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**POLICY CONSIDERATIONS FOR BIOMASS COMMERCIALIZATION AND  
ITS IMPACT ON THE CHARITON VALLEY BIOMASS PROJECT**

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**ABSTRACT**

Growing biomass energy crops on erosive lands, then using them as a substitute fuel in coal-fired power plants can reduce air pollution, greenhouse gas emissions, soil erosion and water pollution. Regrettably, the current market value of biomass, which is higher relative to coal, prevents this substitution. Left out of the equation are the costs of related environmental damages and the public expenditures for their prevention. The cumulative value of the benefits derived from substituting biomass for coal likely outweighs the current market price difference, when the public costs and benefits of clean air and water are considered. Public policy to encourage substitution of biomass for coal and other fossil fuels is a vital component in the commercialization of energy crops. This is specifically demonstrated in south central Iowa where switchgrass is being considered as a coal substitute in the Chariton Valley Resource Conservation and Development (RC&D) area. Marginal land use, rural development, and soil, air and water quality concerns are all drivers for policies to increase the value of switchgrass compared to coal.

**Keywords:** switchgrass, biomass, public policy, resource conservation

**OVERVIEW**

Biomass energy crops, such as fast growing trees and perennial grasses used to substitute for fossil fuels, may soon emerge as a single solution for a seemingly unrelated range of environmental problems. Perennial grasses, such as switchgrass, control erosion and protect water quality when grown on marginal lands. Research also suggests that switchgrass can replace significant amounts of carbon in the soil previously removed through tillage and erosion. These benefits are compounded when biomass is harvested and substituted for coal. Power plant emissions are cleaner and atmospheric carbon is reduced. The current value of biomass crops, however, is higher than coal and prevents a market-based substitution. Producers interested in growing biomass and utilities interested in pursuing renewables have little incentive, despite the environmental benefits available to the public. Left out of the valuations of coal and biomass is the cost of environmental damage to soil, water and air and public expenditures for their protection.

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The Clean Air Act and numerous Farm Bills provide evidence of government action to address environmental problems. Whether directly or indirectly, government policies do cause economic adjustments. As a society we impose policy values that encourage or discourage certain actions. Examples include U.S. energy policies that historically provided incentives to develop fossil fuels such as coal and gasoline, and then more recently, closely regulated emissions from coal-fired power plants. Likewise, incentives, regulations and subsidies have driven U.S. agriculture since the 1930's, influencing farmer decisions to produce crops and to conserve soil. These policy-based market effects are both extensive and firmly entrenched in our economic system.

Therefore, a full accounting of the costs and benefits associated with both biomass and coal, coupled with the public's desire to protect the environment; could have policy implications that improve the commercial potential of biomass. Policies that encourage or require the use of biomass translate to market adjustments that can achieve the aforementioned benefits and result in a cohesive merging of energy and agriculture policy. Indeed, both the United States Departments of Agriculture and of Energy are cooperatively assessing biomass technologies and their policy implications.

### **THE PRECEDENCE FOR BIOMASS POLICY INITIATIVES**

Current U.S. energy policy seeks to secure "a more efficient, less vulnerable, and environmentally sustainable energy future (DOE, 1991). Specifically the Energy Policy Act of 1992 (EPACT) required DOE to develop a least-cost national energy strategy that considers the economic, energy, environmental, and social costs of various energy technologies. In 1992, the U.S. Department of Energy (DOE) indicated that the development of a sustainable biomass energy program in the U.S. was desirable for a number of reasons (DOE, 1992). The use of dedicated energy crops was identified as a major long-term source of renewable fuel to establish domestic energy independence, address global warming, relieve over production in the agricultural sector, reduce water pollution and increase rural incomes. Arguably, the intent of U.S. Energy policy is to strongly consider environmental and other public impacts in the evaluation of total energy production costs.

While environmental impacts or "externalities" are an unintended byproduct of energy and agriculture production, they place significant costs on private individuals and the public in general without any compensation (Baumol and Oates, 1979). A recent comparison of coal and biomass suggests that with consideration of the extensive external costs and benefits, biomass is competitive with coal. The two major factors in this comparison are public costs to control non-point pollution and the potential to reduce CO<sub>2</sub> emissions (Faaij, 1997). It is also well recognized that when the marketplace does not adequately capture these costs, government involvement is appropriate to implement adjustment mechanisms (Miranowski, 1986; Tietenberg, 1996).

