



Biomass Energy and Biofuels from Oregon's Forests

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**OREGON FOREST
RESOURCES INSTITUTE**

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MB&G
Mason, Bruce & Girard, Inc.

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Oregon State
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Jim Bowyer, Consultant

"Keeping America competitive requires affordable energy. And here we have a serious problem: America is addicted to oil, which is often imported from unstable parts of the world. The best way to break this addiction is through technology. ... By applying the talent and technology of America, this country can dramatically improve our environment, move beyond a petroleum-based economy, and make our dependence on Middle Eastern oil a thing of the past."

President George W. Bush
January 31, 2006

"I want you to know that I am committed to making Oregon a national leader in forest biomass energy development.... Our forests make biomass a natural fit for Oregon. We will be able to reduce the risk of forest fires by removing dry debris – and then use that debris to generate energy, all the while creating jobs, attracting new businesses, and shifting our economy into a higher gear."

Governor Theodore R. Kulongoski
Closing Comments to 4th Annual Leadership Summit
January 9, 2006

"Across millions of acres of Oregon's forests, timber stands have become overcrowded with small trees, many of them in poor health and vulnerable to attack by insects, disease and fire. Instead of fueling more of the uncharacteristically severe wildfires that we've seen in recent years, this biomass could be used to generate energy or produce other economic value. Well-planned removal and use of this material holds the promise to restore resiliency to these forests and to boost the state's economy."

Marvin Brown
Oregon State Forester

"The prosperity of states has little to do with the mix of (economic) clusters in a region; it has everything to do with the sophistication and productivity of the clusters. For Oregon, this means focusing economic development efforts on the productivity and technological capability of industry clusters where the state has a critical mass – including traditional industries such as forestry..."

Dr. Michael Porter
Harvard Business School Professor
Opening Remarks to 4th Annual Oregon Leadership Summit
January 9, 2006

Biomass Project Team

**Roger Lord
Carl Ehlen
Mason, Bruce & Girard, Inc.
www.MasonBruce.com**

**David Stewart-Smith
John Martin
Pacific Energy Systems, Inc.
www.PacificEnergySystems.com**

**Dr. Loren Kellogg
Chad Davis
Melanie Stidham
OSU College of Forestry
www.cof.orst.edu**

**Dr. Mike Penner
OSU College of Agriculture
agsci.oregonstate.edu**

**Dr. James Bowyer
Wood Science & BioProducts Consultant
jimbowyer@comcast.net**

Preface

The Oregon Forest Resources Institute (OFRI) commissioned this study on the opportunities and barriers for Biomass Energy and Biofuels from Oregon's Forests. The timely study documented in this report identifies some short-term opportunities to move Oregon forward in developing a biomass industry. Key findings of the study include:

- The conversion of woody biomass to energy in Oregon presents a unique opportunity to simultaneously address three challenging needs: restoring forest health, fire resiliency and wildlife habitat, finding renewable energy alternatives, and revitalizing rural economies.
- An estimated 4.25 million acres (about 15% of Oregon's forestland) have the potential to provide forest biomass by thinning of forest stands to reduce risk of uncharacteristic fire.
- Thinning these acres over 20 years could produce 1.0 million bone dry tons (BDT) per year of woody biomass not including merchantable sawtimber.
- Delivering this 1.0 million BDT of biomass to processing facilities would cost an average of \$59/BDT based on integrated harvesting and collecting which combines costs associated with biomass with the costs associated with merchantable timber. Harvesting and collecting costs for woody biomass would be much higher if only non-merchantable material is harvested.
- The most economically and technically feasible opportunity for woody biomass in the short term is for generation of electricity and production of heat from thinning dry southern Oregon forests. Longer-term, production of biofuels and bio-products to reduce reliance on fossil fuels may prove to be the more significant opportunity.
- One million BDT of biomass could produce about 150 MW of electricity.
- The cost of producing electricity from \$59/BDT of woody biomass in stand-alone electricity generating facilities would be in the 8-9¢/kWh range.
- To produce electricity at stand-alone electricity generating facilities in the 6.5 – 7.5¢/kWh range of current markets, delivered fuel costs would need to be in the range of \$45/BDT. An estimated 0.6 million BDT of delivered biomass per year and electric capacity of 81 MW could meet these current market parameters.
- Electricity produced in a combined heat and power facility, such as a lumber mill with co-generation would result in significantly lower kWh costs.
- The 1.0 million BDT per year of woody biomass created by thinning the 4.25 million acres identified in this analysis could be significantly increased through harvesting western juniper in rangeland restoration, harvesting logging slash in other timber harvests, urban wood waste, agricultural biomass and excess milling residue.
- Collaboration and agreement between stakeholder groups on forest management and industrial development issues will be necessary to develop a biomass industry in Oregon. Projects starting at Warm Springs and Lakeview provide examples of this.

