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Testimony

Before the Subcommittee on Forests and Forest Health

Committee on Resources

United States House of Representatives

Hearing on the *"GAO Report on Promoting Woody Biomass for Energy and Other Uses*" April 27, 2006

A major barrier to the sustainable development of wood based energy is considered to be its cost vs. fossil fuels. If the environmental and social benefits of wood energy are accounted for, then the utilization of forest biomass for the production of energy becomes environmentally, economically and socially justifiable (Eriksson et. al., 2002). I would suggest that if the environmental and social benefits of wood energy are *not* accounted for, then the *lack of* utilization of forest biomass for the production of energy *will* become environmentally, economically and socially *unacceptable*. This statement will be explored in the contents of this testimony.

Woody biomass offers a tremendous source of renewable energy. Biomass can be defined as plant material, vegetation or agricultural waste that can be used as a fuel or energy source. As a source of energy, Biomass is the largest domestic source of renewable energy providing over 3% of total U.S. energy consumption, and surpassing hydropower. The US Department of Energy and US Department of Agriculture, support biomass fuels and products as a way to reduce oil and gas imports and support the growth of agriculture, forestry, and rural economies. When we think of woody biomass, then we can include forest residues remaining after harvesting operations, pre-commercial stems remaining after thinning operations, logging residues and industrial process residues from primary processors, such as sawmills and secondary processors such as furniture manufacturers. This woody biomass represents a significant volume of feedstock which could be converted into energy and high value add chemicals.

The utilization of forest biomass for the production of energy and chemicals can be considered as an industry of the future, providing new markets for forest thinnings, residues and waste. The potential for this industry is continuing to increase because changes in the global economy have caused a reduction in demand for timber in the United States, especially in the southeast where the demand for pulpwood has significantly decreased. This has led to local industry experiencing high inventories and lower prices for small diameter pinewood and thousands of acres of overstocked pine plantations. A biomass energy industry could utilize wood considered to be un-merchantable or underutilized and could contribute to alleviating the nation's economic, energy and environmental concerns. This new industry would create high-volume, non-cyclical markets for forest biomass with new jobs being created, lost jobs restored and existing jobs retained.

Timber products supply and demand through to 2040 has been reported on by Prestemon and Abt (2000). The authors provided data indicating that the southern US will remain the dominant timber supply region, and an increased supply will come from pine plantations. Trends were projected using the Sub Regional Timber Supply Model (SRTS) of Abt et al. (2000). The data indicated that most of the ownership is and will be private, and that production is consumed domestically. Output

was not expected to keep pace with demand expansion. An outcome of this would be rising prices that would provoke an increase in product imports and continued changes in product manufacturing technologies as an effort to reduce the cost of final wood based products. The projections of this work were based upon stable trends in product consumption, economic growth, technological change, population growth, and land use choices. It is obvious that in the last five years stability has been disrupted with closures of pulp mills and rising imports in pulpwood, finished products (e.g., panel products), lumber, and furniture.

Johnson and Steppleton (2005) reported total southern pulpwood production for pulp mills drawing round wood or wood residue in the 13 southern states. From 1994 through 2003, Southern pulpwood production declined by 11%, from 180.8 million green tons to 162 million green tons. This was accompanied by a decline in round wood pulpwood production, softwood round wood production, hardwood round wood production and wood residues.

Table 1. Pulpwood Production (X1, 000 green tons) in the southern U.S. by source of wood, state, year, and number of mills.

STATE	1994	2003	% CHANGE
Alabama	24377	19222	- 20
Arkansas	5437	7751	42
Florida	10475	10096	-4
Georgia	18807	20786	10
Kentucky	534	715	13
Louisiana	13443	11317	- 16
Mississippi	15354	11150	-12
North Carolina	12650	9415	-26
Oklahoma	854	1466	71
South Carolina	12435	10706	-14
Tennessee	3755	4463	18
Texas	5561	7124	28
Virginia	7162	6764	-6
Total	130,844	120,974	-7.6
Residues	49,929	41,039	-17.8
Grand Total	180,773	162,012	-10.4
Number of Mills	104	91	-13.5

The decline in pulpwood production was noted in a report by Wear et al. (2005) which discussed the forces of change driving markets for timber production across the South. The report illustrated that the demand for domestically produced timber products has declined in the U.S. Despite a decline in demand, there has been a steady increase in supply with a dampening of prices. In pulpwood markets, prices are at their 1998 levels and are associated with a decline in capacity, leading to an excess of pulpwood. The report did not see a rebound in this situation for the foreseeable future. The low prices for softwood pulpwood have provided opportunities for engineered wood product manufacturers to build plants in areas where pulp mills have closed. However, demand for pulpwood by these plants will not displace the declines in demand from paper manufacturers. The authors stated that “Emergence of biomass energy markets may play a role in the future but this is highly uncertain at this time”.