The 1963 Clean Air Act was the first attempt by the federal government to establish air quality standards and set the precedence for environmental government intervention. The

act has since been amended and strengthened many times. Most recently the Clean Air Act Amendments of 1990 significantly revised U.S. air pollution laws and mandated stringent regulations designed to become stricter and more comprehensive over time (Cropper and Oates, 1992). Even with this oversight, utility power plants still account for 72% of SO<sub>2</sub>, 35% of CO<sub>2</sub> and 33% of NO<sub>x</sub> emissions into the nation's air (Energy Information Administration, 1994). According to Oak Ridge National Laboratory, coal is the worst contributor and that substituting any other major fuel including biomass reduces emissions of these key pollutants (ORNL, 1994). As utilities are required to abate harmful emissions, the value of biomass use can be valued within the context of damage costs associated with coal emissions and cost of expensive control systems.

While biomass may have a quantifiable value to electric utilities that currently use coal, the greatest value of biomass may be in the agricultural sector to prevent non-point pollution, reduce government expenditures for soil and water conservation and to increase rural economic development. Policies enacted over the past 60 years by the federal government have provided farmers with economic subsidies that have greatly influenced production decisions and land use (Halcrow, et al., 1994). These production oriented policies have not always had a positive effect on the rural economy and have negatively impacted soil and water resources (Miranowski, 1986). Subsidies were paid to producers regardless of the soil and water impacts that resulted during production. Commodity programs directed at production controls created competing objectives with long term resource conservation losing out to short term individual economic self-interests.

Protection of soil and water has only recently emerged as a distinct policy area with objectives not primarily concerned with commodity production. Beginning with the 1985 farm bill, legislation established incentives such as the Conservation Reserve Program (CRP) to idle highly erodible land and set conservation compliance requirements for participation in subsidy programs. (NRC, 1993). As of December 1996, the CRP covered approximately 33 million acres of idled cropland. These acres are concentrated in the Great Plains and western Corn Belt. Annual erosion reductions for the acreage in the program as of December 1996 totaled 626 million tons, or about 19 tons per acre. This is a 20% reduction in cropland erosion compared with conditions prior to the CRP. The scope and the environmental impacts of CRP are both impressive and not without considerable expenditures by USDA. CRP funding for FY 1996 was \$1.7 billion. (ERS, 1996).

### **BIOMASS COMMERCIALIZATION THROUGH PUBLIC POLICY**

Use of marginal lands (less productive, more erosive) for energy crop production has been closely associated with benefits from reduced erosion, increased farm income and improved water quality, an alternative to traditional farm commodity programs and a major strategy for reducing greenhouse gas emissions (Dovring, 1988; Bluhm et al, 1993). The Midwest, especially Iowa has been recognized as having a high potential for energy crop production (Brower, 1993). Switchgrass, a herbaceous species native to Iowa has been cited as having high potential as an energy crop (Woolsey, 1992; McLaughlin et al.

1992). The use of switchgrass as an energy crop can address both water quality and global warming concerns as a substitute for coal and in higher efficiency gasification and ethanol production technologies (McLaughlin et al, 1995). Switchgrass can reduce soil erosion to almost zero, requires relatively low inputs, grows well on marginal soils, and adds significant amounts of carbon to the soil as a sequestering method for atmospheric CO<sub>2</sub> (Downing et al, 1993).

The recognized potential of switchgrass as an energy crop and the need for agricultural markets for products grown on marginal lands has led to close examination of biomass potential in Iowa. As a state, Iowa imports 98% of its energy and has thousands of marginal farmland acres better suited to energy crops than to traditional row crops. Southern Iowa producers faced with reduced federal supports and limited soil resources need to identify alternative markets for sustainable agricultural products that will protect the environment as well as boost the local economy. Biomass is one of the possibilities. Chariton Valley RC&D Inc., a USDA-affiliated rural development organization based in southern Iowa, and Alliant Power, a major Iowa energy company, are leading a coalition of public and private interests to establish an energy crop industry that can capture this potential.

The Chariton Valley Biomass Project will install modifications to a 750 MW coal-fired power plant that will allow Alliant to co-fire switchgrass with coal. At a 5% substitution level, facility modifications will provide a potential market for 200,000 tons of switchgrass annually produced on 50,000 acres of marginal land in southern Iowa. The creation of this market hinges on the value of biomass to Alliant Power.

Emissions regulations, possible renewables requirements and a closed-loop biomass tax credit all contribute to the utility's interest and the economic viability of the project. The production and use of switchgrass for biomass also provides soil and water conservation and rural development benefits. USDA currently spends close to \$10 million annually in CRP payments in the four-county Chariton Valley RC&D area to protect environmentally sensitive land and improve rural farm incomes. Allowing farmers to market switchgrass biomass produced on land enrolled in CRP could provide the same environmental and economic benefits at a lower cost to the public and as a more long-term solution. A major focus of the project continues to be pursuit of the policy initiatives that give specific value to biomass in the above noted circumstances. These conditions, both economic and environmental, are vital to encourage Alliant Power to adopt switchgrass as consistent fuel source. With respect to the incentive mechanisms and environmental protection requirements, project sponsors have identified key policy variables that can commercialize biomass.