The OFRI Board and staff appreciate the thorough and professional work done by the Bio-Energy project team including researchers and analysts from Mason, Bruce & Girard, Inc.; Pacific Energy Systems, Inc.; OSU Colleges of Forestry and Agricultural Sciences; and Dr. Jim Bowyer. We also appreciate the input of the Oregon Forest Biomass Working Group.

Mike Cloughesy
Director of Forestry

Executive Summary

Introduction

The Oregon Forest Resources Institute commissioned this study, *Bio-mass Energy and Biofuels from Oregon's Forests*, to better understand the potential for renewable energy development using biomass derived from Oregon's forests. The study's objectives are as follows:

- *Review existing research* on potential for production of biomass energy and biofuels from Oregon forests (*Chapter 1*).
- *Assess the potential* in Oregon for production of electricity and biofuels from woody biomass, including available wood supply and environmental, energy, forest health, and economic effects (*Chapter 2*).
- *Review and summarizes efforts underway* to promote electric energy and biofuels from wood biomass, and identify gaps in existing efforts (*Chapter 3*).
- *Conduct interviews with Oregon biomass stakeholders* to document the diverse perspectives of various groups concerning the opportunities for forest biomass-based energy production, its potential benefits, and challenges or barriers to development (*Chapter 4*).
- *Assess constraints and challenges* to development of biomass energy and biofuels from Oregon forests, including economic, environmental, legal, policy, infrastructure, and other barriers (*Chapter 5*).
- *Develop recommendations* on how Oregon can best overcome the barriers to production of wood-based bio-energy (*Chapter 6*).

What Is Woody Biomass?

Biomass refers to the sum total of all organic material in trees, agricultural crops and other living plant material. Woody biomass is any biomass composed of wood. In Oregon, it arises from 3 sources:

- *Wood products residue* is the wood waste generated at Oregon sawmills and other wood products plants such as trim, shavings, woodchips, sawdust, bark, and other residues.
- *Urban wood waste* includes discarded wood and yard debris. This waste stream often ends up in landfills but it can be diverted for energy production.

What Is The Opportunity?

- *Forest biomass* is the waste material generated from logging or thinning activities in forests. Although strictly speaking, biomass refers to the entire main stem, branches and tops of trees, the term is commonly understood to refer only to the small diameter waste material, less than 5 to 7" in diameter, that cannot be used for traditional timber products.

This report focuses primarily on forest biomass although it discusses current uses of wood products residue as a secondary topic. Increasing the use of forest biomass presents the largest opportunity for producing additional energy from woody biomass in Oregon.

The conversion of woody biomass to energy in Oregon poses a unique opportunity to simultaneously address three challenging problems:

- The need to restore Oregon's forest health
- The need to find renewable energy alternatives
- The need to revitalize Oregon's rural communities

- **Forest Health**

Evidence indicates that many of our state's forests are out of balance with natural conditions and therefore more susceptible to insects, disease and wildfire than ever before. Fire suppression and other influences over the last several decades have created an accumulation of excess woody material, particularly in the dry forest types of eastern and southern Oregon. This places our forests at risk of wildfires that could cause significant ecological damage at a landscape scale and, no less importantly, places our nearby communities at risk as well. Wildlife habitat is adversely affected as well. Oregon's forests need to be restored ecologically.

