Union of Concerned Scientists

Citizens and Scientists for Environmental Solutions

Principles for Bioenergy Development

Updated April 23, 2007

Introduction

Global warming is one of the most serious challenges humankind has ever faced. The U.S. National Academy of Sciences, the Intergovernmental Panel on Climate Change, and scientific academies of 10 leading nations have all stated that human activity, especially the burning of fossil fuels, is changing our climate at an unprecedented rate. Every time we drive a car, use electricity from coal-fired power plants, or heat our homes with oil or natural gas, we release carbon dioxide and other global warming emissions into the air. We therefore have a fundamental responsibility to future generations to address this profound threat to the natural world before the consequences become irreversible.

The window for holding global warming emissions to reasonably safe levels is closing rapidly. Recent studies have concluded that avoiding dangerous climate change will require the United States and other industrialized countries to reduce their global warming emissions approximately 80 percent below 2000 levels by mid-century. This goal is attainable, but only if we act immediately to improve energy efficiency and shift to renewable energy resources such as wind, solar, and bioenergy.

Diversifying our energy supply in this way would not only help curb global warming but also create tremendous economic opportunities for American companies. In addition, it would enhance our energy security by reducing our reliance on fossil fuels from unstable regions of the world, helping to insulate us from political turmoil that can lead to price shocks and supply disruptions.

This document lays out the opportunities and challenges for bioenergy, as well as a set of principles to help guide us as we travel down the path to a cleaner, more secure energy future.

Definitions

Bioenergy refers to sources of energy (electricity and solid, liquid, or gaseous fuels) derived from **biomass**: plant- or animal-based materials such as crops, crop residues, trees, animal fats, by-products, and wastes. These materials are often obtained from agriculture and forests, but can also be derived from industrial and municipal sources.

Biofuel typically refers to biomass that has been converted into a liquid fuel such as ethanol or biodiesel, but biomass can also be converted into gaseous fuels via biological or chemical

www.ucsusa.org
Two Brattle Square · Cambridge, MA 02238-9105 · TEL: 617.547.5552 · FAX: 617.864.9405
1707 H Street, NW · Suite 600 · Washington, DC 20006-3962 · TEL: 202.223.6133 · FAX: 202.223.6162
2397 Shattuck Avenue · Suite 203 · Berkeley, CA 94704-1567 · TEL: 510.843.1872 · FAX: 510.843.3785

processes such as digestion and gasification. Biomass solids can also be burned alone or with fossil fuels to generate direct heat, steam, and/or electrical energy.

Cool Energy + Cool Fuels = Cool Planet

When biomass is burned to produce electricity, or biofuel is burned to power a vehicle, the carbon in the fuel combines with oxygen in the air to form carbon dioxide—the same global warming pollutant produced by fossil fuels. The carbon in fossil fuels has been locked inside the earth for eons and, when burned, contributes to the accumulation of global warming pollutants in the atmosphere.

Unlike fossil fuels, the carbon in biomass has been recently pulled from the atmosphere through the process of photosynthesis. The production and use of bioenergy therefore constitutes a closed cycle in which carbon moves from the atmosphere to biomass and back to the atmosphere in roughly the same quantity. However, the fact that fossil fuels are typically required to produce bioenergy complicates the equation.

Not All Biomass Is Created Equal

In addition to requiring a certain amount of fossil fuels, biomass production and practices can alter the amount of carbon stored and released by soils and trees. The net impact of bioenergy on atmospheric carbon levels therefore depends on the type of biomass being used, the production and delivery method, the end use, the energy source being displaced, and how the resource would have been used if it was not converted into bioenergy.

For this reason, we must consider the energy, climate, and environmental impact of a kilowatt-hour or BTU of bioenergy or biofuel over the full life cycle. For example, the impact of transportation fuels such as gasoline, coal-derived liquid fuels, and ethanol should be evaluated from extraction (at the wellhead, mine mouth, or cornfield) to emission (from the exhaust pipe).

Challenges and Opportunities

If developed in a sustainable way, bioenergy has the potential to produce both electricity and fuel with fewer risks than those associated with oil, coal, and nuclear technologies. But a rapid global expansion of bioenergy development could have unwanted environmental and economic consequences, possibly including reduced global capacity to produce food, fiber, and industrial materials. Such challenges represent an opportunity to improve the resiliency of our agriculture and forestry sectors.

By the same token, our current antiquated energy production system relies on supplies that lack diversity and are finite, polluting, and highly centralized. These traits leave us vulnerable to shortages and supply disruptions from hurricanes, unrest in oil-producing countries, and terrorist attacks. As we move toward a cleaner, more resilient and secure energy future, we must be careful to avoid building new systems with the same flaws as the old ones.

Guiding Principles

The following principles will help guide bioenergy development in a manner that maximizes the opportunities and helps address the challenges associated with this renewable resource.

1. Minimize global warming pollution.

Our energy choices should give priority to production methods and materials that produce the lowest amount of global warming pollution per unit of energy and offer the greatest overall potential for emission reductions. For example, corn ethanol and soy biodiesel have built the foundation for the U.S. biofuels industry, but these biofuels have limited overall potential to significantly reduce global warming pollution and oil dependence. To realize substantial reductions, we must transition as quickly as possible to new biofuels derived from abundant and diverse materials including energy crops, ecologically safe amounts of forestry and agriculture residues, and other waste materials.

