FOREST RESIDUES IN NORTHEASTERN MINNESOTA:
POLICY OPTIONS TO ENCOURAGE MANAGEMENT AND USE\textsuperscript{1}

by

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INTRODUCTION

Definitions and Magnitudes

Wood is an extremely important material in the economic and social fabric of Minnesota. This importance stems from its abundance throughout the state as well as its unique ability to serve a range of functions, e.g., building products, paper and packaging, generation of energy. Minnesota is fortunate to have 13.6 million acres of commercial forest land which supplies wood fiber to over 1400 wood processing facilities. The state's wood-based industry ranks among the leading three resource industries located within state boundaries (Sinclair and O'Brien 1980). In 1982, the value of wood products harvested within the state combined with value added by secondary manufacturing exceeded $2.5 billion. Such manufacture required the employment of over 52,000 persons (Hendricks 1983).

In recent years, resource professionals have generally acknowledged that wood residues represent a resource potential that has yet to be fully explored. Wood residues occur in several forms, of which five distinct groups can be defined:

- Remnants of trees left in the forest after logging (i.e., branches and tops).
- Uncut stems remaining on harvested sites or entire stands of low quality material.
- Unharvested dead timber.
- Wood products manufacturing waste (i.e., edges, slabs, and sawdust).
- Unused urban wood waste (i.e., construction material, dead trees).

Residues of this nature can be used in various ways of which energy production has received particular attention in recent years. Easy access to relatively inexpensive fossil fuels did much to discourage the use of wood for energy for many decades. With the rapid escalation of fossil fuel prices during the 1970's, however, wood and wood residues received increasingly more attention as a valuable source of energy (Figure 1). It has been estimated that wood energy could supply between 8 and 15 percent of the nation's future energy needs, a magnitude of considerable importance to a nation attempting to reduce its dependence on foreign oil supplies (General Accounting Office 1981).

Figure 1. Consumption of energy produced by wood in the United States, 1850-1980.

This potential for wood energy is nowhere greater than in northeastern Minnesota. In a typical northern hardwood harvest, only 25 to 50 percent of the biomass of merchantable trees is utilized — 50 to 75 percent remains as residue. The Minnesota Department of Natural Resource's Division of Forestry, and the Minnesota Energy Agency have very conservatively estimated there will be over 2 million cord equivalents of residue available per year from Minnesota forests between 1980 and 2020 (Figure 2). Of these residues, over 50 percent will be unutilized given current circumstances (Figure 3). Wood residues used for energy production could make a significant contribution to the state's economy.

A variety of topics concerning wood residue use in northeastern Minnesota will be discussed in what follows. Current policies and administrative rules will be identified; their effect on utilization of wood residues will be examined. Barriers to increased residue use will be noted as will a new state and federal programs designed to overcome such barriers. In addition, policy and program options used elsewhere will be described and analyzed to determine their potential for encouraging wood residue use in the state. And lastly, programs to increase wood residue use in Minnesota will be suggested.
1) Residue from Annual Harvest - Based on total acres harvested annually and the amount of recoverable biomass remaining following harvest.

2) Harvest of Low Productivity Forests - Includes forest stands on poor sites with low site index that cannot be economically managed for conventional forest products. These figures are based on a 40-year liquidation harvest schedule.

3) Volume Removed but Not Currently Used - Wood removed from commercial forest land but not utilized as a product. This includes land clearing, right-of-way clearing, timber stand improvement and reclassification of commercial forest land.

4) Mortality - Assumes 2.5% recovery of annual mortality in forest stands due to scattered widespread distribution patterns. Increases in recovery are due to better stand access development.

5) Non-Commercial Forest Land - Assumes .05 cord/acre annually available from trees on urban land based on a 60-year rotation and .2 cords/acre annually available from other non-commercial forest land.

Source: Division of Forestry, Minnesota Department of Natural Resources.

Figure 2. Projected sources and amounts of wood residues available from Minnesota's commercial and non-commercial forest land. 1980-2020.
Source: Division of Forestry, Minnesota Department of Natural Resources.

Figure 3. Wood residue use from Minnesota's commercial and non-commercial forest land. 1980-2000.
Benefits of Wood Residue Utilization

Increasing wood residue utilization in northeastern Minnesota represents a significant opportunity to generate regional as well as statewide benefits. Of special concern is the impact such actions might have on the intensity of timber management activities focused on the state's forests, the magnitude of pollutants — especially air pollutants — occurring within the region, and benefits represented by regional increases in income and employment. Government actions, properly designed and efficiently administered, may encourage wood energy development with all its benefits.

Improved Timber Management

The removal of wood residues from harvested forest land offers real opportunity to improve subsequent intensity of forest management treatments. Removal of residue from harvested sites would make it easier to establish new timber stands. Unusually cumbersome and expensive site preparation activities associated with wood debris on harvesting sites could be eliminated or greatly reduced. Access to potential regeneration sites could be enhanced and harvested areas brought into production at a more rapid pace.

The development of wood residue markets could also result in the use of stagnant or extremely slow growing timber stands located throughout the state's northeastern region. In present condition, such stands fail to achieve the productive potential of the forest land on which they are located. If occupied by more vigorously growing species planted on well-treated sites, such forest land would more likely meet future timber demands that will undoubtedly occur in the years ahead. Utilizing residue timber from stagnant timber stands may also provide opportunity to convert such sites to more desirable species. The latter may ultimately lead to greater fiber yields having substantially more economic value.

Air Pollution Abatement

The use of wood residues for energy may have large positive impacts on the quality of forest and related environments. For example, wood for energy could reduce the use of fossil fuels and consequently the pollution which results from such fuels. Studies have shown that large wood fired boilers produce less air pollution than similar boilers using coal. Sulfur dioxide is the prime component of the emissions produced by the burning of coal — burning wood produces little if any sulfur oxides. Increased amounts of sulfur resulting from the use of coal has been directly linked to increased levels of rainfall acidity. Acid rain is particularly significant in northeastern Minnesota where it can adversely affect the productivity of forest land and lakes. Utilizing wood for energy should decrease the levels of sulfur emitted and may lead to a subsequent decrease in rainfall acidity levels. Although burning waste wood is not totally free of noxious emissions, means for controlling such emissions are readily available. In general, control
efforts do not significantly reduce the economic viability of producing wood energy.

Proliferation of many small wood burning units, especially in homes, may pose serious local pollution problems. Eliminating such pollutants may require regulations calling for installation of pollution control devices. Regulations of this nature will undoubtedly add to the cost of generating heat from wood.

The removal of material left on harvested sites may also reduce the visual pollution often associated with timber harvesting. The latter is frequently described as aesthetically displeasing. Slash reduction and removal of cull trees could improve aesthetic conditions and may well reduce the public's objection to timber harvesting activities.

Regional Economic Benefits

Minnesota's northeastern region has experienced especially difficult economic conditions during the past 4-5 years. Unemployment has reached staggering levels and regional income has shown a marked decline. Development of a strong wood energy market — relying on wood residues — may be one means of improving these bleak conditions. The wood harvesting and transportation would especially benefit from more widespread use of wood for energy. Substantial growth in wood energy uses would most certainly require a reliable network of wood residue suppliers. Benefit wise, they would be gainfully employed and would receive income resulting from such activities.

Depending on the technology and the scale of production chosen, wood energy could encourage growth of other small business enterprises and diversification of economic activity (Mitre Corporation 1978). Small business hiring is a key factor in increasing employment levels. Indirect employment effects would also be created through increased demand for services required by those directly employed (Legislative Commission on Minnesota Resources 1980). The new or expanded wood energy concerns will also require services not previously sought.

Financial impacts of increased wood energy production would be similar to those following a rise in the use of wood fiber in general (Legislative Commission on Minnesota Resources 1980). An increase in total incomes could be expected from the increased employment. Federal, state and local tax collections may well rise as economic activity accelerates. And increased sale of timber would generate additional revenue for government agencies. Some income changes could, however, be negative if increased consumption of wood for energy purposes reduced supplies available to other wood-using industries (Legislative Commission on Minnesota Resources 1980).

The use of wood to replace energy produced by fossil fuels may help retain capital within the state. Replacing fossil fuels purchased outside the state with locally produced wood may decrease employment outside Minnesota, yet may lead to offsetting local employment increases.
and economic development. And a switch to wood could result in the use of a renewable resource over which the government agencies in Minnesota have a major controlling interest.

BARRIERS TO WOOD–RESIDUE UTILIZATION

Obstacles to more widespread use of wood residues are many and quite complex. Ironically, removing one deterrent may well lead to unexpected positive or negative consequences elsewhere in the technical and economic systems which determine wood residue use. Thus, the importance of carefully devising policies that enhance wood residues use without detracting from other uses of the forest. Barriers to the use of wood–fuels must be inventoried and analyzed; only then can policies be effectively targeted to overcome factors constraining the use of wood residues. What follows is a very general review of five major conditions influencing residue use. It is by no means complete, yet does provide an appreciation of factors that must be considered when new wood–residue policies are proposed.

Technical Barriers

Technical barriers prohibiting expansion of wood residues used as fuel can be linked to the lack of efficient harvesting equipment — especially small scale equipment. Although an extensive amount of research has been focused on improving harvesting technology in past decades, the majority has resulted in equipment that operates most efficiently on a large scale. A typical whole tree chipper including peripheral equipment, for example, may involve an investment of nearly $1 million. For logging operators working on a smaller scale, such costs can be prohibitive. Among other things, the high cost of borrowed capital may make such purchases very unlikely. Additional research is needed to develop equipment that will operate economically on a small scale.

Advances in wood–burning technology have virtually eliminated such concerns as a barrier to the use of wood residue as a fuel. Research funded by government agencies and carried out in concert with wood–based and related enterprises has led to the development of wood boilers that are far more efficient, cleaner and safer than in the past. Such results illustrate the effectiveness of government and private sector cooperation in dealing with technology of this sort.