Federal forest scientists have identified 12.2 million acres of forestland statewide in Fire Condition Classes 2 or 3. These conditions are found primarily on federal forestlands. In these forests, fire regimes are moderately to significantly outside the historic, natural range and the risk of losing key ecosystem components in the event of a wildfire are moderate to high. Treatments such as use of prescribed fire and mechanical thinning could be used to restore these forests to natural conditions. In some cases, fuel loads are so high that scientists believe that prescribed fire cannot be used without mechanical removal of fuels first.

The lack of markets for forest biomass material makes fuel reduction treatments a costly undertaking. Harvest and transportation of small diameter logs and biomass material is more expensive than larger timber. Federal land management agencies and other landowners lack

resources to cover these costs. Yet, to reduce fire hazards, the material must either be physically removed from the site or burned on location. Providing markets for this material to help cover the costs of forest restoration treatments would help solve to forest health and habitat problems.

- **Renewable Energy**

With the peak of worldwide petroleum production in sight, interest in alternative energy sources is growing. Most people recognize that America is placing its economic future and national security at risk by continuing to rely on fossil fuels which are becoming increasingly expensive and often come from societies that are hostile to us. In addition, it is becoming increasingly evident that fossil fuels carry heavy environmental costs that must be addressed.

Bio-energy alternatives are emerging as substitutes for fossil fuels in power generation, transportation fuels (ethanol and biodiesel), steam heat, and production of biochemicals. Conventional technologies are available that can be applied immediately to produce electricity and heat from biomass. In fact, they have been applied for decades by the forest products industry to utilize mill wood wastes and generate a significant amount of energy. The total energy value of biomass fuel in Oregon was about 10% of non-transportation energy consumed in the state in 2003. About 37% of biomass-derived energy came from wood wastes. Another 46% came from combustion of spent pulping liquor, a byproduct of the papermaking process.

The potential payoff from production of liquid fuels from biomass is greater. Technologies to convert cellulosic biomass such as wood to ethanol, while not yet commercial, should be available within the next decade. Ethanol, a substitute for gasoline, can reduce our reliance on fossil fuels for transportation and help bring down fuel prices. Currently, the nation's ethanol supply comes almost entirely from corn. Production of ethanol from cellulosic biomass has many environmental and economic benefits. Production of biochemicals to replace petroleum-based chemicals is also an opportunity that deserves increased attention.

- **Rural Revitalization**

Oregon's rural communities, especially those that have long been dependent on the surrounding natural resources for economic health, are struggling. Many factors have contributed to this – one of which is the decline in timber harvest from federal lands. As timber harvesting has declined, family wage jobs have been lost, mills and supporting businesses have closed and economies have weakened. Rural Oregon communities need revitalization.

How Large Is The Opportunity?

The largest opportunity in Oregon is creation of an industry that is appropriately scaled to match forest restoration needs primarily on public forests in eastern and southern Oregon. Creating such an industry would provide a market for woody biomass material that could help pay the cost of ecosystem restoration.

Biomass utilization for energy should be considered a tool for improving the health of our forests. To ensure a sustainable, appropriate level of development, the needs for forest restoration should determine the scale of the forest biomass energy industry. The magnitude of this opportunity, then, hinges on the question of to what extent forest restoration treatments are needed and how much biomass material would be removed to support restoration goals.

Previously published estimates of forest biomass from forest health thinnings in Oregon vary widely, ranging from 0.8 – 7.3 million BDT annually depending on assumptions of area needing treatment, volume removed per acre, proportion of volume that is biomass versus commercial timber, and the number of years over which treatments are completed. This wide range of estimates naturally leads to a question about which is the most realistic.

We analyzed potential biomass supply from fuel reduction treatments across 20 eastern and southern Oregon counties in the dry, inland forest region of Oregon using the Fuel Treatment Evaluator 3.0, a computer model for assessing fuel reduction opportunities. The analysis was based on the best available forest inventory data from on-the-ground sample plots and quantitative, stand-level criteria were used to delineate the area needing treatment.

The eligible area was defined as public and private timberland with high fire risk outside of designated roadless areas, Wilderness areas, parks and other forestlands where harvesting is excluded. High fire risk areas were defined as those classified as Fire Condition Classes 2 and 3 having either Crowning Index or Torching Index below 25 mph.

