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# *The Department of Energy's Contribution to the President's Bioproduct and Bioenergy Initiative*

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I bring greetings from Bill Richardson, Secretary of Energy, who is a strong supporter of the development and utilization of bioenergy.

There are four key messages that I want to deliver:

- This is an opportune time for the development and utilization of biobased products and energy.
- Success will require a more integrated approach than hitherto.
- Our nation's colleges and universities have a very large role to play.
- Government/industry/academic partnerships will ultimately be the key to success.

The development of clean-energy resources in this country, including bioenergy, has the following driving forces: (1) energy security, (2) electric utility restructuring, (3) environmental quality, (4) climate change, and (5) economic competitiveness.

## ENERGY SECURITY

This is the traditional driving force for work by government, industry and academia relative to energy, with the emphasis on reducing our dependence on foreign oil. Table 1 shows that it is a mounting challenge. Domestic production of oil is declining, whereas requirements are increasing, particularly in the transportation sector and especially as a result of rapid growth in the use of light and heavy trucks. Filling the gap between domestic oil production and domestic transportation requirements, in many respects, represents our biggest energy-security challenge.

TABLE 1. DOMESTIC OIL PRODUCTION AND TOTAL USE

Year	Oil use by			
	Domestic production	Autos	Autos + light trucks	Autos + light & heavy trucks
----- (millions of barrels per day) -----				
1970	9.25	6.25	6.50	7.50
1980	8.50	6.25	8.25	10.2
1990	7.50	6.25	8.25	10.2
2000	7.00	6.00	9.50	12.2
2010	5.25	5.00	12.0	14.5
2020	5.50	5.00	13.7	17.0

### ELECTRIC UTILITY RESTRUCTURING

Currently, about twenty-seven states have introduced competition and choice in some form to their electricity markets. This means that new energy technologies will have increasingly greater opportunities for success in the marketplace. And consumers, whether they are commercial or residential, will have choices in terms of supplier and technology.

### ENVIRONMENTAL QUALITY

It is noteworthy that, in the United States, an extraordinarily high fraction of pollutant emissions result from the production and use of fossil-based energy. Of the total emissions nationally, 97 percent of the NO<sub>x</sub>, 85 percent of CO, 91 percent of SO<sub>2</sub> and 98 percent of the CO<sub>2</sub> result from the use of fossil fuels; this is emerging as a significant environmental challenge. Clearly, the use of renewable resources, including biomass, represents an important new approach to improving environmental quality.

### CLIMATE CHANGE

The substantial growth in carbon emissions that is projected for the next few decades may contribute to global warming. Biofuels have the major advantage of being relatively carbon-neutral.

### ECONOMIC COMPETITIVENESS

In the world today, power production of about three million megawatts is installed. Over the next 20 years, it is projected that in excess of two million megawatts more will be required — almost double.

While these driving forces suggest a bright future for bioenergy, there are serious challenges also. An important point to consider is the need to improve integration across the various focus areas of bioenergy. In other words, the people in chemicals, power, fuels and bioproducts are not working together. The fundamental commonality is that they all work with biomass and see a future for it. In our view, we must increasingly integrate our efforts across those focus areas.

The oil-refining industry is an excellent example of integration. Depending upon technologies, policy influences and market signals, a barrel of oil can be used to make fuels, power, chemicals, and a whole array of products. A similar integrated approach must be developed if biomass is to see the growth that we think it needs. Therefore, an integrated bioenergy industry must look across all these focus areas, advance the technologies, put the right policies in place, and stimulate the appropriate markets.

An integrated bioenergy industry would evaluate and consider all possible resources for biofuel production: trees, grasses, crops, residues, animal wastes, municipal solid wastes. It would evaluate a broad array of conversion processes for the widest spectrum of products. The fact that the product possibilities are far broader than from petrochemicals is a very exciting opportunity that has stimulated people in Washington, DC, to focus in a way that we have not seen before.

Fortunately, “the stars have aligned” in pursuit of this goal, as shown by some of the activities of the past couple of years. Your organization (NABC) issued a very compelling *Vision for Agricultural Research and Development in the 21st Century*. A major National Research Council report on renewable bioproducts was released. And President Clinton’s executive order in August 1999 is a major development in our joint work to move biomass forward. We are seeing an unprecedented level of legislative interest and legislative support. It is rare these days in Washington when the Congress agrees with the White House, the Senate agrees with the House, and the Democrats agree with the Republicans, but when it comes to biomass we have seen very strong legislative support from both ends of Pennsylvania Avenue and across the two parties.

This cooperation has focused on Senator Lugar’s bill, which has been adopted by the full Senate. We expect House passage of a bill shortly, and then resolution in a conference leading to a major new piece of legislation that would authorize new work by the federal government on biomass, and hopefully result also in increased appropriations. We are striving not only to obtain authorization to move forward in a more integrated fashion but also to receive appropriations that would support work in industry, universities and government. We have also seen a modest increase in the current budget in support of work on biomass. And the Department of Energy along with other federal agencies are working on a biobased products and bioenergy vision and roadmap that will link the approach to technologies, policies and markets in a very fundamental way.

President Clinton's goal is to triple use of biobased products and bioenergy (power, fuels, chemicals, materials) within 10 years. We think it is realistic to go from our current use of bioenergy, which is approximately 3 percent of United States primary energy, and triple that by 2010.