Wood storage and handling is an area that could benefit from additional research. Although technical advances in storage and handling of wood residues have been made, there exists substantial opportunity to develop more dependable and efficient mechanisms. Wood fuel is costly to handle and store because of its bulk and size variability. Fossil fuel users view adversely any alternative fuel which is not easily handled or stored. Any savings from burning wood as a fuel may quickly be consumed by the added cost of wood storage and handling systems. Without additional research on such problems, the use of wood as a fuel may be hindered as an efficient replacement for fossil fuels.
Lack of high quality and reliable forest road systems may limit access to forests and thus make some wood residues uneconomical to harvest (Commission on Wood Products 1983). Loggers, for example, must have reasonable access to forest sites if economical harvesting of wood residues is to be accomplished. Access problems are widespread deterrents to harvest of wood residue use on both public and private forests.

**Economic and Financial Deterrents**

Depressed economic conditions of the type experienced nationwide during the past 2-3 years may be the single most important factor impeding the development of projects designed to use wood as an energy source. These conditions have curtailed demand for the products wood-based enterprises manufacture, and, consequently, has imposed severe limits on the need for energy required in manufacturing processes -- including energy from wood. High interest rates and high equipment costs place severe constraints on the purchase of residue harvesting and processing equipment. Combined with bleak markets for forest products, high interest rates may mean the difference between a secure, profitable investment or a marginal one. Having one of the most depressed economic climates in the nation, northeastern Minnesota provides very real challenges to the use of wood residues.

Lack of venture capital also poses a deterrent to wood energy. Financial institutions are often reluctant to extend credit to new and unproven businesses such as wood pelletizers, wood distributors and wood energy harvesters. They may either refuse financial support entirely or charge a premium to cover the perceived risk of lending money to unproven business operations. Although some capital is available through government agencies (e.g., Small Business Administration loans, Department of Energy grants), total investment capital at investment inducing prices remains a problem. Such limitations significantly reduce the ability of the wood energy business to advance and to develop into a competitive force in the fuel market.

Limited funding for wood residue research, marketing and informational programs can also deter wood energy development. Although significant sums of money have been invested in research and demonstration projects by federal agencies over the past decade, current investments have been severely curtailed. The current Department of Energy perspective is that wood energy development and commercialization should be undertaken by the private sector in response to market forces. Consequently, for fiscal year 1982, the Department requested a nominal $9 million for wood energy programs -- 0.065 percent of the $13.8 billion Department energy program request (U.S. Congress 1981). Such a sum is very modest in contrast to investments in nonwood fuel programs. Significant long-term investment in wood-residue research and demonstration projects is required if substantial growth of the wood-energy industry is to be realized.
Institutional and Administrative Conditions

Institutional and administrative conditions impeding greater use of wood-residues abound in number. Ironically, such barriers can often be overcome with relatively minor changes in agency rules and regulations. Consider the following:

- public stumpage pricing procedures which lead to stumpage prices that are alleged to be excessive; thus discouraging loggers and operators from removing low grade or unmerchantable material, i.e., wood residues.

- public timber appraisal procedures that establish minimum merchantability standards without considering economic and environmental benefits that may accrue if more useable wood (i.e., residues) were removed (General Accounting Office 1973).

- public timber-harvesting administration which fails to enforce sale contract provisions that call for removal of not only high value material, but all wood material (including residues) specified in the contract.

- limited coordination among public agencies to set an action agenda for developing wood energy markets and encouraging programs which logically flow therefrom. Lack of coordinated and comprehensive regional plans for management and use of wood residues provide little in the way of a long-range focus on opportunities for utilizing such material.

- limited assurance to wood residue users of reliable wood residue supplies at stable and agreed to prices. Such conditions detract from investments in wood residue harvesting equipment and the energy converting equipment that relies on wood residues. Public and private forest landowners may be reluctant to engage in such contractual arrangements for a variety of reasons (e.g., reduce competition, unable to capture rising prices of wood residue, legal restrictions).

- institutional constraints unique to nonindustrial private forest landowners who own 40 percent of Minnesota's commercial forest land. These owners control small fragmented parcels of forest land, frequently espouse non-timber land management objectives, often have limited knowledge of forest management opportunities and usually face severe financial limits on their interest in managing timberlands. Difficulties of this nature pose severe problems for the use of wood residues located on such ownerships.

- laws restraining prices of energy that compete directly with wood deter optimal flow of potential energy supplies. Regulation of natural gas prices at an artificially low level results in gas consumption at the expense of other more cost effective energy sources such as wood residues.
Informational Constraints

Properly targeted and sustained flows of information about the availability and use of wood residues can encourage the use of such materials. Where lacking, informed decisions by potential users becomes extremely difficult. Also acknowledged as a major information barrier is the lack of wood residue price and production costs. Lacking such knowledge makes wood residue investments appear much more risky than they may in fact be; thus discouraging investment in a viable and often profitable venture. Information voids are especially troublesome to potential investors evaluating new and untried energy sources and processes -- such as wood residues. When compared with tried and proven energy technologies -- e.g., fossil fuel --, wood residues appear riskier. Greater flows of information about the advantages and disadvantages of wood as an energy source can reduce this risk.

Information per se may be a deterrent to wood residue use -- inadequate means of distributing existing information may also be a hindrance. A central source for dissemination of information to potential wood energy suppliers and users would be of great help. Educational programs concerning wood residue availability and the best technologies for their harvest and use can be an effective tool. Action of this sort may be the necessary impetus to informed decisions about such material.

Environmental Concerns

Environmental concerns about increased use of wood residues exist and must be addressed. For example, more intensive timber management activities necessary to utilize wood residues (e.g., additional roads, removal of biomass) may pose potential adverse effects for natural environments. The uncertain effects of whole tree utilization on future timber productivity of forest sites is of concern in some quarters. An increase in the level of air pollutants associated with certain forms of wood burning equipment can also be of concern to development of policies encouraging wood residue use. These problems may be controllable, but may also require troublesome and costly regulatory procedures.
PROGRAMS PROMOTING WOOD USED FOR ENERGY

Federal Initiatives

Various agencies of the federal government have actively encouraged more complete utilization of wood residues. Such efforts were augmented by the 1973 oil crisis and the fossil fuel price increases which occurred thereafter. Of special significance are programs developed by or administered by the General Accounting Office of the U.S. Congress, the USDA Forest Service, the United States Congress and the U.S. Department of Energy. A brief review of the role played by each of these organizations in the area of wood residue use follows.

General Accounting Office

The General Accounting Office (GAO) of the U.S. Congress periodically reviews selected national issues and suggests courses of action by which government may address them. Since 1973, the Office has prepared two major reports addressing the use of wood residues. In both, the Office concluded that the nation would be substantially better off if wood residues were more widely used for energy. The first report was issued in 1973 and recommended that federal land management agencies (i.e., USDA-Forest Service, USDI Bureau of Land Management) take the following actions (General Accounting Office 1973):

- Modify federal timber sale procedures to ensure removal of economically usable wood that can be processed by facilities in the vicinity of the sale area.
- Establish methods and procedures under which economic and environmental benefits to the Government from the increased use of wood will be recognized in determining the amount of wood to be removed from the sale area. The feasibility of shipping the material outside the sale area should be considered.
- Ascertain the level of utilization possible under the best available timber processing technology.
- Analyze the effect of federal assistance programs on increasing timber processing capabilities in areas where the timber resource is underutilized.
- Conduct research to explore ways of increasing wood processing capabilities.

The 1973 General Accounting Office report was published just before the first oil crisis. Therefore, the use of wood as a means to produce energy was given very limited consideration. Yet, the recommendations listed above, if undertaken with an emphasis on the use of wood as a fuel, could increase the utilization of wood residues. The key to achieving this is active participation by the federal government in
solving some of the problems inhibiting increased utilization of wood fiber. The specific recommendations, if followed, may reduce some of the administrative, technological and financial barriers that are presently limiting the use of wood residues for energy production.

In 1981, the General Accounting Office focused on specific opportunities for utilizing wood for energy. In a report entitled "The Nation's Unused Wood Offers Vast Potential Energy and Product Benefits," the Office urged the USDA-Forest Service and the Department of Energy to place a higher priority on encouraging the use of wood for energy (General Accounting Office 1981). The report identified many barriers to increased wood fiber utilization that exist at the national level. Overall program recommendations were as follows:

- Conduct a cooperative program of local assessments focusing on areas believed to have the most promise for increased residue use. The assessments should include a detailed inventory of residue quantities and availability, an evaluation of potential residue uses, a discussion of barriers to increased residue uses, and a proposal for increasing residue use. Specifically, costs should be identified, wood residue volumes and utilization costs should be measured, equipment needs estimated and the benefits and costs of federal actions analyzed. The Forest Service should take the lead role in this assessment.

- Develop a national wood residue plan within two years to be presented to Congress. The plan should include residue use goals and recommendations for policy actions to overcome any barriers to achieving such goals.

- Continue development and demonstration projects involving residue handling equipment.

- Develop standardized methods for evaluating the costs and benefits of wood fuel use in federal facilities.

- Establish a program promoting the use of wood as a fuel. The program may involve demonstration projects, direct technical assistance or provision of educational materials.

Several recommendations were made specifically to the Secretary of Agriculture; they included the following:

- Upgrade the forest survey to provide an inventory of all potentially usable biomass.

- Request legislation that would authorize the Department of Agriculture to grant private firms either title or exclusive license to wood residue technological developments wholly or partly funded by the federal government when needed to stimulate commercialization.
* Adopt a more flexible policy regarding long term contracts to assure that residues from National Forests will be available on a continuous basis.

* Reduce burning of piled material whenever feasible.

Since the General Accounting Office issued its 1973 and 1981 reports, both the Forest Service and the Department of Energy have undertaken initiatives to promote increased utilization of wood residues. Although many of the proposals described have never been fully adopted, they serve as an intelligent outline for government progress.

**USDA-Forest Service**

The Forest Service has been the Department of Agriculture's lead agency in efforts to develop programs to encourage utilization of wood residues. It has made concerted efforts to improve timber utilization standards for several decades. Consider the Pacific Northwest where tremendous volumes of wood fiber frequently remained after harvest. In the past, most of these volumes would be removed by burning in place — much to the detriment of air quality. The Forest Service instituted regulations in federal timber harvesting contracts which required use of such material — consistent with existing technology. Timber harvesters were required to yard unmerchantable material on harvested sites to concentrate residues and thereby increasing their economic attractiveness to potential users. The Forest Service also instituted per acre pricing of small material, hoping that such pricing would result in more material being removed from the harvested site. While these were positive steps toward improved utilization, they placed an inordinate amount of the residue removal burden on timber sale purchasers. Without sufficient residue markets, purchasers were unable to sell the material. These early efforts were positive steps to increase utilization; their success, however, has been somewhat mixed.

