

GAO

Report to the Chairman, Committee on
Resources, House of Representatives

March 2006

NATURAL RESOURCES

Woody Biomass Users' Experiences Offer Insights for Government Efforts Aimed at Promoting Its Use



G A O

Accountability * Integrity * Reliability

GAO
Accountability · Integrity · Reliability

Highlights

Highlights of [GAO-06-336](#), a report to the Chairman, Committee on Resources, House of Representatives

Why GAO Did This Study

The federal government is placing greater emphasis on thinning vegetation on public lands to reduce the risk of wildland fire. To help defray the cost of thinning efforts, it also is seeking to stimulate a market for the resulting material, including the smaller trees, limbs, and brush—referred to as woody biomass—that traditionally have had little or no commercial value. As GAO has reported in the past, the increased use of woody biomass faces obstacles, including the high cost of harvesting and transporting it and an unpredictable supply in some locations. Nevertheless, some entities, such as schools and businesses, are utilizing the material, potentially offering insights for broadening its use.

GAO agreed to (1) identify key factors facilitating the use of woody biomass among selected users, (2) identify challenges these users have faced in using woody biomass, and (3) discuss any insights that these findings may offer for promoting greater use of woody biomass.

In responding to a draft of this report, the Departments of Agriculture, Energy, and the Interior all generally agreed with GAO's findings.

www.gao.gov/cgi-bin/getrpt?GAO-06-336.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Robin M. Nazzaro at (202) 512-3841 or nazzaror@gao.gov.

NATURAL RESOURCES

Woody Biomass Users' Experiences Offer Insights for Government Efforts Aimed at Promoting Its Use

What GAO Found

Financial incentives and benefits associated with using woody biomass were the primary factors facilitating its use among the 13 users GAO reviewed. Four users received financial assistance (such as state or federal grants) to begin their use of woody biomass, three received ongoing financial support related to its use, and several reported energy cost savings over fossil fuels. Using woody biomass also was attractive to some users because it was available, affordable, and environmentally beneficial.

Several users GAO reviewed, however, cited challenges in using woody biomass, such as difficulty obtaining a sufficient supply of the material. For example, two power plants reported running at about 60 percent of capacity because they could not obtain enough material. Some users also reported that they had difficulty obtaining woody biomass from federal lands, instead relying on woody biomass from private lands or on alternatives such as sawmill residues. Some users also cited increased equipment and maintenance costs associated with using the material.

The experiences of the 13 users offer several important insights for the federal government to consider as it attempts to promote greater use of woody biomass. First, if not appropriately designed, efforts to encourage its use may simply stimulate the use of sawmill residues or other alternative wood materials, which some users stated are cheaper or easier to use than woody biomass. Second, the lack of a local logging and milling infrastructure to collect and process forest materials may limit the availability of woody biomass; thus, government activities may be more effective in stimulating its use if they take into account the extent of infrastructure in place. Similarly, government activities such as awarding grants or supplying woody biomass may stimulate its use more effectively if they are tailored to the scale and nature of the targeted users. However, agencies must remain alert to potential unintended ecological consequences of their efforts.

Examples of Woody Biomass Users GAO Reviewed



Source: GAO.
Pulp and paper mill.



Wood-fired heating facility at rural school.

Contents

Letter

Results in Brief	1
Background	2
Financial Incentives and Benefits, Access to an Affordable Supply, and Environmental Benefits Facilitated the Use of Woody Biomass among Users We Reviewed	5
Challenges Faced by Woody Biomass Users Included Inadequate Supply and Costs Associated with Handling and Using the Material	8
Current Users' Experiences Offer Insights for Government Efforts to Expand the Use of Woody Biomass	14
Concluding Observations	19
Agency Comments and Our Evaluation	24
	25

Appendixes

Appendix I: Characteristics of Woody Biomass Users Included in Our Review	26
Appendix II: Objectives, Scope, and Methodology	27
Appendix III: Comments from the Department of Agriculture	32
Appendix IV: Comments from the Department of the Interior	33
GAO Comments	38
Appendix V: GAO Contact and Staff Acknowledgments	40

Table

Table 1: Characteristics of Woody Biomass Users Included in Our Review	26
--	----

Figures

Figure 1: Small-Diameter Logs and Slash Generated from a Montana Fuels Reduction Project	6
Figure 2: Wood Fuel Storage Facility at a Montana School District	10
Figure 3: Equipment and Process for Using Wood Fuel at One Location	16
Figure 4: Maintenance Crew Member Clearing Wood Blockage in Conveyor Equipment	17
Figure 5: Locations of Woody Biomass Users We Reviewed	29

Contents

This is a work of the U.S. government and is not subject to copyright protection in the United States. It may be reproduced and distributed in its entirety without further permission from GAO. However, because this work may contain copyrighted images or other material, permission from the copyright holder may be necessary if you wish to reproduce this material separately.



United States Government Accountability Office
Washington, D.C. 20548

March 22, 2006

The Honorable Richard Pombo
Chairman
Committee on Resources
House of Representatives

Dear Mr. Chairman:

In recent years, extensive wildland fires have drawn attention to the abnormally dense vegetation in many of our nation's forests. The federal government has responded by placing greater emphasis on reducing the danger of such fires by thinning forests and rangelands to help reduce the buildup of potentially hazardous fuels. These thinning efforts are expected to generate large amounts of woody material, including many small trees, limbs, and brush—often referred to as woody biomass—that traditionally have had little commercial value.¹

Widespread thinning efforts will be costly to the federal government. To help defray these costs, and to enhance rural employment and economic development, the government is promoting a market for woody biomass. However, as we have reported in the past,² the increased use of woody biomass faces several obstacles. Officials in federal agencies seeking to promote its use—including the Departments of Agriculture, Energy, and the Interior—told us that woody biomass use is hampered by the high costs of removing and transporting it from forests and the difficulty in obtaining a reliable supply in some areas. Nevertheless, a number of businesses and government entities are using woody biomass for various purposes, including heating schools and hospitals, making lumber and other products, and generating electricity.

¹Although biomass can be considered any sort of organic material—including trees, grasses, agricultural crops, and animal wastes—the term woody biomass in this report refers to small-diameter trees and other traditionally noncommercial material cut as part of thinning, harvesting, or other activities on forests or rangelands. For the purposes of this report, we distinguish woody biomass from other wood residues such as sawmill residues or urban wood waste.

²See GAO, *Natural Resources: Federal Agencies Are Engaged in Various Efforts to Promote the Utilization of Woody Biomass, but Significant Obstacles to Its Use Remain*, [GAO-05-373](#) (Washington, D.C.: May 13, 2005).

In this context, and in response to our previous report describing agency activities to promote woody biomass, you asked us to review current users of woody biomass to determine whether their experiences offer any insights for expanding its use. Specifically, we agreed to (1) identify key factors facilitating the use of woody biomass among selected users, (2) identify challenges these users have faced in using woody biomass, and (3) discuss any insights that our findings may offer for promoting greater use of woody biomass.

To conduct our review, we used a structured interview guide to collect information from 13 users of woody biomass, including power plants, pulp and paper mills, and school and hospital facilities in various locations around the United States. Appendix I contains information about each of the 13 users in our review. We first identified users by interviewing federal and nonfederal officials knowledgeable about the use of woody biomass and by reviewing pertinent documents such as federal agency studies of woody biomass utilization. Users in our review were then selected from a range of industries and geographic regions. The information we collected about these 13 entities should not be generalized to other woody biomass users because of variations in the characteristics of different users. Appendix II provides further details on the scope and methodology of our review. We conducted our work from May 2005 through January 2006 in accordance with generally accepted government auditing standards.

Results in Brief

The primary factors facilitating woody biomass use among users we reviewed were financial incentives or benefits associated with its use, either in the form of financial assistance for using the material or in energy cost savings. Other factors included the availability of an affordable supply of woody biomass and users' interest in environmental benefits associated with its use. Four of the 13 users in our review received financial assistance to begin using woody biomass, including state and federal grants and tax-exempt bonds. Three users also were given ongoing support as a result of their use of woody biomass, including grant funds for expanding their wood storage facilities and payments for producing renewable energy. Moreover, six users reported energy cost savings from using woody biomass in place of fossil fuels such as natural gas. For example, two small school districts individually reported about \$50,000 and \$60,000 in annual fuel cost savings, while two large pulp and paper mills reported several million dollars in such savings. Several of the 13 users also cited the availability of an affordable supply of the material as important in their use of woody biomass—particularly in cases where it was already being

removed as a byproduct of other activities, such as commercial logging or private land clearing. Finally, three users told us that their use of woody biomass was due in part to anticipated environmental benefits associated with using the material, including improved forest health and reduced emissions.