The strategic factors driving timberland ownership in the Southern U.S. states have been discussed by Clutter et al. (2005). Forest products companies have been selling their timberlands since they can purchase raw materials from deep and mature markets in the U.S. Clutter et al. (2005) considered that within the next three years there would be only one traditional forest products company that owned more than a million acres in the southern U. S. A significant amount of timberlands have been purchased by institutional clients, managed by Timber Investment Management Organizations (TIMO’s). The investments are usually for 10 – 15 years which reflects the way in which the timberland is managed. The TIMO’s appear to practice silvicultural management favoring shorter duration treatments. This reflects the investment horizon and the premerchantable stems available at this time. In the absence of pulpwood demand for paper manufacture, this situation could be turned into an advantage for feedstock destined for woody biomass utilization.

Small landowners must not be forgotten. This group is also supplying pulpwood to pulp mills and as the demand gets less for this material the small landowner continues to suffer. The emergence of a woody biomass industry could directly help this group of landowners to enjoy a source of revenue.

Considerable research has been performed to develop short rotation intensive culture (SRIC) forestry plantations for energy. Traditionally, this research has focused on production of energy from fast-growing hardwood species such as eastern cottonwood, American sycamore, sweetgum, willow and non-native species such as the eucalypts (Bruce 1994).

Until recent years, the value of pine plantation thinnings for pulp and paper feedstock has been so high that utilization of this resource for energy has been prohibitive. However, current and future economic trends indicate that utilization of pine thinnings for energy feedstock is becoming a viable alternative.

Lack of perceived economic viability has limited the research performed for utilization of pine plantation materials for biomass production. Eight-to-ten year rotations for plantations are typically applied when managing hardwood stands for biomass (Portland 1994). If thinned by a similar early harvest schedule, the harvest of plantation pine at age 10 for biomass would release residual pine stems to increase their growth rates with the rate increase roughly proportional to the severity of thinning. Faster growth after 10 years of age would act to solve the juvenile wood problem by increasing the percentage of mature wood in relation to the juvenile wood core. By contrast, pine plantation first thinning removal for pulpwood is usually practiced on stands at about 15 years of age. In addition to the earlier increased growth of the residual stand, there are increased economic benefits to landowners if income from thinnings occurs earlier in the rotation (Bullard and Straka, 1998).

Based on the silviculture applied to produce, it is probable that whole-tree chipping will also be the most practical and economical harvesting method for pines. Largest volume of biomass and the least amount of handling of stems would occur if needles, branches, bark and stems are harvested and utilized for a value-added product.

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Woody biomass can be converted into a range of products using several different processes. The biomass can be burnt to produce energy or heat, converted into fuels which can be burnt to produce heat or power or used to produce chemicals and materials. There are a large number of technologies under development which could become commercial and provide the needed conversion routes for the wood biomass. Utilization of industrial sawdust and bark for energy biomass has been practiced by industrial forest products companies for centuries. Typically, sawmill lumber dry kilns utilize the steam generated by burning less desirable wood waste, mainly bark, sawdust and planer shavings which have high energy content and value or particleboard furnish. Higher-value wood chips from green lumber edgings and trimmings have had much higher value as feedstock for the production of pulp and paper than for energy. However, lower demand for industrial wood chips as pulp and paper operations has resulted in lower prices for industrial wood chips. For this reason, utilization of industrial wood chips as well as bark and sawdust for energy production may now be feasible.