The rapid rise of fossil fuel prices during the early 1970's led the Forest Service to further examine various potentials that wood fiber might have as an alternative source of fuel. This examination led to further research in the areas of forest engineering, forest products utilization, and forest economics and marketing. Such efforts resulted in a 1980 report entitled "A National Energy Program for Forestry" (USDA-Forest Service 1980a). Focusing on attainment of a forest biomass energy production goal established by the U.S. Department of Agriculture, the Forest Service report defined five areas in which efforts were to be concentrated:

* Production of current and accurate resource information. Measurement of total biomass should be incorporated into inventory procedures.

* Improvement in resource supply. Application of improved forest management techniques should be initiated.
Development of equipment to improve the recovery of forest biomass. Improved forest biomass recovery should be encouraged by changes in timber sales procedures and additional research.

Improved conservation through the substitution of wood for other raw materials, increases in light frame construction, increased efficiency in management, harvesting and transport, weatherization of buildings and efficient processing of wood products.

Protection of wood products from environmental degradation.

The program placed the Forest Service in a position of leadership involving the utilization of wood residues for energy. Such leadership has been exercised through the agency's biomass energy program as implemented by research activities, cooperative state and private forestry activities, and the national forest system. With adequate funding, this program area may well lead to effective means of addressing problems that currently impede wood use for energy purposes.

The Forest Service has also played an important role in establishing rules and regulations required by the Wood Residue Utilization Act of 1980. A special wood residue utilization program was established by the Forest Service to serve as a medium for carrying out the guidelines of the Act. The program has never been adequately funded. If the law is not reauthorized after a 5 year period, it will expire with little of its potential realized.

U.S. Congress

The U.S. Congress has been active on the wood energy front by enacting several laws to promote specific aspects of wood energy production. Although all are not presently in existence, they serve as examples of the type of programs which may be established. Consider federal investment tax credits. Under the Energy Tax Act of 1978, investors receive a ten percent federal tax credit when they invest in wood conversion facilities. The amount of the investment eligible for the tax credit depends upon the life of the facility and whether the facility is new or used. The amount of the tax credit is limited, but excesses can be carried forward or back. Another tax incentive is rapid amortization of pollution control facilities which can include plants utilizing wood waste or wood residues. And, lastly, the Economic Recovery Tax Act of 1981 increases depreciation rates for equipment used in cogeneration.

Congress also established financial programs to encourage investment in wood energy projects. Since these programs were in effect for only a short period of time, overall program effectiveness is difficult to measure. One such program provided credits for the production of densified wood. The program was difficult to administer at the national level and led to capital investments in projects with an inordinately high level of risk and low chance of success. Congress also established
financial support programs for schools and hospitals converting to wood energy. The program was designed to overcome capital limitations that prohibited such investments. Once capital problems were eliminated, the organizations could afford to bear the much lower variable costs of a wood energy system.

In 1980, Congress sought increased utilization of wood residues by establishing the Wood Residue Utilization Act of 1980. The Act authorized the Secretary of Agriculture to conduct a five year (fiscal year 1982 through 1986) pilot program to develop, demonstrate, and make available information on feasible methods to increase and improve the utilization of wood residues (Appendix A). The program's thrust was to increase and improve wood residue utilization in residential, commercial and industrial or powerplant applications. Properly instituted and financed the law could have successfully promoted forest residue recovery. Yet, success was not realized. Program funding has been severely limited and prospects for funding in the program's final years are bleak. The ideas contained in the program could be resurrected and funded on a statewide or regional basis with the funding coming from some local source.

The promotion of cogeneration activities is another area where Congressional efforts have helped overcome barriers inhibiting growth of wood produced energy. Cogeneration is affected by several federal laws, including the Public Utilities Regulations Policy Act of 1978 (PURPA), the Power Plant and Industrial Fuel Use Act of 1978 (PUA), and the Natural Gas Policy Act of 1978. The Federal Energy Regulatory Commission also has administrative regulations that guide actions concerning cogeneration. The Public Utilities Regulations Policy Act may well be the most important incentive for cogeneration. Under the Act, electric utilities must purchase electricity from qualifying cogenerators as well as sell electricity to them at nondiscriminatory rates. Interconnections must be established between the cogenerator and the utility's system. The Act also exempts cogenerators from certain regulations under the Federal Power Act and the Public Utility Holding Company Act. Legislative backing for the sale of electricity is very important for cogenerators. Since enactment, the utility industry has challenged many of the act's provisions. However, most of the law's contents have been upheld by court action.

Congress has played an active role in the encouragement of greater use of biomass fuels. A careful look at its intentions suggests that even more growth in this area was intended. As energy prices stabilized and budget deficits grew, however, Congressional efforts promoting wood energy have waned. A start and stop approach is not conducive to growth in the utilization of wood for energy production, nor does it provide clear signals to investors in wood energy projects. Some guarantees that government will continue to support the wood energy effort in the long run would seem like an essential ingredient if growth of the wood energy market is to continue.
U.S. Department of Energy

The U.S. Department of Energy is another federal agency which has played an important role in the development of wood energy. As with other agencies discussed, the Department's efforts are relatively recent in origin, resulting primarily from increased concern over alternatives to fossil fuels. The Department has been a leader in the development and funding of wood biomass fuel projects, including various demonstration projects that have proven the reliability of wood produced energy. The Department has also been active in coordinating activities and providing funding for resource availability studies and informational programs used to promote the direct combustion of wood. Another key program involved the funding of research projects that have helped develop improved methods of harvest and delivery of forest residues.

Department of Energy efforts in the area of wood biomass fuels were very strong through the late 1970's and early 1980's. Through the agency's efforts, much progress was made in the development of new technology and in the collection and dissemination of information concerning biomass fuels. However, biomass fuel research has been severely curtailed in recent years; less than one percent of the Department's total budget is allocated for wood energy programs.

State Programs

Several states have developed active programs to promote the use of wood residues for energy production. These programs can serve as models for the state of Minnesota, especially program strategies for implementation of wood energy policies. Although most state programs are based on unique geographic or resource differences, such programs may be adapted or used as guides for future wood energy policy development in Minnesota.

North Carolina Wood Energy Program

North Carolina has one of the most active programs for promoting the use of wood for energy. The state's efforts are based on a coordinated plan that outlines reasonable wood energy objectives; a plan which was developed by a special task force established by the state's governor. The task force, known as the Wood Energy Coordinating Group, included members from the state's Department of Natural Resources and Community Development, Department of Administration, Department of Commerce-Energy Division and the University of North Carolina.

The task force's early efforts included aggressive pursuit of outside funding for demonstration projects, educational programs and technical and financial assistance programs. This activity resulted in substantial funding by the U.S. Department of Energy, the U.S. Environmental Protection Agency, the North Carolina Energy Institute, the National Science Foundation and other organizations. These projects have provided much of the information necessary for analysis of the
feasibility of specific wood energy systems. The information gathered also helped in the successful development of other programs to promote further utilization of wood energy.

During the planning process specific activities and responsibilities for the Wood Energy Coordinating Group were laid out in a master plan (Appendix B). These activities and responsibilities included developing markets for wood fuel, developing supply systems for wood fuel, developing research mechanisms, assessing the processes and techniques of using wood fuel, and analyzing the use of wood as a home fuel. Within these areas separate programs of education, demonstration, technical assistance and research were developed.

The task force operated under the direction of a full time Wood Energy Project Coordinator. Through the efforts of the task force, the state has been quite successful in encouraging a large number of energy intensive industries (i.e., brick making and textile plants) to convert to the use of wood as their major energy source.

The North Carolina legislature has also promoted the use of wood for energy. Tax assistance legislation provides a 15 percent increase in depreciation which allows more rapid write-off of wood burning equipment. This rate is available to industrial concerns that convert from a fossil fuel energy system to a system that uses wood.

Along with the work done by the wood energy task force, North Carolina has developed a strong extension program to promote the use of wood energy. An extensive slide-tape presentation has been prepared to describe the use of wood, disadvantages, advantages, supply issues and other pertinent information for anyone considering switching to wood fuel. The program has proven to be an effective tool for promoting wood energy development throughout the state.

North Carolina's success is based upon the cooperation of the state's wood energy group and its university extension department. These group efforts have helped to alleviate the information gap concerning wood fuel and wood burning energy systems. Effective communication of the wood energy group's work occurs through publication of an annual report which provides an update on wood energy conversions and current research projects. The report not only provides information to the public but increases the awareness of the current situation concerning the use of wood for energy production.

Oregon Wood Energy Development Program

The State of Oregon has taken a different approach than North Carolina in promoting use of wood energy. The state realized that utilizing waste wood or excess wood from timber harvests could significantly reduce pollution problems resulting from current wood residue disposal methods. Switching to wood energy was also perceived as a means to create jobs and reduce future energy demands. With these ideas in mind, Oregon developed a program of tax incentives and financing
programs designed to encourage investment in equipment to burn wood for energy. Oregon carefully coordinates state programs with those available at the federal level so as to provide a broad spectrum of methods to increase the economic feasibility of waste wood utilization.

Oregon offers a tax credit to reduce the cost of installing solid waste utilization facilities. This credit can be applied to facilities which convert wood waste into energy or other usable products and can also be used for additions to solid waste handling facilities that increase the production of energy from the plant. The amount of the credit varies with the life of the facility, up to a maximum of 50 percent. Oregon also provides tax relief in the form of a 10 percent tax credit on certified investments in economically lagging areas. This credit is meant to promote future economic development within the state's depressed areas. To qualify for the credit, investments must exceed $25,000 and the new facilities must have a reasonable expectation of creating new permanent jobs. These requirements can usually be met by larger wood energy conversion facilities. And lastly, an additional tax incentive to investors is a one year bonus of an extra 20 percent write-off on qualifying property. This extra write-off is in addition to the regular depreciation allowance.