A mix of thinning treatments was applied on the eligible treatment area to estimate removals. Trees were removed until Crowning and/or Torching Index values indicated a significant reduction in fire risk.

Results of this analysis suggest that a biomass supply of approximately 20 million BDT would result from treatment of 4.25 million acres of eligible forestland, or approximately 27% of the total timberland area in the 20 counties. About 71% of the eligible forestland is publicly owned and nearly all of this is federal. Private lands account for 29% of the eligible treatment area.

If treated over a 20 year period, approximately 1 million bone dry tons

(BDT) would be produced annually assuming no allowance for growth. Average delivered cost would be \$59/BDT in today's dollars based on integrated harvesting and collection costs and assuming processing facilities were well distributed across the region. Over the entire landscape, revenues from sale of merchantable timber and biomass could cover direct treatment costs (harvesting and hauling) if sawtimber revenues were allowed to subsidize biomass harvest and transport costs.

In addition to the statewide analysis, we also conducted two sub-state assessments within a 75-mile radius of Klamath Falls in southern Oregon and La Grande, in northeast Oregon. Comparisons illustrate dissimilarities in forest types and conditions in the two areas. The Klamath Falls analysis found 1.1 million acres eligible for treatment within 75 miles. Treatment would produce 9.4 million BDT at an average delivered cost of \$76/BDT. In the La Grande area, 292,000 acres were eligible for treatment yielding 1.0 million tons of biomass at average delivered cost of \$73/BDT. These volumes are from forest types that typically experience surface and mixed fire severities. An additional 2.9 million tons for Klamath Falls and 1.5 million tons could be delivered to Klamath Falls and La Grande, respectively, from treatment of forest types that tend to have high intensity fires under natural conditions.

How Much Energy Would This Produce?

- **Electricity**

One million tons of feedstock under the assumptions shown below would be capable of producing about 150 MW of electrical power. Assuming eight plants at the hypothetical locations used in the analysis, average capacity would be about 18 MW. By comparison, the 2004 total installed electrical generation capacity in Oregon was 5,734 MW, with load growth expected to be a little over 100 MW per year.

The average net cost of the biomass-produced electricity would be 8.1¢ per kWh for the first five years by taking advantage of the federal production tax credit (PTC) and 9.0¢ for the next five years. This net cost is competitive with alternatives such as natural gas but is not competitive with other renewables such as wind.

To produce electricity in the 6.5 – 7.5¢/kWh range of current markets, fuel costs would need to be in the range of \$45/BDT. At an average delivered cost of \$45/BDT, electricity production cost drops to 7.9¢/kWh and the net production cost for the first five years, after the PTC, would be 7.0¢/kWh. However, based on our supply curve, only 0.6 million BDT per year could be delivered at that cost. Total electric capacity falls to 81 MW when average delivered cost is limited to \$45/BDT.

Cost savings from these estimates are possible depending on addi-

What About Other Sources Of Woody Biomass?

tional subsidies that may be available from the Energy Trust or federal development grants. In some ways, this is a worst-case scenario since it is based on a stand-alone power plant with no market for the steam produced by the process. A power plant associated with a lumber products mill, especially an expansion of existing power facilities, could result in significantly lower costs. Fuel savings are also possible from the combined use of mill residues and chipped forest thinnings.

- **Ethanol**

Assuming the entire 1.0 million annual BDT supply was to be directed to ethanol production when technology becomes available, it would produce approximately 61 – 66 million gallons per year. To put this into perspective, the ODOE estimates that in 2002, up to 60 million gallons of ethanol were used to oxygenate over 1.5 billion gallons of gasoline consumed by Oregonians.

Other sources of woody biomass were also considered. In total, it is conceivable (though not proven economical) that these three additional sources could provide another 1.0 million BDT of woody biomass supply annually over at least a 20-year period.