2. Combine bioenergy with efficiency, conservation, and smart growth.

To achieve timely reductions in both global warming pollution and fossil fuel dependence, expanded bioenergy use must be pursued in conjunction with aggressive increases in energy efficiency, reduced energy demand through conservation, and reforms in transportation and land use policies ("smart growth"). Wise energy use will not only bolster bioenergy's role but also lower operating costs for consumers, raise profits for producers, reduce other types of pollution, and ensure long-term availability of resources.

3. Protect public health.

In general, replacing coal with biomass at power plants would reduce both global warming pollution and toxic emissions that threaten public health. But some bioenergy applications can degrade air, water, or land quality, creating tradeoffs between the potential benefits and public health risks. We must evaluate the health risks and potential unintended consequences of bioenergy production and use, and make choices that maintain and improve public health.

4. Promote ecologically sound bioenergy systems.

- ***Protect air, water, and soil quality.*** Bioenergy feedstocks should be produced and used in ways that maintain or improve the quality of environmental resources. To accomplish this, we must analyze the impact bioenergy production and use will have on air, water, and soil quality, and establish criteria that ensure bioenergy is produced in a sustainable manner. Progress in light of these criteria should be monitored as bioenergy resources are developed.

- ***Protect biodiversity and ecosystem services.*** The development of new sources of biomass will involve major changes in domestic and international land use and management. These changes could either enhance or degrade the quality of agricultural, forest, rangeland, and wildland ecosystems and the ecological services they provide (e.g., clean water, crop pollination). Biomass production should conserve biological diversity, protect wildlife habitat, and ensure the continued delivery of ecosystem services. Protected areas, lands possessing high conservation value (such as old-growth forests, wilderness, and wildlife habitat), and other areas considered rare or valuable should not be used for biomass production.

- ***Use biotechnology wisely.*** Genetically engineered biomass should be supported only where the benefits outweigh the risks, and where traditional breeding or other alternative approaches are not feasible. Risks and benefits should be assessed on a case-by-case basis prior to commercialization. Outdoor releases of genetically engineered crops, trees, and microorganisms deserve special scrutiny because modified organisms or the novel genetic traits they carry can spread into the environment with little or no hope for recall. Any genetic modification to commodity crops that are also grown for food (corn, soy, wheat, etc.) should not endanger the food system or undermine the value of these crops as food or feed for domestic consumption or export.

- ***Limit the risk of invasive species.*** Hundreds of supposedly beneficial plant species have been introduced into the United States only to become costly pests. Insofar as possible, biomass production should not exacerbate this already serious problem by using plants or microorganisms with invasive properties. Nor should we confer invasive properties on plants modified through conventional breeding or genetic engineering. If potentially invasive plants are introduced, containment and monitoring should be required.

5. Ensure bioenergy investments expand economic opportunity.

- ***Create opportunities for stable economic development.*** Investments in bioenergy should ideally strengthen each "link" in the commodity chain, including producers, processors, and distributors. Accomplishing this goal, however, will entail overcoming historical economic inequities among these groups, lessening the centralization and vulnerability of our current energy system, and increasing the resiliency of bioenergy production. Therefore, policies should seek to maximize the benefits of bioenergy use for local populations in biomass-producing areas, which will help rural communities profit from the processing and production of bioenergy.

- ***Promote a responsible shift to bioenergy production through effective government policies and investments.*** To compete with existing crop and energy subsidies, and quickly and fully realize its potential benefits, bioenergy production must be supported by government policies that set appropriate performance standards. Effective, targeted public investments in the form of research, market-creating purchases and mandates, and producer price supports should be provided for emerging bioenergy technologies and industries.

Conclusions

Developed responsibly, bioenergy has the potential to produce both electricity and fuel with fewer risks than those associated with oil, coal, and nuclear technologies. But this opportunity will only be realized fully if we make wise decisions about how the technology is developed.

Given the urgency of reducing our global warming emissions, it is essential that we choose those forms of bioenergy that, over the full life cycle of the fuel, promise the greatest emission cuts in the shortest period of time. In addition, bioenergy development should not create or exacerbate health or environmental problems such as air and water pollution or degrade biological diversity. Investments in bioenergy development should bolster the economic foundation and quality of life in those communities where biomass is produced and processed. And, as bioenergy technologies improve, we should expect performance standards to become more stringent as well.

The United States has a responsibility both to itself and the rest of humanity to confront the momentous challenge of global climate change effectively, equitably, and with minimal environmental damage. Using the principles above, we can develop bioenergy as one of the many solutions needed to address this challenge. And we can use our country's market and political power to leverage environmentally and socially sound policies and practices elsewhere in the world.

Evaluating our bioenergy options will raise complex issues and, as various policies and programs are explored, it may prove difficult to develop a single solution that satisfies all of the principles presented above. Nevertheless, these principles should serve as valuable guideposts to decision makers both in the United States and abroad.