Oregon also offers a variety of financing options that may be used by investors for wood energy projects. These include a substantial reduction in the interest rate charged for borrowed capital for wood conversion projects. The financing options depend on the sale of industrial development revenue bonds and are available from the state to finance certain business projects, from the counties for financing pollution control facilities or from the various port districts for development within port areas.

The tax incentive and financing options create a positive investment climate for private firms in Oregon. Investments in wood fueled energy production are riskier than many other business investments. Incentive programs serve to lessen the risk and induce companies into making new capital investments. Oregon bears some of this risk and probably encounters a short term decrease in tax revenues. However, if these programs are successful in stimulating significant investment, then the state should reap substantial benefits in the long run. Oregon has provided conditions that should spur investors to consider the option of investing in new processes to utilize wood residues. The willingness of the state to try to alleviate some of the costs and risks of new investments could lead to significant new developments.

Washington Wood Energy Directives

Although planning for wood energy in Washington has not been as extensive as in North Carolina and Oregon, significant actions have been taken. A key feature of the state's planning is the recognition of the need to consider wood energy options. The latest timber management plan prepared for Washington specifically proposes using wood for energy -- if wood is the most economical use. This recognition places the use of
wood for energy on equal footing with other wood fiber uses. Additionally, the 1980 Washington legislature enacted a law requiring the Utilities and Transportation Commission to grant higher rates of return for utilities generating electricity by cogeneration or from renewable resources. The legislature also allowed production costs to be exempt from a 3.6 percent Public Utility Tax. Washington's efforts while not extensive, provide an example of some sample initiatives a state can choose in its effort to promote wood energy. If the effort is supported by all state agencies involved, then the overall program is likely to succeed.

PROGRAM AND POLICY OPTIONS

Policy and program options for encouraging the use of wood energy are numerous as previous discussions have made apparent. What follows is a listing — along with appropriate summaries — of major policy and program types which governments might focus on a region to encourage the use of wood residues. An effort is made to describe new program types which could prove effective. Obviously, however, the ultimate combination of policies and programs must be designed with a clear understanding of the physical, economic, administrative and political conditions which prevail. The following "laundry-list" is presented as a means of airing alternatives, realizing that many may in fact be infeasible for one of many reasons.

Tax and Financial Policies

The broad area of tax and financial incentives provides many opportunities to eliminate barriers that are preventing full scale utilization of wood residues for production of energy. These programs must be carefully designed to prevent subsidization of overly risky proposals or to pay for projects which would "normally" occur without government assistance. Tax programs should not create unwieldy administrative problems nor lead to fiscally irresponsible allocations of public capital.

Coal Use Tax

Coal is not mined in Minnesota; major supplies are located in Wyoming and Montana. In 1978, 84 percent of the coal used in Minnesota produced energy. An import tax on coal shipped into Minnesota could, by raising its price relative to wood, provide a significant incentive to the use of wood produced energy. An import tax could have some advantages. The tax could have a positive effect on economic development in the depressed areas of northeastern Minnesota by employing more loggers, truckers and related services. Any development that alleviates some of the economic problems currently facing the northeastern region of the state would be welcome. A tax on coal by discouraging its use could also increase air quality since coal has been identified as a major contributor to acid rain. A significant decrease in the use of coal should somewhat lessen the extent of this problem. However, a coal
import tax has serious disadvantages. Its adoption would be very controversial and would definitely meet strong opposition from coal using energy producers and possible retaliatory import taxes on products shipped from Minnesota. Since little is known about the relationship between the size of such a tax and its effect on wood used for energy, a coal import tax may in fact be highly counter productive. Then too, economic development may be reduced as a result of increased energy costs. Some important sectors, such as iron mining, which use large amounts of coal for energy may be placed under excessive pressure considering their already tenuous hold on profitability. It would seem more logical to seek ways of lowering their costs than raising them.

Government Guaranteed Loans

The capital cost to develop wood energy systems can be prohibitively expensive given the high and often unknown risks often associated with such investments. With government guarantees of loan repayment, the risk to private lenders is significantly lessened. And by lowering the risk, private lenders are encouraged to lower the rate of interest charged to developers of wood energy projects. Positive results may be achieved with minimal costs to public agencies involved if the approval of loan applications is carefully monitored. Government's willingness to assume a portion of the risk in new economic developments has been evident in the past. In a serious effort to improve the economy of northeastern Minnesota, the government sector needs to become actively involved. Loan guarantees can serve as a low cost method to spur development within the wood energy market.

Government loan guarantees are not without problems. When a guaranteed project fails, the public is required to repay privately financed the loan. Sound program administration is the key to limiting such defaults. A loan guarantee program with tight controls that provides approval to only the most worthwhile projects should achieve the anticipated results while incurring minimal public costs.

Increased Local Funding

Increased development in wood energy projects can be accomplished through direct financial support from local government sources. In Minnesota, the Iron Range Resources and Rehabilitation Board (IRRRB) and the Arrowhead Regional Development Commission (ARDC) serve as examples of public agencies that have provided development capital to energy projects. The possibility of increased economic development as a result of capital investments in wood energy projects should be sufficient incentive to encourage actions by these development agencies. Here too, direct financial support must be directed to projects offering the highest probability of economic benefits, i.e., job creation, increased local income, and lowest risk.

As with loan guarantees, the development agencies must have firm control over project applications. Public money should not be invested frivolously in unduly risky projects. Administrative judgements that
are overly conservative will also limit the chance of program success. Developments within new areas are bound to entail some risks, yet with proper control these risks are not inappropriate. The need for economic growth in northeastern Minnesota is such that risks must be taken to improve the welfare of the general public.

Timber Harvest and Pricing Policies

Policies and regulations that guide public forest administrators can have a significant effect on the use of wood residues. Agencies frequently have difficulty in adopting rules and regulations to promote wood used for energy because, unlike private firms, their goals are not linked exclusively to the maximization of net revenues. Policies developed by public forest managers are under constant scrutiny by a variety of user groups having vastly different ideas of how public forests should be managed. Public agencies must continually balance policies so that a particular group is not unduly favored. In such an environment, administrators must be especially creative and innovative. In the following sections, policy changes in timber harvest regulations and stumpage pricing fees are explored, that, if properly instituted, could encourage increases in forest residue utilization in a cost effective manner. Strong administrative leadership is likely to be required if these ideas are going to be accepted by the general public. Also the policies must be flexible to allow for adjustments as problems arise.

Long-term Residue Harvesting Contracts

A major barrier to increased wood energy development may be the lack of guaranteed fuel supplies at reasonable and stable prices. A possible solution to this problem involves the development of long-term residue removal contracts with public agencies managing forest land (contracts guaranteeing residue removal rights for up to 10 years at an agreed upon stumpage fee). A wood energy supplier, with a guaranteed supply and a fixed price, could offer potential users essential information to assess the future competitive position of wood fuel in relation to their current fuel. This information is essential to determine the potential gains from using wood fuel. Without guaranteed supplies, wood energy users face unknown risks of wood fuel shortages or rapidly escalating wood prices. The minimizing of this risk may be key element to more widespread use of wood residues.

A long-term residue removal contract could be written to include only residues from harvested sites or it could include the rights to material in otherwise unmerchantable low quality stands. Among forestry professionals currently managing public lands, very little interest is evident for pursuing the use of long-term residue removal contracts as a means of increasing fiber utilization. The reasons for this lack of interest include: 1) loss of control over land use when contract rights are given for long periods, 2) risk of revenue loss if wood fiber prices rise significantly, and 3) realization that long-term contracts would favor one resource using sector over all others. These concerns are important and when combined may seriously limit the use of long-term contracts to encourage residue utilization.
Stumpage Price Reductions

Reduced stumpage prices or even negative pricing may be necessary to encourage residue removal that would not otherwise be removed. As noted previously, there are many benefits to be gained from increasing the level of wood residue utilization. If lower prices for residues are found to be the key link to increase their utilization, then consideration should be given to such an approach. The benefits from increased utilization could be set against the loss in revenue or the cost of the subsidy. The price of residues could be set so that benefits are greater than any costs incurred. This relatively simple concept to encourage greater resource use is often resisted by public forest administrators that fear reduced stumpage prices or negative pricing will create a public perception of timber being given away. If this perception did develop, it could be damaging to the efforts of public forest administrators to properly manage the forest resource. The fears of the general public, however, could possibly be overcome with a program of educational publicity detailing the benefits of such an approach. These potential benefits include: 1) recovery of material already paid for through land management activity and fire protection, 2) addition of new revenue to loggers -- however small, 3) reduced regeneration costs for establishment of next timber stand, and 4) capturing a forested area's future productivity, which may be foregone without price incentives.

A price reduction concept could be instituted on a trial basis in an area that presently has an active wood energy market. During this trial period, an appropriate pricing system for residue removal could be developed. The use of open bidding for residue sales could encourage a free market activity in which an optimal price could be established. During the trial period, program costs could be clearly identified.

Joint Timber Harvest Scheduling

Public timber managing agencies with intermingled land ownerships could jointly schedule timber harvesting for all or selected portions of their forest land ownerships. Such action may well encourage more efficient management of the timber resource and could increase wood residue utilization. Larger timber sales may encourage the use of more economical wood residue recovery equipment. Opportunities for securing better, less costly access to forest sites and the availability of larger volumes of residue material could encourage more efficient use of whole tree harvesters and related equipment. Timber purchasers could be spared the costly and time consuming process of moving from one small site to another.

Joint timber harvest scheduling could only be accomplished with substantial cooperation among local, state and federal forest landowners. Their differing goals, perspectives and clientele may well preclude such cooperation. Small scale cooperative efforts could, however, be tested. If the approach proves ineffective, the cost of failure would be slim.
Long-term Planning

Recognition of wood energy and wood fiber utilization goals in long-term forest planning processes is an additional method to improve wood residue utilization. Incorporation of such goals would allow forest managers to more effectively focus on residue utilization goals and means of achieving them. Without any consideration for wood energy uses of forest fiber, other goals resulting from the planning process may be overvalued. The inclusion of potential benefits and costs of increased wood residue use in statewide and forest plans would alert forest managers to the possible impacts of such a use. With proper planning, negative impacts could be minimized while realizing the full potential of positive impacts. Through the planning process, managers can establish goals for wood utilization and effective techniques to achieve such objectives.

