate the fact that many alternative visions of this future are in play or that numerous technical plans and possibilities are being explored. Any issue of Bioenergy Update (14) in recent years describes the details and prospects of bioenergy technology concepts, proposals, pilot projects, demonstrations, tests, and more. But this developmental ferment is largely unknown and unseen by outside stakeholders.

D. Information Gap Is Large And Persistent

As might be expected, most public information about bioenergy is long on general concepts but short on facts and data. The most frequent request of stakeholders in discussions is for more information - for data on environmental impacts and sustainability, and for net benefit evaluations (1). More than 80 requests and questions were collected from 25 environmental groups in the course of conducting discussions over an 8 month period.

Environmental stakeholders request information in order to understand what's going on and to develop their positions about bioenergy. They ask for evidence on feedstocks and conversion process impacts. The desired feedstock information is often not yet available (results of ongoing but unfinished environmental studies). But the conversion process information more likely doesn't exist except as plans, proposals or ideas in someone's brain. Thus, these requests are often referred somewhere else or are not answered at all. Some requests can now be referred to web sites where FAQs (frequently asked questions) and some answers await. In the field, however, we met the old misinformation on ethanol again and again.

Overall, this state of affairs does little to answer serious stakeholder questions or remove these major uncertainties that plague stakeholders desiring answers and results. Several have repeatedly requested firm data that would enable comparisons with other energy systems such as natural gas or fuel cells. Some of the unanswered questions about the full-scale bioenergy industry include:

- Is GE necessary for a bioenergy future?
- Can large-scale biofuels feedstock production be carried out sustainably?
- What will the future full scale bioenergy industry look like?
- What infrastructure needs to be created, permitted and financed for bulk scale transport and retail delivery of ethanol?
- What's the net benefit assessment of feedstock X or conversion process Y?

E. Many Ideas But Little Public Discussion

While there are many different ideas and visions about the bioenergy cycle of the future, there is little or no public discussion of these ideas. These ideas and visions could benefit from wider exposure for comparison, analysis, or (at the minimum) acknowledgement. Perhaps this stage of development .....when multiple paths are being pursued and tested .....does not warrant or could not withstand public exposure.

But we should understand that silence and lack of answers have major costs as potential supporters in the environmental and agricultural communities turn away to pursue other goals. They operate with a world view which often does not include a bioenergy option at all.

F. Organizational Uniqueness Vs. Coalition Unity

Among environmental organizations, as among organizations elsewhere, differing organizational foci, values, and experiences mean different visions. Different visions of the somewhat obscure bioenergy "elephant" arise in part from the differing policies and focus of the many environmental organizations. Stakeholders see things through their own special lenses, as illustrated by the variety of concern, issues, and reactions to bioenergy encountered to date. Past experience can strongly shape current policies and ideas, as in the anti-combustion views of many environmentalists who opposed waste incineration in the 1970s. Others had bitter experiences with corporations and developers involved in stripmining, siting of landfills or other locally undesired facilities, or unregulated waste discharges.

Countering the variability and uniqueness induced by the above factors, national environmental organizations also experience pressures for mutual support and uniformity of positions. They practice "division of labor" on many issues and build coalitions to exert political influence. Practical strategic and tactical considerations and need to preserve coalitions are weighed against existing policy when another group or coalition partners take a public stand as in the Hague Conference on global warming (COP6). In these cases, mutual support expectations may result in joining the action or in silence so that a unified front is maintained. For instance, after the failure of the Hague conference, many U.S. organizations **not previously** involved in the issue either adopted the stance of the three principal groups that were involved (FOE, WWF and Greenpeace), or remained silent.

G. Economic Interests Drive Farmers

Farmers are driven to consider new options - anything that could assist in making a living - by their primary economic interests. The relentless advance of industrial agriculture and the vertical integration of agribusiness force all farmers to consider their options carefully. In the corn belt, most are faced with rising land values and declining crop prices. Small farmers with less productive lands or who have been adversely affected by changing markets and impacts of agribusiness ask when will there be a functioning market for energy crops and residues. Larger commodity crop farmers see entrepreneurial opportunities if only capital could be accessed. Organic farmers watch bioenergy skeptically, doubtful that any crops in the current agricultural mode of "mining the soil" will be sustainable and concerned that *bt* corn and beans will speed up insect resistance to *bacillus thuriengensis* upon which they depend for natural means of insect control.