There are several options available for using woody biomass to produce energy, either as heat and electricity or liquid fuels

- Combustion of forest thinnings for Electricity or Combined Heat and Power (CHP)
- Gasification – Liquid Fuels, Chemicals, or CHP
- Small Modular Biomass Units – Electricity or CHP
- Pyrolysis to produce Chemicals, Bio-Crude and Liquid Fuels
- Fermentation of wood cellulose to Ethanol
- Integration of Gasification and/or Fermentation

Woody biomass is used to generate electricity by the electric power sector. Consumption as Quads of Btu (British Thermal Units) is shown in Table 2. It is interesting to note that woody biomass is the principal source of biomass, the industrial sector consumes the most woody biomass, which is represented by the forest products industry e.g. pulp and paper mills.

Table 2. National Renewable Energy Consumption as Wood for Electricity Generation by Energy Use Sector, 2000 – 2004 (Quads Btu) (EIA, 2005).

SECTOR/SOURCE	2000	2001	2002	2003	2004
TOTAL	3.995	3.439	4.109	4.150	4.269
TOTAL BIOMASS	0.826	0.833	1.004	0.902	1.092
Wood/Wood Waste	0.496	0.486	0.605	0.519	0.710

SECTOR					
Commercial	-	-	-	-	0.001
Industrial	0.369	0.370	0.464	0.362	0.551
Electric Power	0.126	0.116	0.141	0.156	0.158

The net generation and fuel consumption at power plants consuming coal and biomass is shown in Table 3.

Table 3. Net Generation and Fuel Consumption at Power Plants

consuming coal and biomass (EIA, 2005).

				PERCENT OF ENERGY CONSUMED FROM		
	NET ELECTRICITY GENERATION (X1,000 KW Hrs)	TOTAL ENERGY CONSUMED (MMBTU)	ENERGY CONSUMED FROM BIOMASS	BIOMASS	COAL	OTHER
NATIONAL TOTAL	93,304,634	1,709,765,399	630,926,946	36.90	53.78	9.32

The production of electricity from woody biomass was not considered to be economically competitive in a report by the American Forest and Paper Association (2005), especially when compared to coal. The national average costs for producing electricity from wood in 50 and 100 MW plants is 1.4 – 2.2 cents/KWh more than for coal but far less in several southern states. In States where woody biomass generating costs are close to coal costs, there is a concern that biomass energy development could threaten pulpwood supplies and even sooner if subsidies are given to encourage biomass energy production. There appears to be significant potential for generating electricity from woody biomass. The potential for producing liquid fuels and chemicals from woody biomass is far higher and more profitable, than producing electricity. The greatest opportunity lies in the production of liquid fuels, placing rural areas in the forefront of the movement away from petroleum import dependence (Bowyer, 2006).

The emphasis on the production of electricity in co-fired power plants for hub and spoke reticulation needs to be re-considered. The development of a form of distributed energy could be much more attractive, especially to rural communities.

Combined Heat and Power (CHP) units are available which can be run from wood chips or wood pellets. These CHP units would lend themselves particularly well to small communities, especially supplying energy requirements for key installations such as schools, clinics and fire stations. Local economies could derive direct benefit from locally developed energy and local communities could retain the revenue from the production of wood based fuels.

Reports by the GAO have stated that there are several barriers preventing the full emergence of a woody biomass based industry. Federal policy changes such as increased subsidies could address obstacles to woody biomass utilization. Research and development efforts, combined with market forces, will eventually result in an “equilibrium”. Woody biomass utilization needs to find its appropriate level. If cost-effective uses of woody biomass can be found, its utilization will increase. Production tax credits or subsidies may be successful in getting businesses or industries started. However, they may not be sustainable over the long term.

Market-driven solutions are more appropriate—for example, providing information to exploit the existing market, or developing requirements or incentives (such as renewable portfolio standards) that create a market on their own.

The South is rich in woody biomass (lignocellulosic) material. The woody biomass can be obtained from wood residues and also forest thinnings. Wood could be specifically grown for conversion to energy and chemicals. The future for energy and high value chemical products is with lignocellulosic feedstock. Some high level goals for utilization of woody biomass can be listed as:

- Biomass availability

- Sustainability
- Feedstock Infrastructure
- System profitability

A final question that can be asked is what next for woody biomass utilization? This can be answered by stating that the U. S. Department of Energy and the U.S. Department of Agriculture are committed to expanding the role of biomass as a source of energy and chemicals. This commitment can be viewed as a way to support new industries manufacturing fuels, chemicals and other products. Additional work is required to develop appropriate conversion technologies and to determine the impact of Forest Biomass Utilization on traditional Forest Products markets.

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