The potential to increase energy production from woody mill residues in Oregon is limited by available supply. In 2002, 6.8 million BDT of mill residuals were produced in Oregon. Sixty-four percent was subsequently used in the production of secondary products, 25% was used as fuel, and less than 1% was un-used. Secondary products such as pulp, paper, particleboard, and other products currently represent higher value uses than energy production, so diversion of the fiber used for these products into energy production is unlikely, at least in the near future.

The largest source of forest biomass, other than fuel treatment of overstocked forestlands, is the 3.6 million acres of western juniper forest in 14 eastern Oregon counties. The control and eradication of juniper is a significant issue for range management and ecology. Juniper biomass has a high fuel value and few alternative uses. Control over a 20-year period would involve treatment of 178,000 acres per year, producing 0.60 million BDT of juniper biomass annually. The delivered cost per BDT is unknown. Control of juniper is an expensive undertaking but experience in California suggests that further investigation into the use of juniper for energy production in Oregon is warranted.

Logging slash from commercial timber harvests other than fuel treatments could also contribute to the forest biomass supply. Much of this volume is located in westside counties outside our 20-county study area but up to 0.45 million BDT/yr could be available within the 20-county study region.

What Are The Environmental Benefits?

Science on the environmental issues surrounding use of forest biomass for energy production indicates environmental benefits arise from reducing the risk of catastrophic wildfire, restoring overcrowded forests to conditions that are more natural, and from replacing non-renewable energy with renewable energy. Benefits include air quality improvement, reduction in greenhouse gases, soil and water conservation, and protection and restoration of wildlife habitat and biodiversity. Some benefits accrue from both forest restoration and fossil fuel replacement. For example, air pollution and greenhouse gases emissions are reduced by reducing wildfire likelihood and by reducing emissions from energy production as biomass replaces fossil fuel. Other impacts are characterized in terms of short-term versus long-term risk.

Environmental benefits of biomass energy are estimated at 11.4¢/kWh. The value of avoided forest overgrowth is estimated as 20.2¢/kWh. The estimated net benefit of fuel reduction treatments is \$606 - \$1,402+ per acre. These results suggest that the environmental benefits of forest biomass use for energy are well in excess of the market value of the electricity produced.

What Are The Other Benefits?

A primary benefit is an improvement of forest health and fire resilience, which should reduce resource losses to wildfires, improve public safety, and reduce wildfire suppression expenses. As measured by Crowning and Torching Indices, fuel treatments modeled in our analysis significantly reduced fire risk on 4.25 million acres. Losses to insect and diseases should be reduced also as general forest health conditions are improved.

Woody biomass energy can help Oregon achieve its goal of supplying 25 percent of the state's energy needs from renewable resources by 2025. Reducing our dependence on fossil fuels and foreign oil supplies supports national goals of lowering the trade deficit and may help alleviate national security concerns related to the political conflicts of the Middle East and parts of South America.

Closer to home, a direct economic impact related to forest biomass utilization is job creation, predominantly in the rural areas of Oregon. Production of 150 MW of electricity from woody biomass would create about 900 jobs. This does not count indirect job creation, which is usually in the range of 2 - 3 indirect jobs per direct job.

What Is Being Done Already?

Activities promoting woody biomass to energy conversion are occurring at many state, federal levels and in the private sector. These are documented in Chapter 3.

- **State**

Within Oregon state government, there are several efforts underway promoting renewable energy in general as well as forest biomass utili-

zation specifically. Many of these efforts have been initiated only within the last one or two years. We reviewed them under the following framework:

- Policy and legislation
- Working Groups and Initiatives
- Agency Activities
- Incentives
- Research and Development

Key policies include the Renewable Energy Action Plan, Oregon Business Plan, and Senate Bill 1072, which was signed into law in 2005. A series of interagency working groups, which also involve outside stakeholders, have been formed for the purposes of promoting action on renewable energy. A key group is the Forest Biomass Working Group, which is exploring how utilizing biomass can improve forest health and create a viable biomass industry. The 35+ member Group represents diverse interests: forest and energy industries, resource agencies, environmental organizations, elected officials, tribes, labor representatives, and local communities. State agencies including the Departments of Energy, Forestry, and Agriculture are active in various ways to promote renewable biomass energy.