Many offices of the federal government are working cooperatively to achieve this: the Department of Agriculture, Department of Energy and a number of related entities, including the National Science Foundation, Environmental Protection Agency, Department of the Interior, and the Department of Commerce. As an example of these activities, an interagency council on biobased products and bioenergy has been established, jointly chaired by the Department of Energy and the Department of Agriculture. I chair it from the DOE side and Miley Gonzales, the Under Secretary for Technology, chairs it from the USDA side. In addition, a new advisory committee is being formed that will have university representation, to advise the government on its approach to bioenergy and biobased products. Also, an office to coordinate the federal government's various functions has been established and is under way. These activities represent a large strategic planning effort addressing questions such as: Are we spending money in the right ways? Are we coordinating in the right ways? Have we placed the right level emphasis on our work with industry and universities?

The development and widespread use of bioproducts face a number of challenges from the technological side, such as securing reliable feedstock sources, developing new delivery systems, and, perhaps most important, reducing conversion and downstream processing costs. The cost curves for these issues must be reduced, no matter what the technology is, if bioproducts are to compete with the petrochemical-based processes already in existence.

Also, many market challenges exist. Reliable biomass supplies must be established. Securing capital for new technologies can be difficult, especially when the "dot coms" are wooing Wall Street. Factors such as the price, quality, and availability of alternative sources of power and fuels, e.g. fossil-derived fuels, in addition to the replacement costs of facilities, will also determine the development of biobased industries. Practical aspects must be considered such as sales, distribution and service networks, trade opportunities and foreign-market access; some of the biggest opportunities will lie overseas.

And there are key policy challenges. How will the tax code affect the development and utilization of biobased products? What decisions will be made on a state-by-state basis regarding electric utility restructuring, and ultimately at the federal level when legislation is finally adopted? How will these resources be treated under environmental regulations, particularly clean-air regulations? Where does this fit in our response to global climate change, rural economic development policies, and government procurement. As a matter of interest, the federal government is the largest user of energy in the world, representing 2 percent of all energy consumed in the United States.

Several ongoing projects across the country are jointly financed by the federal government and industry. In New York State and Vermont, hybrid willow is being used in a co-firing process with fossil fuels. Alabama Power is also involved in a co-firing project. Switchgrass is being grown in a number of states, also for co-firing. New gasification technologies are being developed that, instead of direct burning, are able to gasify biomass material or black liquor waste from the forest-products industry to make a medium-BTU gas that will turn a turbine to make electricity.

We are excited also about the prospects for cellulosic ethanol. Production plants are under development in Louisiana, New York State, California, North Carolina, Idaho and North Dakota, some of which are supported by DOE.

The data below represent a realistic projection of the total ethanol production over the next 20 years in the United States. With cost declines, improved technologies, and current biotechnological advances, we believe there is a bright future for cellulosic ethanol.

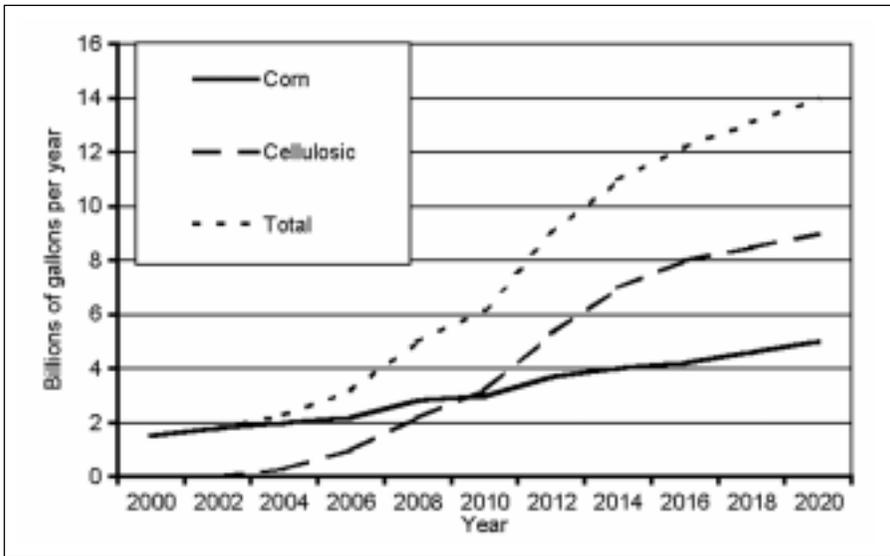


Figure 1. Projected production of ethanol, 2000–2020.

There are also some interesting relationships to other emerging energy technologies. Some companies are looking at biofuels as a source of hydrogen to power fuel cells. In late 2001, General Electric is planning to market residential fuel cells.

Opportunities exist also in rural areas for wind power, which is the fastest growing source of electricity in the world. Major advances in this technology in a Minnesota project recently have driven the price down from 40 cents per kilowatt hour in 1979 to 4 cents per kilowatt hour (unsubsidized). In farm

country from the Dakotas to Texas, in Kansas, Nebraska, Minnesota and Iowa, there is huge wind-power potential and we are seeing major developments.

Recently, there have been major advances also in the technology of harnessing solar energy. Systems are well developed and costs are decreasing.

A broad array of funding opportunities from various federal agencies is available to universities and industry. Currently, there are active solicitations for work on biobased products, co-firing research, analytical tools, and bio-refineries. These solicitations have enjoyed huge responses across fuels, power and chemicals to generate the best ideas in industry and academia on how to progress with a more integrated approach. Furthermore, we are increasingly interested in working with the state universities and land-grant colleges in this area of endeavor, and are hopeful that such partnerships will be fruitful.

To conclude, a wonderful opportunity exists for bioenergy and biobased products. The stars truly have aligned from a policy prospective, the technologies are developing well, there is increasing market interest and, over the next decade, we look forward to working with you to move this vision forward.