Using woody biomass, however, was not without challenges for the users we reviewed. Users cited insufficient supply, increased equipment and maintenance costs, and other factors that limited their use of woody biomass or made it more difficult or expensive to use. In contrast to users citing an available supply of woody biomass, seven users reported they found it difficult or impossible to obtain a sufficient supply of the material. For example, two power plants reported running at about 60 percent of their capacity because they could not obtain enough material to operate at full capacity. Five users told us they had difficulty obtaining woody biomass from federal lands, which was of particular concern to users located in areas where federal lands constitute a substantial portion of the landscape. Such users relied more on woody biomass from private lands or on alternative wood materials such as sawmill residues (including sawdust, chips, bark, and similar materials) or urban wood waste (made up of tree trimmings, construction debris, and the like). Several users also told us that, despite the financial advantages of using woody biomass in place of oil or natural gas, they had incurred costs in using woody biomass that they would not have incurred had they burned these other fuels. Users cited costs for additional wood-handling equipment, such as storage bins and conveyors, and added operation and maintenance costs, including costs arising from problems in storing and handling woody material.

Our findings offer several insights for promoting greater use of woody biomass, specifically: (1) attempts to encourage the use of woody biomass may serve to stimulate the use of alternative wood materials such as sawmill residues instead, (2) government activities may be more effective in stimulating woody biomass use if they take into account the extent of logging and milling infrastructure, and (3) efforts to encourage woody biomass use may need to be tailored to the scale and nature of individual recipients' use.

- If not appropriately designed, attempts to encourage the use of woody biomass may simply stimulate the use of mill residues or other alternative wood materials, which some users told us are cheaper or easier to use than woody biomass. For example, in 2003, the Forest Service provided a grant to fund a Montana school's conversion to a

wood heating system in order to stimulate the use of woody biomass in the area. However, at the time of our review, the school was using less expensive wood residues from a nearby log-home builder rather than woody biomass. Further, in using woody biomass, users in our review often used the tops and limbs from trees harvested for merchantable timber or other uses rather than the small-diameter trees that contribute to the problem of overstocked forests. As the federal government seeks to stimulate the market for materials that result from forest-thinning activities, it should consider the potential impacts of its actions to ensure that they promote greater use of small-diameter trees and not simply increase the use of other wood materials.

- Government activities may be more effective in stimulating woody biomass use if they take into account the extent to which a logging and milling infrastructure is in place in potential users' locations. The availability of a reasonably low-cost supply of woody biomass depends in part on the presence of a local logging and milling infrastructure to collect and process forest materials, even though this infrastructure also generates alternatives to woody biomass. Without a milling infrastructure, there may be little demand for forest materials, and without a logging infrastructure, there may be no way to obtain the materials. Indeed, officials at one power plant operating at a reduced capacity because of a shortage of wood for the plant told us that the shortage was due to the lack of a local logging infrastructure—in other words, there simply were not enough loggers to carry out needed forest projects, and it was not cost-effective for the plant to obtain material from more distant sources. In general, the type and amount of effort needed to increase the use of woody biomass may vary among locations, depending on the extent to which a logging and processing infrastructure is already in place. The presence of such an infrastructure, however, may also increase the availability of mill residues—potentially complicating efforts to promote woody biomass use by offering cheaper or more readily available alternative materials.
- Similarly, government activities may be more effective in stimulating woody biomass use if their efforts are tailored to the scale and nature of the users being targeted. Most of the large wood users we reviewed, such as pulp and paper mills or power plants, were primarily concerned about supply, and thus might benefit most from federal efforts to provide a predictable and stable supply of woody biomass. In fact, one company currently plans to build a woody biomass power plant in eastern Arizona largely in response to a nearby federal thinning project

that is expected to last 10 years and generate a stable, long-term supply of the material. In contrast, small users we reviewed did not express concerns about the availability of supply, in part because their consumption was relatively small; however, several relied on external financing for their up-front costs to convert to woody biomass use. Such users might benefit most from financial assistance such as grants or loan guarantees to fund initial conversion efforts, and indeed, federal agencies are providing grants intended to promote the use of woody biomass, including a Forest Service grant program specifically intended to help defray federal thinning costs by stimulating woody biomass use. However, agencies must remain alert to potential unintended consequences of their efforts to stimulate the use of woody biomass. As we noted in our prior report, some officials expressed concern that developing a market for woody biomass could result in adverse ecological consequences such as unnecessary forest thinning to meet demand for the material. Further, while agency grants to woody biomass users may provide the users with benefits such as fuel cost savings, these grants may not in all cases defray agency thinning costs.

In responding to a draft of this report, the Departments of Agriculture, Energy, and the Interior all generally agreed with our findings.

Background

Woody biomass—small-diameter trees, branches, and the like—is generated as a result of timber-related activities in forests or rangelands. Small-diameter trees may be removed to reduce the risk of wildland fire or to improve forest health, while treetops, branches, and limbs, collectively known as “slash,” are often the byproduct of traditional logging activities or thinning projects. Slash is generally removed from trees on site, before the logs are hauled for processing. It may be scattered on the ground and left to decay or to burn in a subsequent prescribed fire, or piled and either burned or hauled away for use or disposal. Figure 1 depicts woody biomass in the form of small-diameter logs and slash.

Figure 1: Small-Diameter Logs and Slash Generated from a Montana Fuels Reduction Project



Source: GAO.

Woody biomass, both small-diameter logs and slash, can be put to various uses. Small-diameter logs can be sawed into structural lumber, particularly as some sawmills have retooled to process these logs in addition to, or instead of, larger logs. Other users of whole small-diameter logs include some log-home builders and post and pole makers. After bark, branches, and leaves are removed, logs can be chipped and processed to make pulp, the raw material from which paper, cardboard, and other products are made. Chipped wood also is used by manufacturers of oriented strand board and other such engineered wood products. Both small-diameter logs and slash also can be chipped or ground and used for fuel, either in raw form or after being dried and made into fuel pellets. Various entities, including power plants, schools, pulp and paper mills, and others, burn woody biomass in boilers to turn water into steam, which is used to make electricity, heat or cool buildings, or provide heat for industrial processes.

Federal, state, and local governments, as well as private organizations, are working to expand the use of woody biomass. Recent federal legislation, including the Biomass Research and Development Act of 2000,³ Healthy Forests Restoration Act of 2003,⁴ Consolidated Appropriations Act for

³Pub. L. No. 106-224, Title III, 114 Stat. 428 (2000), as amended.

⁴Pub. L. No. 108-148, Title II, 117 Stat. 1901 (2003).

Fiscal Year 2005,⁵ and Energy Policy Act of 2005,⁶ contains provisions for woody biomass research and financial assistance. For example, the Consolidated Appropriations Act for Fiscal Year 2005 made up to \$5 million in appropriations available for grants to create incentives for increased use of woody biomass from national forest lands; in response, the Forest Service awarded \$4.4 million in such grants in fiscal year 2005. State and local governments also are encouraging the use of woody biomass through grants, research, and technical assistance. For example, the Bitter Root Resource Conservation and Development Council, a nonprofit organization sponsored by state government entities and three counties in Montana,⁷ is helping to coordinate a federally funded effort—known as the Fuels for Schools program—to install wood-fired heating systems in rural school buildings. Other states, such as Idaho, Nevada, and North Dakota, also are participating in the Fuels for Schools program.

Private corporations also are researching new ways of using woody biomass and wood waste, often in partnership with government and universities. For example, one corporation has partnered with the University of Georgia, and has developed and plans to license biorefinery technology for making chemicals, agricultural fertilizer, and transportation fuels such as ethanol from woody biomass. Another private company has developed technology that it hopes will significantly increase the ethanol yield from any type of biomass, including woody biomass.

⁵Pub. L. No. 108-447, 118 Stat. 3076 (2004).

⁶Pub. L. No. 109-58, § 210, 119 Stat. 658 (2005).

⁷Resource Conservation and Development Councils are part of the Resource Conservation and Development Program, managed by the Department of Agriculture's Natural Resources Conservation Service. The program is intended to encourage and improve the capability of state and local units of government and local nonprofit organizations in rural areas to plan, develop, and carry out programs for resource conservation and development.

Financial Incentives and Benefits, Access to an Affordable Supply, and Environmental Benefits Facilitated the Use of Woody Biomass among Users We Reviewed

The users in our review cited several factors contributing to their use of woody biomass, primarily financial incentives and benefits but also other factors such as an affordable supply of woody biomass and environmental considerations. Financial incentives encouraging the use of woody biomass included financial assistance, while financial benefits included energy cost savings from using woody biomass in place of other fuels. In addition, some users had access to a readily available and affordable supply of woody biomass, particularly in areas where material was being removed as part of commercial activities such as logging. Other users told us that their use of woody biomass was due in part to environmental or other perceived benefits.

Financial Incentives and Benefits Encouraged the Use of Woody Biomass by Several Users

Financial incentives for, and benefits from, using woody biomass were the primary factors for its use among several users we reviewed. Four of the 13 users in our review told us that initial financial assistance in the form of grants or bonds allowed them to begin using woody biomass. Three public entities—a state college in Nebraska, a state hospital in Georgia, and a rural school district in Montana—received financial grants covering the initial cost of the equipment that they needed to begin using woody biomass. In the case of the state college, a state grant of about \$1 million in 1989 covered the cost of installing two wood-fired boilers used to heat about 1 million square feet of campus building space, as well as an expansion to the college’s central heating plant to house the new boilers and the requisite wood storage and handling system.⁸ The college received a subsequent grant of about \$100,000 in 2003 to help defray the costs of installing a chiller powered by woody biomass, which supplies cool air to campus buildings. The state hospital in Georgia received about \$2.5 million in state funds during the early 1980s to pay for the purchase and installation of wood-handling equipment, and the Montana school district received about \$900,000 in federal funds in 2003 for the same purpose.⁹ The fourth user—a wood-fired power plant in California—received financial assistance in the form of tax-exempt state bonds to finance a portion of the plant’s construction, part of a statewide effort to promote the use of biomass

⁸Dollars are unadjusted for inflation.