Transportation System

Improving wood residue utilization depends on the existence of adequate forest road and general transportation systems. Lack of forest roads or poorly maintained roads can be a major physical and economic barrier to residue harvest as can inadequate state highway and rail systems. Suggestions for improving transportation systems at the state level have been suggested (Commission on Wood Products 1983). The (Minnesota) Governor's Commission on Wood Products recommended a six point program in 1983, namely:

- Finance road improvements according to the "State Forest Road Plan."
- Increase the priority of state and county highway improvements within the forested areas of the state.
- Support and improve the "Minnesota Rail Service Improvement Program."
- Permit a 10 percent tolerance in forest products vehicle weights if loaded in woods or other places where scales are not available.
- Investigate opportunities to improve shipping of forest products.
- Standardize load width standards in the state with those of the federal government.

Such a program should be considered by any measures designed to enhance the utilization of forest residues for energy. Forest residue removal and utilization are particularly dependent on an adequate transportation system that will permit wood fiber to compete effectively with other fuels.

Road and other transportation improvements require substantial amounts of capital from state and federal governments. The availability
of such large capital investments are unlikely unless funds from gasoline and highway taxes become available in large sums. Improved transportation is not the major barrier to increased residue utilization. Yet without substantial improvements in current transportation systems, forest residue utilization will be inhibited.

**Heating Government Facilities With Wood**

An opportunity exists for county, state and federal governments to make a stronger leadership commitment in the use of wood as a fuel source by using wood energy themselves. At the present time, there are few significant efforts on the part of government agencies to examine or actually install wood burning boilers or generators. Although risks exist with the use of wood as a fuel, the present number and history of current wood fuel users should provide an indication of its reliability. Considering the many potential benefits of increased wood fiber utilization, state officials could easily assume the lead in this respect. Such actions may be a dramatic catalyst to the development of a wood fuel market and bring wood more into the forefront as a major alternative fuel source within Minnesota.

The conversion to wood fuel by any public facility should be carried out only if the benefits of doing so can be proven to outweigh the costs. Additional study should probably be given to benefit-cost analyses of wood heating systems for public buildings. Administrative inertia in the face of often overwhelming evidence often inhibits conversions and should be addressed. A positive step toward the latter would be conversion of a major public facility to wood fuel -- an example of the opportunity that exists.

**Wood Energy Specialists**

Specialists in wood residue utilization and wood energy marketing could substantially enhance opportunities for the use of wood residues. These persons could be assigned to the staffs of the Minnesota Department of Natural Resources, the University of Minnesota and county governments. The ability of regional development agencies in northeastern Minnesota to address wood energy issues would also be enhanced by the addition of wood energy experts. Persons with expertise in such areas would allow greater amounts of effort to be targeted toward increasing the use of wood residues for energy. Wood energy specialists would be free to concentrate exclusively on the pursuit of innovative methods and programs to stimulate increased utilization of wood fiber for energy purposes. This approach has been successfully applied in other parts of the nation. Experience indicates dramatic increases in wood residues used for energy as a result of staff promoting wood as an alternative fuel source. Such specialists would require funding from governmental units involved; but costs are relatively modest. The positions could be temporary (i.e., approximately five years), after which time the wood fuel market should be sufficiently established so that government support is no longer necessary.
APPRAISAL OF PROGRAM AND POLICY OPTIONS

Appraisal Procedures

Policy and program options for encouraging the use of wood residues are many, each with a variety of advantages and disadvantages. In order to wisely choose from among such options, they must be systematically evaluated and presented. What follows is such an evaluation; its preparation involved definition of evaluating criteria, summarization of program approaches previously discussed, application of criterion to program options, and development of observations and conclusions. The criteria used to judge program and policy options were:

- **importance of problem (barriers) addressed.** Importance of the problem (barrier) to the utilization of wood residues.

- **cost of implementing.** Magnitude of financial investment (public sector only) required to carry-out the program area.

- **government coordination required.** Extent of public agency coordination required to make program a success.

- **impact on wood residue utilization.** Degree to which the program area will encourage utilization of wood residue.

- **economic impact.** Degree to which the program area will enhance economic activity (e.g., employment, income, stability).

- **likelihood of success.** Certainty that goals and objectives addressed by the program will be achieved.

- **cost effectiveness.** Relative cost effectiveness in achieving program goals and objectives.


- **potential acceptability.** Likelihood that program area would be agreed to and supported by high level government policy makers (e.g., agency heads, legislators), public forest land managers, wood industry policy makers and managers, and the general public.

Application of the above criteria resulted in ratings of program areas. Ratings assigned to each of the latter were:

- **H** = high
- **M** = moderate
- **L** = low
- **NA** = not applicable
Since empirical evidence relating criterion to program areas is limited or non-existent, the assignment of ratings is obviously highly subjective. Furthermore, since the scale of program areas differs markedly (e.g., deregulation of fossil fuel prices versus wood utilization extension position), judgements about program outcomes are difficult. And last, alternative program areas are evaluated in a discrete fashion; certainly a combination of program areas would result in synergistic effects. All such problems recognized, an appraisal of program areas often suggested as means of encouraging utilization of wood residues is offered in the spirit of more clearly defining their potentials and encouraging judgements as to their effectiveness on the basis of a broader set of decision rules (criteria) (Table 1).
Table 1. Appraisal of public programs to promote the use of wood residues in the production of energy.

<table>
<thead>
<tr>
<th>Program Areas</th>
<th>Importance of Problem Area</th>
<th>Cost of Implementing Program</th>
<th>Government Coordination Required</th>
<th>Impact on Residue Utilization</th>
<th>Economic Impact</th>
<th>Likelihood of Success</th>
<th>Cost Effectiveness</th>
<th>Near Term Impacts</th>
<th>Short Term Impacts</th>
<th>Long Term Impacts</th>
<th>Department Influences</th>
<th>Public Forest Managers</th>
<th>Industry Influences</th>
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<td>B. Increase knowledge of wood energy among - public agencies</td>
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<td>- large businesses</td>
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<td>C. Increase training of wood harvesting labor force to improve utilization efficiency</td>
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<td>D. Develop and expand technical assistance workshops on wood burning technology</td>
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<td>E. Encourage wood industry to increase educational assistance on wood residues</td>
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<td>F. Establish and fund wood utilization extension specialist</td>
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<td>G. Establish and fund wood energy utilization extension specialist</td>
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<td>A. Establish stringent wood utilization standards for - public forest land</td>
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<td>B. Deregulate price of all fossil fuels</td>
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<td>A. Prepare and adopt statewide wood energy plan</td>
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<td>B. Identify wood residue objectives and programs in long-term timber management plans</td>
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<td>C. Intensity state and regional forest resource studies</td>
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<td>D. Establish and fund wood energy coordinator position</td>
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<td>E. Develop and expand use of wood energy demonstration projects</td>
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<td>F. Encourage use of wood generated energy in public buildings</td>
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<td>G. Increase funding emphasis on - reforestation</td>
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<td>H. Improve and expand forest road systems</td>
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<td>I. Adopt joint scheduling of public timber harvests</td>
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<td>J. Institute new residue pricing policies - negative pricing</td>
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<td>K. Establish long-term wood residue utilization contracts</td>
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* Ratings of program areas are: H = high, M = moderate, L = low, and NA = not applicable.
Policy Program Proposal

Public programs to enhance wood residue use implies the existence of benefits that in all likelihood would not have achieved if left to traditional market systems. Such is probably the case with wood residues. But public involvement to encourage wood residue use -- and the benefits which result therefrom -- must be well designed and properly planned. Important is a thorough understanding of public program objectives and the steps necessary for their achievement. Expectations should be realistic -- the risk of failure should be minimal. Since programs focused on enhancing wood residue utilization are relatively new and often untried, they should be designed with a certain degree of flexibility so as to accommodate unforeseen technical, economic and administrative events. Program managers and planners must carefully monitor progress toward agreed to objectives. Implementation of wood utilization programs will require the involvement of many user and problem solving groups (USDA - Forest Service 1980a). Federal, state and local land managing agencies, universities, private consultants, research organizations, industrial entities, and trade and dealer associations must communicate and coordinate efforts to achieve program objectives in an efficient and effective manner. In addition, program success at the state level will rest heavily on:

- Legislative appropriation of state funds.
- Governor's personal leadership.
- State university participation via research and extension programs.
- State and county forest management agencies working to support the use of wood for fuel.
- Visible demonstrations of wood supply and commercial, industrial, and institutional applications within the state.

With the above program-design criteria in mind, a set of policies and programs to encourage the use of wood residues in Minnesota can be set forth. They should not be viewed as "the final word," but rather as a starting point for discussion and debate. Specifically, a wood residue program in Minnesota could entail the following:

- Development of a well conceived wood energy plan under direction of a wood energy coordinator.
- Continued development and emphasis on educational and technical assistance programs for the promotion of wood energy.
- Wood energy conversions in public buildings.
- Improved forest management programs focused on wood residue.
• Long-term contracts for sale of residues or otherwise unmerchantable public timber.

• Development of a guaranteed loan program for investments in wood energy projects.

A most important step in establishing an effective wood residue program is development of a wood energy plan. Such a plan should outline goals, programs and resources required for implementation, and should have special focus on Northeastern Minnesota. The plan should be constructed with input from all interested parties and should include instructions concerning the level of effort expected of each participating organization. The plan could best be developed under leadership of a designated wood energy coordinator and should focus state efforts on especially meritorious projects. Cogeneration, large and small scale process steam projects, and district heating programs are worthy of attention. Small scale process steam projects, however, appear as having special merit for the use of wood residues.

In addition to a well designed wood energy plan, establishment of a wood energy marketing system is essential. Only through the use of such a system can the cost of wood biomass become competitive and supplies to consumers dependable. As previously discussed, consumer apprehension about wood fuel supplies is a major factor limiting conversion to wood energy. Wood energy conversions in public buildings and forest management activities designed to assure residue supplies could enhance marketing projects. Extension programs may well be an effective vehicle for informing wary consumers of wood energy opportunities.