- **Federal**

At the federal level, we focused on outlining key policies, incentive and grants programs, and research and development efforts. Key policies include the National Energy Policy, National Fire Plan, and forest stewardship contracting. An important tax incentive is the federal Production Tax Credit, which was recently extended to “open loop biomass,” a category that includes forest biomass. Oregon projects have benefited from the use of several of the grant programs including the USFS Woody Biomass Grants and Economic Action Program grants. Other programs have not had use in Oregon related to forest biomass.

- **Other Activities in Oregon**

In addition to reviewing state and federal efforts, Chapter 3 lists private sector efforts and describes a number of specific biomass projects in various stages of development in Lakeview, central and southwest Oregon, Warm Springs, LaPine, Sisters, Prineville, and Wallowa.

- **Activities in Other States**

Chapter 3 also provides information on state incentives for renewable energy, and recent biofuels legislation in other states.

How Do Various Stakeholders

Most of the 40 participants in a semi-structured interview opinion study, detailed in Chapter 4, held the general opinion that converting forest biomass to energy in Oregon is a beneficial policy direction.

View This Opportunity?

Almost all of the participants saw this as a possibility in eastside and southwestern forests where fire suppression has altered the fire regime of the forest. However, it is important to note that there was a wide range of opinions on whether this is a good idea or not expressed within the conservation organizations. On one end of the spectrum were organizations actively promoting projects and research that would convert forest biomass to energy. On the other end were organizations that are highly skeptical of, and in some cases opposed to, the idea, particularly if the majority of material would come from federal forests.

Opportunities for converting forest biomass to energy most commonly fell under the headings of forest restoration, rural economic development, and renewable energy. Forest restoration was generally seen as the most important driver of the momentum to convert forest biomass to energy in Oregon.

Barriers to converting forest biomass to energy typically fell into eight categories: supply issues, general lack of supportive public policies, public perceptions and trust, institutional issues within the federal agencies, market access, technical issues, costs, and potential negative environmental impacts. The most common barriers were under the general categories of obtaining supply, public policies, and public perceptions and trust.

Strategies to overcome the barriers tended to be specific to an individual's experiences and knowledge. Two that came up frequently: at a broad scale, most participants indicated that a collaborative approach would be essential to overcoming the barriers. More specific to biomass conversion to energy, many participants felt a renewable portfolio standard (RPS), with a specific target for biomass energy, would help ensure competitive prices for biomass-generated power assuming that unintended adverse consequences can be avoided. An RPS is a policy set by state or federal government requiring that a certain percentage of a utility's overall or new generating capacity or energy sales must be derived from renewable resources.

Guidelines that should be in place if this policy direction were to continue to move forward were related to sustainable forest management and scaling the facility to ensure that the projects were driven by local forest restoration needs and not the needs of an energy industry.

What Are The Constraints And Challenges?

A number of constraints and challenges need to be addressed if biomass energy development is to help achieve forest restoration goals. We classified these as public acceptance, biomass supply, market constraints, public policies, institutional issues, and technical issues. The state should take a leadership role in addressing these challenges.

Constraints and challenges have been organized into the following categories and detailed in Chapter 5:

- **Public Acceptance** – Without a social license from the public, development of a woody biomass energy industry will not proceed very far. Many of the questions the public have are related to the environmental impacts of biomass energy in general and forest biomass harvesting in particular.
- **Biomass Supply** - Assured access to an affordable, long-term supply of suitable woody biomass for fuel or feedstock is often identified as a major challenge in biomass energy projects.
- **Markets** – Market-related issues including the overall competitiveness of biomass energy, project startup and energy market entry barriers, and other issues also rank high in terms of importance.
- **Public Policies** – Both the state and federal government have made strides over the last few years in putting into place public policies supporting renewable energy. However, there remain some challenges in the public policy arena that need to be addressed.
- **Institutional Issues** – Since a large portion of the potential woody biomass supply from Oregon originates from forest restoration treatments on federal lands, the policies and capabilities of the two primary federal land management agencies, the USDA Forest Service and Bureau of Land Management, are critical to building a successful woody biomass energy industry.
- **Technical Issues** - There are technical issues that require research and development attention. These include research on emerging energy technologies, forest restoration and fuel treatments, harvesting technologies, biomass supply, and alternative uses of harvested material.