⁹Another user in our review that chips woody biomass into raw material for pulp and paper plants has obtained a federal grant to build a sawmill capable of processing small-diameter logs into lumber. However, this sawmill was not yet in operation at the time of our review.

power plants and thereby reduce air pollution created by burning the material in the open.

Three users in our review also received additional financial assistance, including subsidies and other payments that helped them continue their use of woody biomass.

- The California wood-fired power plant received about \$10 per megawatt hour from the state government during 2003 and 2004, according to a plant official.¹⁰ This subsidy, which also was provided to other biomass-fueled electricity producers in the state, was paid for by a “public goods” surcharge on consumers’ utility bills. The plant also benefited from an artificially high price received for electricity during its first 10 years of operation, a result of California’s implementation of the federal Public Utility Regulatory Policies Act of 1978.¹¹ The act—a response to the unstable energy climate of the late 1970s—required utilities to purchase electricity from certain facilities producing electricity from renewable sources, including woody biomass, at prices established by state regulators.¹² However, the initial prices established by California—based on expectations of sharply rising oil and natural gas prices—proved to substantially exceed market prices in some years, benefiting this power plant by increasing its profit margin.
- The Montana school district also continues to receive financial assistance through its participation in the Fuels for Schools program. For example, the Bitter Root Resource Conservation and Development Council paid for the installation of a 1,000-ton wood fuel storage facility at the school district, capable of storing over a year’s supply of fuel. The council also financed the up-front purchase of a year’s supply of fuel for the district, which the district repays as it uses the fuel. This ongoing assistance helped the district obtain wood fuel for about \$24 per ton during the 2005-2006 school year, in contrast to the \$36 per ton it paid

¹⁰A megawatt is a unit of power equal to 1 million watts, or enough electricity to power about 750 homes at any given time.

¹¹Pub. L. No. 95-617, 92 Stat. 3117 (1978).

¹²States set rates, pursuant to general regulations issued by the Federal Energy Regulatory Commission, based on the buyer’s “avoided cost.” Avoided costs are the energy and facilities costs that would have been incurred by the purchasing utility if that utility had to provide its own generating capacity. According to the commission, while it provides general avoided cost regulations, states set rates that often are above market rates.

for woody biomass in the previous year. Moreover, when some of the school district’s wood fuel supply decayed more rapidly than expected, the council also arranged for the Forest Service to provide higher-quality woody biomass from a nearby fuels reduction project at a price of \$10 per ton. Figure 2 shows the 1,000-ton wood fuel storage facility.

Figure 2: Wood Fuel Storage Facility at a Montana School District



Source: GAO.

- One Colorado power plant that generated electricity by firing woody biomass with coal received ongoing financial benefits for using woody biomass by selling renewable energy certificates. Renewable energy certificates (sometimes referred to as “green tags”) represent the environmental benefits of renewable energy generation—that is, the benefits of displacing electricity generated from nonrenewable sources, such as fossil fuels, from the regional or national electric grid. The certificates are sold separately from the electricity with which they are associated. Certificates can be purchased by utilities seeking to meet state requirements for renewable energy generation or by other entities seeking to support the use of renewable energy sources, and their sale can serve as an additional source of revenue to power plants using such sources. The Colorado power plant in our review generated about 730

megawatt hours of electricity through its use of woody biomass,¹³ and sold the associated renewable energy certificates to the Forest Service for \$23 per megawatt hour, or about \$17,000 in total. The Forest Service purchased the certificates in order to promote woody biomass use and to offset the power plant's costs for using woody biomass.

Energy cost savings also were a major incentive for using woody biomass among six of the users we reviewed. Of the four users that produce central heat with wood, two users—small rural school districts in Pennsylvania and Montana—told us that they individually had saved about \$50,000 and \$60,000 in annual fuel costs by using wood instead of natural gas or fuel oil. Officials at one of these districts told us that these savings represented the equivalent of one teacher's annual salary, stating "we could either burn fuel oil and watch that money go up the chimney, or burn wood and put the money toward education." Likewise, the state college in Nebraska, which uses woody biomass to heat and cool about 1 million square feet of space in several campus buildings, typically saves about \$120,000 to \$150,000 annually, while the Georgia state hospital reported saving at least \$150,000 in 1999, the last year for which information was available. Similarly, the two pulp and paper mills we reviewed each reported saving several million dollars annually by using wood rather than natural gas or fuel oil to generate steam heat for their processes; officials at one mill stated that the mill's operating costs would increase significantly without the savings generated by burning wood, making it difficult for the mill to remain competitive. Each of these users told us that they planned to continue their use of woody biomass because they anticipated continuing high fossil fuel prices.

An Affordable Supply Facilitated the Use of Woody Biomass

An affordable supply of woody biomass facilitated its use, especially in areas where commercial activities such as logging or land clearing generated woody biomass as a byproduct. For example, the Nebraska state college was able to purchase woody biomass for an affordable price because logging activities in the area made slash readily available. Logging companies harvested timber in the vicinity of the college, hauling the logs to sawmills and leaving their slash; the college paid only the cost to collect,

¹³The 730 megawatt hours represent a small fraction of the plant's output, nearly all of which is generated by burning coal. However, the plant determined—and a third-party certifying body agreed—that 730 megawatt hours could be directly attributed to burning woody biomass.

chip, and transport the slash to the college for burning. One official told us that without the area's logging activity, the affordable supply of woody biomass used by the college would be severely jeopardized and the college would have to pay much higher prices to heat and cool its campus.

Two Pennsylvania users in our review also obtained an affordable supply of woody biomass generated through commercial activities. Officials of a rural school district told us that nearby lands are being cleared for development, and that a portion of the wood generated from land clearing is chipped by contractors for purchase by the school. Similarly, a Pennsylvania power plant uses wood from a combination of sources, including woody biomass from land-clearing operations that are, on average, more than 130 miles from the plant, according to a plant official.¹⁴ This official told us that the developers clearing the land are required to dispose of the cleared material but are not allowed to burn or bury it, so they often are willing to partially subsidize removal and transportation costs in order to have an outlet for the material.

Forest management activities also contribute to the availability of an affordable supply of woody biomass. For example, small-diameter trees have been available to a large pulp and paper mill in Mississippi in part because of thinning activities by area landowners. In this area, as in much of the southeastern United States, forests are largely privately owned, and much of the forests are plantations meant for production. Small-diameter trees are periodically thinned from these forests to promote the growth of other trees, and traditionally have been sold for use in making pulp and paper. Officials at the Mississippi pulp and paper mill told us that these trees are a relatively inexpensive source of material compared with the cost of the material in other parts of the country because the structure of southeastern forests—with level terrain and extensive road access—reduces harvesting and hauling costs, in contrast to other parts of the country where steep terrain and limited road access may result in high harvesting and hauling costs.

¹⁴Other sources of material used by the plant, according to this official, include slash from conventional logging, chips from sustainably managed forestry operations, sawmill waste, and urban wood waste.

Environmental Benefits and Other Factors Played a Role in the Use of Woody Biomass

Three users cited potential environmental benefits, such as improved forest health and air quality, as prompting their use of woody biomass; other users told us about additional factors that increased their use of woody biomass. Two users—the Montana school district and the coal-fired power plant in Colorado—started using woody biomass in part because of concerns about forest health and the need to reduce hazardous fuels in forest land; they also hoped that by providing a market for woody biomass, they could help stimulate thinning efforts. The Montana school district was the first of a series of Fuels for Schools projects intended to stimulate demand for woody biomass generated from forest fuels reduction, and the Colorado power plant began using woody biomass in an effort to contribute to the health of the forest by using material from nearby fuels reduction projects.

Air-quality concerns spurred the use of woody biomass at a Vermont power plant in our review. According to plant officials, the utilities that funded it were concerned about air quality and as a result chose to build a plant fired by wood instead of coal because wood emits lower amounts of pollutants. Other users cited the air-quality benefits of burning woody biomass under the controlled conditions of a boiler rather than burning it in the open air (whether through slash pile burning, prescribed burning, or wildland fire) because doing so generates significantly fewer emissions.