Public forest management and timber harvesting programs should encourage development of reliable and accessible supplies of wood residue for the production of energy. Harvesting of low quality understocked or stagnant timber stands could create substantial wood residue supplies and allow for more intense timber management practices to be applied to newly established stands (Office of Technology Assessment 1980). Long-term wood residue removal contracts may well be an effective tool for encouraging wood-residue use.

State authority to develop and implement a loan guarantee program encouraging investments in wood energy projects should also be considered. If properly administered, such loans could ease the private investors financial burdens by enabling private lending institutions to charge lower interest rates -- rates consistent with the risk being assumed. Quite possibly such a program could involve limited state financing, if projects are wisely chosen and mechanisms for collecting administrative costs are set in place.

In conclusion, Minnesota is faced with a fine opportunity to enhance the use of wood in a fashion that will encourage energy conservation and economic development. This opportunity is especially noticeable in the state’s northeastern region. From many perspectives, the resources required to capture such an opportunity are not overwhelming.
Their investment in a comprehensive wood residue utilization program should be given serious consideration.
BIBLIOGRAPHY


Keegan, C. E., III. 1981. The Cost and Availability of Forest Residue in the Northern Rocky Mountains. Bureau of Business and Economic Research, School of Business Administration, University of Montana, Missoula, MT.


Minnesota Department of Natural Resources. 1980. Minnesota Wood Residue Studies. Published in agreement with the Minnesota Energy Agency. St. Paul, MN.


APPENDIX A

Wood Residue Utilization Act of 1980
An Act

To authorize a pilot program to encourage the efficient utilization of wood residues, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Wood Residue Utilization Act of 1980".

SEC. 2. The purpose of this Act is to develop, demonstrate, and make available information on feasible methods that have potential for commercial application to increase and improve utilization, in residential, commercial, and industrial or powerplant applications, wood residues resulting from timber harvesting and forest protection and management activities occurring on public and private forest lands, and from the manufacture of forest products, including woodpulp.

SEC. 3. (a) The Secretary may establish pilot projects and demonstrations to carry out the purposes of this Act. The pilot projects and demonstrations established under this section (1) may be operated by the Secretary; or (2) may be carried out through contracts or agreements with owners of private forest lands or other persons, or in conjunction with projects, contracts, or agreements entered into under any other authority which the Secretary may possess: Provided, That nothing contained in this Act shall abrogate or modify provisions of existing contracts or agreements, including contracts or agreements for the sale of national forest timber, except to the extent such changes are mutually agreed to by the parties to such contracts or agreements.

(b) Pilot projects and demonstrations carried out under this section may include, but are not limited to (1) establishment and operation of utilization demonstration areas; (2) establishment and operation of fuel wood concentration and distribution centers; and (3) construction of access roads needed to facilitate wood residue utilization: Provided, That the residue removal credits may be utilized by the credit only as provided in section 4.

SEC. 4. The Secretary may carry out pilot wood residue utilization projects under which purchasers of National Forest System timber under contracts awarded prior to October 1, 1986, may, except as otherwise provided in this section, be required to remove wood residues not purchased by them to points of prospective use in return for compensation in the form of "residue removal credits." Such projects may be carried out where the Secretary identifies situations in which pilot wood residue utilization projects on the National Forest System can provide important information on various methods and approaches to increasing the utilization, in residential, commercial, and industrial or powerplant applications, of wood residues and where such information cannot reasonably be obtained unless the pilot projects are done in conjunction with normal National Forest timber sale activities. The residue removal credits shall be applied against the amount payable for the timber purchased and shall represent the anticipated cost of removal of wood residues. The following guidelines shall apply to projects carried out under this section:

(1) Except in cases where wood residue removal is determined to be necessary for fire prevention, site preparation for regeneration, wildlife habitat improvement, or other land management purposes, the Secretary may not provide for removal of wood residues in instances where the anticipated cost of removal would exceed the anticipated value.

(2) The residue removal credits authorized by this section shall not exceed the amount payable by the purchaser for timber after the application of all other designated charges and credits.

(3) The Secretary may sell the wood residues removed to points of prospective use for not less than their appraised value.

(4) Pilot projects, demonstrations, and other programs established pursuant to this Act shall be carried out in a manner which does not result in an adverse effect on the furnishing of timber, free of charge, under any other provision of law.

(5) Wood residues shall be collected from a site so as to avoid soil contamination or erosion giving full consideration to the protection of wildlife habitat.
(6) For the purposes of the sixth undesignated paragraph under the heading "forest service" in the Act of May 23, 1908 (35 Stat. 260; 16 U.S.C. 500), and section 13 of the Act of March 1, 1911 (36 Stat. 963; 16 U.S.C. 500), (A) any residue removal credit applied under this section shall be considered as "money received" or "moneys received", respectively, and (B) the "money received" or "moneys received", respectively, from the sales of wood residues removed to points of prospective use shall be the proceeds of the sales less the sum of any residue removal credit applied with respect to such residues plus any costs incurred by the Forest Service in processing and storing such residues.

Sect. 5. The Secretary shall make annual reports to the Congress on the programs authorized by this Act. These reports shall be submitted with the reports required under section 3(c) of the Forest and Rangeland Renewable Resources Planning Act of 1974.—

Sect. 6. The Secretary shall issue such regulations as the Secretary deems necessary to implement the provisions of this Act.

Sect. 7. For purposes of this Act, the term:

(1) "Anticipated cost of removal" means the projected cost of removal of wood residues from timber sales areas to points of prospective use, as determined by the Secretary at the time of advertisement of the timber sales contract in accordance with appropriate appraisal and sale procedures.

(2) "Anticipated value" means the projected value of wood residues as fuel or other merchantable wood products, as determined by the Secretary at the time of advertisement of the timber sales contract in accordance with appropriate appraisal and sale procedures.

(3) "Points of prospective use" means the locations where the wood residues are sold or otherwise put to use, as determined by the Secretary in accordance with appropriate appraisal and sale procedures.

(4) "Person" means an individual, partnership, joint-stock company, corporation, association, trust, estate, or any other legal entity, or any agency of Federal or State government or of a political subdivision of a State.

(5) "Secretary" means the Secretary of Agriculture.

(6) "Wood residues" includes, but is not limited to, logging slash, down timber material, woody plants, and standing live or dead trees which do not meet utilization standards because of size, species, merchantable volume, or economic selection criteria and which, in the case of live trees, are surplus to growing stock needs.

Sect. 8. There is hereby authorized to be appropriated not to exceed $25,000,000 for each of the fiscal years 1982, 1983, 1984, 1985, and 1986 to carry out the pilot projects and demonstrations authorized by section 3 of this Act, the residue removal credits authorized by section 4 of this Act, and the other provisions of this Act: Provided. That not to exceed $2,500,000 of such amount may be appropriated for administrative expenses to carry out this Act for the period beginning October 1, 1981, and ending September 30, 1986. Such sums shall be in addition to those provided under other provisions of law and shall remain available until expended.

Sect. 9. This Act shall become effective October 1, 1981.

Approved December 19, 1980.

LEGISLATIVE HISTORY:

HOUSE REPORT No. 96-1526 (Comm. of Conference).
SENATE REPORT No. 96-634 (Comm. on Agriculture, Nutrition, and Forestry).
Mar. 25, considered and passed Senate.
Aug. 18, H.R. 6755 considered and passed House; passage vacated and S. 996, amended, passed in lieu.
Dec. 5, House agreed to conference report.
Dec. 8, Senate agreed to conference report.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS, Vol. 16, No. 51:
Dec. 13, Presidential statement.
APPENDIX B

Plan to Promote the Use of Wood for Energy

in North Carolina
A Plan to Promote
The Use of Wood for Energy in North Carolina

A Working Document of
The Wood Energy Coordinating Group
Department of Natural Resources and Community Development
Department of Administration
Department of Commerce - Energy Division
University of North Carolina

Adopted December 14, 1978

P.O. Box 27687
Raleigh, North Carolina 27611
Abstract

-A Plan to Promote the Use of Wood for Energy in North Carolina-

Forest products industries have long used wood for energy, but a need for additional markets for low-grade fiber exists. This can be accomplished by developing non-wood industry energy markets. Energy economics should provide the impetus to apply systems of harvesting, handling, and energy conversion to many industrial and commercial firms, thereby creating markets for the otherwise unmerchantable fiber scattered across the state. Forest management opportunities will increase, and additional growth of high value conventional products will result.

The many benefits from this process dictate that broad support should be generated by government. The "plan" identifies current activities in the public and private sectors related to wood energy, and lists desirable activities and participants for future involvement. These activities encompass programs of education, demonstration, technical assistance, and research.
A Plan to Promote the Use of Wood for Energy in North Carolina

1. Introduction

1.1 The role of wood as a fuel
1.2 Potential for use of wood as a fuel in North Carolina
1.3 Benefits to North Carolina
1.4 Purpose of this plan

2. Organizations Involved

2.1 Wood Energy Coordinating Group
   2.11 Natural Resources and Community Development
   2.12 Commerce
   2.13 Administration
   2.14 University of North Carolina

2.2 Other

3. Current Activities

3.1 Educational
3.2 Demonstrations
3.3 Industrial Contacts
3.4 Industry Involvements
3.5 Research

4. Planned Activities and Responsibilities

4.1 Developing markets for wood fuel
   4.11 Educational programs
   4.12 Demonstrations
   4.13 Assistance programs
   4.14 Legislative programs

4.2 Developing supply systems for wood fuel
   4.21 Educational programs
   4.22 Demonstrations
   4.23 Assistance programs

4.3 Assessment of Processes and Techniques

4.4 Research Mechanisms

4.5 Wood as a home fuel

5. Evaluation
Fossil fuels have rapidly risen in price and decreased in reliability of supply. Oil has doubled in four years, coal in three, and natural gas rose 136% from 1972 to 1975. Oil embargoes, coal strikes, and gas deregulation appear as distinct possibilities. Latest projections indicate that both oil and coal will rise in price an additional 150% by 1990 -- just over 11 years away.