What Are The Recommendations?

Resolve Forest Restoration Questions

Public acceptance of a forest biomass energy industry hinges on support for the forest restoration treatments on public lands. The lack of consensus on management of the nation's public lands has led to extended controversy, which has greatly reduced the opportunity for active management of federal lands. Regardless of the worthiness of other goals such as renewable energy and rural development, growth of a forest biomass energy industry will not proceed until the public reaches a consensus on what management strategies are appropriate on these public lands. Scientific evidence and demonstrated results are needed to restore public confidence and support.

On-going collaborative efforts and continued multi-party monitoring

of the results will be key to maintaining this momentum. Based on our interviews with stakeholder groups, we believe there is potential for further strengthening public support for restoration treatments. The keys are collaboration and science-driven policy.

Address Other Challenges

As forest restoration issues are resolved, if forest biomass removal is part of the forest health solution, there are other challenges to be addressed by policymakers. If Oregon is to proactively develop a renewable energy industry as a means of achieving forest restoration goals it will need to find ways to address the many constraints and challenges we have identified. It must also use care to design appropriate incentives and policies that promote forest restoration goals and encourage an industry that is scaled appropriately based on these goals.

Guiding Principles for Forest Restoration & Woody Biomass Energy Development in Oregon

- Use collaborative, transparent decision-making processes
- Rely on best available science and adaptive management
- Start small and monitor the results
- Assure a sustainable level of development
- Promote the highest use of forest biomass
- Reduce market risk to attract private investment
- Environmental benefits of biomass energy should be paid for by the beneficiaries

The following is a complete list of recommendations, which are described in Chapter 6.

Recommendations to Promote Forest Restoration

1. Build forest restoration programs on scientific understanding of restoration needs and treatments, and increase knowledge through research, monitoring and adaptive management.
2. Encourage community collaboration and multi-party monitoring.
3. Initiate an outreach effort to build awareness of forest restoration needs, science-informed treatments and bio-energy opportunities among the Oregon public.
4. Where consistent with management objectives, encourage integrated forest management across all diameter classes of trees.
5. Build federal land management agency capacity.
6. Develop larger scale, long term, fully funded forest steward-

ship contracts and restoration programs.

7. Promote long-term research efforts into the methods and effects of forest restoration and juniper control.

Recommendations to Promote Biomass Energy Development

8. Explore development of a Renewable Portfolio Standard for Oregon that creates a market for woody biomass energy and resolves concerns about unintended adverse consequences to ratepayers.
9. Explore development of a Renewable Fuels Standard for Oregon that resolves concerns about unintended adverse consequences to the Oregon economy.
10. Level the playing field vs. other renewables and non-renewables.
11. Adopt a comprehensive state policy on renewable energy.
12. Promote the goals of sustainable biomass energy development.
13. Promote increased use of incentives and grant programs.
14. Look for synergies that make biomass energy economically sustainable.
15. Build community and workforce capacity
16. Promote establishment of a pilot cellulose-to-ethanol plant.
17. Promote small-scale uses of biomass, where appropriate.
18. Encourage involvement of existing bio-energy producers.
19. Engage the state pulp and paper industry in examining the potential for co-production of biochemicals and biochemical feedstocks.
20. Promote needed research and development efforts.
21. Recognize the role of woody biomass in achieving the Governor's 2025 carbon emission goal.
22. Encourage local governments to adopt the ODOE model land use standards for small-scale energy development.

Summary

Development of an appropriately scaled forest biomass energy industry in Oregon has the potential to address three important issues: the need to restore Oregon's forest health, find renewable energy alternatives, and revitalize Oregon's rural communities.



Oregon Forest Resources Institute

317 SW Sixth Avenue, Suite 400

Portland, Oregon 97204

(971) 673-2944

1-800-719-9195

www.oregonforests.org

Leslie Lehmann, Executive Director

Mike Cloughesy, Director of Forestry

Dave Odgers, Director of Communications