Finally, other factors and business arrangements specific to individual users encouraged the use of woody biomass, either by insulating users from the effects of changes in the price and availability of woody biomass or by enabling users to profitably add woody biomass use to their business. For example, an official at one wood-fired power plant told us that the plant has been able to operate because the plant's owners—a group of utilities—have the financial capacity, as well as a long-term outlook, to withstand short-term fluctuations in its profitability. Without this ownership, according to officials, the plant might have shut down during periods of decreased revenues resulting from variations in the price or availability of woody biomass. Another user, which chips wood for use as fuel in a nearby power plant, has an arrangement with the power plant under which the plant purchases the user's product at a price slightly higher than the cost the user incurred in obtaining and processing woody biomass, as long as the user's product is competitively priced and meets fuel-quality standards. The arrangement guarantees the user a long-term market for its product at a price that allows it to cover its costs. Three users whose operations include chipping woody biomass and other activities, such as commercial logging or sawmilling, told us that having

these other operations within the same business is important because costs for equipment and personnel can be shared between the woody biomass chipping operation and the other activities.

Other users helped offset the cost of obtaining and using woody biomass by selling byproducts resulting from their use of the material. For example, one pulp and paper mill in our review sold turpentine and other byproducts that were produced during the production of pulp and paper, while another user—a wood-fired power plant—sold steam extracted from its turbine to a nearby food-canning factory. Other byproducts sold by users in our review included ash used as a fertilizer, bark for landscaping material, and sawdust used by particle board plants.

Challenges Faced by Woody Biomass Users Included Inadequate Supply and Costs Associated with Handling and Using the Material

Users in our review experienced factors that limited their use of woody biomass or made it more difficult or expensive to use, including insufficient supply and increased costs related to equipment and maintenance. Two users were unable to obtain a sufficient supply of woody biomass, and several more told us they had difficulty obtaining the material from federal lands. Several users also told us that, despite the economic advantages of using woody biomass in place of oil or natural gas, they had incurred costs that they would not have incurred had they burned oil or natural gas—including additional equipment for handling woody biomass and added operation and maintenance costs, such as costs arising from problems in storing and handling woody material.

Woody Biomass Was Not Always Sufficiently Available

Seven users in our review told us they had difficulty obtaining a sufficient supply of woody biomass, either because of constraints on the supply of the material or because of insufficient availability of loggers to collect it. Two users, both power plants, reported to us that they were operating at about 60 percent of their capacity because they were unable to obtain sufficient woody biomass or other fuel for their plants. Officials at both plants, each of which burned mostly woody biomass but also supplemented the material with mill residues and urban wood waste, told us that their shortages of wood were due at least in part to a shortage of nearby logging contractors. According to plant officials, the lack of logging contractors meant that nearby landowners were unable to carry out all of the projects they wished to undertake, resulting in what one plant official termed a “backlog of standing timber.” While officials at one plant attributed the plant’s shortage entirely to the insufficient availability of

logging contractors, an official at the other plant stated that the lack of woody biomass from federal lands—particularly Forest Service lands—also was a significant problem. One plant reported taking a financial loss in each of the past 3 years, the result of operating below capacity.

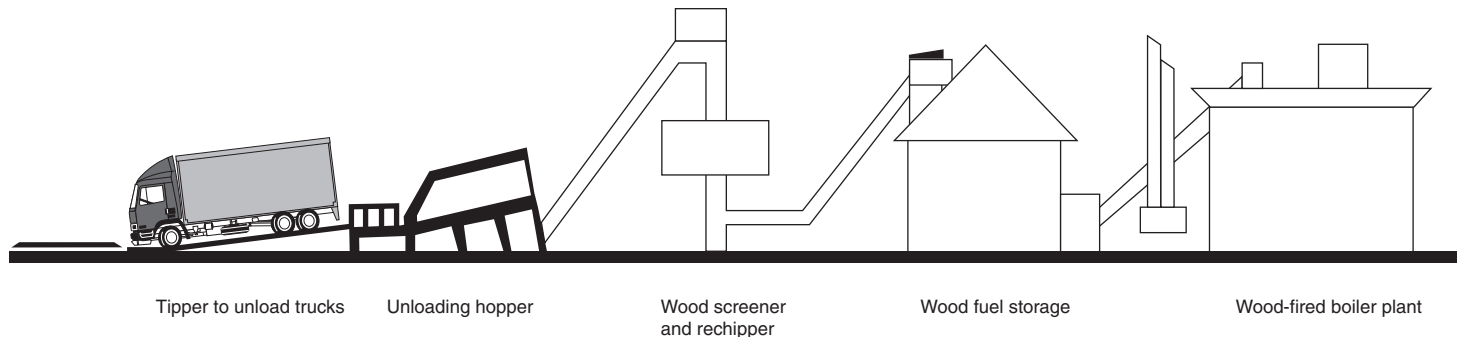
The lack of supply from federal lands was a commonly expressed concern among the woody biomass users on the West Coast and in the Rocky Mountain region, with five of the seven users we reviewed in these regions (including one of the power plants running at about 60 percent capacity) telling us they had difficulty obtaining supply from federal lands. One such user ceased operations for several months because of an interruption in its supply of woody biomass from federal lands. Users with problems obtaining supply from federal lands generally expressed concern about the Forest Service’s ability to conduct projects generating woody biomass; in fact, two users expressed skepticism that the large amounts of woody biomass expected to result from widespread thinning activities will ever materialize. One official stated, “We keep hearing about this coming ‘wall of wood,’ but we haven’t seen any of it yet,” adding that emphasizing uses for woody biomass without an adequate supply “is putting the cart before the horse.”¹⁵ Of the remaining six users in our review, one obtained about 5 percent of its woody biomass from federal lands while the other five used no federal woody biomass at the time of our review. In such cases, users obtained woody biomass from state or private lands, or relied on alternative wood materials such as sawmill residues or urban wood waste.

¹⁵In commenting on a draft of this report, officials from both the Department of the Interior and the Forest Service stated that their agencies are seeking to increase the availability of woody biomass from federal lands. Interior officials commented that the department has established a contract clause, to insert in all solicitations and contracts through which biomass is expected to be generated, allowing the use of all material so long as it is ecologically appropriate and in accordance with the law. Interior stated that this clause could increase the availability and affordability of woody biomass from Interior lands. Forest Service officials told us that their agency is seeking new opportunities for providing a reliable and consistent supply of woody biomass, including working with Interior to streamline processes for developing stewardship contracts and agreements. Stewardship contracting involves the use of any of several contracting authorities on the part of the Forest Service and Interior’s Bureau of Land Management, including the ability to exchange goods for services and to enter into contracts of up to 10 years. Stewardship contracting authority expires in 2013. Other Interior agencies, including the Fish and Wildlife Service, have related authorities; see, e.g., 50 C.F.R. § 29.5.

Users Choosing Woody Biomass over Oil or Natural Gas Made Additional Investments in Equipment and Incurred Additional Operations and Maintenance Costs

Several users in our review told us they incurred costs to purchase and install the equipment necessary to use woody biomass beyond the costs that would have been required for using fuel oil or natural gas. These costs included scales for weighing incoming material; truck tipper to assist in unloading material; wood-storage buildings or concrete pads for storing wood; chippers to chip the material to the proper size; and conveyors and other mechanisms for transporting the material to the boiler. Some users needed other equipment as well; an official at one location told us a front-end loader was dispatched every 45 minutes to push wood chips to a loading area, where a mechanical conveyor could pick the chips up. Figure 3 is a schematic of the equipment and process used by one user in our review.

Figure 3: Equipment and Process for Using Wood Fuel at One Location



Source: GAO analysis of Georgia Forestry Commission information.

The cost of this equipment varied considerably among users, in part as a result of the differences in the amount of wood consumed. For example, a school district burning about 850 tons of wood fuel per year reported spending about \$385,000 for the necessary equipment, including the boiler, while a pulp and paper mill burning about 216,000 tons per year in its boiler—about 250 times the school district’s annual consumption—reported investing \$15 million in equipment necessary to use the material. Not all users reported additional substantial expenditures on equipment, however; one power plant burning wood mixed with coal told us that the only additional equipment it needed was a ramp for a front-end loader, which was constructed at minimal cost.

Wood utilization also tended to increase operation and maintenance requirements for users. One power plant official told us that wood is more expensive to handle than coal, citing handling costs of \$4.50 per ton for wood compared with \$1.50 per ton for coal.¹⁶ Wood also can create problems; for example, if wood chips are not properly sized, they can create blockages in machinery that require prompt action. During our visit to one facility, wood chips jammed on a conveyor belt, dumping wood chips over the side of the conveyor and requiring a maintenance crew member to manually clear the blockage. Figure 4 shows the crew member attempting to clear the blockage.

Figure 4: Maintenance Crew Member Clearing Wood Blockage in Conveyor Equipment



Source: GAO.

After one facility converted from natural gas and fuel oil to wood, it reported that the number of personnel needed to maintain its central heating plant nearly doubled, from about 8 or 9 to about 14 to 16. At

¹⁶It should be noted that this plant used substantially more coal than wood, and, as a result, the lower handling cost for coal might be attributable in part to economies of scale.

another facility—the power plant mixing woody biomass with coal—an official told us that a wood blockage in the feed mechanism led to a fire in one of the plant’s coal-storage units, requiring the plant to temporarily reduce its output of electricity and leading the plant to pay \$9,000 to have its remaining stock of wood rechipped. Two users also reported spontaneous combustion in their wood storage piles that resulted from decaying wood.