The average energy cost to manufacturers nationwide is $2.73 per million BTU. In North Carolina, fuel oil at 33-45¢ per gallon contains energy at $2.20 - $3.15 per million BTU. Southern Appalachian coal is delivered at around $45 per ton, containing energy at about two dollars per million. At projected 1990 levels, energy from coal will cost five dollars per million BTU, and oil energy will be in the $5.50 - $7.90 range.

As energy costs increase, the impetus to shift to wood energy will strengthen. Existing mill residues will receive the first attention since these are relatively cheap (two to five dollars per ton) and are available in some areas of the State. Next, logging residues will be utilized. These materials are generally left on the forest floor, hampering regeneration, or are wastefully burned, creating air pollution. Energy economics, however, will provide the relatively small thrust required to move these materials to replace fossil fuels if wood fuel markets are available. This additional effort required will be small since the harvesting crews and much of the equipment are already operating in the area, and negotiations with the woodland owners have taken place.

The last stage, and most significant, is that of harvesting tracts of standing trees primarily for fuel. This is the stage that will allow economic removal of unwanted trees so that well-stocked stands can be thinned appropriately or so that entire tracts that are worthless can be reforested with desirable trees.

The amount of fiber in North Carolina that should be removed, from a forest management view, is enormous, perhaps 30 million green tons annually. By realizing that this quantity can replace over 30 million barrels of oil annually (industrial and commercial firms consumed 31 million barrels in 1976), it is hard to imagine that statewide competition for wood fuel will become intense within the foreseeable future. Current estimates of $12 to $14 per ton for green whole-tree chips produced and delivered primarily for fuel should remain relatively constant (in today's dollars). At these levels, energy is delivered in a range from $1.40 to $1.65 per million BTU's.

1.3 BENEFITS TO NORTH CAROLINA

The substantial array of benefits of wood energy use indicates that many governmental programs have, or should have, a stake in the concept. To begin, renewable wood resources will be furnished by local, dependable entrepreneurs to replace fossil fuels which are scarce or imported. National trade deficits can be lessened considerably.
Fossil fuels have rapidly risen in price and decreased in reliability of supply. Oil has doubled in four years, coal in three, and natural gas rose 136% from 1972 to 1975. Oil embargoes, coal strikes, and gas deregulation appear as distinct possibilities. Latest projections indicate that both oil and coal will rise in price an additional 150% by 1990 -- just over 11 years away.

The average energy cost to manufacturers nationwide is $2.73 per million BTU. In North Carolina, fuel oil at 33-45¢ per gallon contains energy at $2.20 - $3.15 per million BTU. Southern Appalachian coal is delivered at around $45 per ton, containing energy at about two dollars per million. At projected 1990 levels, energy from coal will cost five dollars per million BTU, and oil energy will be in the $5.50 - $7.90 range.

As energy costs increase, the impetus to shift to wood energy will strengthen. Existing mill residues will receive the first attention since these are relatively cheap (two to five dollars per ton) and are available in some areas of the State. Next, logging residues will be utilized. These materials are generally left on the forest floor, hampering regeneration, or are wastefully burned, creating air pollution. Energy economics, however, will provide the relatively small thrust required to move these materials to replace fossil fuels if wood fuel markets are available. This additional effort required will be small since the harvesting crews and much of the equipment are already operating in the area, and negotiations with the woodland owners have taken place.

The last stage, and most significant, is that of harvesting tracts of standing trees primarily for fuel. This is the stage that will allow economic removal of unwanted trees so that well-stockedstands can be thinned appropriately or so that entire tracts that are worthless can be reforested with desirable trees.

The amount of fiber in North Carolina that should be removed, from a forest management view, is enormous, perhaps 30 million green tons annually. By realizing that this quantity can replace over 30 million barrels of oil annually (industrial and commercial firms consumed 31 million barrels in 1976), it is hard to imagine that statewide competition for wood fuel will become intense within the foreseeable future. Current estimates of $12 to $14 per ton for green whole-tree chips produced and delivered primarily for fuel should remain relatively constant (in today's dollars). At these levels, energy is delivered in a range from $1.40 to $1.65 per million BTU's.

1.3 BENEFITS TO NORTH CAROLINA

The substantial array of benefits of wood energy use indicates that many governmental programs have, or should have, a stake in the concept. To begin, renewable wood resources will be furnished by local, dependable entrepreneurs to replace fossil fuels which are scarce or imported. National trade deficits can be lessened considerably.
2.1 WOOD ENERGY COORDINATING GROUP

To promote the development of wood energy, the Governor established the Wood Energy Coordinating Group (Appendix 1). In the group are the State Forester, State Energy Director, State Property and Construction Officer and Vice President of Research and Public Service Programs of the University of North Carolina. The chairman is the deputy secretary of Natural Resources and Community Development. There is also a staff coordinator.

2.11 The Department of Natural Resources and Community Development

This Department is responsible for state programs in forestry, air quality, water, land, and minerals, and in community development. The Wood Energy Coordinating Group was formed as an outgrowth of a movement to stimulate markets for low grade fiber in order to enhance forest management. The historical clients of the Division of Forest Resources -- woodlot owners, wood dealers, and forest products industries -- will gain tremendously from the wood energy program. Decisions by these private industry segments will ultimately determine the success of the program.

Because of close ties with all energy systems across North Carolina, the Air Quality section of the Division of Environmental Management will also play a key role in widespread success. Meaningful reductions of sulfur and nitrogen emissions will result from shifts to biomass from fossil fuels.

State plans to enhance economic development in small communities will be benefited by the wide-spread use of wood fuels in North Carolina. Local employment and incomes will increase.

Close linkages among the public, private, and educational sectors are necessary for the operating divisions of Natural Resources and Community Development to carry out their missions in conservation, preservation, and wise development. The Department's 26 boards, commissions, and committees will provide a framework to insure that widespread efforts will be in accordance with policies developed to benefit the whole of North Carolina.

2.12 Department of Commerce

The Energy Division provides broad contact with all important energy consuming sectors. Its programs include energy allocations and energy conservation, and it serves as staff for the Energy Policy Council. The Council plans for energy management, conservation, and research and development.
3. CURRENT ACTIVITIES

3.1 Educational

Statewide workshops in 1977 sponsored by Extension Forest Resources at North Carolina State University and the Division of Forest Resources resulted in awareness of opportunities in wood energy by the industrial sector. Seminars in combustion techniques, tours of harvesting operations, and presentations on home use of wood energy are currently being held by Extension Forest Resources.

3.2 Demonstrations

Two state institutions are in the design stage of engineering wood boiler systems. A wood marketing center project is underway to relate resources to uses.

3.3 Industrial Contacts

Extension Forest Resources has employed a wood combustion advisor to assist industries and institutions in the evaluation of wood energy for their specific systems. Additional personnel to work in this area are planned, to be funded by various agencies (State, Appalachian Regional Commission, U.S. Forest Service).

3.4 Industry Involvements

Numerous non-wood firms are now considering wood energy. One textile plant has test-fired wood pellets and is planning to convert to this fuel. A brick company is using mill residue in two kilns, and plans to convert two more. Another brick firm is converting a kiln to use wood, and is operating a whole-tree chip harvesting team. Many raw wood suppliers are hoping to increase their sales and/or production whenever markets develop. Several wood pelleting groups are in various phases of planning, design, and construction.

Since the most critical activity appears to be personal contact and technical evaluation and assistance to prospective wood energy users, efforts are being made to orient existing technical groups toward helping develop the concept. These groups include air quality engineers, boiler safety inspectors, energy conservation teams, and private engineering and boiler service firms.
3.5 Research

3.51 Electric Power

Feasibility of small wood-fired electric power plants. Status - Complete.
Impacts of wood and peat-fired electric power plants. Status - Funded.

3.52 Forestry & Resources


3.522 Quantification of markets for mill residues. Status - Funded.


3.53 Operations

Economics and operating characteristics of various materials handling systems and wood fuels in small to medium-sized boiler facilities. Status - In process.

3.54 Equipment


3.55 Overall

A program for utilizing wood for energy in Western North Carolina. Status - Funded.
Wood Energy Responsibilities
- Agency Identification -

Department of Natural Resources and Community Development
Division of Forest Resources (FR)
Division of Environmental Management, Air Quality Section (AQ)
Wood Energy Project Coordinator (WEPC)

Department of Commerce
Division of Energy (ED)
Division of Industrial Development (ID)
Division of Business Assistance (BA)
Energy Institute (EI)

North Carolina State University
Department of Extension Forest Resources (EFR)
Agricultural Extension Service (AES) (includes Extension Home Economics)
Industrial Extension Service (IES)

Department of Administration (A)

Department of Labor
Division of Boiler Inspections (BID)

Other
North Carolina Society of Engineers (NCSE)
North Carolina Industrial Developers Association (NCIDA)
4. PLANNED ACTIVITIES, RESPONSIBILITIES, AND SCHEDULES FOR

4.1 Developing Markets for Wood Fuel

4.11 Educational programs

4.111 Short presentations on the benefits and limitations of using wood for fuel at industry association workshops, dinner meetings, conventions, etc.

**Time:** Continuing
**Responsibility:** EFR, WEPC, ED

4.112 One day meetings for plant managers, engineering firms, and other interested parties to present the state-of-the-art in using wood as an industrial fuel.

**Time:** Continuing
**Responsibility:** EFR, ED

4.113 Energy tours - One day tours of wood burning facilities and whole-tree chipping operations for plant managers, engineering firms, and other interested parties to present the state-of-the-art in using wood as an industrial fuel.

**Time:** Continuing
**Responsibility:** EFR, ED

4.114 Mass media - Ten to thirty-minute programs on wood for fuel for TV and radio, and newspaper releases. Media representatives will also be invited to a general presentation on the benefits, ramifications, and considerations of wood energy.

**Time:** Winter 1978-79
**Responsibility:** EFR, FR, and industrial cooperators

4.12 Demonstrations

4.121 State institutions:
Select and convert state institutions to act as demonstration facilities for (a) steam production, and (b) cogeneration of steam and electricity.

Institutions should be dispersed so that, if feasible, both steam production and cogeneration can be demonstrated in each region.
A definite commitment should be made by the State in the immediate future to convert at least two state institutions to wood (one mountain and one piedmont). If these cannot be financed by the institutions to be converted, then a direct appropriation should be sought from the State Legislature and/or an application should be made to DOE or other appropriate funding agencies for demonstration money.