Clarification of the applicability of tax credits for biomass authorized by Title XII; section 1212 of the Energy Policy Act of 1992 is a high priority for the Chariton Valley Biomass Project and other biomass efforts across the nation. Defined in Section 45 of the Internal Revenue Code, eligible electric producers receive a tax credit of \$.015 per Kilowatt-hour for electricity produced from "closed-loop" biomass. While switchgrass in the Iowa project meets the closed-loop definition, the Alliant facility was placed in

service prior to the originally designated date. A legislative change of this "placed in service" date to sometime before 1983 would make the Alliant plant eligible and, according to company officials, would add approximately \$20 per ton to the value of switchgrass.

Another factor that contributes to the Alliant interest in and ultimately its willingness to use biomass, is the possibility of federal renewables requirements. This policy if implemented would require that utilities use a certain amount of renewable fuel-based generation capacity. In the Chariton Valley case, switchgrass would no longer be compared to \$15 per ton coal, but to the cost of other renewable power sources such as wind energy. This comparison in Iowa would result in a base value of approximately \$35 per ton for switchgrass.

From the agricultural perspective, the Chariton Valley Biomass Project is also concerned with capturing the environmental value and the rural economic impacts of biomass production. Current CRP payments to farmers in the Chariton Valley area average close to \$80 per acre annually. This payment buys soil conservation, water quality protection and wildlife benefits on that particular acre for one year. We have in essence, through the CRP, quantified the value of these environmental measures to the public. As noted above, biomass production on these marginal lands can provide these same benefits plus significant atmospheric carbon reduction. Redirecting existing CRP to biomass production or creating a similar program would reduce the cost of biomass up to \$15 - \$20 per ton. The productive use of CRP lands as opposed to the current idle state would also have a positive impact on the local rural economy through farm labor, agricultural supply and equipment businesses.

Finally, switchgrass managed for biomass production can sequester soil carbon and its substitution for coal can further reduce atmospheric CO<sub>2</sub>. This cumulative effect may become the most important aspect of the Chariton Valley project. Regulation of CO<sub>2</sub> emissions and a system of tradable carbon credits are very real possibilities in response to international climate change concerns.

The following table illustrates how these potential policy changes can impact on the value of switchgrass and how current issues could quickly increase demand for switchgrass and subsequently the producers willingness to supply.

## **CLOSING THE GAP**

### How Public Policy Can Affect the Value of Biomass

<b>Economic Variable</b>	<b>Value Per Ton</b>	<b>Switchgrass Value Cumulative Per Ton</b>
Coal Equivalent	\$15	\$15
Renewable Requirement (Wind Equivalent)	\$20	\$35
Closed Loop Tax Credit	\$21	\$56
CRP-Based Incentive	\$20	\$76
Carbon Sequestration	??	\$76+
Minimum Price Needed for Delivered Switchgrass	\$50-70	

All of the above variables can positively affect the value of biomass in southern Iowa as well as in other parts of the United States. Ongoing efforts in the Chariton Valley Biomass Project are directed at determining the current cost of switchgrass as a boiler fuel. This information will define the existing cost gap with coal and establish the importance of these policy variables in a more comprehensive valuation of biomass. To the extent that these policies can increase public benefits, accomplish stated national objectives in energy and agriculture, and do so in a cost-effective manner, will define the true commercial value of biomass.

## **CONCLUSIONS**

The Chariton Valley Biomass Project is driven by the need to find alternative markets for sustainable forages to protect the local environment and boost the local economy. The efficient production of biomass and the method of converting it to energy are of great importance and are a large part of project activities. However, technology alone cannot make biomass commercially viable. The main focus of Chariton Valley and similar projects is the identification of economic and environmental circumstances that encourage power producers to adopt energy crops as a fuel source at a price level that allows local producers to profit. The extent that biomass is used by the utility and the profitability of its production by local farmers will be determined as much by government policy decisions as by technical issues.

Current policies to protect air and water resources either mandate specific actions or provide market incentives for the private sector to reduce environmental damages. To the extent that tax dollars finance these environmental policy controls, the public pays for externalities collectively through federal government expenditures. In areas of policy where the public already pays (i.e. CRP) to prevent excess damages, compatible activities that can increase benefits and/or reduce control costs represent a more efficient use of public resources.



Merging energy and agriculture policy objectives to encourage biomass use could easily close the market value gap between coal and switchgrass. Refocusing existing control costs in the agricultural sector through the Conservation Reserve Program can result in incentives for farmers to develop an energy crop industry to supply Alliant Power. Tax incentives and the potential of greenhouse gas reduction policies can provide the utility an incentive to substitute switchgrass for coal. The resulting increase in cumulative benefits can be achieved at current or reduced control cost levels. The cumulative effect of these actions can produce a market correction favorable to biomass and a commercially viable industry.

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