Other issues specific to individual users also decreased woody biomass use or increased costs for using the material. For example, an official with one user, which chips small-diameter trees and sells the resulting chips to pulp and paper mills, told us that the pulp and paper mills prefer sawmill residues to chipped trees and will purchase his product only when sufficient sawmill residues are unavailable. This official told us that demand for his product has been so low in some years that he has operated his chip processor for only 6 months during the year. Another user, the Vermont wood-fired power plant, is required by the state to obtain 75 percent of its raw material by rail, in order to minimize truck traffic in a populated area. According to plant officials, shipping the material by rail is more expensive than shipping by truck and creates fuel supply problems because the railroad serving the plant is unreliable and inefficient and experiences regular derailments. This same power plant is required by the state to restrict its purchases of woody biomass to material coming from forest projects that meet state-approved environmental standards. To ensure that it meets this requirement, the power plant employs four full-time foresters—an investment the plant would not have to make if it did not use woody biomass. Another power plant was required to obtain a new emissions permit in order to begin burning wood in its coal-fired system. An official at a third power plant told us that “woody biomass is expensive to harvest, process, transport, and handle—and it has only half the [energy] of coal”;¹⁷ he summed up his concerns by stating, “Biomass energy is not the most efficient way to make electricity.” However, he added that using woody biomass to make electricity provides benefits to society by consuming material that would otherwise be burned in the open or deposited in landfills.

¹⁷According to the Forest Service’s Forest Products Laboratory, the typical heating value of wood ranges from about one-quarter to one-half that of bituminous coal, depending on the moisture content of the wood. However, some power plants use lower grades of coal that can have heating values comparable to that of oven-dried wood.

Current Users' Experiences Offer Insights for Government Efforts to Expand the Use of Woody Biomass

Our findings offer several insights for promoting greater use of woody biomass. First, rather than helping to defray the costs of forest thinning, attempts to encourage the use of woody biomass may instead stimulate the use of other wood materials such as mill residues or commercial logging slash. Second, government activities may be more effective in stimulating woody biomass use if they take into account the extent to which a logging and milling infrastructure to collect and process forest materials is in place. And finally, the type of efforts employed to encourage woody biomass use may need to be tailored to the scale and nature of individual recipients' use.

It should be noted, however, that drawing long-term conclusions from the experiences of users in our review must be done with care because our review represents only a snapshot in time and a small number of woody biomass users. Changes in market conditions could have substantial effects on the options available to users and the materials they choose to consume, and the effects of changes in the market are complex and difficult to predict. For example, the price of fossil fuels such as natural gas plays a role in determining the cost-effectiveness of woody biomass use; if the price of natural gas were to rise, increased energy cost savings through woody biomass use might persuade more entities to convert to the material despite the up-front costs of conversion. On the other hand, if the cost of diesel fuel were to rise along with that of natural gas, the cost of harvesting and transporting woody biomass would increase because the machinery used to perform these tasks generally runs on diesel fuel—diminishing the advantages to be gained by using woody biomass.

Market Forces May Lead Wood Users to Forgo Small-Diameter Trees in Favor of Alternatives

One goal of the federal government's efforts to stimulate woody biomass use is to defray the cost to the government of thinning millions of acres of land at risk of wildland fire by creating a market for the resulting materials. Because a substantial component of these materials consists of small-diameter trees, it is important that government efforts include a focus on finding uses specifically for these trees. Without such a focus, efforts to stimulate woody biomass use may simply increase the use of mill residues or other wood materials—which several users told us were preferable to woody biomass for a variety of reasons—or slash from commercial logging operations.

Indeed, an indirect attempt to stimulate woody biomass use by one Montana user in our review led to the increased use of available mill residues instead. The Forest Service provided grant funds to finance the

Montana school district's 2003 conversion to a wood heating system in order to stimulate the use of woody biomass in the area; the agency required as a condition of the grant that at least 50 percent of the district's fuel consist of woody biomass during the initial 2 years of the system's operation. Officials told us that the district complied with the requirement for those 2 years, but for the 2005-2006 school year, the district chose to use less expensive wood residues from a nearby log-home builder rather than woody biomass. The cost of these residues was \$24 per ton, in contrast to the \$36 per ton the district paid for woody biomass the previous year. A district official said that the district was willing to use woody biomass in the future if it could be obtained more cheaply than alternative materials.¹⁸ The district was not alone among users in our review in its use of mill residues and other wood materials; eight users in our review used such materials in addition to, or instead of, woody biomass. Officials at one of these users—a pulp and paper mill—told us that they began their operation by using mill residues, switching to woody biomass only when competition for mill residues began driving up the price. Emphasizing users' preference for mill residues, a Forest Service official in Montana told us that his national forest sometimes has difficulty finding a market for woody biomass resulting from forest projects because the numerous log-home builders operating in the area offer a cheaper and more accessible source of wood in the form of mill residues.

This is not to say that the use of mill residues is entirely to the detriment of woody biomass. The use of mill residues can play an indirect role in facilitating woody biomass utilization by providing a market for the byproducts of industries using woody biomass directly, such as sawdust or other residues from small-log sawmills. The existence of a market for these byproducts can enhance the profitability of woody biomass users and, consequently, improve their ability to continue using woody biomass cost-effectively. In addition, the availability of both mill residues and woody biomass provides diversity of supply for users, allowing them to continue operations even if one source of supply is interrupted or becomes prohibitively expensive. Nevertheless, these indirect effects, even where present, may be insufficient to substantially influence the use of woody biomass.

¹⁸Subsequent to our review of the school district's operations, the district obtained about 550 tons of woody biomass (about 75 percent of its annual consumption) from a nearby thinning project at a price of \$10 per ton. This price represents only a fraction of the material's processing and handling costs, most of which were borne by the Forest Service.

Mill residues aside, even those users that consumed material we define as woody biomass, particularly those that used wood for fuel, often used the tops and limbs from trees harvested for merchantable timber or other uses rather than the small-diameter trees that contribute to the problem of overstocked forests. One woody biomass user in our review reported using only the slash from commercial logging rather than small-diameter trees, while another user reported that 80 percent of the woody biomass it used consisted of logging slash and 20 percent consisted of thinned small-diameter trees. Two users reported using residues from land-clearing operations conducted as part of commercial land development. Logging slash can be cheaper to obtain than small-diameter trees when it has been already removed from the forest by commercial logging projects; such projects often leave slash piles at roadside “landings,” where trees are delimbed before being loaded onto log trucks. Unless woody biomass users specifically need small-diameter logs—for use in sawing lumber, for example—they may find it cheaper to collect slash piled in roadside areas than to enter the forest to cut and remove small-diameter trees. And while consuming logging slash may have environmental benefits—by, for example, decreasing smoke emissions by reducing the amount of slash burned in the open—it does not necessarily contribute to the government’s goal of stimulating forest thinning or reducing thinning costs. Further, users’ reliance on material whose cost of removal was subsidized by commercial activities suggests that, even if the government succeeds in stimulating a market for the woody biomass, it still may need to bear a substantial portion of thinning costs in order to make the material economically attractive for users.

The experience of the Montana school district also illustrates the unintended market consequences that may result from indirect attempts to stimulate woody biomass use. The school district is located in an area where several industries, including pulp and paper, plywood, and others, purchase commercially produced mill residues for their operations. By purchasing mill residues, the school district began competing for the same raw materials desired by these other industries. The impact on the market is likely to be small, as the school district uses only a small fraction of the wood used by these other industries. Nevertheless, in addition to spurring woody biomass use from forest-thinning operations, as originally envisioned by Forest Service officials, these grant funds also introduced more competition into an existing market for mill residues.

The Effectiveness of Efforts to Encourage Woody Biomass Use May Depend on the Presence of Other Wood-Related Industries

Government activities may be more effective in stimulating woody biomass use if they take into account the extent to which a logging and milling infrastructure is in place in potential users' locations. The availability of an affordable supply of woody biomass depends to a significant degree on the presence of a local logging and milling infrastructure to collect and process forest materials. Without a milling infrastructure, there may be little demand for forest materials, and without a logging infrastructure, there may be no way to obtain the materials. Indeed, officials at one power plant operating at less than full capacity because of a shortage of wood for the plant told us that the shortage was due to the lack of a local logging infrastructure—in other words, there simply weren't enough loggers to carry out the forest projects that nearby landowners wanted to undertake. The user said it was not cost-effective to obtain the material from more distant sources because of transportation costs.

Similarly, an official with the Nebraska state college in our review told us that the lack of a local logging infrastructure could potentially jeopardize the college's woody biomass use in the future. The college relied on logging slash from commercial loggers working nearby, but this official told us that the loggers were based in another state and the timber they were harvesting was hauled to sawmills over 100 miles away. The official said the loggers would prefer to work closer to the sawmills in order to reduce transportation costs, but could not find closer logging opportunities. According to the official, if more timber-harvesting projects were offered closer to the sawmills, these loggers would immediately move their operations—eliminating the nearby source of woody biomass available to the college.