**Time:** Immediately  
**Responsibility:** A, WEPC, with assistance where necessary from members of Wood Energy Coordinating Group

4.122 Industry:

Work with a small number of representative industries and their engineering and boiler service firms to assist in converting to wood as a primary or supplementary fuel to act as demonstration facilities for (a) steam production, and (b) cogeneration.

Primary selection should be by type of industry, for example textiles, brick manufacturing, food processing, and chemicals. Availability of fuel will also be a criterion.

In addition, a comprehensive search for existing wood-fired systems in the region should provide example installations, some of which may be used for models or for evaluation. Industries should be encouraged to finance conversion themselves but, proposals should be developed and submitted to DOE and other appropriate funding agencies for demonstration money to be used with selected situations where deemed necessary.

**Time:** Immediately  
**Responsibility:** WEPC, in association with industry representatives (users and suppliers), with assistance where necessary from members of the Wood Energy Coordinating Group, also IES, BID, AQ

4.13 Assistance programs to individual industries and institutions

4.131 Development of information packages on wood use for new and existing industry.
A package of information explaining the feasibility of using wood as a primary or supplementary fuel should be developed for new and existing industries planning to build boiler facilities.

Time: Immediately
Responsibility: WEPC and EFR

4.132 Identification of state institutions

Efforts should be made to identify new and existing institutional plants where it is economically feasible to switch to wood alone or in combination with another fuel. These installations should be actively encouraged to consider wood.

Time: Immediately
Responsibility: A, WEPC

4.133 Identification of private industry

Efforts should be made to identify new and existing industries where it is economically feasible to use wood alone or in combination with another fuel. These plants should be actively encouraged to consider wood.

Time: Immediately
Responsibility: ED, ID, BA, EFR, IES, AQ, BID, NCSE, NCIDA

4.134 Boiler operator seminars

One to two day meetings for boiler operators at plants using wood-fired systems on how to improve boiler efficiency.

Time: Spring 1979
Responsibility: EFR and IES

4.14 Legislative programs

4.141 Develop legislation to provide tax incentives for private organizations installing equipment to burn wood as fuel.

Time: Immediately
Responsibility: WEPC and ED
4.142 Study other legislative needs to promote wood as a fuel.

Time: Fall-Winter 1978-79
Responsibility: WECG

4.2 Developing Supply Systems for Wood Fuel

4.21 Educational programs

4.211 Evening or one-day meetings for landowners on forest management of small woodlots and production of fuel wood.

Time: Start as market for fuel wood develops
Responsibility: EFR

4.212 Harvesting and forest management tours and demonstration days to demonstrate available technology for loggers, dealers and landowners.

Time: Start as market for fuel wood develops
Responsibility: EFR and FR

4.22 Demonstration Concentration Yard

A concentration yard, or marketing facility, should be established in conjunction with institutional or industrial wood burning facilities. A private cooperator should be encouraged to finance the yard. In addition, a proposal should be developed and requests made to funding agencies for demonstration money to be used to establish the concentration yard and/or its key elements.

Time: Immediately
Responsibility: WEPC, FR, ED in association with a private cooperator

4.23 Assistance programs to individual landowners and wood users and suppliers

4.231 Landowners

Assistance should be provided to individual landowners on harvesting of their land for fuel wood and other products and how best to reforest their land.

Time: Start as market for fuel wood develops
Responsibility: FR
4.232 Wood user procurement

Assistance should be provided in the location of dependable fuel wood supplies.

Time: Immediately
Responsibility: FR, EFR, in cooperation with private sector

4.233 Wood suppliers

Assistance in training of forest operators in environmental harvesting techniques should begin immediately to prepare for increased pressure on forest lands. The program should incorporate guidelines proposed under the 208 program.

Funding should be requested of U.S. Forest Service.

Time: Immediately
Responsibility: FR, EFR

4.3 Assessment of Processes and Techniques of Using Wood for Energy

Widest applications of wood for energy are sure to involve fuel processing, drying, and densification in many instances, as well as direct combustion, gasification, and pyrolysis. Encouragement should be given to cooperators in both the private and public sectors so that as many of the various techniques as are technically and economically sound can be demonstrated.

Encouragement may involve educating, technology transfer, feasibility studies, and grants and other incentives. Proposals should be developed for appropriate funding agencies such as DOE, the U.S. Forest Service, the State, and appropriate regional commissions and groups.

Time: Immediately
Responsibility: Members of WECG

4.4 Research Mechanisms

Needed research relating to the use of wood as fuel will be identified and prioritized so that efforts can be made to obtain commitments and funding for high priority projects.

The North Carolina Wood Energy Coordinating Group will structure research subcommittees drawing on representation from universities, government, and industries operating in the state. The Director of the N.C. Energy Institute shall chair or supervise these subcommittees; thus strengthening coordination and the integration of wood energy concerns into the state's overall energy programs.
The Southern Appalachian Research/Resource Management Cooperative (SAR/RMC) is a regional consortium of agencies and universities which has also formed a wood energy committee to identify these needs. A committee-sponsored workshop is planned in November 1978 for this purpose.

4.5 Wood as a Home Fuel

It is felt that primary state emphasis should be on the development of wood as an industrial fuel. However, use of wood as a home fuel should not be ignored.

Slide/tapes and publications on selection and storage of firewood, fireplace accessories, selection and installation of stoves, and safe use of chain saws have been, or are in the process of being completed by NCSU Agricultural Extension Service (EH and EFR). These materials will be published and made available through the county extension offices.

In addition, workshops and demonstration days should be held around the state on use of wood for home heating and timber stand improvement through firewood production.

Time: Fall-Winter 1978-79
Responsibility: EH, EFR, ED, FR

5. EVALUATION

Success in meeting the objectives of the "Plan to Promote the Use of Wood for Energy in North Carolina" will be evaluated at two levels. Section 4 of the plan lists activities together with responsibilities. Satisfactory completion of assigned responsibilities as scheduled is essential for successful implementation of the plan and will be evaluated at quarterly meetings of the Wood Energy Coordinating Group. A record of the number of inquiries for information on wood as a fuel, press releases, attendees at workshops, speaking engagements, funded research and demonstration projects, etc., will be an important part of this phase of evaluation. However, of much greater significance are the number of tons of wood burned for energy production by non-wood products industries and commerce, and consequently the savings in imported fuels; the number of acres of unmarketable timber harvested for wood fuel and the revenues to landowners from these sales; the number of acres of forestland placed under active management as a result of the sale of wood fuel; and the number of jobs created directly in the harvesting, supply, and processing of wood fuel. These will be quantified annually.

It is expected that by the end of FY 1979 at least 6 non-wood products companies or institutions will have announced plans to utilize wood as a prime energy source. These facilities are expected to use in excess of 0.5 million tons of wood a year when operational. This is the equivalent of approximately 2.5 percent of
the lumber and pulpwood currently harvested for the wood products industry. Assuming that 20 cords of wood fuel are available per acre on land which will typically be harvested, then 10,000 acres of timber land would be needed to supply this wood.

It is felt that further projections are impossible because the success of these first conversions will determine future progress.
MEMORANDUM OF UNDERSTANDING

Wood Energy Coordinating Group

I. Authority. The Governor of North Carolina hereby authorizes the North Carolina Departments of Administration, Natural Resources and Community Development, and Commerce and The University of North Carolina to enter into cooperative agreements for developing the use of wood as industrial energy.

II. Function and Purpose. To establish a functional group to coordinate programs of participating agencies so as to effectively promote and develop wood for energy.

III. Background. Studies show that it is now desirable economically, environmentally and technically to harvest one of North Carolina's large renewable resources—standing low-grade timber—for fuel. The broad adoption of this concept will provide important benefits:

- by reducing consumption of fossil fuels
- by increasing employment in rural areas
- by stimulating local economies
- by increasing productivity of forest lands

Federal agencies which are likely to become interested and involved include: the Energy Research and Development Administration, the Federal Energy Administration, the Economic Development Administration, the Appalachian Regional Commission, the Coastal Plains Regional Commission, the Forest Service, the Department of Labor, the Small Business Administration and the Environmental Protection Agency.

State agencies with important roles include those dealing with energy, forestry, employment, economic development, property control, and research, extension and public service.

IV. Implementation. The Wood Energy Coordinating Group will be composed of five (5) representatives from the following offices:

a. N.C. Department of Natural Resources and Community Development, Office of the Deputy Secretary (Lead Agency)

b. N.C. Department of Natural Resources and Community Development, Division of Forestry

c. N.C. Department of Commerce, Division of Energy

d. N.C. Department of Administration, Office of Property and Construction

e. The University of North Carolina, General Administration

V. Group Organization and Administration. The Department of Natural Resources and Community Development will be the lead agency for implementing these concepts, and the Chairman of the Group will be the representative from that agency. The Chairman will call
and conduct meetings, establish working teams and submit recommendations to agencies for action.

VI. Working Teams. The Chairman may appoint working teams from organizations with expertise and interest, so long as the head of the organization approves. Working teams' reports and recommendations will be submitted to the group for review, approval and action.

VII. Financing. Salary, travel and incidental costs of group and team members will normally be borne by their respective agencies. Extraordinary costs shall be covered by written agreement.

VIII. Effective Date and Terms. The Wood Energy Coordinating Group will begin operations effective with the signing of the memorandum by the Secretaries of the above departments and the President of The University. Although the term of this Group is indeterminate, an agency head may withdraw his support by notifying the Group Chairman.

The Group Chairman will prepare and submit annual reports to the heads of the agencies involved. Overall progress and the status of major projects will be documented, and recommendations for future activities will be made.

Signed: [Signature]
Governor of North Carolina

Date: Sept. 21, 1977

Signed: [Signature]
Secretary of Natural Resources and Community Development

Date: Sept. 26, 1977

Signed: [Signature]
Secretary of Commerce

Date: Sept. 27, 1977

Signed: [Signature]
Secretary of Administration

Date: Jan. 30, 1977

Signed: [Signature]
President of The University of North Carolina

Date: Oct. 7, 1977