Biomass and Biotechnology : A Key to Sustainability

Mark Finkelstein and John Sheehan
Biotechnology Center for Fuels and Chemicals
National Renewable Energy Laboratory
Golden, Colorado 80401

"Sustainable development," according to the United Nations' World Commission on Environment and Development, "meets the needs of the present without compromising the needs of the future generations." It is hard to argue with the idea of sustainability when it is couched in these terms. Beyond this broad and highly idealized view of sustainable development lies a more problematic definition—one that recognizes sustainable development as a careful balancing act among issues of environmental protection, public health and safety, and sound economic development.

In this sense, sustainability is both a "buzzword" and a potential "buzz saw" in the public arena. Why? Because it ties together two seemingly opposed ideas—doing what is good for the environment and what is good for the economy. It means many things to many people. The concept of sustainable development implies that these two strategies are not and must not be mutually exclusive strategies. For the world-renowned naturalist E.O. Wilson, it is a way of life—a matter of ethics:

> "The common aim must be to expand resources and improve quality of life for as many people as heedless population growth forces upon Earth, and do it with minimal prosthetic dependence. That, in essence is the ethic of sustainable development."

In this view of the world, we are required to take a more systemic view of the trade-offs we face in sustaining our lives. Though Wilson is an avowed advocate of the benefits of modern biology, he is also admonishing us to avoid creating layers and layers of technological fixes ("prostheses").

Three elements of sustainability contribute to its buzz saw nature: 1) uncertainty, 2) risk and 3) the political and ethical issues it embodies. The same three elements contribute to the heated debate about the benefits and risks of biotechnology. As with sustainability, the notion of "biotechnology" conjures vastly different visions among the public and the practitioners in the field. In its simplest sense, biotechnology is the product of humankind's intellect and inventiveness in the use of our biological resources. Seen in this context, biotechnology is not only a reasonable tool for the betterment of society, but it is as old as recorded history itself. Today's vision of biotechnology is clouded by concerns about the risks of the unprecedented and powerful tools of genetic engineering—evoking fears of "Frankenfood" and new man-made creations run amok in the environment. Somewhere between the optimistic technologist and the fearful environmentalist there is a more balanced perspective.

Uncertainty is the overarching reality we face in trying to discuss the benefits of sustainable development, biotechnology and the role of biotechnology in sustainable development. If we keep this in mind, it is easy to see that sustainable development, seen as an absolute goal, is a utopian notion with little practical value. Some ecologists prefer to see sustainable development more in terms of "risk management." This is a much more practical view of the world, and it is one which allows us to talk more frankly about the role of biotechnology—or any form of technology—in the trade-offs we make to move us in a more sustainable direction.

Faced with growing concern about genetic engineering, many biotechnologists will be tempted to take a strident position about the clear benefits of and the need for biotechnology—especially as a critical strategy on the path to a more sustainable society. We would, instead, encourage a rational debate about the uncertainty, risk and ethical issues that underlie both sustainable development and biotechnology. Using biomass and bioenergy as an example, we will outline some of the benefits and risks of biotechnology to improve the use of biomass as a renewable source of energy and other products that enhance the sustainability of our lives.