The nature of farm ownership is itself changing. Facing severe cash flow problems, large and small owners confront different options. Ownership is increasingly separated from management control of the land. Large owners have chosen to 1) become larger in order to survive, 2) sell their land and become contract farm managers for their neighbors or large corporate farms, 3) become absentee owners while others manage their lands, or 4) leave farming altogether. The options open to small owners are more restricted, mainly including 1) selling their land, 2) becoming absentee owners, or 3) taking up some form of alternative agriculture, e.g., specialty cropping, hobby farming, or investigating new options such as energy crops and other uncertain futures. Many of the small farmers we spoke with are in a holding action, marking time. Those involved in EC trials view bioenergy trials as a way to extend their options. They use the modest payments to "pay the taxes another year" and hold on to their land.

Farmers face an impossible role conflict: how to 1) be lowest cost effective competitor in a global economy, and 2) fulfill special stewardship responsibilities as keepers of land and soil resources.

H. Wider Context Issues In The Culture

General anxiety and unease over the speed of change and future prospects for both rural and urban folk is a common feature of contemporary life. Fears and concerns about rapid change in agriculture, social systems and technology futures may be amplified and focused when phenomena such as global climate change, genetic engineering, and long term soil mining appear. The GE Starlink corn episode raised public awareness of biotechnology as the GE Food Alert campaign joined concerns over

food safety with biotechnology. Further discussion of how stakeholder concerns fit into the wider context may be found in the background report (3).

I. Siting Bioenergy Facilities In The Future

The most challenging stakeholder issue still remains to be faced. Actual siting of conversion facilities will bring out a very different type of stakeholder than most considered in this study...the NIMBYs (Not In My Back Yard groups). These new stakeholders who typically emerge quickly after a proposal is made public may oppose any new manufacturing/conversion facility being located in their community. Plants burning poultry litter and other biomass for power are being planned/discussed in several poultry-growing states. It is not clear to what extent farmer ownership of such facilities, e.g., cooperatives which own, build, and operate ethanol plants, will insulate the facilities from local protests. Certainly the local response to the proposed MNVAPP alfalfa gasification facility was mixed and displayed strong NIMBY aspects. Without broader public and stakeholder understanding as the full range of bioenergy conversion facilities is developed, siting with public acceptance is likely to be problematic.

VI. Conclusions And Observations

Conclusions and observations can be grouped into five categories. First, we briefly discuss the current status of bioenergy. This is followed by a look at reactions that are unique to a single set of stakeholders. After that we summarize differences and similarities in concerns and interests between the two major sets of stakeholders. Essentials for public acceptability and stakeholder support of current and future bioenergy options are given. Finally, we assess the original theses and the blind men and the elephant analogy in this context.

A. The Current Status Of Bioenergy

The nature, variety and complexity of bioenergy are part of the problem. Not only is bioenergy the only renewable energy source that comes in physical form, bioenergy feedstocks and conversion processes come in multiple varieties, each with its own set of environmental impacts. Unlike other renewable sources such as solar and wind energy, bioenergy can produce liquid fuels, is storable for extended period and can be available upon demand. Many stakeholders and the general public are unfamiliar with bioenergy options and have few opportunities to learn about them.

Only some bioenergy systems currently exist. The rest are concepts or possibilities shrouded in fog, uncertainty, and the scaffolding of different visions. Many future bioenergy systems are still under development and **not fully formed**. Stakeholder views of future bioenergy systems are limited by the few existing bioenergy conversion technologies that are visible. Current technologies may not represent next generation technologies now under development or the full benefits of mature, integrated bioenergy systems.

B. Reactions Unique To One Set Of Stakeholders

Some of the least sustainable examples of biomass (e.g., mixed solid waste, ethanol from corn kernels) have come to represent the whole of bioenergy for many environmental stakeholders.

The confusion induced by these uncertainties weakens and deflects stakeholder interest and support. Environmental stakeholders withdraw from the uncertainty and complexity or remove bioenergy from their present agendas altogether.

The resulting information gap is serious and difficult to deal with. Stakeholders may lose interest when their queries are not or cannot yet be answered.

Bioenergy support from stakeholders is selective, tentative, and conditional. Many bioenergy options are ignored and some are actively opposed by environmental stakeholders. Some see bioenergy merely as an interim step toward more suitable and sustainable energy systems. Farmers' support is also tentative and is primarily conditional upon biomass/bioenergy becoming a viable system.