In contrast, users located near a milling and logging infrastructure are likely to have more readily available sources of woody biomass. One Montana official told us that woody biomass in the form of logging slash is plentiful in the Missoula area, which is home to numerous milling and logging activities, and that about 90 percent of this slash is burned because it has no market. The presence of a logging and processing infrastructure, however, may increase the availability of mill residues, potentially complicating efforts to promote woody biomass use by offering more attractive alternative materials.

Efforts to Encourage Woody Biomass Use May Be More Effective If They Are Tailored to the Scale and Nature of Recipients' Use

Government activities may be more effective in stimulating woody biomass use if their efforts are tailored to the scale and nature of the users being targeted. Most of the large wood users we reviewed, such as pulp and paper mills or wood-fired power plants, were primarily concerned about supply, and thus might benefit most from federal efforts to provide a predictable and stable supply of woody biomass. Such stability might come, for example, from long-term contracts signed under stewardship contracting authority, which allows contracts of up to 10 years.¹⁹ In fact, one company currently plans to build a \$23 million woody biomass power plant in eastern Arizona, largely in response to the White Mountain stewardship project in the area, a thinning project expected to treat 50,000 to 250,000 acres over 10 years. Although the company is relying in part on \$16 million in loan guarantees furnished by the Department of Agriculture, the assurance of supply offered by this long-term project was a key factor in the company's decision to build the power plant. Furthermore, a Department of Agriculture official told us that the assurance of supply also was critical to the department's decision to provide the loan guarantee. Similarly, in November 2005, officials of a South Carolina utility told us that the utility was planning to burn woody biomass resulting from thinning efforts in a nearby national forest, and was intending to purchase about 75,000 tons annually to burn along with coal in a coal-fired power plant. Although the utility did not yet have an agreement in place to purchase the woody biomass, the officials told us that the utility anticipated investing \$4.4 million in wood-handling equipment and realizing substantial annual fuel and emissions cost savings.²⁰ The national forest expects to conduct several long-term thinning projects, and officials told us that the utility would not have considered making this investment in woody biomass use without this likelihood of a stable, long-term supply.

In contrast, small users we reviewed did not express concerns about the availability of supply, in part because their consumption was relatively small. However, three of these users relied on external financing for their up-front costs to convert to woody biomass use. Such users—particularly small, rural school districts or other public facilities that may face

¹⁹For a description of agency use of stewardship contracting authority, see GAO, *Federal Land Management: Additional Guidance on Community Involvement Could Enhance Effectiveness of Stewardship Contracting*, GAO-04-652 (Washington, D.C.: June 14, 2004).

²⁰Utility officials told us they estimate saving about \$1.4 million annually, but noted that this figure could vary significantly depending on prices for coal and wood and on the amount of wood used.

difficulties raising the capital to pay needed conversion costs—might benefit most from financial assistance such as grants or loan guarantees to fund their initial conversion efforts. And as we noted in our previous report on woody biomass,²¹ several federal agencies provide grants for woody biomass use—particularly the Forest Service, which is, among other efforts, providing grants of between \$50,000 and \$250,000 to increase the utilization of woody biomass from or near national forest lands.

However, federal agencies must take care that their efforts to assist users are appropriately aligned with the agencies' own interests, and that their efforts do not create unintended consequences. For example, while individual grant recipients might reap substantial benefits from their ability to use woody biomass—through fuel cost savings, for example, as demonstrated by several users in our review—benefits to the government, such as reduced thinning costs, are uncertain. Without such benefits, agency grants may simply increase agency outlays but not produce comparable savings in thinning costs. The agencies also risk adverse ecological consequences if their efforts to develop markets for woody biomass result in these markets inappropriately influencing land management decisions. As noted in our prior report on woody biomass, agency and nonagency officials cautioned that efforts to supply woody biomass in response to market demand rather than ecological necessity might result in inappropriate or excessive thinning.

Concluding Observations

The variety of factors influencing woody biomass use among users in our review—including regulatory, geographic, market-based, and other factors—suggests that the federal government may be able to take many different approaches as it seeks to stimulate additional use of the material. However, because these approaches have different costs, and likely will provide different returns in terms of defraying thinning expenses, it will be important to identify what kinds of mechanisms and what types of resource investments are most cost-effective in different circumstances. This will be a difficult task, given the variation in different users' needs and available resources, differences in regional markets and forest types, and the multitude of available alternatives to woody biomass. Nevertheless, if federal agencies are to maximize the long-term impact of the millions of dollars being spent to stimulate woody biomass use, they will need to

²¹GAO-05-373.

design approaches that take these elements into account rather than using boilerplate solutions.

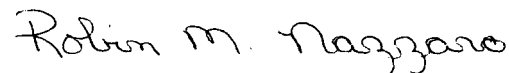
Agency Comments and Our Evaluation

We provided a draft of this report to the Secretaries of Agriculture, Energy, and the Interior for review and comment. The departments generally agreed with our findings and provided technical comments that were incorporated into this report, as appropriate. Comments from the Departments of Agriculture and the Interior are reprinted in appendixes III and IV, respectively. The Department of Energy provided comments via e-mail.

As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies to the Secretaries of Agriculture, Energy, and the Interior; Chief of the Forest Service; Director of BLM; and other interested parties. We also will make copies available to others upon request. In addition, this report will be available at no charge on GAO's Web site at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-3841 or at nazzaror@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report are listed in appendix V.

Sincerely yours,



Robin M. Nazzaro
Director, Natural Resources and Environment

Characteristics of Woody Biomass Users Included in Our Review

Table 1 provides information on the type and amount of wood fuel consumption reported by each woody biomass user in our review. This information is based on the amount of wood used in the last full year for which complete data were available.

Table 1: Characteristics of Woody Biomass Users Included in Our Review^a

Woody biomass user	Primary use	Wood used per year (bone dry tons) ^b	Woody biomass as a percentage of all wood used	Logging slash as a percentage of woody biomass used ^c	Percent of woody biomass obtained from federal lands
Contractor, MI	Wood fuel	110,000	100	93	5
Contractor, MT	Wood fuel	75,000	67	80	10
Contractor, OR	Chips for pulp	60,000	100	Not provided	45
Power plant, CA	Electricity generation	126,000	67	Not provided	49
Power plant, CO	Electricity generation	760 ^d	100	0	100
Power plant, PA	Electricity generation	140,000	74	100	0
Power plant, VT	Electricity generation	180,000	75	100	0
Pulp and paper mill, MS	Pulp and paper; process steam	1,600,000	50	Not provided	0
Pulp and paper mill, MT	Pulp and paper; process steam	966,000	30	30	less than 5
Rural school district, MT	Building heat	490	67	40	100
Rural school district, PA	Building heat	850	100	100	0
State college, NE	Building heat	6,000	100	100	0
State hospital, GA	Building heat	9,000	0 ^e	N/A	N/A
Total		3,274,100			

Source: GAO analysis of users' data.

^aFigures were derived from information provided by users in our review.

^bOne bone-dry ton represents 1 ton of wood at 0 percent moisture content; green wood generally contains about 50 percent moisture. This column represents all types of wood used, including alternative materials such as mill residues, during the most recent year for which complete information was available.

^cFigures presented in this column include residues generated by commercial land clearing activities as well as logging slash generated by commercial logging operations.

^dThis power plant mixed woody biomass with coal on a trial basis to determine its feasibility. The amount of woody biomass the plant burned represents a small fraction of the plant's annual consumption of coal.

^eThe state hospital in Georgia has historically used woody biomass, but had not done so during the most recent year for which complete information was available.

Objectives, Scope, and Methodology

The objectives of our review were to (1) identify key factors facilitating the use of woody biomass among selected users, (2) identify challenges these users have faced in using woody biomass, and (3) discuss the insights our findings offer for promoting greater use of woody biomass. To meet these objectives, we reviewed the operations of 13 public and private organizations throughout the United States that use woody biomass to make a variety of products.

Because no comprehensive list of woody biomass users exists, we asked knowledgeable federal and nonfederal officials to identify woody biomass users. As part of these interviews, we asked for names of additional officials—regardless of location or agency affiliation—who could provide additional information about, or insights into, woody biomass users. Federal officials we met with included various officials from the Department of Agriculture’s Forest Service, Department of Energy, and Department of the Interior. We also contacted nonfederal officials, including representatives of the Appalachian Hardwood Center, Biomass Energy Resource Center, Bitter Root Resource Conservation and Development Council, Center for Biological Diversity, Montana Community Development Corporation, National Association of Conservation Districts, Natural Resources Defense Council, Society of American Foresters, Southern Alliance for the Utilization of Biomass Resources, USA Biomass Power Producers Alliance, and Wilderness Society. We asked these federal and nonfederal officials to identify woody biomass users across the United States. We continued this expert referral technique until the references we received for woody biomass users became repetitive. We also reviewed documents that identified possible woody biomass users and provided background information about woody biomass use.

