A technical and economic analysis of willow biomass crops grown on conservation reserve program land in New York State.

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The fossil fuel intensive energy budget of New York State (NY) raises several concerns related to energy security and environmental pollution. Producing bioproducts or generating power by cofiring willow biomass feedstock produced on Conservation Reserve Program (CRP) land has the potential to address these concerns. This paper presents an analysis of the technical feasibility of growing willow on CRP land, and uses a detailed costing model developed by members of the Salix Consortium [1], to assess the economic potential of its production and utilization.

The importation of nearly 92% of its energy fuels, at a cost of over $30 billion dollars per year, makes NY especially vulnerable to energy supply fluctuations and reduces opportunities for economic development [2]. The environmental impacts of energy generation also cause concern, especially with nearly 67% of electric power being generated by the burning of fossil fuels [2]. In addition to the ongoing struggle to comply with the regulations of the Clean Air Act, the Environmental Protection Agency (EPA) reports that climate change can have far reaching impacts on NY, including possible changes in precipitation and soil moisture regimes, and increased erosion along the coastline [3]. Additionally, since the 1950's, declining rural industry and agricultural activities have led to an abandonment of more than half of NY's farmland [4]. Since 1993, the Salix Consortium[a] has pursued the goal of facilitating the development of a commercial willow biomass enterprise in NY and the northeastern U.S. [5]. While invaluable experience and knowledge has been gained about many aspects related to biology, plantation silviculture, business management and technology transfer, there is a continued need to develop farmer interest, expand crop acreage and develop long term markets for the feedstock.

The production and utilization of willow crops for energy generation provides an array of benefits that are currently considered positive externalities. These include reduction in soil erosion and non-point source pollution, which will protect precious ground and surface water supplies, and enhancement of wildlife habitat and landscape-diversity, relative to agricultural fields. Further more, as a fuel source, willow biomass is CO_2 neutral, and when mixed with coal, leads to a reduction in SO_2 and NO_X emissions from the power plant. Willow biomass crops have the potential to revitalize rural areas that have been economically depressed due to the declining farm economy in NY.

Ensuring the economic viability of this enterprise requires that it be profitable for all parties concerned - the grower, aggregator and power plant – to produce and utilize the feedstock. Previous economic analysis indicated that willow biomass feedstock would cost (assuming a minimum 6% rate of return to the grower) approximately $2.90/MMBtu to purchase, which is twice the price of coal [1]. This plant-gate price is unable to ensure a reasonable rate of return to the power plant, rendering it unfeasible from the

[a] The Salix Consortium is a collaboration among 20 organizations with the stated aim of facilitating a commercial willow biomass enterprise in New York State. The primary members are: SUNY-ESF, Niagara Mohawk Power Corporation, South Central Resource Conservation and Development (RC&D), Cornell University Department of Biological and Agricultural Engineering, Laboratory of Ornithology, NY State Energy Research and Development Authority and several other federal and state agencies and universities.

perspective of the power plant. However, this analysis only included the externalities that currently have a market value such as reduced SO_x and NO_x emissions from power plants that cofire willow biomass with coal. Mechanisms that will help growers and power plants appropriate a value for many of the other positive externalities mentioned above are critical to enhance the viability of this enterprise.

One way to enable growers to appropriate a value for some of the water and soil quality, and wildlife habitat benefits associated with willow biomass crops, and address the need for increased grower involvement and acreage is through programs such as the Conservation Reserve Program (CRP). CRP is an important federal soil conservation program authorized by the Food Security Act of 1985. According to this program, owners of land that meet a certain level on an environmental benefits index can opt to enter into a 10 year agreement with the United States Department of Agriculture (USDA) wherein they will retire the land from agriculture and maintain a "permanent vegetative cover" of grasses or trees. In return, the farmers are eligible for annual rent payments for the life of the contract as well as cost sharing funds to offset the establishment costs of a vegetation cover. The October 1999 Amendment to the Food Security Act of 1985 (Sec.1232 (a)(7)) provided for the harvest of biomass crops on 101,000 ha of CRP land in the United States. Up to six pilot projects will be approved, with no more than one in each state. A proposal was developed that would incorporate willow biomass crops with other herbaceous cover on just over 6,000 ha of CRP land in central and western NY. The proposal was considered by both the Farm Service Agency State Committee and the NY-USDA State Technical Committee, and was forwarded to Washington, D.C. with a recommendation for approval. The areas proposed for planting would be in an 80 km radius of the Dunkirk Power Plant in western NY, the Greenidge Power Plant or the Colgate University Steam Heating Plant in central NY.

A way to strengthen the economic viability from the perspective of the power plant would be, in addition to the previously mentioned SO_2 and NO_x credits, to implement policy instruments such as tax credits for CO_2 mitigation (closed-loop carbon credits) and premium price for energy from willow (green premium pricing). Upon assigning a premium price, and values to various emission credits and taxes, it emerges that the power plant may be willing to pay up to $4.10/MMBtu for willow feedstock. The rate of return to both the grower and power plant at this price is nearly 14%. On the other hand, by including CRP rental payments and the USDA cost share option, the enterprise provides similar returns to both the grower and power plant, at a price of around $2.89/MMBtu. The paper will present a detailed analysis of the relative impact of the proposed CRP harvesting exemption for willow biomass crops, in combination with other policy instruments, on the success of the enterprise from the perspective of all parties concerned.

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