Farmers are waiting for a real bioenergy market to develop in hopes that the economic promise of bioenergy crops and residues can augment their problematic incomes.

Farmers differ in their interest in bioenergy according to their age, land productivity, size of holdings, ownership/contractor status, and economic options in the rapidly changing agricultural environment that is increasingly controlled by agribusiness. Some smaller farmers with small incomes (and often fallow land) see bioenergy crops as a means to extend their land ownership for a while by enabling them to pay the taxes on their land.

C. Comparisons Of Responses Of The Two Sets Of Stakeholders

Differences between the two sets of stakeholders (farmers and environmentalists) are currently greater than similarities in their concerns about or support for bioenergy. Except for a small group of sustainable/organic /alternative agriculture farmers who often agree with many environmental groups, key areas of disagreement between the two sets of stakeholders include:

- combustion as an acceptable conversion process for bioenergy
- sustainability of high intensity agricultural practices especially current monocultures without crop rotation
- acceptability of ethanol generated from corn kernels, and
- genetically engineered crops.

Issues on which the two sets agree include more general concepts or ideas such as conserving resources, concern for the environment, the value of sustainability, and the need for a level playing field to enable a fair competition between bioenergy and existing fossil energies such as coal or oil.

D. Achieving Public Acceptability And Stakeholder Support

To achieve public acceptability and stakeholder support, it will be necessary to involve stakeholders now in development and evaluation of the different possible paths for creating viable bioenergy cycles for the future. The promise of fully developed bioenergy cycle(s) needs pro-active discussion and evaluation by/with stakeholders. Different visions need broad, open discussion, comparison and analysis, or at least acknowledgement.

The many concepts and plans being developed represent good news to share with stakeholders. Involving stakeholders in **development of sustainable bioenergy systems** can support positive interactions and dialogue between DOE and its stakeholders.

It would be useful to **develop in-depth descriptions and analyses of the different bioenergy feedstocks and conversion processes with approximate sustainability rankings.** Such information would be responsive to the continuing requests of environmental groups (1) for **net benefit analyses** of bioenergy feedstocks and operations. DOE could support the ongoing efforts of some environmental groups to develop this information, or conduct its own analyses and rankings.

Stakeholder interest and/or support currently depends upon how they assess the possibilities and promise of bioenergy and how they deal with the several uncertainties that surround future bioenergy cycles. Each set and subgroup sees different aspects of and raises different concerns about bioenergy according to their particular interests and economic status. They deserve answers to questions where available, frank discussion of different "big picture" visions and involvement in development of new sustainable bioenergy systems.

The above steps are critical to creating a positive, informed base of information BEFORE extensive siting of bioenergy conversion facilities is attempted. The history of failed siting attempts

includes facilities as varied as manufacturing, power plants, shopping malls, churches, and mental health facilities, when local neighbors and community interests have not been consulted in advance.

E. Revisiting Both Theses and the Elephant-Blind Men Analogy

Thesis l: For a variety of reasons, bioenergy stakeholders see only parts of the elephant.

The evidence seems to support this thesis.

Stakeholders don't have knowledge of or access to the DOE/industry vision of the various paths toward robust bioenergy systems in the future.

Thesis 2: The differences between stakeholder visions of what the elephant(s) will be like are a potential source of difficulty on the long road to establishing viable bioenergy systems.

On the basis of much general historical evidence, there is strong likelihood that the thesis will be supported.

Now that a new federal administration is reprogramming DOE goals about different paths toward developing future bioenergy systems, the relationship with stakeholders will be altered as well. Achieving these bioenergy goals is problematic without active support of major groups of both environmental and agricultural stakeholders. As before, bioenergy will have to compete with established energy systems and their many established supports and subsidies. Both sets of stakeholders have the power to block DOE goals in bioenergy as in other areas, to maintain a neutral stance, or to support the establishment of some or all of the possible bioenergy conversion modes.

Most worrisome is the absence altogether of bioenergy in many stakeholder visions of the future.

The Usefulness of the Elephant-Blind Men Analogy.

Because most future bioenergy system(s) of the last 3-5 years are still under construction or on the drawing board only, it turns out that the analogy is only partly useful. Stakeholders certainly view the world through their own tinted lenses, but they cannot see or judge plans that have not yet been initiated or presented for discussion. Recognizing the situation openly, however, would be useful for all so that opinions and policies about bioenergy can be based more nearly on real and current circumstances and, if possible, upon jointly shared and constructed visions of the future.

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