From the several hundred entities that were reported to us as using woody biomass, we selected for further review a nonprobability sample of 14 woody biomass users from different industries and geographic locations.¹ These users produced a range of different products from woody biomass, such as building heat, electricity, pulp, paper, and wood fuel, and were located in various geographic locations around the country. Of these users, 13 participated in our review; the remaining user, a sawmill using small-

¹Results from nonprobability samples cannot be used to make inferences about a population, because in a nonprobability sample, some elements of the population being studied have no chance or an unknown chance of being selected as part of the sample.

diameter logs to make lumber, did not respond to our request to participate. The woody biomass users we reviewed included

- a state college in Nebraska,
- a state hospital in Georgia,
- two rural school districts in Montana and Pennsylvania,
- two pulp and paper mills in Mississippi and Montana,
- three logging and wood products operations in Michigan, Montana, and Oregon, and
- four electric power producers in California, Colorado, Vermont, and Pennsylvania.

The general locations of the users we reviewed are shown in figure 5.

Figure 5: Locations of Woody Biomass Users We Reviewed



Source: GAO.

We then developed a structured interview guide to review the operations of the 13 woody biomass users and to obtain general information about their operations. Because the practical difficulties of developing and administering a structured interview guide may introduce errors—resulting from how a particular question is interpreted, for example, or from differences in the sources of information available to respondents in answering a question—we included steps in the development and administration of the guide for the purpose of minimizing such errors. We

pretested the guide at one location and conducted a second pretest by telephone. We also provided a draft version of the guide to federal officials knowledgeable about woody biomass in order to obtain their comments on the draft. Based on these steps, we modified the structured interview guide to reflect questions and comments we received.

Factors Facilitating the Use of Woody Biomass among Selected Users

To collect information about the factors that facilitate woody biomass use, we used our structured interview guide to obtain information about the 13 users in our review, including the types and amount of woody biomass used, when their woody biomass use began, and the type of materials that woody biomass use replaced. We also asked users about economic factors that facilitated their use of woody biomass, such as the cost and availability of their supply. During discussions, we also gathered users' opinions about factors that might increase their use of woody biomass. To corroborate the information we gathered through interviews, we compared interviewees' responses with other information we reviewed, when available, such as contracts, third-party evaluations of user activities, financial analyses, and the like. Because the documentary evidence we reviewed generally agreed with the information provided by woody biomass users, we believe the data are sufficiently reliable to be used in providing descriptive information on the factors facilitating woody biomass use by users in our review.

Challenges Faced by Selected Users of Woody Biomass

We also used our structured interview guide to ask the 13 users about challenges they faced or other factors that might diminish their use of woody biomass. For example, we asked users about the affordability of their supply of woody biomass and the farthest distance from which they can affordably obtain it, and gathered users' opinions about factors that might diminish their use of woody biomass. To corroborate the information we gathered through interviews, we compared interviewees' responses with other information we obtained, when available—again including documentation such as contracts, third-party evaluations of user activities, financial analyses, and the like. Because the documentary evidence we reviewed generally agreed with the information provided by woody biomass users, we believe the data are sufficiently reliable to be used in providing descriptive information on challenges associated with the use of woody biomass by users in our review.

Insights Offered by Our Findings

To describe the insights offered by our findings, we relied principally on the information gathered during our discussions with woody biomass users. In addition, we used information gathered from interviewing potential and current users as well as agency officials and others knowledgeable about woody biomass use, including information gathered during our prior review of woody biomass. Our intent was to highlight issues that we observed in our review of current woody biomass users and that we believe should be considered by those seeking to develop a market for woody biomass.

We performed our work from May 2005 through January 2006 in accordance with generally accepted government auditing standards.

Comments from the Department of Agriculture

 United States
Department of
Agriculture

Forest
Service Washington
Office

1400 Independence Avenue, SW
Washington, DC 20250

File Code: 1420

Date: MAR 02 2006

Ms. Robin M. Nazzaro
Director, Natural Resources and Environment
U.S. Government Accountability Office
441 G Street NW
Washington, DC 20548

Dear Ms. Nazzaro:

Thank you for the opportunity to review and offer comments on the draft Government Accountability Office's (GAO) report entitled, "Agriculture Natural Resources: Woody Biomass Users' Experiences Offer Insights for Government Efforts Aimed at Promoting Its Use" (GAO-06-336). In general, we are in agreement with the results of the study. Our specific comments are set forth in the enclosure. This report comes at a most opportune time for us. We have provided additional leadership through enhanced collaboration with other Federal departments as well as providing a bio-energy and biomass coordinator from the Chief's Office. Marcia Patton-Mallory, the coordinator, will work with the existing woody biomass utilization team in their continued response to issues associated with woody biomass utilization, while strengthening our Memorandum of Understanding with the Department of The Interior and the Department of Energy.

In addition, we are in the early stages of developing a single national woody biomass strategic plan that will help to focus on three key strategic issues:

1. Developing a reliable woody biomass supply
2. Enhancing markets and technological advancement
3. Fostering partnerships

If you have any additional questions or concerns, please contact our Agency's External Audit Liaison, Sandy T. Coleman, 703-605-4699.

Sincerely,



DALE N. BOSWORTH
Chief

Enclosure



Caring for the Land and Serving People

Printed on Recycled Paper



Comments from the Department of the Interior

Note: GAO comments supplementing those in the report text appear at the end of this appendix.



United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

MAR - 1 2006

Robin M. Nazzaro, Director
Natural Resources and Environment
United State Government Accountability Office
441 G Street, NW
Washington, D.C. 20548

Dear Director Nazarro:

The General Accounting Office recently issued a Draft Report, *Natural Resources: Woody Biomass Users' Experiences Offer Insights for Government Efforts Aimed at Promoting Its Use (GAO-06-336)*. The report is a well-prepared document that appropriately focuses on strategic issues.

The report aptly describes the nature of the biomass user's challenges and successes. Likewise, it accurately portrays the range of issues that may have impacts on small wood industries which seek to use by-products of resource management and hazardous fuel reduction treatments.

The report makes eight specific observations. This letter is to comment on these observations and suggest some additional pieces of information be included in the report.

- ***Financial Incentives and Benefits Encouraged the Use of Woody Biomass by Several Users.***

We agree that incentives would encourage the use of woody biomass. Recent studies, most notably the Western Governor's Association Clean and Diversified Energy Initiative, have looked at market-based incentives -- rather than short-term subsidy programs or programs designed on nameplate capacity -- to encourage and reward bioenergy production. They note that multiple benefits flow from increased use of biomass, including many not captured by market forces; e.g. cleaner air, reduced greenhouse gas emissions, reduced landfill demands, improved fish and wildlife habitat, and reduced threats to communities and domestic watersheds from catastrophic wildfires. Other benefits include national energy security, rural employment, electrical grid stability and voltage support, as well as improved firm capacity (relative to most other renewable energy). If market-based solutions are effective, there should be limited need to future grant or subsidy programs.

See comment 1.

**Appendix IV
Comments from the Department of the
Interior**

The Western Governor's study indicates that biomass energy production is not given a level playing field relative to other renewable energy. For example, existing biomass plants are only given half the production tax credit and half the time frame as wind, geothermal or closed loop biomass (dedicated energy crops).

We also note that you state the non-renewable displacement values of Renewable Energy Credits. However, we suggest that other important, and marketable, environmental benefits (as described above) should be kept separate and ask that you emphasize this in your Final Report.

- ***An Affordable Supply Facilitated the Use of Woody Biomass.***

The GAO report cites several examples where affordable fuel is available for bioenergy applications. We suggest that GAO include a paragraph stating that the Department of the Interior has established a contract clause to insert in all solicitations and contracts when biomass is expected to be generated. It allows the use of all material that is ecologically appropriate and in accordance with the law. The contractor has the option to remove biomass within the project area. The historical observations gathered by the GAO from the 13 end users are based on their experiences prior to the existence of this clause. This clause could increase the availability and affordable use of biomass from the Department of the Interior lands.

- ***Environmental Concerns and Other Factors Played a Role in the Use of Woody Biomass.***

The GAO report addresses thinning to reduce the risk of wildfire, harvesting and removing small-diameter trees. While this is certainly true, federal land managers also design restoration and forest management projects that describe an after-treatment stand condition. The result of these treatments is biomass in varying sizes, and can involve the removal of larger size trees. The emphasis is not on the size of material removed, but on the resulting stand condition that is left after the treatment is completed. Removal of this biomass can have a value that helps reduce or eliminate the net costs to the government of treatments. There are numerous small wood and value-added markets which have found creative and cost-efficient uses for both smaller and larger trees. We suggest a more robust discussion of small wood and value-added industries and their importance to an integrated, cost-efficient forest products industry.

- ***Woody Biomass Was Not Always Sufficiently Available.***

The Draft Report states that five of the seven western users "had difficulty obtaining supply from federal lands." As noted previously, we suggest that GAO include a paragraph stating that the Department of the Interior has established a

See comment 2.

See comment 3.

See comment 2.

**Appendix IV
Comments from the Department of the
Interior**

contract clause to insert in all solicitations and contracts when biomass is expected to be generated.

The ability of some Department of the Interior units to supply woody biomass for an extended or indefinite time period is limited. Presently there is a considerable hazard fuel reduction workload and resulting biomass that could be utilized. As for Department of the Interior lands in the East, they would probably have shorter transportation distances to the users, but most of them are smaller acreage units with a limited or irregular amount of hazard fuel/woody biomass being produced. We are approaching these challenges with other federal and non-federal partners, seeking common solutions.

• ***Users Choosing Woody Biomass Over Oil or Natural Gas Made Additional Investments in Equipment and Incurred Additional Operations and Maintenance Costs.***

All 13 users in the GAO report were using biomass for heat and/or electricity. These are the lowest value uses of biomass. This report should include value-added biomass utilization, such as posts and poles, furniture, building material, signs, animal bedding material, erosion reduction structures, etc. If a community is able to utilize biomass in a number of disparate entities, there is a higher likelihood of realizing value from the material.

• ***Market Forces May Lead Wood Users to Forego Small-Diameter Trees in Favor of Other Alternatives.***

We agree with the statement that "government efforts include a focus on finding uses specifically for small trees"; both the Department of the Interior and the USDA Forest Service have emphasized creating markets and providing opportunities for utilization of small trees. However we disagree with the premise, based on a survey of a limited sample of users, that demands for small diameter material will likely be met by limbs and tops from commercial harvesting operations and/or mill residues. While mill residues and logging slash may be more cost effective than small tree harvest, we view this as "slack" in the demand curve. Large, industrial scale operations and/or wider penetration of small wood industries will create competition for this material, increasing the value and potential harvest of small diameter tree thinnings.

The commercial timber and value-added markets should help drive the demand for small trees and the potential for bioenergy applications. The Draft Report makes little mention of the hugely successful biomass thinning program in northern California; over a million acres of private industrial forest lands have been commercially thinned, producing small wood products and bioenergy. This thinning was done to return revenue to the industrial landowner while protecting investments in forest health, forest products yields, and wildfire risk reduction. Several hundred thousand acres of public lands have also been commercially

See comment 4.

See comment 5.

**Appendix IV
Comments from the Department of the
Interior**

thinned using these techniques. This success story is due to an integrated forest products and bioenergy industry and often stiff competition for raw materials for the small wood industries.

- ***The effectiveness of efforts to encourage Woody Biomass Use May Depend on the Presence of Other Wood-Related Industries.***

We agree that a successful logging and milling infrastructure is important to the utilization of woody biomass. We have directed most of our efforts to areas where such infrastructure exists – especially those areas where the decline in conventional timber products is significant and the potential for the complete collapse of the industry is eminent. Once the industry disappears it is highly unlikely to return, thus reducing our opportunities to implement cost-effective forest health and hazardous fuel reduction treatments.

The Draft Report states that “the presence of a logging and processing infrastructure, however, may increase the availability of mill residues, potentially complicating efforts to promote woody biomass use by offering more attractive alternative materials.” As we noted previously, we do not view the competition for mill residues as negative.

- ***The Effectiveness of Efforts to Encourage Woody Biomass Use May Depend on the Scale and Nature of Individual Recipient’s Use.***

We agree with the statement that stability of the fuel supply can be enhanced by stewardship contracts with contract terms of up to ten years. This valuable tool is playing an increasing role in our forest management and land stewardship role. We suggest, however, that you note that this is a temporary authority for the Bureau of Land Management and the USDA Forest Service and expires in the year 2013. We also suggest that you mention that the U.S. Fish and Wildlife Service and the National Park Service have permanent authorities to enter into such agreements (for FWS authorities please see 50 CFR 29.2 and 29.5; for NPS, please see 16 U.S.C. 6).

The Draft Report correctly states that these long-term contracts facilitate the successful financing of larger scale wood industries. There has been other dialogue of extending the contract term to 20 or 30 years for stewardship contracts. While we recognize the value to industry, we have concerns about the potential risks to the government. For example, we believe it is important to have performance “mileposts” to ensure that the hazardous fuel reduction or forest health treatments are being accomplished in a timely manner versus waiting until the 19th year of a 20 year contract. We also have concerns about periodic payments and bonding. We also suggest consideration of shorter contract terms (five to ten years) with the opportunity to extend the contract periodically (say every five years, up to a maximum contract term of 30 years) if performance and payment are satisfactory. Finally, there must be some provision or reconsideration of the initial National

See comment 6.

See comment 7.

See comment 8.

Appendix IV
Comments from the Department of the
Interior

Environmental Policy Act decision. We welcome the opportunity to work with the Congress on developing any such long-term contract proposals.

We note the Draft Report identifies a concern about grant programs achieving desired benefits. We suggest consideration of long-term (at least ten year) market or tax incentives which reward performance, rather than potential. We believe such incentives would facilitate industry development and financing. Grant programs subject to annual appropriations cycles are costly to implement and have limited utility to financial markets or investors.

Finally, we note the concern that “efforts to supply woody biomass in response to market demands rather than ecological necessity might result in inappropriate or excessive thinning.” We understand your concern and assure the GAO that our land ethics will drive our land treatments, not a “boom and bust” biomass industry.

We appreciate the interest of Congress in oversight of the biomass and forest health programs and welcome the opportunity to provide our response to any recommendations in *Natural Resources: Woody Biomass Users' Experiences Offer Insights for Government Efforts Aimed at Promoting Its Use (GAO-06-336)*. We look forward to working with the GAO on future reports.

Sincerely,



R. Thomas Weimer
Assistant Secretary
Policy, Management and Budget
U.S. Department of the Interior

The following are GAO's comments on the Department of the Interior's letter dated March 1, 2006.

GAO Comments

1. We agree that the multiple benefits listed by the department may indeed flow from the increased use of woody biomass. However, the objectives of our review were to evaluate the experiences of individual users, not to identify the general benefits of using woody biomass. In instances in which users cited certain benefits facilitating or resulting from their use of woody biomass, we included such benefits in our report.
2. We have modified our draft to include reference to the department's contracting clause.
3. We understand that projects focusing on after-treatment stand conditions may generate a variety of materials, including commercial sawtimber and lower-value materials, and that the commercial component of these materials can help offset project costs. However, while it is not possible to separate the two issues entirely, the focus of our report—embodied in our definition of woody biomass—is on small-diameter trees and other traditionally noncommercial material.
4. The focus of our report goes beyond heat and electricity production, and includes two users manufacturing pulp and paper from woody biomass and three contractors processing woody biomass for other users. Nevertheless, we recognize that users in other industries—or even other users in the same industries we examined—may offer additional insights into expanding the use of woody biomass.
5. Large-scale operations or widespread penetration of small wood industries might, as the department suggests, create competition for the materials and increase the value of small-diameter trees. However, while such a scenario may come about in the long term, our intent was to provide insights and information applicable to the current situation. Similarly, the scope of our report generally is limited to the experiences of individual users in our review, not to broader efforts such as the northern California woody biomass thinning program.
6. We do not necessarily look at mill residues as a negative influence on using woody biomass—in fact, we acknowledge that the use of mill residues and other sources of wood can benefit woody biomass utilization in several ways. However, we do believe that it can serve as a

complicating factor in the government's efforts to stimulate the use of small-diameter trees specifically.

7. We have modified our draft to reflect the current expiration date of 2013 for Forest Service and Bureau of Land Management stewardship contracting authority, as well as to note the related authorities available to other Interior agencies.
8. While the department's suggestions regarding stewardship contracting and market and tax incentives are beyond the scope of our review, the agencies or the Congress may wish to consider these options as they evaluate the success of contracting and grant programs.

GAO Contact and Staff Acknowledgments

GAO Contact

Robin M. Nazzaro, (202) 512-3841 or nazzaror@gao.gov

Staff Acknowledgments

In addition to the contact named above, David P. Bixler, Assistant Director; Lee Carroll; Steve Gaty; Tim Guinane; Richard Johnson; Amanda Miller; Alison O'Neill; and Judy Pagano made key contributions to this report.

GAO's Mission

The Government Accountability Office, the audit, evaluation and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through GAO's Web site (www.gao.gov). Each weekday, GAO posts newly released reports, testimony, and correspondence on its Web site. To have GAO e-mail you a list of newly posted products every afternoon, go to www.gao.gov and select "Subscribe to Updates."

Order by Mail or Phone

The first copy of each printed report is free. Additional copies are \$2 each. A check or money order should be made out to the Superintendent of Documents. GAO also accepts VISA and Mastercard. Orders for 100 or more copies mailed to a single address are discounted 25 percent. Orders should be sent to:

U.S. Government Accountability Office
441 G Street NW, Room LM
Washington, D.C. 20548

To order by Phone: Voice: (202) 512-6000
TDD: (202) 512-2537
Fax: (202) 512-6061

To Report Fraud, Waste, and Abuse in Federal Programs

Contact:

Web site: www.gao.gov/fraudnet/fraudnet.htm

E-mail: fraudnet@gao.gov

Automated answering system: (800) 424-5454 or (202) 512-7470

Congressional Relations

Gloria Jarmon, Managing Director, JarmonG@gao.gov (202) 512-4400
U.S. Government Accountability Office, 441 G Street NW, Room 7125
Washington, D.C. 20548

Public Affairs

Paul Anderson, Managing Director, AndersonP1@gao.gov (202) 512-4800
U.S. Government Accountability Office, 441 G Street NW, Room 7149
Washington, D.C. 20548